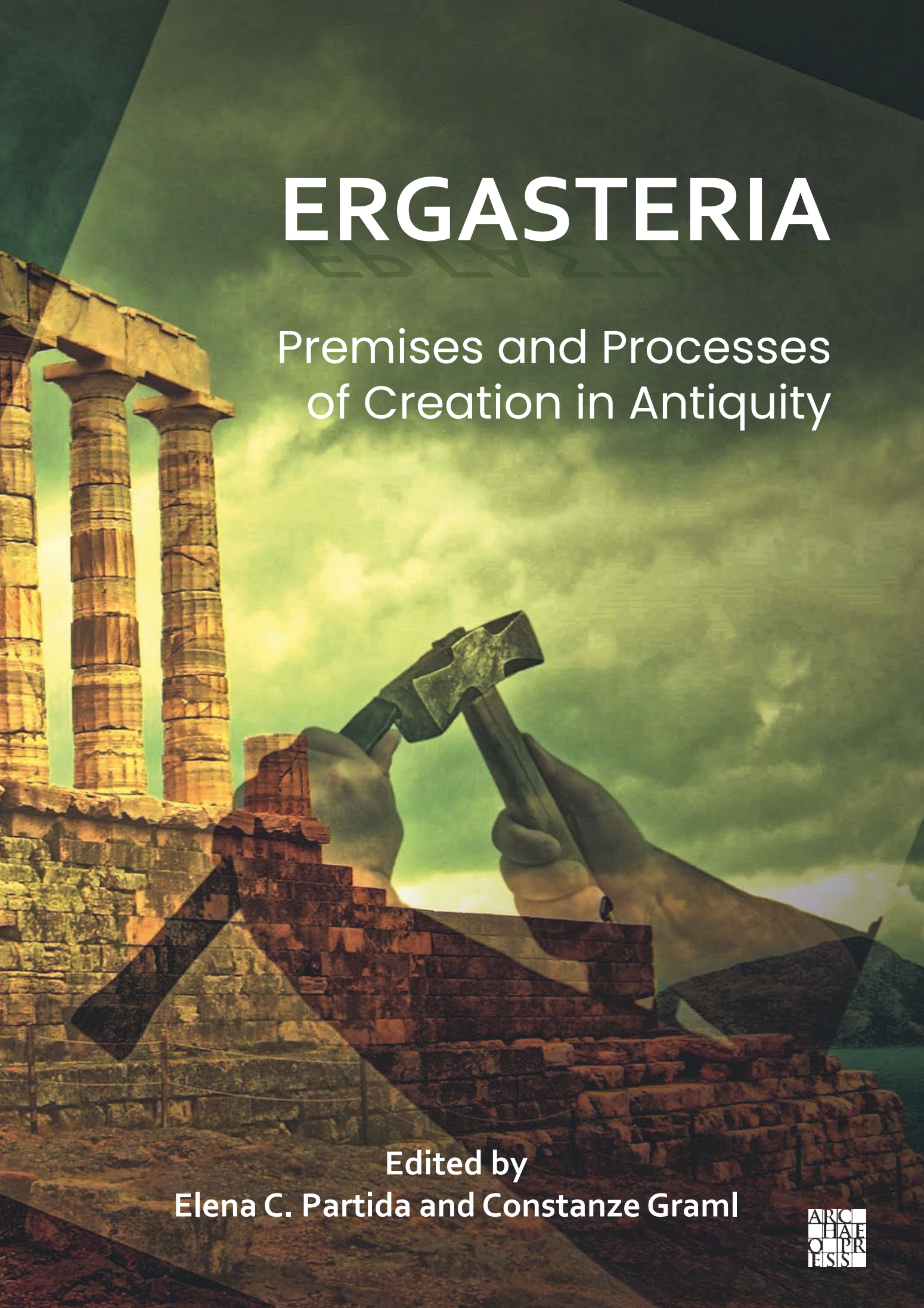


ERGASTERIA

Premises and Processes of Creation in Antiquity

Edited by
Elena C. Partida and Constanze Graml

ARCHAEOPRESS

ERGASTERIA

Premises and Processes of Creation in Antiquity

Edited by
Elena C. Partida and Constanze Graml

Archaeopress Archaeology

Archaeopress Publishing Ltd
13–14 Market Square
Bicester
Oxfordshire
OX26 6AD
United Kingdom
www.archaeopress.com

ISBN 978-1-80327-825-4
ISBN 978-1-80327-826-1 (e-Pdf)

© Archaeopress and the individual authors 2025

Cover designed by Petros Georgopoulos and Ilias Partidas

Supported by the University of Regensburg
Image-use permissions have been secured by the authors individually

This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/ or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

This book is available direct from Archaeopress or from our website www.archaeopress.com

In memory of my father, my inspirator
E.C.P.

Contents

List of Figures and Tables ..... **iii**

Chapter 1. ΕΡΓΑΣΤΗΡΙΑ: Premises and Processes of Creation in Antiquity. An Introduction **1**
Elena C. Partida and Constanze Graml

A SPATIAL APPROACH TO WORKPLACES: URBAN, RELIGIOUS, LITTORAL CONTEXT

Chapter 2. Tales from the workshop and normative beauty **9**
Gerhard Zimmer

Chapter 3. Craft production and nuisance in the ancient Greek city: Spatial and functional approaches to urban industrial activities **42**
Giorgos M. Sanidas

Chapter 4. Dyeworks network around the Gulf of Corinth: A specialised seaside textile workshop in Late Classical-Hellenistic Helike **55**
Dora Katsonopoulou

Chapter 5. Workplaces in the southern sacred area at Olbia Pontica **69**
Alla V. Bujskikh

Chapter 6. Handicraft activities in the small town of *Fanum Martis*: (Famars, northern France): Analysing and interpreting spatial organisation and production size **79**
Raphaël Clotuche, Sonja Willems, Jean-Hervé Yvinec, Marie Derreumeaux, Jennifer Clerget, Nicolas Tisserand, Bérangère Fort, Gaëtan Jouanin

Chapter 7. Evocations of Apollo in northern Gaul and craftsmen engaged in his representation: The example of *Fanum Martis* **92**
Raphaël Clotuche and Damien Censier

WORKSHOPS RELATED TO QUARRIES AND SCULPTURE

Chapter 8. Ancient Greek quarries: Installations and workshops – extraction and sculpture techniques ... **109**
Georgia Kokkorou-Alevras

Chapter 9. New evidence about the exploitation of Nisyrian millstone lava: and its use in Nisyrian workshops in antiquity **124**
Eirene A. Poupaki

Chapter 10. Heracles rock reliefs at quarries and construction sites in Roman Greece: An interpretative approach **135**
Georgios Doulfis

Chapter 11. Roman calcite alabasters in Tunisia **145**
Ameur Younès

Chapter 12. All about marble carving? In search of craftspeople of polychromy in the ancient Roman sculpture workshop **163**
Amalie Skovmøller

IN THE ATELIERS OF POTTERS AND COROPLASTS

Chapter 13. The 'Cracking the Code' project: Stamna's pithoi workshops – unveiling pottery heritage 175
Gioulika Christakopoulou and Helene Simoni

Chapter 14. The coroplast's workshop and its production: Reflecting on the craft practices of the Archaic πλάστης in Magna Graecia 200
Eukene Bilbao Zubiri

Chapter 15. Localisation, distribution and nature of pottery production of the fourth-century BC ceramic workshops in Ano Petralona, Athens: A synthesis of the available archaeological evidence 214
Marilena Kontopanagou

Chapter 16. Local *knowledgescapes* in pottery production: A new heuristic approach to the Iron Age pottery workshops between the Arno Valley and the Po Plain 230
Raffaella Da Vela

CONSTRUCTION SITES, OPEN-AIR WORKSHOPS AND BUILDING WORKFORCE

Chapter 17. Athenian architecture abroad in the fifth century: Fashion or imperialism? 248
Jacques des Courtils

Chapter 18. More on Athenian architecture abroad: Xanthos as a case study 255
Laurence Cavalier

Chapter 19. Contextualizing the scaffold: Workspace within cult space and the dynamics of construction sites at Delphi 261
Elena C. Partida

Chapter 20. Building procedures of the fortification at Kastraki on Milesian Agathonisi: Quarrying and construction sites as open-air provisional *ergasteria* 280
Konstantinos Sarantidis

REPAIR, RE-USE AND SPOLIA: CONCEPTS OF CHAÎNE OPERATOIRE

Chapter 21. Less piety, more pragmatics: Some diachronic observations on the re-use of Greek funerary monuments 296
Constanze Graml

Chapter 22. The practicalities of spoliation: Tool marks, craftspeople, and building logic 308
Anna M. Sitz

Chapter 23. Learning by ...? And learning what? Possibilities and limitations of chaîne(s) opératoire(s)-approaches using the example of the Elgin Lyre 326
Susanne Bosche

ACADEMIC APPARATUS

Abbreviations 355

Bibliography 357

Indices 410
Varia 410
Locorum 415
Personarum 418

List of Figures and Tables

Chapter 2

Figure 1: Marble copy of the Doryphoros from Pompeii ... 10
Figure 2: Athenian red-figure oinochoe from Capua, c. 470 BC ... 11
Figure 3: Fragment of a casting mould with fingerprints ... 11
Figure 4: Soft-fired lumps of clay with fingerprints from kneading. From the Athena Promachos workshop on the south slope of the Acropolis in Athens ... 11
Figure 5: Plan of the excavation at Amalias avenue in relation to the City Walls and Eridanos river ... 13
Figure 6: Building the casting pit for the experiment of the foundry institute of the RWTH ... 14
Figure 7: Cross-section of the casting pit at Murlo, Tuscany ... 15
Figure 8: Wax model with pouring channels and drains ... 15
Figure 9: Filling of the wax model with tamped clay ... 15
Figure 10: Experiment in Murlo, Tuscany: The innermost layer of fine clay is applied with a brush on the rear of the 'praying boy'-wax model ... 15
Figure 11: Experiment in Murlo, Tuscany: Heating and drying of the casting mould ... 16
Figure 12: Detail of the cast surface inside the shattered mould created by the foundry institute of the RWTH ... 16
Figure 13: Detail of the Athenian red-figure Foundry Cup, dating to the early fifth century BC ... 16
Figure 14: Area of the excavation at Amalias avenue ... 16
Figure 15: Area of the excavation with casting pit 4 at Amalias avenue ... 17
Figure 16: Sketch of the excavation with casting pits 2 and 3 at Amalias avenue ... 18
Figure 17: Area of the excavation with casting pit 4 at Amalias avenue ... 18
Figure 18: Clay crucible after a successful smelting experiment of the foundry institute of the RWTH ... 19
Figure 19: Detail of the excavation plan at Amalias avenue illustrating the different building phases ... 20
Figure 20: Plan of the workshop of Phidias at Olympia, showing a podium ... 21
Figure 21: Plan of the 'Promachos pit' on the south slope of the Acropolis at Athens ... 22
Figure 22: Demetrias, Anaktoron. Reconstruction of the working installations ... 22
Figure 23: Experiment in Murlo, Tuscany: The uncovered raw cast of the head ... 23
Figure 24: Experiment in Murlo, Tuscany: Wax model of the head with chaplets ... 23
Figure 25: Mould fragment from the workshop at Amalias avenue (X 6/OM 3718a) ... 24
Figure 26: Mould fragment from the workshop at Amalias avenue (X 2/336) ... 24
Figure 27: Experimental cast, Aachen. Part of the lower leg of the 'praying boy' with chaplets ... 24
Figures 28, 29: Funnel fragment from the workshop at Amalias avenue (X 2/ stroma 2/ OM 574a) ... 25
Figure 30: Fragment of a support from the workshop at Amalias avenue (X 4/OM 3487 b/13.2.13) ... 25
Figures 31, 32: Funnel fragment from the workshop at Amalias avenue (X 2/OM 581-11) ... 26
Figures 33, 34: Funnel fragment from the workshop at Amalias avenue (X 2/ OM 382) ... 26
Figures 35, 36: Gate fragment from the workshop at Amalias avenue (X 4/ OM 3487c) ... 27
Figures 37, 38: Support with clay core from the workshop at Amalias avenue (X 4 / OM 3487,2) ... 28
Figures 39, 40, 41: Three views of a lid from the workshop at Amalias avenue (X 2/OM 383) ... 28
Figure 42: Lid with plug from the context of the workshop on the Acropolis south slope ... 29
Figure 43: Reconstruction of a moveable crucible for melting bronze ... 29
Figure 44: Successful melting experiment with a crucible of clay and three bellow-pipes ... 29
Figure 45: Fragment of a crucible from the workshop at Amalias avenue (X 2/ OM 581e) ... 30
Figures 46, 47: Fragments of tuyères from the workshop at Amalias avenue ... 31
Figures 48, 49: Two views of a bellow-mouth from the workshop at Amalias avenue (X 6/OM 3721 Kb) ... 32
Figure 50: Mouth of a tuyère from the workshop at Amalias avenue (X 2/135) ... 32
Figures 51, 52: View and cross-section of a casting mould fragment from the workshop at Amalias avenue, mended of two pieces (X 4 / OM 2533st) ... 32
Figures 53, 54: View and cross-section of a mould fragment for casting a convex fold (Faltenrücken), from the workshop at Amalias avenue (X 4/ 3480a) ... 33
Figures 55, 56, 57: Two views and cross-section of a mould fragment for casting a fold, from the workshop at Amalias avenue (X 4/ OM 3480 a) ... 34
Figures 58, 59: Statue of Athena from the Hephaesteum, Athens ... 34
Figure 60: Small piece-mould for the end of a fold, from the workshop at Amalias avenue (X 4 / OM 3487 ib) ... 35
Figures 61, 62: View and cross-section of a mould fragment for a fold end, from the workshop at Amalias avenue (X 4 / OM 3492 B) ... 35
Figures 63, 64: View and cross-section of a mould fragment for a fold end from the workshop at Amalias avenue (X 4/ OM 3492 B form no. 3) ... 36
Figures 65, 66: Mould fragment from the workshop at Amalias avenue, and print in plasticine (X 6 / OM 3718a) ... 36
Figures 67, 68: Mould fragment of a finger from the workshop at Amalias avenue (X 7/ OM 3631 b) ... 37
Figure 69: Mould fragment from a working process from the workshop at Amalias avenue (X 2 / str. 4 – OM 581) ... 37
Figures 70, 71: Fragment of a small mould from the workshop at Amalias avenue (X 7/ OM 3956i) ... 38
Figures 72, 73: Lower side of small mould fragment with the imprint of a lip and the print of the mould in plasticine ... 38
Figure 74: Plaster cast of the mouth of the Athena Lemnia ... 38

Chapter 3

Figure 1: Map with the ancient sites referred to in the text ... 44
Figure 2: Athens, Agora: the 'Rubble Structures' with workshop remains east of the Panathenaia Street; fifth-fourth century BC ... 48
Figure 3: Rhodes, evidence of ancient bronze-statue foundries with casting pits, from the late fourth to the late first century BC ... 49
Figure 4: Athens, concentration of workshops south of the sanctuary of Dionysus ... 51
Figure 5: Argos, evidence of ancient craft activities from the Archaic to the Hellenistic period ... 53

Chapter 4

Figure 1: The environs of the Helike search area including the 1988 sonar survey ... 56
Figure 2: Drone photo of the four-tank unit and surrounding structures ... 58
Figure 3: Plastered channelling, detail ... 58
Figure 4: Plastered conical immersion vat ... 58
Figure 5: Drone photo of the dyeworks building complex ... 59
Figure 6: Clay basin north of the four-tank unit ... 59
Figure 7: Storage area showing the pithoi arrangement ... 59
Figure 8: Pithos with ancient repairs, details ... 60
Figure 9: Hellenistic pottery from the excavated building complex ... 60
Figure 10: Black-glazed, West Slope and ivy-decorated pottery sherds from the excavated building complex ... 61
Figures 11, 12: Stamped amphora handles from the excavated building complex ... 61
Figure 13: Relief pottery with figural scene ... 61
Figure 14: View of the dyeworks complex from the east, showing the polygonal stone footing of the walls ... 62
Figure 15: The room where stored lime was discovered, a consolidated sample remaining in situ ... 62
Figure 16: Fragment of a big terracotta roof tile preserving traces of blue-green colour ... 63
Figure 17: Conical and pyramidal loom weights from the excavated building complex ... 63
Figure 18: Specific plastered areas of the shallow tanks floors ... 64
Figures 19, 20: Stamped disc-shaped loom weights from the excavated building complex ... 64
Figure 21: Depiction of the flax plant on an inscribed vessel from the site of Kafizin in Cyprus ... 66
Figure 22: The flax plant *linum usitatissimum Linaceae* ... 67

Chapter 5

Figure 1: Olbia plan showing the three sacred zones location: 1. Western *temenos*; 2. Eastern *temenos*; 3. Southern *temenos* ... 70
Figure 2: Southern *temenos*: I. Late Archaic times. 1. Temple of Aphrodite; 2. *Bothros*; 3. Precinct; 4. Working place; II. Classical times. 5. Temple of Aphrodite; 6. Cisterns; 7. Precinct; 8. *Bothroi*; III. Preserved parts of the city-grid ... 71
Figure 3: Central part of the Late Archaic bronze/metal workshop. On the right, a Classical cistern ... 72
Figure 4: Early Classical ceramic kiln: 1. Level of destruction; 2. Foundation level; 3. South-Ionian bird-shaped plastic lekythos ... 73
Figure 5: 1: Western water cistern from the North; 2: Chian amphora; 3: base of Attic red-figure cup with dedication to Aphrodite ... 74
Figure 6: 1: Northern water cistern; 2: Attic black-glazed cup of the Delicate class; 3: shell of *Emys orbicularis* ... 75
Figure 7: 1: Amphora body at the top of the northern water cistern and under ceramic kiln, from the west; 2: Ceramic kiln and oven from the latest period of the workshop's lifespan, from the east ... 76
Figure 8: Stone moulds for the casting of lead votive objects: 1: Double-axe; 2: Herms. Lead items: 3: Female herm; 4: Male herm; 5-9: Bucrania; 10: Quadriga; 11: Earring; 12: Sword; 13: Nike and Heracles ... 78

Chapter 6

Figure 1: Location of *Fanum Martis* in its Roman context ... 80
Figure 2: Localities of various handicraft activities spread in the small Roman town during the second and up to the beginning of the fourth century AD ... 82
Figure 3a: Crushed bones discarded in a pool; 3b: Close-up view of the crushed bones ... 83
Figure 4: Intaglio in red jasper representing a *modius* with scales and bundles of wheat ... 84
Figure 5: Lime-kiln situated in the eastern part of town ... 85
Figure 6: Ritual obliteration (sealing) of a kiln flue by the deposition of a pot ... 86
Figure 7: Distribution of the Famars pottery production ... 87
Figure 8: Spatial arrangement of pottery kilns ... 87
Figure 9: Chart of the locally produced main pottery types ... 89
Figure 10: Potter's stamp reading *Nericcvs* ... 89

Chapter 7

Figure 1: Location of the excavations (*Technopôle* and Rhonelle) at *Fanum Martis* ... 93
Figure 2: View of the lime kiln at the *Technopôle* ... 94
Figure 3: Head of a satyr ... 94
Figure 4: Head of Apollo ... 95
Figure 5: Unidentified life-size figures ... 95
Figure 6: Fragments of a colossal statue of Apollo ... 95
Figure 7: Fragment of a dummy spear cast in bronze ... 96
Figure 8: 'Valenciennes Good-Stone' mining zone and diffusion area ... 96

Figure 9: General plan of the excavation at Douchy-les-Mines (ZAC des Prouettes) ... 97
Figure 10: Macroscopic view of limestone quarried at Douchy-le-Mines ... 98
Figure 11: Stratigraphic section of the Douchy-les-Mines quarry face ... 99
Figure 12: Limestone quarrying systems and location of workshops ... 100
Figure 13: Quarried blocks and failed or aborted pieces ... 100
Figure 14: Wall painting depicting architectural elements ... 101
Figure 15: Representation of Apollo *citharoedus* ... 102
Figure 16: Representation of a maenad ... 103
Figure 17: Representation of a temple in plaster ... 103
Figure 18: Reconstitution of the Temple of Apollo based on archaeological data ... 104
Figure 19: View of the lime kiln on the Rhonelle ... 104
Figure 20: Drawn reconstruction of the cithara based on finds amid the temple debris ... 105
Figure 21: Bronze cymbal ... 105
Figure 22: Statue finger of Carrara marble ... 106
Figure 23: Furniture applique representing Attis and Cybele ... 106

Chapter 8

Figure 1: Reconstruction of an ancient quarry by T. Koželj ... 111
Figure 2: Map of Naxos with the main quarry sites ... 112
Figure 3: Smaller than life-size, unfinished kouros K 21, Naxos Archaeological Museum ... 115
Figure 4: Unfinished kouros of Penteli ... 115
Figure 5: Unfinished marble kouros inv. ΜΠ 301, Archaeological Museum of Polygyros ... 115
Figure 6: Smaller than life-size unfinished kouros K 21, Naxos Museum ... 115
Figure 7: Unfinished marble kouros, Archaeological Museum of Polygyros ... 115
Figure 8: Unfinished kouros 17, Naxos Archaeological Museum ... 115
Figure 9: Unfinished kouros 17, Naxos Archaeological Museum ... 115
Figure 10: Unfinished kouros K 24, Naxos Archaeological Museum ... 115
Figure 11: Unfinished kouros K 37, Athens National Archaeological Museum ... 115
Figure 12: Unfinished kore inv. ΣΤΑ 1051 ... 115
Figure 13: Unfinished colossal kouros *in situ* at Pharangi, Naxos ... 117
Figure 14: Unfinished colossus *in situ* at Phlerio, Naxos ... 117
Figure 15: Unfinished colossal Dionysus *in situ* at the Apollonas quarries, Naxos ... 117
Figure 16: Unfinished kore inv. ΣΤΑ 1051, Archaeological Museum of Polygyros ... 117
Figure 17: Unfinished crouching lion-statue from Pentelicon ... 119
Figure 18: Unfinished lion-statue, from Vathy, Samos ... 119
Figure 19: Unfinished sphinx-torso inv. 6529, Naxos, Naxos Archaeological Museum ... 119
Figure 20: Part of a building above the inscription Ὅρος ἱεροῦ Ἀπόλλωνος, Apollonas quarries, Naxos ... 119

Chapter 9

Figure 1: Map of Nisyros island ... 126
Figure 2: Fragments of 'Olynthian' handmills from Halasarna, carved in Nisyrian lava ... 127
Figure 3: Traditional stone-built cottage ('*spiladhi*'), Argos ... 128
Figure 4: Unfinished 'Olynthian' handmill, Argos ... 129
Figure 5: 'Olynthian' handmill, Argos ... 129
Figure 6: Series of wedge-holes, Argos ... 129
Figure 7: Quarry-front and extracted blocks left *in situ*, Argos ... 129
Figure 8: Pole-hole close to the quarry, Argos ... 130
Figure 9: Entrance to the underground quarry close to Agia Eirene ... 130
Figure 10: Tunnel/Gallery of underground quarry close to Agia Eirene ... 131
Figure 11: Soft pyroclastic rock inside the underground quarry ... 131
Figure 12: Interior of the cave underneath the Drakospilo tower ... 132
Figure 13: Foundation of the Drakospilo tower ... 132

Chapter 10

Figure 1: Map of places referred to in relation to Heracles reliefs or inscriptions ... 136
Figure 2: Corinth, the Isthmus. The Heracles relief in the middle ... 137
Figure 3: Corinth, the Isthmus. Heracles relief ... 137
Figure 4: Prosilion, Roman aqueduct of Gytheion. The eastern Heracles relief ... 138
Figure 5: Prosilion, Roman aqueduct of Gytheion. The western Heracles relief ... 138
Figure 6: Vatheia Mouzi. The site and Heracles relief ... 139
Figure 7: Vatheia Mouzi. Heracles relief ... 139
Figure 8: Asopos. Part of the quarry, Heracles relief in the middle ... 140
Figure 9: Asopos. Heracles relief ... 140
Figure 10: Thasos. Heracles relief ... 140

Chapter 11

Figure 1: Location map of Roman towns and alabaster quarries in Tunisia ... 147
Figure 2: Location map of Roman towns and alabaster quarries in northern Tunisia ... 148
Figure 3: Geological sketch map of Jebel Oust ... 148

Figure 4: Alabaster and grey limestone quarries in Jebel Oust. a: open-air quarry of alabaster and grey limestone; b: underground alabaster quarry 149
Figure 5: Alabaster varieties from Jebel Oust. a: first alabaster variety; b: second alabaster variety; c: third alabaster variety; d: fourth alabaster variety; e: fifth alabaster variety 150
Figure 6: Alabaster and grey limestone quarries in Jebel Rouas and Jebel Ben Klab. a: alabaster and grey limestone quarry; b: heap of rock debris in the quarry area; c: alabaster and grey limestone quarry; d: visible extraction marks 151
Figure 7: Alabaster varieties from Jebel Rouas. a: first alabaster variety; b: second alabaster variety; c: third alabaster variety; d: fourth alabaster variety 152
Figure 8: Map of the alabaster quarries in Jebel Saïkha 153
Figure 9: Alabaster quarries in Jebel Saïkha. a: view of the third alabaster quarry; b: marks of alabaster extraction in the second quarry; c: extraction traces of a column-shaft 155
Figure 10: Alabaster varieties from Jebel Saïkha. a: first alabaster variety; b: second alabaster variety; c: third alabaster variety 156
Figure 11: Alabaster varieties from Bou Gaba (rural site), *Meninx* and *Gigthi*. a: small alabaster blocks in the rural site of Bou Gaba; b: first alabaster variety (*Meninx*); c: second alabaster variety (*Meninx*); d: third alabaster variety (*Meninx*); e: fourth alabaster variety (*Meninx*); f: alabaster variety (*Gigthi*) 157
Figure 12: Alabaster varieties from the Roman archaeological sites. a: first alabaster variety (*Thuburbo Maius*); b: second alabaster variety (*Thuburbo Maius*); c: alabaster variety (Oudhna); d: alabaster variety (*Ziqua*); e: first alabaster variety (Carthage); f: second alabaster variety (Carthage); g: alabaster variety (Dougga); h: two alabaster varieties (*Bulla Regia*) 158
Table 1: Sizes of the underground quarries 150
Table 2: Sizes of the quarries 154
Table 3: Sizes of cut and pre-cut blocks and column-shafts 154
Table 4: Data on the alabaster varieties from the quarries of Jebel Saïkha and from the visited ancient archaeological sites in the region of Medenine 159
Table 5: Data on the alabaster varieties from the quarries of Jebel Oust, Jebel Rouas, Jebel Ben Klab and from the visited archaeological sites of the ancient towns 160
Table 6: Distances between the quarries and the ancient archaeological sites 161

Chapter 12

Figure 1: Portrait head of an unidentified Roman Youth, from Rome 166
Figure 2: Sculptor Matthew Simmonds carving a detail of the Roman Youth with a point-chisel while comparing to the surface of the original 167
Figure 3: Special-effects maker Per Kapper, from Kappercreations, applying layers of paint onto the marble 168
Figure 4: Painted marble copy of the Roman Youth 168
Figure 5: Detail of the painted marble copy showing areas where Egyptian blue grains are visible to the bare eye as small, black spots 168
Figure 6: Detail of the painted marble copy showing the glossy shine of the polished marble working its way through the painted layer adding lustre to the finish 168
Figure 7: Carnelian ring-stone 170

Chapter 13

Figure 1: Tripod pithoi or pithos-shaped vessels used for inhumations and cremations 176
Figure 2: Tripod pithoi or pithos-shaped vessels used for inhumations and cremations 177
Figure 3: The sealing of the pithos's *stomion* 179
Figure 4: Strengthening the outer walls of the pithoi 180
Figure 5: Pithos external offerings 181
Figure 6: Typological classification of the pithoi from Stamna 182
Figure 7: Protogeometric/Geometric presence in Aetolia-Acarnania to date 184
Figure 8: Typological classification of the pithoi from Stamna 185
Figure 9: Distribution of burial clusters in Stamna. Shape and size vary based on a) the quantity of pithoi; b) the quantity of pithoi and their relative proportion in each category 189
Figure 10: Tripod pithos 191
Figure 11: Storage pithoi 192
Figure 12: Pithoi with vertically positioned bases 192
Figure 13: Entry of the deceased into the pithos after the removal of its wall 193
Figure 14: Small, handcrafted vessel Π170/1, with rope ornament and impressed decoration 195
Figure 15: Pithos with plastic decoration 195
Figure 16: Pithos with impressed decoration 196
Figure 17: Pithos 45/99 that bear signs of repairs 198

Chapter 14

Figure 1: Greek *poleis* of Magna Graecia during the Archaic period 202
Figure 2: *Kourotrophoi* from Poseidonia and Tarentum 204
Figure 3: Clothed and naked dedicants from Metapontum and Poseidonia 205
Figure 4: Female type adapted into two variants from Metapontum 206
Figure 5: Female types from Locri 206
Figure 6: Female figurines with mortise-and-tenon system or related, from Croton and Metapontum 207

Figure 7: Enthroned female type with hand-made headdress from Metapontum 207
Figure 8: Female figurines in a warlike gesture and representing a *potnia theron* from Sybaris and Metapontum 208
Figure 9: *Acroteria* from Tarentum 209
Figure 10: Female figurine in a warlike gesture and enthroned female figurines from Poseidonia 210
Figure 11: Female mixed-technique figurines from Locri 211

Chapter 15

Figure 1: The area of Ano Petralona in Athens, west of the Hills to be linked by routes for visitors 215
Figure 2: Athens. The spread of different archaeological sites excavated in the area of Ano Petralona 216
Figure 3: Athens, the '*odos dia Koiles*'. View from the East 217
Figure 4: The Koile Fountain, Ano Petralona 219
Figure 5: The Munich hydria depicting a workshop scene, attributed to the Leagros Group 219
Figure 6: Junction of Dimofontos and Dorieon streets, Ano Petralona. General view of the excavated walls 221
Figure 7: 15 Dorieon street, Ano Petralona. A bronze-casting workshop 221
Figure 8: Junction of Dorieon and Troon streets. View of the cisterns 222
Figure 9: 111-113-115 Dimophontos street, Ano Petralona 223
Figure 10: 36 Dryopon street, Ano Petralona. Plan of the excavation with an ancient road running to the South 223
Figure 11: 36 Dryopon street, Ano Petralona. Ancient road surface and retaining-wall 224
Figure 12: 6 Tellou street, Ano Petralona. Ground-plan of part of the excavation 224
Figure 13: 6 Tellou street, Ano Petralona. Vitrified clay pieces 225
Figure 14: 6 Tellou street, Ano Petralona. Miniature *situla* 225
Figure 15: 159 Trion Hierarchon street, Ano Petralona. Plan of the excavation 225
Figure 16: 159 Trion Hierarchon street, Ano Petralona. Kiln 2, with shattered vases *in situ* 226
Figure 17: 159 Trion Hierarchon street, Ano Petralona. Clay ring with the letter E (epsilon) 226
Figure 18: 159 Trion Hierarchon street, Ano Petralona. Kernos A 21872 227
Figure 19: 159 Trion Hierarchon street, Ano Petralona. Kernos A 21877 227
Figure 20: 159 Trion Hierarchon street, Ano Petralona. Kernos bowl A 21882 227
Figure 21: 10 Valavani street, Ano Petralona. Vases from the workshop area 228
Figure 22: Junction of Aioleon and Psamathis streets, Ano Petralona. General view of the unearthed walls 228
Figure 23: Junction of Aioleon and Psamathis streets, Ano Petralona. Loom-weight with the letters 'ΓΑΥΚ' stamped on it 229

Chapter 16

Figure 1: Pottery workshops in the Apennines and the surrounding plains between the ninth and the fifth century BC 232
Figure 2: Infrastructural embedding of pottery workshops in their socio-natural networks. View of the Reno Valley from the plateau at Marzabotto 236
Figure 3: Several workshops north of the Apennines were located in the Secchia Valley, which was rich in raw materials and constituted a natural route toward the Apennines 236
Figure 4: Distribution map of the vacuolated pottery, strigilated and impressed pottery 238
Figure 5: *Knowledgescapes* as 'ResourceComplexes' 242
Figure 6: Diachronic evolution of *knowledgescapes* in pottery workshops 243
Table 1: Workshops in the region of the Northern Apennines (seventh to fifth centuries BC), with bibliography and particular features: (k) number of kilns, (ph) phases, (O) round kilns, (R) rectangular kilns, (Y) wall-trace deviating the kiln mouth, (C) stone closing the front of the kiln mouth, (H) cylindrical stand, (•) perforated floor, (D) dolium fragments as structural parts, (U) working pit in front of the kiln mouth, (W) simultaneous work at different, adjacent kilns, (p) system of water-pipes or channel, (T) roofed area, (X) cleansing rituals 234
Table 2: Distribution of impressed (X), vacuolated (v) and strigilated (s) pottery, with bibliography 239

Chapter 17

Figure 1: Delos, Temple of the Athenians: T-clamp 250
Figure 2: Argos, Heraeum, South Stoa: orthostates of the east wall 251
Figure 3: Argos, Heraeum, South Stoa: T-clamp of the north wall 252
Figure 4: Argos, hypostyle hall: orthostates of the south wall 252
Figure 5: Argos, hypostyle hall: T-clamp of the south wall 252
Figure 6: Thasos, Temple of Athena: T-clamp in the foundations 253

Chapter 18

Figure 1: T-dowel: Nereid monument, block no. 631 258
Figure 2: Fragment of an Ionic capital from Limyra and drawing of an Ionic capital from the Erechtheum 259

Chapter 19

Figures 1, 2: East pediment of the Siphnian treasury, Delphi 264
Figure 3: Triangular pillar drums, Delphi 265
Figure 4: Proposed 3D rendering of the Apollo temple under construction, by John Goodinson 267
Figure 5: Plan of the sanctuary of Apollo at Delphi 268
Figure 6: Proposed 3D reconstitution of niche (atlas *230) and the Siphnian treasury under construction, by John Goodinson 268

Figure 7: Locality of niche (atlas *230) in Apollo sanctuary, Delphi. St Elias cemetery and buttressed wall visible in the background ... 269
Figure 8: 'Agia Barbara' between Delphi and Chrisso. Aerial view of the excavated site ... 270
Figure 9: 'Agia Barbara' between Delphi and Chrisso. View of polygonal retaining-wall ... 270
Figure 10: Trail connecting Kirrha with the Apollo sanctuary, passing by the Mycenaean citadel at Chrisso and Agia Barbara ... 271
Figure 11: Ancient buttressed wall at the modern St Elias cemetery, Delphi ... 272
Figure 12: Topographical diagram of the acropolis at Molykreion ... 273
Figure 13: Aerial view of the stoa beside the temple at Molykreion ... 273
Figure 14: Sites discussed in the paper, plotted on Google Earth map ... 274
Figure 15: Unfinished column-drum at Kirrha ... 276

Chapter 20

Figure 1: Topographical plan of the fortification at Kastraki on Agathonisi ... 283
Figure 2: Photo and drawing of the inv. K644 incised roof-tile from Kastraki on Agathonisi ... 284
Figure 3: Isometric restoration proposal of the tower and the fortification on terrace 1 at Kastraki, based on the architectural remains and the incised drawing on the roof-tile inv. K644. View from the southwest ... 284
Figures 4, 5: Carved wedge-holes at Kastraki, 4: series of wedge-holes on terrace 1, and 5: wedge-holes positioned at right angles on terrace 2 ... 287
Figures 6, 7: Carved pole-holes at Kastraki, 6: terrace 1, and 7: terrace 2 ... 288
Figures 8, 9, 10: Artificially leveled surfaces, 8: terrace 2, 9: terrace 3, and 10: quarried shoreline ... 290
Figure 11: Kastraki from above in 2010. Notable is the artificial rectangular shape of terrace 1 ... 292
Figure 12: Terrace 3. South fortification wall section sampling and stone quantification: exterior face and interior face ... 292
Figure 13: Terrace 1. Tower's north wall sampling and stone quantification ... 293
Table 1: Stone classification ... 286
Table 2: Stone quantification ... 289
Table 3: Labour estimate ... 291

Chapter 21

Figure 1: The funerary monuments discovered at the Sacred Gate in the Kerameikos at Athens, *in situ* ... 299
Figure 2: Wall 8 of the *temenos* walls of the Artemis Soteira sanctuary in the Kerameikos at Athens showing the immured body of a funerary lekythos ... 300
Figure 3: Palmette stele of the Koroibos precinct in the Kerameikos at Athens ... 300
Figure 4: Architrave of the Korallion relief, kept in the Kerameikos Museum in Athens ... 301
Figure 5: Grave stele of Krito and Timarista, kept in the Archaeological Museum of Rhodes ... 301
Figure 6: Grave stele of Krito and Timarista, detail ... 302
Figure 7: The so-called Charon relief with its foundation exposed ... 302
Figure 8: The Hydrophoros relief, with rubble-stone foundation, overlaying a stone cist grave ... 303
Figure 9: The so-called Albani rider relief ... 304
Figure 10: Diagram of the outlined in the text potential chaînes opératoires while re-using funerary monuments ... 305

Chapter 22

Figure 1: Plan of Labraunda ... 312
Figure 2: Labraunda. Interior of Andron A with marked find-spot of block M02 (*I.Labraunda* 137) ... 313
Figure 3: Labraunda. Top view of block M02 (*I.Labraunda* 137) ... 313
Figure 4: Labraunda. Side view of block M02 (*I.Labraunda* 137) showing the quarrying channel ... 314
Figure 5: Labraunda. Close-up view of the quarrying channel on block M02 (*I.Labraunda* 137) ... 314
Figure 6: Labraunda. Aerial view of Andron A and the Oikoi ... 315
Figure 7: Labraunda. Collapse of the Oikoi dome ... 315
Figure 8: Burdur Museum. Baptistery from Uylupınar ... 316
Figure 9: Burdur Museum. Inscribed spolia (*I.Mus. Burdur* 184) in the baptistery from Uylupınar ... 316
Figure 10: Claros. Column-drum with cavity opened by diggers for metal clamps, who missed the spot ... 318
Figure 11: Claros. Column-drum with cutting for metal wedge ... 318
Figure 12: Claros. Column-drum re-cut on two sides into a cubic shape, with visible guideline for the continuation of the re-cutting ... 319
Figure 13: Corycian Cave (Cilicia) Clifftop Temple-Church. Ground plan ... 320
Figure 14: Corycian Cave (Cilicia) Clifftop Temple-Church. View to the east ... 321
Figures 15, 16, 17: Corycian Cave (Cilicia) Clifftop Temple-Church. View of the northeast *anta* ... 322

Chapter 23

Figure 1: Today's exhibition of the Elgin Lyre, kept in the British Museum, London ... 327
Figure 2: Reconstruction of the Elgin Lyre by the team led by Conrad Steinmann ... 329
Figure 3: Visualisation of a chaîne opératoire as a simple 'chain' with chain-links representing single work-steps and/or components ... 330
Figure 4: Visualisation of a chain-link as *Assoziator* (without relation between lower-graded *Assoziators)* ... 333
Figure 5: Visualisation of a chaîne opératoire as a simple 'chain' with chain-links related to preserved and lost components ... 336
Figure 6: Visualisation of a chaîne opératoire as a simple 'chain' with chain-links embedded into a web of external relations ... 341

Figure 7: Drawing of the connection between the yoke and the left-side arm 342
Figure 8: Visualisation of three ramified forms of a chaîne opératoire with ramifications realised by the contact points of the chain-links (a), by extension factors/external web (b), and both the above (c) 343
Figure 9: Visualisation of a chaîne opératoire as a simple 'chain' with extensional webs around the single chain-links, several chain-links tying them together and the whole chain 352

Chapter 1
ΕΡΓΑΣΤΗΡΙΑ
Premises and Processes of Creation in Antiquity
An Introduction

The globalised state of modern, industrialised production systems was challenged in multiple ways during the pandemic years – as was the production of this book, too. Everyone was accustomed to a nearly instant and, irrespective of seasonality, availability of raw materials and final products, taking for granted the unhindered transfer of both goods and professionals/specialists involved in their development; all of a sudden, with the whole world almost put on pause, the modern just-in-time-production, relying on a prompt transportation system, reached its limits. During the same period, the incident with the container ship 'Ever Given', which carried goods from China to the Netherlands in order to supply the whole of Europe but, instead, blocked the Suez Canal for six full days, demonstrated anew the tight-knit economic global networks: other container vessels were caught up in a traffic jam waiting in the Mediterranean and the Red Sea or had to re-chart their route, circumnavigating the African continent.[1] Thereby the chains of production were affected at a global level, production rates were reduced and certain products, such as the pharmaceutical ones, became scarce commodities. On a smaller scale, the state of seclusion ('under house arrest') incited people to focus on home production. In Germany, for example, the habit of making pastries grew so excessive that the purchase of flour had to be limited to a certain amount per capita and yeast was sold out for many weeks. By contrast, in Greece the unprecedented purchase rate of bicycles and rackets via the internet shows a sudden turn to physical exercise, apparently as a means of evading or escaping the imposed seclusion. Having not foreseen such circumstances, our call for papers, publicised in January 2020 with the aim to explore the multiple facets of production and production sites in antiquity, received additional and unexpected food for thought, especially due to this exceptional worldwide experience.

The contributions compiled in this collective volume provide a kaleidoscopic insight into different aspects of creation, artistry, craftsmanship, manufacture and processing in antiquity. The comprehensive bibliography assembled at the end of the volume bears witness to the wide range of topics discussed and the various approaches attempted. Effortlessly this book brings forward the interlacing and intersection of evidence, as well as the confluence of observations, which automatically enhance the validity of an interpretation. Instead of summarising all contributions in a linear fashion, which would recreate the sequence of the table of contents, we prefer to outline/delineate here our quests and considerations while preparing this book, and to allow the keynote benefit from each author's perspective to interlock and intertwine. It becomes obvious that every author's multifaceted optics yield a proportionate amount of remarks and conclusions; as a whole, these eventually empower our further understanding.

Setting out to shed light on ancient production, our knowledge is certainly patchy, since the topic is vast in its complexity. Production did not take place only in specialised workshops or worksites, but also within the walls of a household, since self-sufficiency in at least some aspects was necessary. On the other hand, craftsmanship on a trading scale or for public use would be expected to be reflected in the size of the respective production places, without necessarily meaning that their remains would be more durable or traceable in archaeological terms.

Ateliers of renowned creators, such as the one of Phidias at Olympia are rare finds and illuminate the process of creation at a given time, for a particular and widely known end-product. The same cannot be asserted for Scopas' or Exekias' workplace – much less for the sheds of anonymous craftsmen, who nevertheless created masterpieces in all sorts of materials. Although they all originated from a certain cultural background and were nurtured in a certain regional tradition, they were also exposed to and receptive of influences, as we shall see. Regardless of their fame or recognition,[2] craftsmen

[1] Cf. contemporary with the incident articles in the Washington Post <https://www.washingtonpost.com/world/2021/03/31/suez-shipping-crisis-coronavirus/> (latest accessed 30 January 2023) and by the Rotterdam School of Management, Erasmus University <https://www.rsm.nl/discovery/2021/opinion-suez-blockage/> (latest accessed 30 January 2023).

[2] Among the recent writings of our erudite teacher, Andrew F. Stewart, was his approach to the ancient sculptor's social standing, the recognition/reputation and reimbursement he may have earned, and the change to his social rank entailed by the acquisition of land

reflect contemporary society, being in dialogue with its values, its symbolism and evolution, and eventually expressing all the above. The authors of this volume converge in discerning a dialectic relation between tradition and innovation, with the introduction of new techniques, ideas and styles being a catalyst in making progress.[3]

It is always intriguing to view craftsmen and artists in their social and geopolitical setting. For instance, the Achaean goldsmiths and the stonecutters who specialised in funerary stelae represent not only the artistic production in Late Hellenistic Patras and Dyme but, furthermore, the cultural background of the Achaean League, a famous political and military confederation. Moreover, the two specialties are likely to have collaborated in a 'post mortem honour' industry. The vegetal scrolls carved on grave stelae and typifying them as a local West Greek production recur in golden diadems from funerary context in the same area. Reasonably the stone moulds for this motif were crafted by the same indigenous stonecutters/sculptors. Those ateliers in Achaea were succeeded in the Roman Republic and Imperial period by local industries of glasswork (probably fabricating also window panes), mosaics and sarcophagi, as suggested by particular motifs, designs and unparalleled forms. The whereabouts of their facilities are gradually being discovered. On the other hand, cases of large-scale production of foodstuff, pharmaceuticals, clothing or building material, which did not require a 'head of design'-artist (much less a master developer), are also very scarcely known; for this reason, the discovery of ancient 'processing quarters', e.g. for fish sauce in Andalusia[4] or flour production in southern France[5] shed some light on the sophistication of these workplaces in terms of ergonomics and economics.

If indeed, as usually postulated, workshops within religious premises were provisional modest shacks made of perishable material, the possibilities of their preservation and, consequently, of a fair reconstitution of their original appearance is minimised. Often the only traces left behind are stone flakes, abort or unfinished products, and very seldom architectural remnants of the building itself. The supposedly (often) ephemeral nature of workplaces contrasts the sense of endurance and permanence given out by the artefacts created inside them.

The fact that such workshops produced ritual vases alongside tableware, considered together with the frequent multi-functionality of a workshop's components, suggests the lack of 'labels' and – instead – the flexibility and adaptability of both the artisans and their installations. The case of a polyvalent and, at the same time, specialised workshop is highlighted by **Alla V. Bujskikh** at Olbia Pontica, where an open-air production space operated for almost two centuries within a sanctuary. Three workshops successively replaced each other on the same spot, involving different handicraft activities and probably serving rituals pertinent to the worship of Aphrodite.

Turning now to an urban setting, spaces of production were not always separated in districts defined as 'industrial'. Nor were they always marginal. In Paros, boundary stones demarcated a cluster of workshops[6] in a sort of a suburban quarter distinct from the settlement. In Miletus, in the late sixth century BC, a metallurgical and a potters' workshop were installed on the acropolis of Kalabaktepe, whereas, at the harbour, the area of the temple of Athena has yielded storage spaces along with traces of a goldsmith's workshop.[7] Clazomenae saw a bronze-foundry and an oil-mill operating at the same time in the city centre, near a river.[8] The term Kerameikos, used in ancient Athens and Selinus eloquently shows the designation of an urban district to pottery production. With regard to the use of urban space and the legal aspects of landownership in ancient Athens, **Gerhard Zimmer** elaborates on an Athenian atelier/worksite probably of some master bronze-sculptor. The sophisticated work installations and tools unearthed below modern Amalias avenue in Athens attest to the fact that material culture forged the advance of immaterial civilisation and the advance of knowledge. Bronze foundries in fifth-century BC Athens were the birthplace of subtle notions regarding beauty and aesthetics, proportions and harmony, rules and norms which perfected the statuary, as well as its impact. The mastery of modelling in bronze evolved from coping with constraints and obstacles throughout the work in the foundries. In this respect, bronze casters should be ranked as creators.

Obviously advantageous for a workplace was its proximity either to the source of material or to overland or maritime routes, which would facilitate its distribution. Transportability of raw materials in itself formed part of a wide operational network (réseau

property (Stewart 2019). Although Andrew's untimely departure bedimmed our hearts, his excellence in understanding and reconstructing the Past will continue to illuminate our path in this direction.

On the 'Meisterforschung' (Meister, αρχιτεχνίτης, μάστορας), methodological advantages and limitations, with emphasis on the role of every artist/craftsman within the society, expressing societal values, etc.: Borbein 2005.

[3] Particularly on the values established through creation processes, see Hochscheid and Russell 2021.

[4] Cf. at Baelo Claudia: Bernal-Casasola *et al.* 2021.

[5] Cf. at Barbegal watermill complex: Leveau 2007.

[6] Papadimitriou 2018.

[7] Verčík 2017.

[8] Cevizoğlu and Ersoy 2016.

opératoire). About the shipping of purple dye across significant distances and possibly through the agency of travelling professionals, experts in dyeing, we learn from inscriptions of the second/third century AD, which also illustrate the distinguished social status of purple workers.[9] In Hierapolis of Phrygia, an individual named Marcus Aurelius, son of Alexandros Moschianos, was commemorated on his gravestone as 'a member of the civic council and purple dealer' (πορφυροπώλης).[10] The dyeing installation at late Classical/Hellenistic Helike, presented by **Dora Katsonopoulou**, profited from its vicinity to the shore of the Corinthian Gulf, especially since it represents a professional and commerce-oriented industry, rather than a family enterprise, and therefore it affected the economy of the entire society.

In terms of spatial arrangement, **Giorgos M. Sanidas** explores how a workshop's location with reference to the overall site-plan brings forward parameters, such as the nuisance generated, for example, by a bronze foundry, which could be intolerable, depending on its operational duration but, mostly, on what it neighboured. Obviously the planting of a shoemaker's atelier and shop near a street in the Athenian Agora caused no nuisance from a sensorial perspective. Interlaced with the location of an atelier, and decisive as to whether this could be afforded within urban environs (*intra urbem*), is the noise, the smell, the fumes and other annoying or unhealthy side-effects of the fabrication process.

Nevertheless, the possible localities of workshops seem to be unlimited and, to a certain extent, determined by the purpose and needs they met. The Late Classical pottery kiln excavated in the valley of ancient Dyme in Achaea was established within a short distance from two necropoleis of the Classical/Late Classical period. An ensemble of red-figure vases of the fifth and fourth century BC, found as grave-offerings in these two cemeteries, is considered by the excavator Vassilis Argiropoulos to have been produced by a local Achaean workshop active in the countryside of Dyme, near the borderline with Elis. Moreover, these vases bear recognisable influence from South Italian ceramic workshops and especially those of Apulia with a tradition in red-figure vase-painting. To verify the plausible assumption that these funerary vases (from the outset meant to furnish graves) were fabricated in the aforementioned kiln, archaeometric and laboratory analyses of clay are being conducted.[11] Established also near a cemetery at the end of the Classical/beginning of the Hellenistic period was a workshops' quarter at Xobourgo (Tenos in the Cyclades), equipped with a pottery kiln, metallurgical pits, probably a stoa and other constructions.[12] Early on, in the Aegean islands a studio of sculptors or stonecutters could be set up literally on the site of a marble quarry.

This brings us to the very beginning of creation, namely the extraction of material, ranging from volcanic stone for the manufacture of mills on Nisyros in the Dodecanese (presented by **Eirene Poupaki**), to alabaster in Tunisia for architectural elements (investigated by **Ameur Younès**). Studies on the premises of quarries and other infrastructural worksites reveal also traces of cult[13] via relief representations of Heracles (perhaps an allegoric visual connotation of the 'heroic' power required for the extraction and manoeuvring of stone blocks) besides aspects of management and administration. The subsumption of quarries under governmental control in the Roman period hints at their evaluation as a natural source with repercussions upon the accomplishment of public works (**Georgios Doulfis** in this volume). As regards the actual process of creation and the synthesis of the workforce, quarries in the Cyclades – already in the Archaic period – were manned with specialised stonecutters and sculptors, who carved the marble volumes to an advanced degree, prior to their ultimate refinement (**Georgia Kokkorou-Alevras** in this book).

That the craftsmen made progress *in situ*, while inventing ways to overcome obstacles in the process of making is inferred from the 'blueprint', the guidelines for quarrying in northern Gaul (**Raphaël Clotuche, Damien Censier** and **Sabine Groetembril** in this volume). Cuttings and marks in those open-air workshops indicate a methodical planning of the activity, credited to the input of skilful and experienced quarrymen. The subsequent change of technique with the quarrymen working at different levels/floors enabled them to choose from the stone vein and to cut out blocks of the desired consistency and dimensions.

The backstage of the erection of a colossal sculpture is elucidated, when we take into account the excessive amount of work accomplished at the quarry. **Georgia Kokkorou-Alevras** walks us through the entire procedure, also comparing between techniques implemented in different periods. We actually watch an artefact evolve through the creator's eyes. Examples of what a sculptor faced in case of faulty material,

[9] The overall importance of textile production is reflected in the administrative/managerial texts, often also with religious connotations, already in the Bronze Age; see Michel and Nosch 2010, whose edited volume covers the Bronze Age Near East and eastern Mediterranean.

[10] Gambash *et al*. 2022. We are thankful to Gil Gambash for willingly allowing us access to his team's research when libraries were out of reach, due to the covid-19 crisis.

[11] In the Geology Department of Patras University. Argiropoulos 2017: 55-57; Argiropoulos 2021: 231-234.

[12] Kourou 2023 and 2024.

[13] As we are writing this, a brand new publication is released on the topic: Gatto and Van Haeperen 2023.

for instance, and how this could have impeded the completion of his work, provokes the reader's empathy for the craftsman and thus adds a sentimental dimension to our book. Unfinished/ἡμίεργα sculptural works preserve marks and guidelines analogous to those we observe on architectural blocks. So, this essential first treatment by stonecutters within the confines of a quarry, which was much more advanced than a preliminary roughening, may be extrapolated on the shaping of architectural elements, too. Subtle technical details, such as the double incision outlining the body-form, suggest that figures were sketched by incision before the carving process commenced. Indicative of the diligent preparatory work is the sketching of a statue's outline on the rock-face of the quarry before the marble piece/block was even extracted, no different from the aforementioned 'blueprint', which guided the cutting of blocks at the quarry of Famars (**Raphaël Clotuche, Damien Censier** and **Sabine Groetembril** in this volume).

Open-air workshops, that is, the workshops of the stonemasons who carried out large-scale public projects, such as the building of temples or fortifications, have so far been overshadowed by the respective monuments' grandeur. Particularly the interaction of artists, architects and workforce in general, traceable especially in major sanctuaries, adds a new dimension to the exchange and dissemination of ideas and technical expertise. Throughout the centuries, the mobility of craftspeople – including builders and other specialities – propelled the diffusion of knowledge, the improvement of techniques, the evolution of 'the making'. By juxtaposing the architectural setting and spatial arrangement at Delphi to epigraphic testimonies and material comparanda also from other Classical sanctuaries, **Elena C. Partida** unfolds the immense potential of worksites operating in parallel, their interlocking, cases of merged crews, and the meticulous pre-planning in a major temenos. Considering that monumentality was a common denominator in public, religious, civic or military building programs, the need for a detailed drawing up of the ergonomics in advance was intense. The logistics of a different large-scale building operation, namely the erection of defensive walls on Agathonisi in the Dodecanese, is analysed in depth by **Konstantinos Sarantidis**, who starts from calculations about the necessary manpower, the timeline and budget, also taking into account the available building material, the volume and extent of construction, the levelling of the terrain, etc. Quantitative estimates of this sort allow us to trace the organisation of an open-air stonemasons' workshop. Preparation was an entire process, which preceded the materialising process. By approaching the building procedures at different sites, however, we realise that adjustments were made as required and solutions were improvised on the spot.

Likewise adaptive were the craftsmen in the Roman town *Fanum Martis* in Gaul (Famars in northern France), who – confident in the quality of their raw materials, fabrics and techniques – developed a management system efficient enough to meet the demands of regional, as well as long-distance, trade. Their advanced level of production control and specialisation (analysed by **Raphaël Clotuche, Sonja Willems, Jean-Hervé Yvinec, Marie Derreumeaux, Jennifer Clerget, Nicolas Tisserand, Bérangère Fort** and **Gaëtan Jouanin**) is ascribed to a long-standing tradition, originally brought to the north by Mediterranean potters. Primarily due to its variety in productions, *Fanum Martis* evolved into a centre of processing and distribution, with a pivotal role in the economy of northern Gaul. Handicraft activities were dispersed across the urban tissue, with no particular sector allocated to a specific craft. Differently laid out but equally active commercially, *mutatis mutandis*, was the potters' quarter at Ano Petralona in Classical Athens (illustrated by **Marilena Kontopanagou**). It consisted of clusters of workshops within a short distance from the urban centre of public life. Its location in proximity to the city walls[14] and the harbour, therefore to transportation routes, facilitated the circulation of its products across a broad market beyond the city, as far as the Greek colonies.

Is it possible for a workshop to reflect the current society even if no physical remains of the actual working place have been preserved? Going back to the early historical phases (the Protogeometric period), a variety of pithoi from the settlement of Stamna in Aetolia, presented by **Gioulika Christakopoulou** and **Helene Simoni**, attest to the existence of multiple techniques and specialised knowledge in producing ceramics of the particular typology. The pithoi seem to have evolved from storage vessels to funerary containers (coffins), being adapted to demand. Besides the production structure of this early settlement, the pithoi reveal facets of the concurrent cultural background: their possession by specific individuals indicates resource management, while the transition in their use implies some significance to be set against religion and society in Iron Age western Greece.

Moving further west, in a colonial ambience, we are transferred to a workshop of terracotta figurines in Archaic Magna Graecia,[15] featuring the typical

[14] Noteworthy at this point is the recent work by Vincenzo Capozzoli (2024), who traces the layout of *demes* in relation to the city walls, even the enigmatic ones, traceable via indirect testimonies rather than physical finds.

[15] On the topic, and artisanal production in general, see the just published volume edited by De Cazanove *et al.* 2023b.

combination of the mould technique with manually crafted/shaped parts. **Eukene Bilbao Zubiri** brings forward the richness and diversity of practices employed by the coroplasts, which allow us to grasp the plurality in expression, but also in the synthesis of the population. The perseverance or co-existence of traditions, the codification of the imagery/iconography with religious connotations and, eventually, the different trends, stylistic influences and mixed techniques are taken to mirror cultural processes in a multicultural society. Local traditions and knowledge seem to reflect socio-cultural belonging and, in this respect, workshops clearly demonstrate how they fit into a multifaceted 'lived world' (after the all-encompassing German term 'Lebenswelt').

In the present volume, the space, the setting that enveloped the makers is consistently taken into account; all the different settings examined – in different geographical areas – manifest how the premises of creation may affect creation itself. In each case, the natural or built environment was differently exploited and adjusted to the particular needs. Artisans always made the best of it. **Raffaella Da Vela**'s extensive study of the Etruscan pottery production on both sides of the Apennines builds on the theoretical framework of local knowledge combined with the setting, and introduces the term 'knowledgescapes'. The mountainous region is perceived as a contact zone rather than a barrier, while the craft is perceived as a social or societal constituent. Due to the multiple encounters fostered by this contact zone, the craft was susceptible or rather open to technical innovation. Local knowledgescapes are thought to define dynamic networks of material and immaterial resources, in turn related to the socio-cultural dynamics. In the *ergasteria* of the northern Apennines, tradition and innovation were part of a daily routine comprising production, crafts and social values.

The socio-historical setting/context also had an impact upon artisans. Underlying factors, usually stemming from politics and military coalitions, could instigate but also disturb or even disrupt a creative process. In his reconstitution of the ambitious building program on the island of Thasos in North Aegean, **Jacques des Courtils** demonstrates that the spread of a certain fashion – in this particular case, Athenian architectural practices – was occasionally conscious, deliberate and fostered by interstate relations or alliances. So, the dissemination of techniques and traditions did not always result from the role of itinerant craftsmen as 'carriers'. Unfortunately on Thasos political grudge eventually led to the abandonment of a worksite. By comparison, the radiance of the reputable Athenian achievements in architecture is imprinted upon worksites of Asia Minor in a... smoother manner. From specific traits on sepulchral monuments of Xanthos in Lycia **Laurence Cavalier** is able to 'read' that their architects were familiar with Athenian techniques, which they consciously implemented alongside their own indigenous modes. Their motivation could simply be a matter of taste.

Adaptive reuse is a big chapter in the history of construction, approachable from the viewpoint of aesthetics, as well as logistics and ergonomics. To some extent, recycling depended on circumstances, as it could take place hastily under pressure or at leisure. A piece could be put to use analogous to its original function, or immured, or otherwise repurposed. By studying such decisions and 'gestures', we gain a glimpse into what may have happened in grandiose ancient sanctuaries and necropoleis. Apparently they did not turn into open-air museums, treated as untouchable and unchangeable revered places. On the contrary, they remained vivid by adapting to (or serving) current conditions.

Investigating the chaîne opératoire and its applicability to objects in secondary use, **Constanze Graml** concentrates on the re-use of Greek funerary monuments and illustrates that their deconstruction and re-employment in different settings, where they could be visible or not, was quite common. While dealing with pragmatics, namely the actual, physical handling of the marble furnishing of Greek funerary monuments, **Graml** raises matters of ethics and sentimentalism, touching upon grief, remembrance and religious beliefs. In addition to her conclusion that adaptability and a practical mentality predominated against wasting ready-made and re-usable material, she manages to absolve/exonerate the reworking and repurposing of a sepulchral monument. In the light of this, any assumption-based attempt to characterise such a practice as religious misconduct should be treated with scepticism and caution, given the absence of contemporaneous testimonies. Instead, Christian values unconsciously extrapolated by scholars are likely to have shaped the perception of re-use as supposedly sacrilegious.

Should we reckon with teams of masons specialised in selecting, trimming and adapting spolia? To what extent was this planned rather than a rescue operation? As regards the spoliation and management of spolia, was the edict by Majorianus realistic and enforceable? Along the lines of aesthetics, were the re-employed spolia concealed or on display creating some particular pattern[16] and therefore visual impact? The above questions represent a modern mind's concern (if not obsession) with the hidden meaning behind re-use, whereas the stonemasons actually involved in it would

[16] As in the Castle of Patras, where the immured spolia were on display and almost recreating courses of the source-building, interspersed with column-drums.

probably be preoccupied with practical issues of moving, cutting and re-shaping older blocks. An entire building project could be designed around the available spolia. Based on her observations of different sites in Late Roman Asia Minor, **Anna M. Sitz** shows that decisions concerning the exploitation of spoliated material were made *ad hoc*, without necessarily conforming to legal pronouncements. Instead, local conditions affected the motivations and methods of spoliation. Whereas aesthetic factors could be a priority in large-scale projects, it appears that, in smaller-scale projects, the builders gravitated towards utility. Although one might assume that such 'informal' reworking operations did not require much competence and specialisation, on the contrary, the traces of workmanship on the spolia reveal the craftsmen's know-how and skill.

A different approach of the chaîne opératoire is attempted by **Susanne Bosche**, who juxtaposes work to work processes, namely the concept of chaîne opératoire. Having her theoretical approach projected against the example of the Elgin Lyre, **Bosche** discusses various discrepancies between the purely theoretical concept on the one hand, and the sensory, knowledge-based approach (applied in material studies) on the other. Her paper's backbone is the oscillation between three levels, namely, a highly theoretical one, which includes formal descriptive concepts, a theoretical but content-charged level with concepts related to a 'general reality' and a third level of a 'historical reality.'

Tightly associated both with production *ex novo* and cases of re-usage is the aspect of aesthetics, which surfaces often in the pages of this book. The aesthetic impact of ancient sculpture would be different, if parts of the stone surface had been coloured, to accentuate details of a figure's garment, for instance. It would be entirely different, however, if the total surface of a marble statue was painted, and dramatically different, if the face, too, was colourful. Raised already by early archaeologists,[17] and apparently encouraged by the extant Egyptian statuary of painted limestone, the matter has been vividly debated ever since.[18] Most recently, samples taken from a marble centaur head belonging to the Parthenon sculptural programme[19] (today in the National Museum of Denmark) were analysed, to explain the traces of a brown coating. In particular, the aim was to determine whether this brown film could have been developed by some biological organism such as lichens, bacteria, algae or fungi, or whether it was the remains of some paint layer. The samples were subjected to a number of different analyses[20] but no sort of biological trace was detected, except perhaps a bird's egg that had broken on the marble in antiquity. Even less probable is that the marble surface had been painted.

The existence of a local workshop of sculpture at Epidaurus in the Roman period is inferred from the large number of re-used and reshaped sculptural pieces of that era.[21] Interestingly in this corpus there is no reference to colour traces, even though there is evidence for the gilding of parts of statuettes, including votive reliefs. What appeared to be the traces of a reddish-brown or sometimes purple pigment eventually turned out – by chemical analyses – to be the binding agent (a sort of glue) between the marble surface and the attached thin golden sheets. The polished surface of the marble was meant to simulate the texture of the ivory body-parts of chryselephantine statues. This was the aesthetic effect they wished to achieve.

The application of paint layers on ancient sculpture is revisited here by **Amalie Skovmøller**, who conducts an experiment on the potential reconstitution of polychromy on a Roman portrait. Moreover, seeking the whereabouts of a painter's actual workshop, **Skovmøller** proposes that an encaustic painter was based in a sculptor's workshop unearthed at Aphrodisias. So, the two specialists worked in the same premises, if not also in co-ordination.

[17] On Hellenistic funerary monuments, in particular, see Abramitis and Abbe 2019.

[18] As concerns cultic environs of the Roman period in particular, Vicky Jewell (Jewell 2024) draws attention to polychromy in temples of Mithras, by examining the way colours were perceived by ancient writers and how this may have contributed to a haptic-visual experience of Mithraic ritual spaces. By 'seeing colour in Classical art', Jennifer Stager (Stager 2022) contributes to the discussion. Other currently conducted projects cover areas/cultures beyond the Greco-Roman Mediterranean world: the Tracking Colour Project, housed at the Ny Carlsberg Glyptotek Copenhagen (<http://trackingcolour.com/>, last accessed 20 March 2024) and the project 'PolyChroMon Colours Revealed – Polychromie römerzeitlicher Monumente der Donauprovinzen', under the auspices of the Austrian Academy of Sciences (<https://www.oeaw.ac.at/oeai/forschung/altertumswissenschaften/antike-religion/polychromon>, last accessed 20 March 2024). Under publication is the special issue 'Polychromy in Ancient Sculpture and Architecture' of the Heritage journal, edited by Joanne Dyer (<https://www.mdpi.com/journal/heritage/special_issues/polychromy_sculpture_architecture>, last accessed 20 March 2024), in which, among other important case studies, the above-mentioned projects contribute.

[19] On the detection of traces of Egyptian blue on pedimental statues of goddesses from the Parthenon, held at the British Museum, see https://www.archaeology.org/issues/544-2403/digs/12133-dd-greece-parthenon-paint-job?fbclid=IwAR3HZdGKYKnBIQn2huJXYhlcuDrIbbDCaCtkJjsl3npTidkKXsLfqjy4STM>, accessed 13 March 2024.

[20] Including protein analysis and Laser Ablation Inductively Coupled Plasma Mass Spectrometry. In 1851 the German chemist Justus von Liebig determined that the brown film contained oxalates, i.e. salts of the oxalic acid. This was confirmed by later analyses, though where it originated from could not be resolved. Members of the research team: Kaare Lund Rasmussen (Physics, Chemistry and Pharmacy, University of Southern Denmark), Frank Kjeldsen and Vladimir Gorshkov (Department of Biochemistry and Molecular Biology at University of Southern Denmark), Bodil Bundgaard Rasmussen (former Head of the Antiquities Collection at the National Museum of Denmark), Delbey Thomas (Cranfield University), Ilaria Bonaduce (Università di Pisa), <https://lnkd.in/dWf7hwTe>, accessed 30 January 2023.

[21] Katakis 2002.

The manifold approach of ancient workplaces finally offers insight into possible future research. The alabaster quarries illustrate the rich geology of Tunisia (**Ameur Younès** in this volume) and we can only envisage the optical effect of such a colour spectrum on the respective buildings. It would be interesting to explore whether these varieties have been recognised beyond Tunisia, and whether their exploitation had perhaps started in earlier times. If inaugurated in the Roman Imperial period, should these quarries be ascribed to an initiative of the Roman authorities, or some local elite class?[22]

Evidence of an ancient military workshop of the Sassanid era, AD 224 to 651, was found in a mountainous region of northern Iran,[23] in September 2023. Measuring 80m by 100m, the cave's entrance is said to be one of the largest natural ones in the world. Its identification as perhaps an arms-making installation is induced from the metal melting furnace and the variety of weapons, ranging from arrowheads, daggers and harpoons to half-made swords. Obviously, scope for new discoveries is infinite.

As we had hoped while setting out the aims of this endeavour, a broad range of topics – both thematically and geographically – is addressed on occasion of new finds from Greece, North Africa, the Black Sea, Italy and Central Europe. For the realisation of this book we heartily thank all contributors, our dear colleagues and teachers, who willingly responded to our proposal, entrusted us with the outcome of their research, collaborated with us throughout the reviewing and editing process, and endured every challenge posed by the pandemic and its aftermath. For the book-cover's artistic design, we are grateful to Petros Georgopoulos and Ilias Partidas. We are indebted to the University of Regensburg for kindly, willingly and generously funding the Open Access publication of this volume. Last, but not least, we sincerely thank Professor David Davison and Mike Schurer of the Archaeopress, for yet another impeccable co-operation.

The Editors
Elena C. Partida and Constanze Graml
March 2024

Bibliography

For the works cited above, please refer to the bibliography compiled at the end of the volume.

[22] The publication on Marmor Numidicum (Beck, D.M. 2024. *Simitthus 6: Marmor Numidicum. Gewinnung, Verarbeitung und Distribution eines antiken Buntmarmors*. Wiesbaden: Reichert Verlag) may shed light on our queries, but was not yet available to us while writing our introductory section.
[23] Announced online by the Archaeology Information Network.

A spatial approach to workplaces: Urban, religious, littoral context

Chapter 2
Tales from the workshop and normative beauty

Gerhard Zimmer

Abstract

The findings of bronze statues from the sea, as well as of workshops where such works had been cast, have considerably expanded our knowledge about the technology of the ancient Greek bronze casters, over the past 50 years. The findings of workshops dating from the fifth century BC are particularly important in this context. One of them was installed in the area today occupied by Amalias avenue in front of the Parliament building in Athens. It was discovered and unearthed during the works for the metro station at Syntagma Square. A huge amount of fragments that originated from the smashing of the casting mould, after a cast in the 'lost wax' process had been completed, testify to an elaborate technology. The pouring channels and the shafts for the liquid bronze were prepared in such a fashion as to prevent failed casts. This casting technology aimed to exploit the full potential of the metal for the conversion of the draft model into bronze work, but in parallel, the finds reveal how the casting technology could influence the aesthetic design of the work, as well.

The many mould fragments indicate that the workshop was used over a longer time-span for casting life-sized, mainly female statues from the middle of the fifth until the beginning of the fourth century BC. Among the finds, there are fragments from the casting of garment pleats and others from the processing of fingers and lips. It seems that such details could have been used for the production of several statues, having influenced their appearance, too.

Especially in the Classical period, we witness the intense discussion of proportions and harmony, as concerns the effect/impact of human images, which for example led to Polycletus creating a statue, which represented that norm and was called 'canon'. The finds from Syntagma Square imply that such thoughts did not primarily evolve in the philosophers' schools, but developed from the concrete steps of work in the workshops of bronze casters. In fact, the philosophers frequented workshops, as the Platonic Dialogues show, where we often find Socrates visiting a workshop.

Περίληψη

Η ανεύρεση χάλκινων αγαλμάτων στο βυθό της θάλασσας, καθώς και των εργαστηρίων στα οποία τέτοια έργα είχαν χυτευθεί, έχουν σημαντικά εμπλουτίσει τις γνώσεις μας στα τελευταία 50 χρόνια, όσον αφορά την τεχνολογία των αρχαίων Ελλήνων χαλκοπλαστών. Τα ευρήματα από εργαστήρια του πέμπτου αιώνα π.Χ. είναι ιδιαίτερα σημαντικά στο εν λόγω πλαίσιο. Ένα τέτοιο εργαστήριο ήταν εγκατεστημένο στην περιοχή όπου σήμερα διέρχεται η Λεωφόρος Αμαλίας, μπροστά από τη Βουλή των Ελλήνων στην Αθήνα. Εντοπίστηκε και αποκαλύφθηκε κατά τη διάρκεια εργασιών για τον σταθμό του μετρό στην Πλατεία Συντάγματος. Μια τεράστια ποσότητα θραυσμάτων προερχόμενων από το σπάσιμο του καλουπιού/μήτρας χύτευσης μετά την ολοκλήρωση της τεχνικής διαδικασίας του 'χαμένου κεριού', μαρτυρούν την εξειδικευμένη και επιτηδευμένη τεχνολογία. Οι αύλακες και οι αγωγοί ροής του υγρού χαλκού προετοιμάζονταν κατά τρόπο ώστε να αποτρέπεται η αποτυχία στην χύτευση. Η συγκεκριμένη τεχνολογία στόχευε να αξιοποιήσει όλες τις δυνατότητες του μετάλλου για τη μετατροπή του σχεδιασμένου μοντέλου σε χαλκοπλαστική, όμως, παράλληλα, τα ευρήματα φανερώνουν πώς η εργαστηριακή τεχνολογία χύτευσης μπορούσε να επηρεάσει τον σχεδιασμό του έργου και σε αισθητικό επίπεδο.

Τα ευάριθμα θραύσματα μήτρας αποτελούν ένδειξη πως το εργαστήριο χρησιμοποιείτο επί μακρότερο χρονικό διάστημα για την παραγωγή φυσικού μεγέθους, κυρίως γυναικείων, αγαλμάτων από τα μέσα του πέμπτου έως τις αρχές του τέταρτου αιώνα π.Χ. Στα ευρήματα συγκαταλέγονται σπαράγματα από τη χύτευση πτυχώσεων ενδυμάτων, και άλλα για να παραχθούν δάκτυλα και χείλη. Φαίνεται ότι τέτοιες λεπτομέρειες θα χρησίμευαν στην κατασκευή αρκετών αγαλμάτων, ενώ θα επηρέαζαν και την εμφάνισή τους επίσης.

Ειδικότερα στην Κλασική περίοδο, βρισκόμαστε ενώπιον έντονης συζήτησης σχετικά με το ρόλο των αναλογιών και της αρμονίας στον αισθητικό αντίκτυπο που είχαν οι εικόνες θνητών – πράγμα που οδήγησε, για παράδειγμα, τον Πολύκλειτο να δημιουργήσει ένα άγαλμα, το οποίο αναπαριστούσε αυτές τις προδιαγραφές και ονομαζόταν 'κανόνας'. Από τα ευρήματα στην Πλατεία Συντάγματος συνάγεται ότι τέτοιες σκέψεις δεν γεννήθηκαν στις φιλοσοφικές σχολές, αλλά προέκυψαν και αναπτύχθηκαν μέσα από πολύ συγκεκριμένα βήματα τεχνικής εργασίας μέσα στα εργαστήρια των χαλκοπλαστών. Μάλιστα, οι φιλόσοφοι σύχναζαν σε εργαστηριακούς χώρους, όπως βλέπουμε στους Πλατωνικούς Διαλόγους, όπου ο Σωκράτης συχνά επισκέπτεται κάποιο εργαστήριο.

Keywords: bronze casting; workshop operation; chaîne opératoire; Syntagma Square in Athens; Alcamenes

The development of the aesthetic canon of male beauty in the middle of the fifth century BC is closely connected with the statue of the so-called Doryphoros. The slightly larger-than-life statue of an ephebe who is shouldering his spear (δόρυ) with his left hand was popular during the whole Roman epoch. Numerous marble copies, most of them collected in the exhibition organised by Peter C. Bol in Frankfurt in 1990,[1] testify to this. The most famous copy originates from the Samnite Palaestra in Pompeii and is set up today in the National Archaeological Museum in Naples (**Figure 1**).

Since 1970 a lot of effort has been put into dating the different copies. Basically, it was possible to date most of them to the time-span between the reign of the Emperor Augustus and the end of the second century AD, thus highlighting the nearly constant interest in this image. The examination of the different copies has also shown that it is impossible to reconstruct the appearance of the original bronze work. It is lost beyond recall. Somehow it makes sense when Anton H. Borbein depicts the bronze statue of the Doryphoros in the main building of the Ludwig-Maximilians-Universität in Munich, which was built as a monument for the dead soldiers of World War I by Georg Roemer in 1921.[2]

Texts from the Roman times teach us that the statue was actually created as an archetype by Polycletus under the designation of 'canon', meaning rule/norm or guideline. Behind that lays the thought that harmony is determined by clearly predefined proportions and as such allows the perception of beauty. Since 'beautiful' in its ancient definition also meant 'morally beautiful and good', in the end we arrive at a basic/essential term of the Classical times, the *kalokagathia* (καλοκαγαθία).

For a long time, research has tried to regain the construction of Classical beauty through the reconstruction of clearly defined, harmonious proportions. Historically that research paralleled the experiments on finding out the measurement in feet of temple buildings. These studies were mainly advanced by Ernst Berger in Basel, who had an excellent instrument of research in his abundant collection of plaster casts.[3] Since in the end it was impossible to decide which measurements within the human body were crucial, those thoughts did not lead to a sustainable result.

The scholarly discussion of measurements led to the ambience of workshops, where such questions were surely discussed. The image was less that of a real bronze-casting workshop with all its noise, dust and smoke caused by work. It was much more about

Figure 1: Marble copy of the Doryphoros from Pompeii. National Archaeological Museum Naples, inv. 6011 (https://de.wikipedia.org/wiki/Datei:Doryphoros_MAN_Napoli_Inv6011-2.jpg; Marie-Lan Nguyen [2011]).

the great masters, much as the great artists of the Renaissance such as Michelangelo and Leonardo Da Vinci, who explained the basic idea of their work to the public.

The notice that Polycletus considered the point when the clay lay on the nail as the most difficult leads us closer to the real situation at work. Despite many discussions and thoughts – most recently by Nadja Koch – the meaning of this sentence is not quite clear.[4] An oinochoe from the Berlin Antikensammlung can be taken into consideration (**Figure 2**).[5] On this Athenian

[1] Bol *et al.* 1990; Bol 2004: 123-131; Borbein 2002; Hafner 1997.
[2] Borbein and Boehringer 1995: 267.
[3] Berger *et al.* 1993.
[4] Koch 1999.
[5] Zimmer 1982: 33, colour pl. 1.

Figure 2: Athenian red-figure oinochoe from Capua, *c.* 470 BC. Antikensammlung Berlin, SMPK, inv. F 2415 (Staatliche Museen zu Berlin, Antikensammlung / Johannes Laurentius, CC BY-SA 4.0, F 2415).

red-figured oinochoe from around 470 BC the goddess Athena is shown working, in her role as Athena *Ergane*. Of her usual attributes she only wears the helmet, her outer garment is wrapped around the hip, to leave the hands free for work. She holds a lump of clay in her left hand and is forming the nostrils of a horse. The coarse consistency of the clay is implied by a realistic heap at the feet of the horse. The tools hanging on the wall show that we are in a workshop for statuary bronze-casting, for a saw and an Archimedean drill with matching bow have no function in a pottery workshop.

Among the findings of the workshops studied up to now, numerous fragments of the casting moulds show fingerprints that testify how the clay was pressed into the cavities (**Figure 3**). Unfortunately, the clay was not fine enough to allow us to recognise the fingerprints of individuals, as is possible for the black-glazed pottery in Metapontum.[6] The soft-fired lumps of clay, which a worker pressed with his hands to test the right consistency of the material for the form, is characteristic as well (**Figure 4**). Since the clay is slightly baked, these finds probably come from the area of the workshop where the form was fired, but we cannot exclude the possibility that such lumps got from the 'moulding shop' to the 'foundry'.

Figure 3: Fragment of a casting mould with fingerprints (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Figure 4: Soft-fired lumps of clay with fingerprints from kneading. From the Athena Promachos workshop on the south slope of the Acropolis in Athens (OM 32 – 14.07.2006) (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Naturally, this raises the question of the actual appearance of such a workshop for the bronze-casting of statuary. Until recently the challenge was that we could not prove the existence of a permanent workshop, but only of places that were used for one or more works, situated close to the site where the final product would be put up; the workplace would supposedly be abandoned after the completion of the project.[7]

The excavations underneath Amalias avenue in front of the House of Parliament in Athens

In this context, the complex excavations underneath Amalias avenue, south of the House of Parliament in Athens are of particular importance. They were conducted during preparation of the building of the

[6] Cracolici 2003: 159-171.

[7] Zimmer 1990.

Metro Station in the early 1990s.[8] Although the work was thorough, especially considering the huge extent of the area, the state of publication remains unsatisfactory, with only a few finds having been documented.[9]

In many regards the excavations have provided important insights into the development of the city. A series of facilities attesting to several workshops for statuary bronze-casting is particularly interesting. The traces of the installations, which are grouped around differently-sized pits dug in the ground, are scattered about almost all the excavated area and were referred to with consecutive numbers after their discovery.

Among the finds noted, the remains of a workshop for statuary bronze-casting, which was active from the second half of the fifth century BC to the first decades of the fourth century BC, deserve special attention. In all likelihood, this was the main quarter of a bronze-caster's workshop, which met part of the demand for statues in Classical Athens. Just how important this context of a workshop is for us becomes clear when we look at the other bronze-casting features of the fifth century BC, at Olympia, the Kerameikos in Athens, the Hephaesteum and the south slope of the Acropolis in Athens, all of which have in common a merely temporary existence.[10]

All famous masters of fifth-century sculpture worked with bronze. Because of this workshop's pivotal significance for research on bronze-casting workshops, we shall try to reconstruct the activities in this workshop and thus gain insight into a technology that was ground-breaking for the development of sculpture in High-Classical times, since the artistic potential surpassed that of sculptors from the period of the Severe Style.

This paper cannot and will not serve as the primary publication of the results of the excavation; it is rather restricted to the interpretation of those features that are tightly connected to the bronze-casting process, especially the fragments made of soft-fired clay, which when being stored for a longer time are extremely vulnerable due to their fragility. This paper shares with the scientific community the various insights into the technology of the late fifth century BC, which we gain from the study of the workshop excavated underneath Amalias avenue.[11]

Outlining the location of the fifth-century BC workshop in the ancient city

Contrary to the feeling of a modern visitor, the workshop of the fifth century BC did not lie in the centre of the city of Athens, but some 250m to the east of Themistocles' fortification, which corresponds to about 1.5 Attic stadia (**Figure 5**). The area did not form part of the urban tissue until the extension of the surrounding wall in the time of Hadrian. It is very likely that no buildings or burial sites, which Pausanias would have deemed worthy of notice, stood there – at least in the traveller's time.

In terms of traffic, the position of the workshop was extremely favourable, since the road which left the city through a gate and led to the surrounding regions in the east, ran in the immediate vicinity.[12] The exact position of the gate is not known due to the high building density south-west of Syntagma Square, but it interrupted the walls in the area between the modern streets Voulis, Apollonos and Mitropoleos.[13] Thus the workshop was easily reached from the city, so that we can well imagine interested pedestrians or clients visiting the workshop, as can be presumed by the depiction of onlookers on side B of the Berlin Foundry Cup.[14] On the other hand, raw materials such as clay, firewood, charcoal, sand or other goods needed for the work could be delivered from the hinterland right to the doorstep.

For the work in the foundry, sufficient access to running water was at least as important as the connection to the road network. Here the vicinity of Eridanos river and its springs is significant. It has its source at the slope of the Lycabettus, traversed the whole city from east to west until it left the city of Athens/άστυ at the Kerameikos, next to the Sacred Gate, and supplied the craftsmen's establishments outside the Themistoclean Walls, such as potters and metalworkers, with its water.[15]

The situation east of the city is comparable, though the exploration of this area leaves a lot to be desired because of the modern building development. A creek bed has been identified underneath Amalias avenue, at the height of the junction with Othonos street. Thus, the course of the Eridanos or one of its tributaries is secure, as well as the fact that the brook 'entered' the city at a gate, which seems logical; the entry or exit of a stream or river is always a problem in case of defence.[16]

[8] The excavation was conducted from 2 November 1992 until 14 May 1994.

[9] Zachariadou 1994: 27-32; Parlama and Stampolidis 2000: 149-161. The excavation uncovered an area of 5500sq.m.

[10] Zimmer 1990.

[11] My thanks go to excavator Peggy Michaelidou for the possibility to work on the finds with evidence regarding the technology. Of the vast amount of finds – more than 60 boxes – only an especially significant part is consulted for interpretation. The travel expenses were paid for by the Deutsche Forschungsgemeinschaft DFG.

[12] Theocharaki 2020: 343-345, TH 49, 50 and 51.

[13] Travlos 1971: 159-160.

[14] Foundry Cup, Antikensammlung Berlin, SMPK, inv. F 2294.

[15] Up until now we only had the casting pits west and inside of building Z as concrete examples for bronze-casters at the Kerameikos (Zimmer 1984), but now work on the burial of the Lacedaemonians showed that the earthfill contained lots of small fragments of foundry refute/waste, which offers evidence for brisk metal-working activity as early as the fifth century BC (Stroszeck and Zimmer 2023 [in press]).

[16] On the gate situation with a watercourse entering the city, see

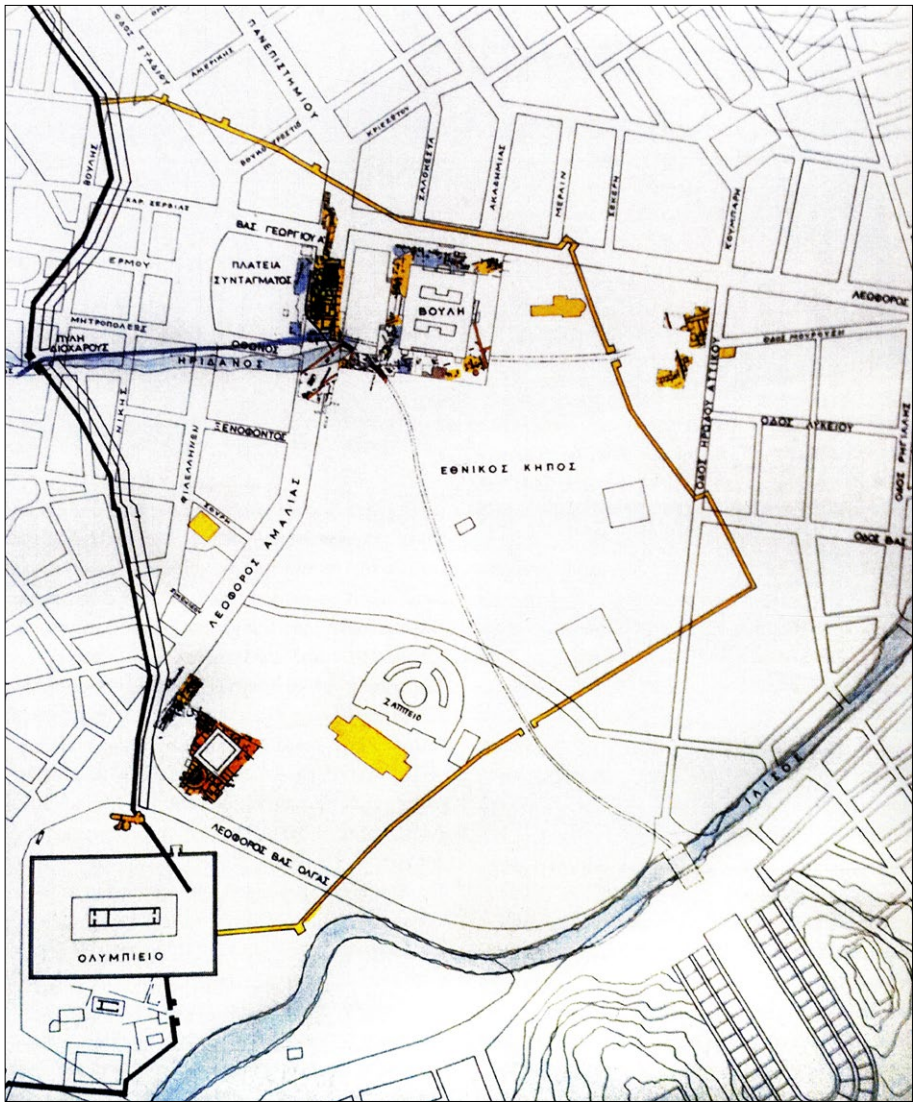


Figure 5: Plan of the excavation at Amalias avenue (with marked building phases) in relation to the City Walls and Eridanos river. The blue area to the left shows the workshop of the fifth/fourth century BC (Bentz and Helms 2018: 119 fig. 13).

Judging from Walther Judeich's plan, this brook joined the main branch of the Eridanos at the Kapnikaraia Church. For the workshop this means that water was available all year round in abundant amounts at a distance of 100m at most and could be easily transported using vessels. Water was crucial for the foundry-men, as they worked with clay and loam which had to be produced in different grades of tempering, but also had to be kept moist during the mould-building process. Since working with clay, particularly when built in layers, always called for stages of drying, most moulding took place in the warm season and craftsmen depended on constant water supplies. Brooks that dried out or became tiny trickles during summer were of no use for that purpose. Under those circumstances, the position of this workshop was ideal, and the proximity to the city gate may be looked upon as extremely privileged. For such a prominent and advantageous location, a high price may be presumed, comparable to the price of plots of land in a sepulchral context, as well as in certain sanctuaries, with regard to the establishment of votive offerings. The workshop's owner must have been extraordinarily well off and highly esteemed.

Theocharaki 2020: 343-344, TH 49.339. Cf. the complexity of the fortification at the Sacred Gate in the Kerameikos: Kuhn 2017: 63-65.

The work installations

To understand the findings and features from the excavation of the workshop underneath Amalias avenue, we first have to understand the functions of the particular work installations. The centre of every workshop for statuary bronze-casting is the pits, which are dug out and faced with mud-bricks. Inside them the form that has to be cast -that is, the statue- is built as a wax model. The layout and depth of the pit has to be adapted to the casting, which means that the pit should be neither too shallow nor too deep. This is why from the measurements of a pit we can deduce whether a life-sized statue or single/separate parts, such as legs and arms, were cast inside. Since the master and the

subsidiaries had to carry out many work-steps inside the pit, good accessibility had to be ensured. If there was enough space, steps were hewn into the bedrock, from both sides as a rule. At a depth of more than two metres, a lot of space was needed, even if the steps led down steeply. The big casting pits on the south slope of the Acropolis or in Rhodes reached an extent of 11 to 13m. The pits were not only used as workspace for the craftsmen to move but also for the heat to circulate and to properly fire the model. In the process, the heat had to affect the mould evenly to prevent the clay layers from developing cracks and thus rendering the form unusable, because liquid melt could flow out through those openings. This is why only 50cm of space were left between the mould and the wall of the pit, just enough to make work possible while applying the outermost layer. The heating situation also resulted in the entrances from the stairs having to be closed after the casting mould was finished, usually with air dried mud-bricks. Installing a pit was a difficult task because it had to be spacious enough to accommodate both the moulding activity and optimum heating conditions for the proper firing of the model.[17]

A joint experiment of the foundry institute of the RWTH (Rheinisch-Westfälische Technische Hochschule) Aachen and the Antikensammlung Berlin that was conducted in 1995 at Murlo in Tuscany shows best how we should imagine the work-process in such a pit.[18] The dimensions of the cavity set out for the casting of a statue of only 1.28m were smaller, of course. The centre of the pit was clad with mud-bricks and insulated (**Figures 6, 7**).

The wax model was built on a pedestal in the centre, with the pouring channels and the drains for the liquid bronze being added (**Figure 8**). Since it was a casting on a core, the wax model had to be filled with clay that was tamped, which turned out to be difficult: the wax model was on the verge of bending because of its weight (**Figure 9**). When the work had succeeded this far, the wax model was clad in several layers of clay that were differently grogged. The especially fine innermost layer was applied with a brush, in order to reproduce all the details of the model (**Figure 10**).

In the end, the wax model had vanished inside a cylindrical structure with a funnel and vents at the upper end. As soon as the interior had been closed up towards the stairs with mud-brick walls, it was heated for two nights and a day, using wood that was stacked around the mould inside the pit and continuously stoked.

Figure 6: Building the casting pit for the experiment of the foundry institute of the RWTH (Rheinisch-Westfälische Technische Hochschule) Aachen and the Antikensammlung Berlin at Murlo, Tuscany (photo by the author).

After the wax had flowed out and the mould was completely heated and dried (**Figure 11**), the liquid bronze could be poured. When the bronze was solidified and the whole pit had cooled down a little bit, the foundry-men smashed the mould and pulled the raw cast out of the pit, to work on it in another place. Up until that moment, all the work took place in and around the pit and it becomes clear why those installations constituted the core of every workshop.

An experiment conducted at the same time at the foundry institute at the RWTH Aachen vividly showed what such a raw cast looked like after the mould had been shattered (**Figure 12**). The master of the early fifth-century BC Berlin Foundry Cup shows us an abbreviated depiction of the same working process (**Figure 13**).

If we look at the workshop site underneath Amalias avenue (**Figure 14**) with that knowledge, we can see at once how difficult it is to define the single features. Overall in workshop contexts, we have to expect short-term changes, that is, if it turned out that an additional small pit was needed during the process, the workers

[17] The temperatures around the mould had to reach several hundred degrees Celsius. Experiments proved this, as well as the hard exterior of the mould.

[18] The experimental phase was partly embedded in the 'experimental archaeology course' led by Edilberto Formigli. The results are published in the catalogue by Zimmer and Hackländer 1997.

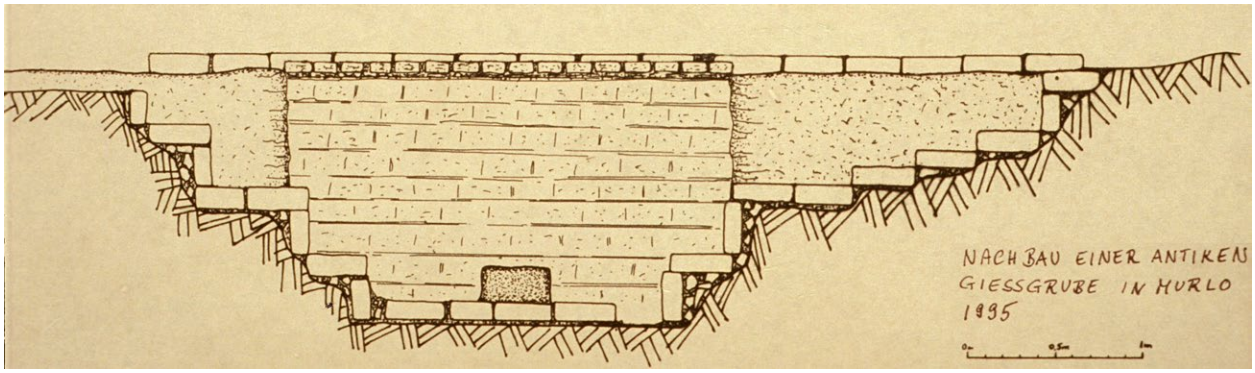


Figure 7: Cross-section of the casting pit at Murlo, Tuscany (drawing by Nele Hackländer).

Figure 8: Wax model with pouring channels and drains (photo by the author).

Figure 9: Filling of the wax model with tamped clay (photo by the author).

Figure 10: Experiment in Murlo, Tuscany: The innermost layer of fine clay is applied with a brush on the rear of the 'praying boy'-wax model (photo by the author).

just dug it out and possibly backfilled it afterwards, because for the next job such a pit would not be needed and they wanted to avoid stumbling over it all the time. For us, this means that not every artificial pit in the bedrock was made to last and not all pits were used at the same time. Another challenge is the consistency of the workshop floor, made of compacted loam, often trampled along with ash, charcoal, bronze spills, or other waste. We should therefore assume that even if the 'industrial' area is most carefully excavated, we will never be able to definitely identify

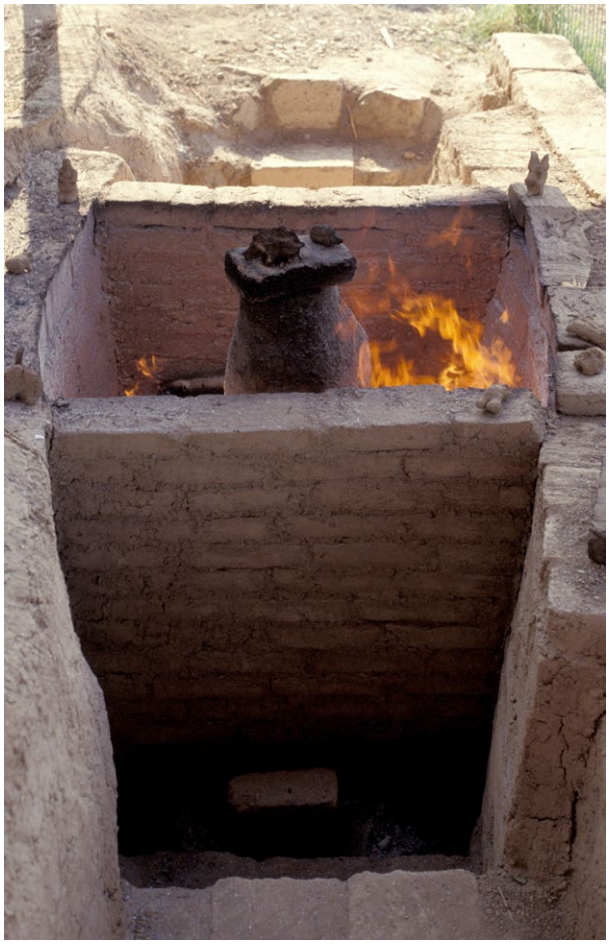


Figure 11: Experiment in Murlo, Tuscany: Heating and drying of the casting mould (photo by the author).

Figure 12: Detail of the cast surface inside the shattered mould created by the foundry institute of the RWTH (Rheinisch-Westfälische Technische Hochschule) Aachen (photo by the author).

Figure 13: Detail of the Athenian red-figure Foundry Cup, dating to the early fifth century BC. Antikensammlung Berlin, SMPK, inv. F 2294 (Staatliche Museen zu Berlin, Antikensammlung / Johannes Laurentius, CC BY-SA 4.0, F 2294).

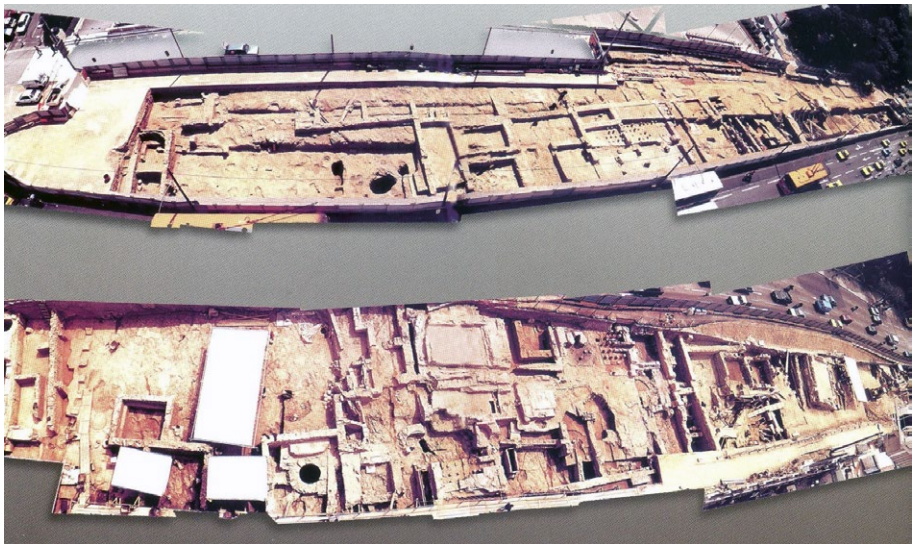


Figure 14: Area of the excavation at Amalias avenue (Parlama and Stampolidis 2000: 152 fig. 3).

all single features. Under these circumstances it makes sense to begin with the three casting pits that, through findings, were clearly dated to the second half of the fifth century BC by the excavators. The shards all around the pits are contemporary with their contents and strongly suggest that the workshop was obsolete/abandoned at the beginning of the fourth century BC.[19]

[19] Zachariadou 1994: 27-32.

Casting pit 2

The pit lies underneath the northern half of Amalias avenue in front of the House of Parliament and is aligned northwest to southeast, with the entrance at the narrow side in the southeast. The overall shape is oval, the length about 4.50m, the widest part is 2m. The deepest part is 3.10m below the level of the workshop floor, with the floor of the pit rising slightly towards the entrance. We do not know whether this slight difference of 10cm was made on purpose. In any case, the pit is dug into the bedrock. Its oval shape with sufficient room inside for the mould to be built and the entrance from the narrow side is no different from other installations of Classical times, such as the ones at the Hephaesteum[20] or the south slope of the Acropolis.[21] However, two peculiarities that had not been observed anywhere else before are characteristic of pit 2. For once, the entrance was not by a stair but by notches in the perpendicularly rising narrow side on the southeast, which have to be interpreted as climbing assistance, by which the craftsmen could enter and exit the pit. Since those fixtures are more difficult to use than a stair hewn into the rock, the reason for them can only be to save space.

Figure 15: Area of the excavation with casting pit 4 at Amalias avenue (Parlama and Stampolidis 2000: 156 fig. 9)

[20] Zimmer 1990: 61.
[21] Zimmer 2009.

The second peculiarity is a bridge about 75cm wide, from the time when the pit was hewn into the rock. Workers who wanted to help in building the mould would have to climb down into the quite narrow anteroom of about 1.20 x 1.20m. From there, they could enter the workspace itself by passing under the bridge.

The bridge left in the rock only makes sense as having been used while building the mud-brick wall for melting out the wax and heating the casting mould. Here the rock provided an additional foothold against the pressure from inside, when sand was filled in before pouring the liquid melt to absorb the pressure inside the big mould. The peculiarities described can be explained when we imagine a workshop where several statues of about the same size were cast over a long period of time. The wall below the bridge could be easily removed after the casting process and was as easily rebuilt for the next cast. The compact form of the pit points to a fixed amount of space within the workshop that could not be changed. The depth of 3m, which could vary by using pedestals of different height, was fit for statues up to about 2m tall, that is, for life-sized statues.

Casting pit 3

A second pit, which could also be identified as an installation of the foundry due to the finds within, lies at a distance of about 2.50m from pit 2 (**Figure 16**). It is aligned east/west and, with a length of 2.75m and a maximum width of 1.80m, it is considerably smaller. The depth is 1.80m. Its shape is oval with a straight end at the entrance lying in the west. At the centre of the bulge, traces of two lower parts of moulds could be found. At the widest part of the pit a canal of about 25cm wide, getting wider towards the end, and 35cm deep, leads north at a right angle. The installation shows all characteristics of a casting pit and was probably used to cast smaller parts of statues which were made separately, such as arms and legs. The canal constitutes an unparalleled/singular feature, and its interpretation is difficult. Since, according to the excavation reports, neither cladding of loam nor traces of combustion were found, one could think of a device to lead the air into the heating chamber using bellows. The observations made at Murlo allow for such a possibility, even if caution is necessary, because one-sided heating is likely to cause cracks in the casting mould during firing.

Casting pit 4

To the southwest of the two pits described above, there is another installation of the foundry, similar to pit 2 and comparable in size (**Figures 15, 17**). When the open-air museum in front of the new university in Athens was established, the pit was moulded using an intricate

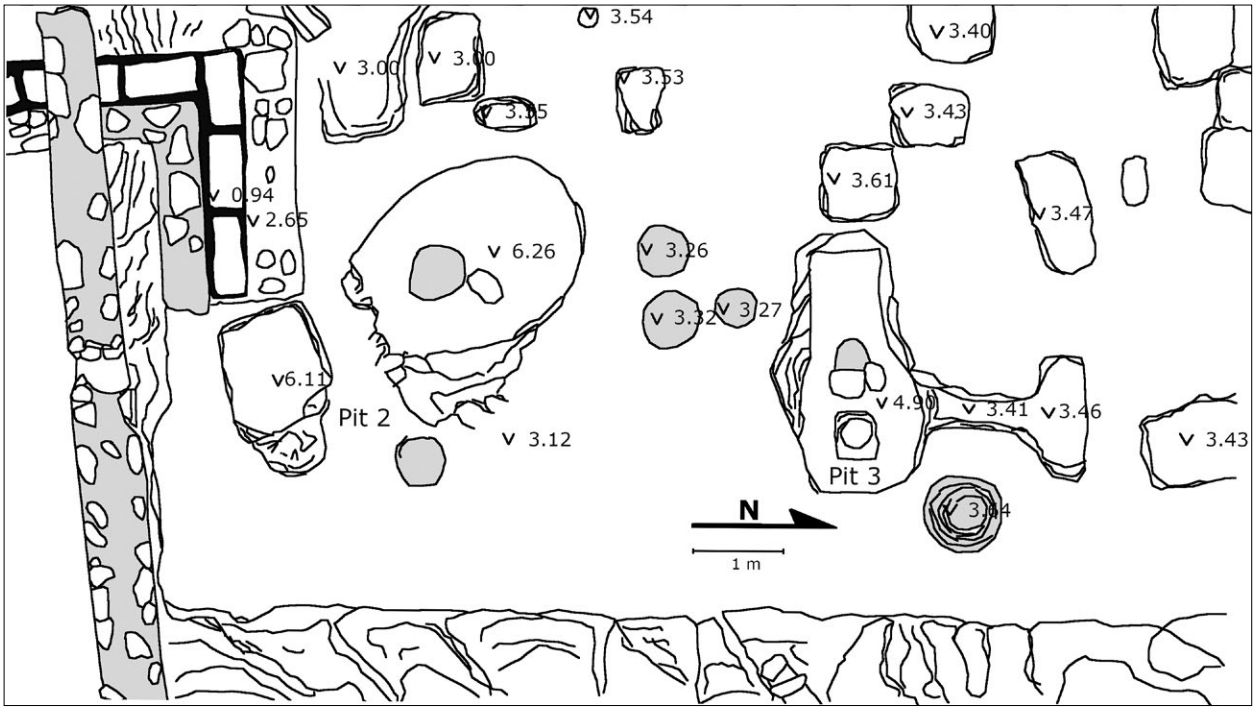


Figure 16: Sketch of the excavation with casting pits 2 and 3 at Amalias avenue
(Courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

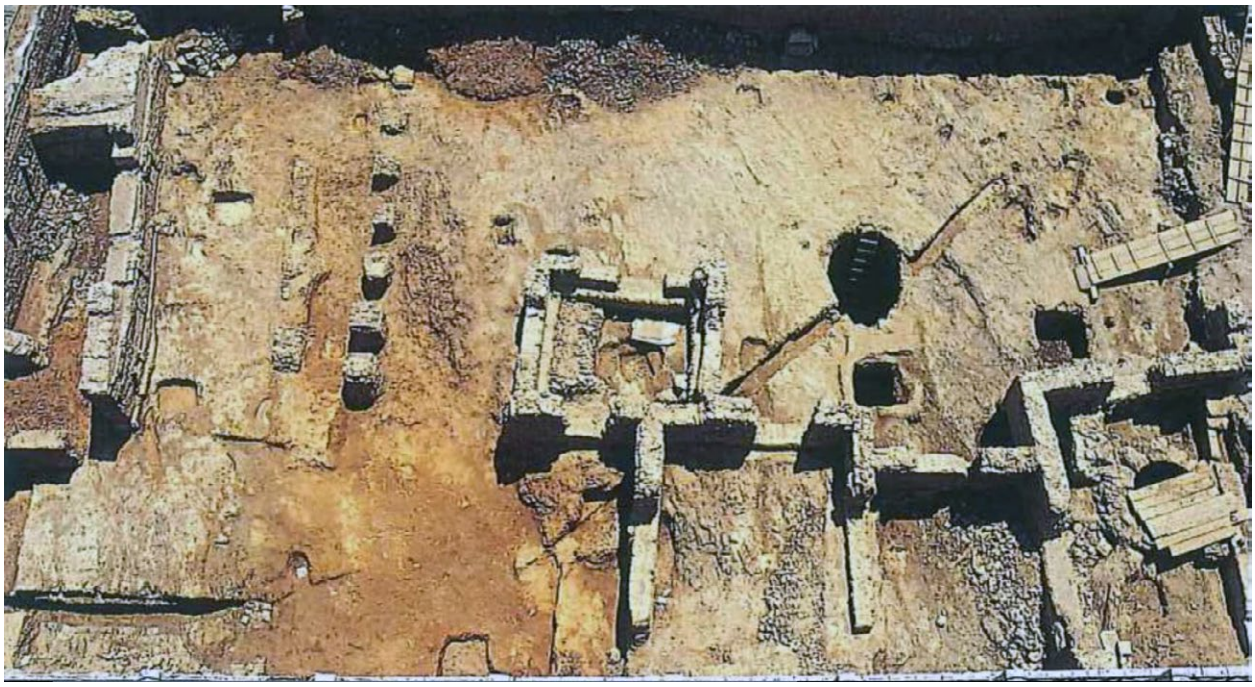


Figure 17: Area of the excavation with casting pit 4 at Amalias avenue
(Parlama and Stampolidis 2000: 154 fig. 6)

method and rebuilt there for teaching purposes.[22] The pit consisted of an oval heating chamber, in the centre of which the lower part of a mould was preserved. Like pit 2, pit 4 was entered through a roughly square manhole, with the connection to the heating chamber being provided through a small opening in the wall that had been built to fire the mould and seems to have been only partly removed. The heating chamber itself was clad and insulated with mud-bricks, which probably have been removed and reused after the workshop had been abandoned. During the work they had been fired hard and were thus excellent material for building. The

[22] Parlama and Stampolidis 2000: 156, fig. 9.

dimensions suggest that the pit was used for casting life-sized statues. Its current state of preservation is determined by a Hellenistic canal which cuts the pit diagonally, but did not cause further damage.

Pits 2, 3 and 4 are the most prominent installations of the workshop, which was active during the second half of the fifth century BC. The form of the pits and their arrangement was determined by the desire for a space-saving solution, which does not impede moving around inside the workshop. The dimensions of the work facilities were decided so as to accommodate the production of life-sized bronze statues, which were on demand in large numbers in Classical Athens. The pits were not in constant use and could have been covered with wooden boards or planks when not in use. During the winter months, from December to February/ March, when no work could take place in the pits, due to the difficulty in drying, 'cold' works, like chiselling and refinement could be performed in the peristyle courtyard. It also becomes clear that a sophisticated heating technology was applied in the pits of this workshop. The necessity for an antechamber/vestibule, through which the craftsmen accessed the pit, is justified by the tight positioning of the mould at an even (yet, short) distance from the walls, thus making the circulation and movement of the craftsmen inside the pit difficult. In the absence of an antechamber, the craftsmen would have climbed into the heating chamber by using a ladder.

Other installations in the workshop area

The excavators found a total of seven holes dug in the bedrock, which could be identified as casting pits from the remains of lower parts of moulds. They are either smaller or less compelling due to disturbance caused by the building of the Roman baths superimposed on the Classical remains. Pit 7 could only be uncovered partly, because it lay on the western border of the excavated area and the biggest part of the site had already been dug in the nineteenth century, when a retaining-wall was built towards Syntagma Square. The pit identified as no. 1, on the other hand, lies at a greater depth below the baths and definitely does not belong to the workshop of the fifth century. It can rather be seen as evidence that foundry-men were active in this area over a long period of time, as is known from the Kerameikos and the Agora excavations, as well.[23] It shall therefore not be considered in our examination.

The area surrounding the pits 2, 3 and 4 shows a series of smaller indentations in the bedrock. They vary in size and some of them contained charcoal. Since the filling was contaminated with foundry refuse everywhere, those pits surely were among the installations necessary for work on the site. We lack insight as to their function, as well as to whether they were contemporary or consecutive. Without speculating too much, we have to assume that during a period of 50 years – two or even three generations of foundry-men would have worked there – changes must have been made several times. Maybe for ten years a small pit was used for the drying and casting of the moulds for piece castings such as hands or feet. After a while, this pit was backfilled and another one was dug out, because it turned out to be more convenient or make more sense. Our possibilities for insight end here but it seems important to keep those possible steps of work in mind.

Three round depressions between pits 2 and 3 are striking. They have a diameter of 50cm and are relatively flat, with a depth of about 15cm. They are cut into the bedrock, and they were filled with burned refuse when they were found. This could be the place where big crucibles were set up on a bed of embers and were heated up with the use of bellows, before the molten mass was poured into the funnel of the mould. The proximity of the smelting installation to the casting pits would have made the transport of the crucibles easier. An experimental setup at the foundry institute of the RWTH Aachen has shown that the necessary temperature of 1100 degree Celsius was best achieved by heating the crucible from below, as well (**Figure 18**).[24] Three crucibles did not suffice for the casting of a statue, and surely more crucibles had to be heated somewhere else, maybe in the courtyard.

In the excavators' opinion, the traces of a rectangular structure right next to pit 2 belong to the same period as the rest of the foundry installations. Could the sides, each one formed of three longitudinal blocks, have a functional connection with the workshop (**Figure 19**)? The blocks themselves are laid upon a bedding of levelled bedrock and are solidly based, so that they could bear heavy loads. Parallels can be found in the so-

Figure 18: Clay crucible after a successful smelting experiment of the foundry institute of the RWTH (Rheinisch-Westfälische Technische Hochschule) Aachen (photo by the author).

[23] Stroszeck and Zimmer 2023 (in press).

[24] Zimmer 2006.

Figure 19: Detail of the excavation plan at Amalias avenue illustrating the different building phases. The blue area to the left marks the workshop of the fifth/fourth century BC (Bentz and Helms 2018: 119 fig. 14).

called workshop of Phidias in Olympia, where we know of a carefully constructed square of mud-bricks next to the casting pits (**Figure 20**),[25] but also in the big pits on the south slope of the Acropolis, where a podium was built of heavy blocks of conglomerate stone (**Figure 21**).[26]

Such constructions, which are also found in workshops of later dates, such as in Rhodes or Demetrias, were used for the work on the raw casting and for the fitting and provisional mounting of the statues. The position of those work-podiums immediately next to the casting pits is explicable, if we consider how difficult it is to pull the heavy finishing casting (Rohguss) out of the pit, rid it of the investment mould, and place/put it on the podium. The stone base next to pit 2 would meet all those requirements.

The overall appearance of the workshop underneath Amalias avenue can be roughly outlined. The excavator noticed that pits 2, 3 and 4 lay within a peristyle courtyard, with the sockets for the posts carrying the roof suggesting a wooden construction, like those known from sanctuaries of the sixth century BC. A wall segment running north-south, of which the non-preserved extension must have run close to pits 2 and 3, also belongs to this peristyle. Post-holes are preserved north of pit 4. South of the peristyle, single rooms of unknown function were probably also associated with the foundry. In any case, this is what the stockpiled mud-bricks in room D 22 would suggest.[27]

As our experiment in Murlo showed, the architecture of a simple hall, open at one side, is ideal for the installation of a casting pit. On the one hand, the building of the investment-mould takes a long time, dictated by phases of drying, and cannot be interrupted by rain – which is why a protective roof is necessary. On the other hand, the heating and firing of the mould takes several days, with the generated smoke and heat not allowing such work to be conducted indoors. For this reason, the foundry at Demetrias was set up in a peristyle courtyard of the Anaktoron, though at a later date, in the second century BC (**Figure 22**).[28]

[25] Zimmer 1990: 44-47.
[26] Zimmer 1990: 66.
[27] Zachariadou 1994: pl. 17 Γ.
[28] Zimmer 2003: 27, fig. 7.

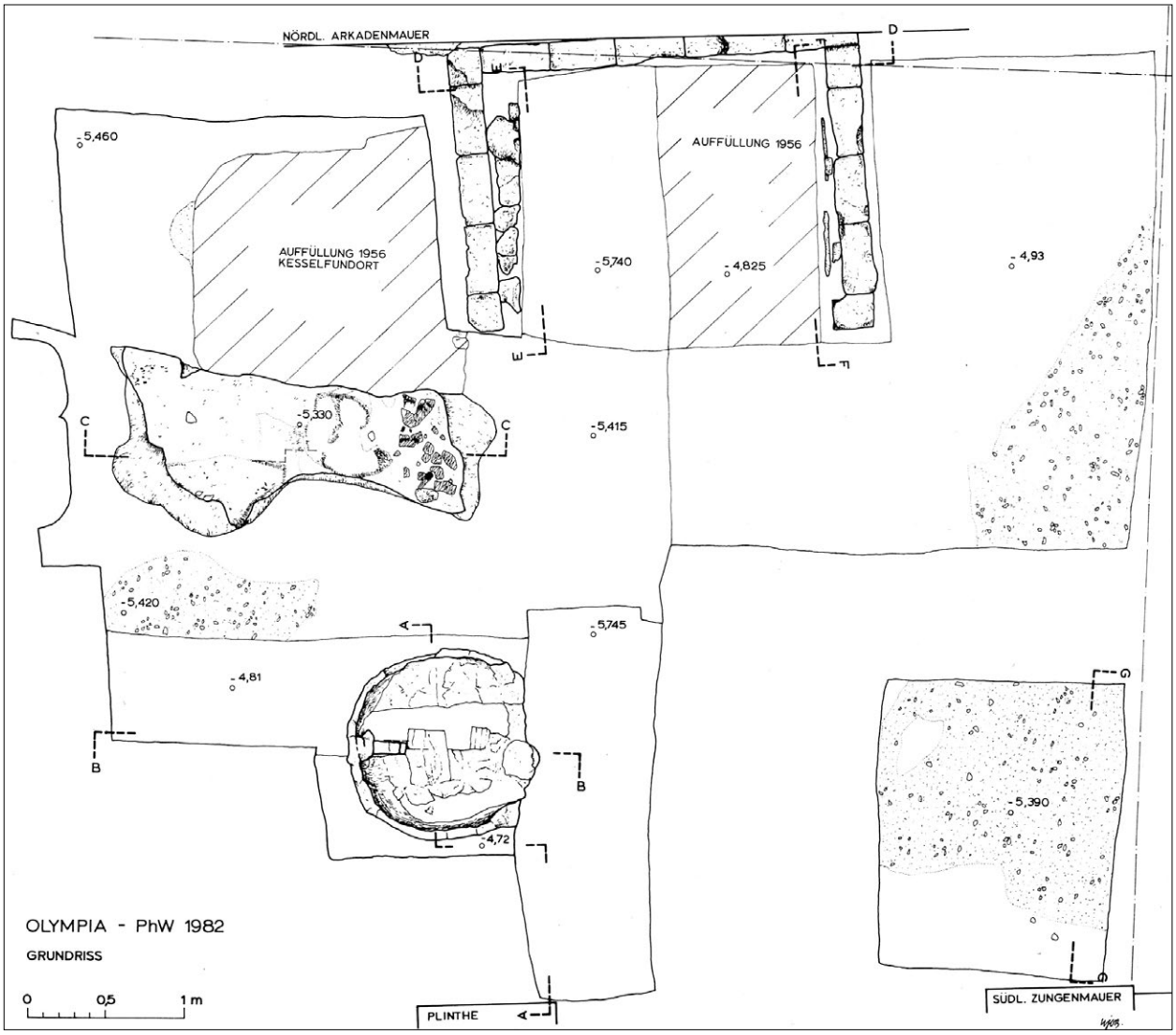


Figure 20: Plan of the workshop of Phidias at Olympia, showing a podium (drawing by Werner Jo Brunner).

The closed court of the peristyle is ideal for the bronze-worker, because raw material such as wood for firing the mould, enough charcoal for operating the crucibles or differently grogged clay for the building of the mould had to be stored somewhere. The excavation underneath Amalias avenue yielded evidence for a raw material that was important for the foundry, but could never before be documented and had not even been noticed in an excavation. In the southwestern part of the peristyle large amounts of red sand were found, according to Peggy Michaelidou. While preparing clay for the building of the casting mould, potters usually grog the fresh clay with clay that has already been fired. This reduces the shrinkage during the drying process and prevents the formation of cracks, which could damage the casting. Of course, the foundry-men had such slightly fired, so-called technical, pottery at hand since the first cast and, through chafing and grinding, they could obtain red sand similar to the one we know today from the construction of tennis courts. This not only explains the sand found in the workshop but also elucidates why, in proportion to the cast objects, there are relatively few mould fragments found in the workshops. The stockpiling of this 'moulding sand', just like the storage of prepared mud-bricks, suggests a permanently installed workshop with a long history of production.

Finds relevant to the casting process

Most of the finds from the workshop underneath Amalias avenue are fragments of clay investment-moulds. Essentially, apart from the great number of fragments, probably resulting from the long history of work, the context is not very different from those of other workshops. Only a small part of the pieces is significant, most of them are fragments, which do not reveal what they produced or had been shattered on all sides when the mould was broken, and were further worn down during burial (**Figure 23**).

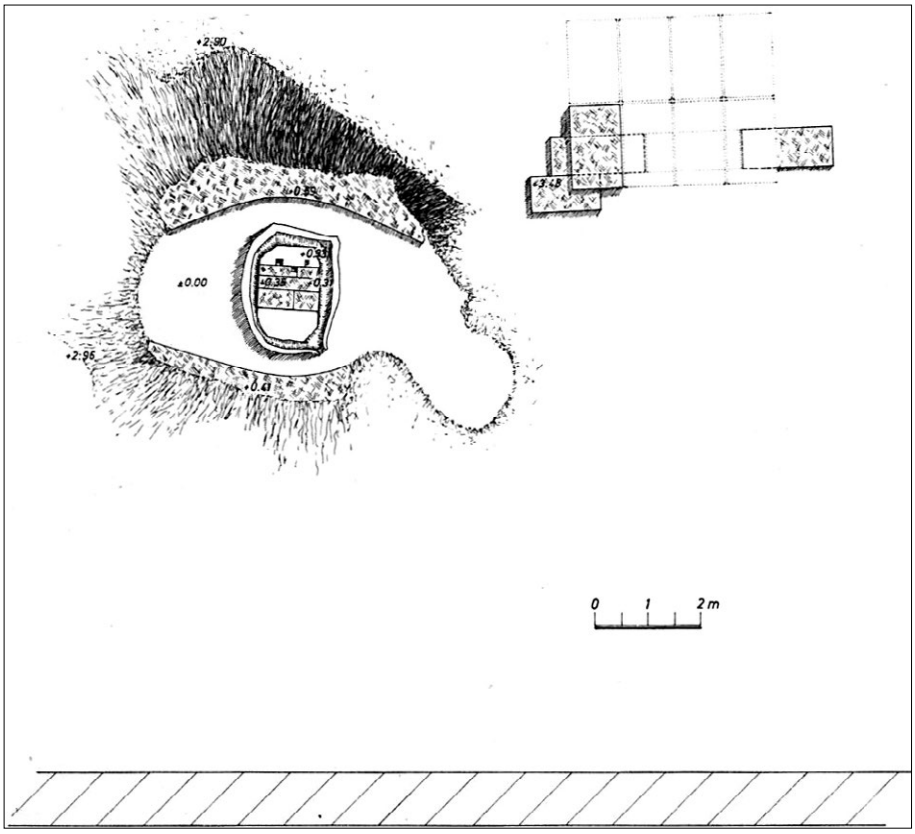


Figure 21: Plan of the 'Promachos pit' on the south slope of the Acropolis at Athens (Zimmer 1990: 65).

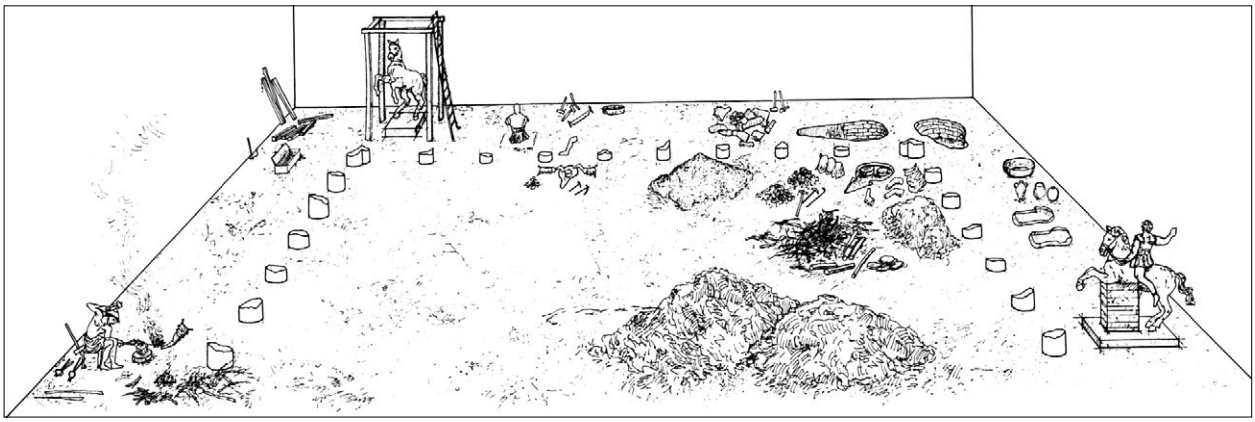


Figure 22: Demetrias, Anaktoron. Reconstruction of the working installations (drawing by Werner Jo Brunner).

The state of preservation is determined by the technique of the construction of the mould. Gates and vents for the liquid bronze are integrated into the form, as well as chaplets that reach into the core from the outside and prevent the core from sliding into the cavities caused by firing the mould and thus provoking a spoiled casting (**Figure 24**). Because of them, the casting-mould breaks into tiny pieces when the raw casting is laid open and, unlike what happens with a broken piece of pottery, there is no chance of reconstructing a significant part of the investment-mould through mending its pieces. At the same time, the more sophisticated and advanced the drainage system, the better the cast, but reconstruction becomes far more difficult. Funnels in which the molten mass has not risen all the way up and small moulds that form the details of statues, such as lips, drapery that was welded on later, or fingers, are the best-preserved ones.

The mould fragments from the workshop underneath Amalias avenue confirm our picture from the context known so far and attest to the high standards of casting technology achieved during the Classical period. The building of the investment-mould for casting required acute knowledge of the material properties of clay and the potentials of different grogging. Here we can assume an intensive cooperation with potters and coroplasts, since the potential of the material had to be exploited

Figure 23: Experiment in Murlo, Tuscany: The uncovered raw cast of the head (photo by the author).

to the maximum. Technological progress would have been reached through the intense discussion between the two branches of craft, which conveniently resided very close to each other.

The casting moulds had to combine several opposing qualities. It was essential that the mould should not develop cracks during drying or firing at a temperature of up to 300 degree Celsius. To prevent this, it was built in layers. Liquid bronze that got in small cracks anyway was stopped at the borders of the layers. Shrinkage or cracks were also dealt with by using various additions, such as hair, straw, small stones or the already mentioned 'brick powder'.

The findings from the workshop-complex underneath Amalias avenue show high standards of craftsmanship and professional treatment of the clay. They also imply the existence of additional workplaces, though, like pits for grading clay outside the workshop, or a regular supply by potters. While building the mould, the role of the innermost layer was to reproduce all the details of the surface of the wax model. Therefore, the clay had to be finely graded and evenly applied with a brush, of which the strokes we can recognise (**Figure 10**). This layer is normally coloured grey from the contact with the liquid bronze. As soon as the first layer had dried, a second layer was applied, which now included the supply pipes and made sure that no cavities occurred between the gates and the surface of the object. This is why we often find fingerprints on this layer, which show how the malleable clay was pressed into the cavities. Individual examples also show how parts of the inner layer adhered to the bronze, which is visible as a void on that surface (**Figure 25,** cf. **Figure 3**).

Here the fragment of a mould from pit 2 (X 2/336) sets a good example. The fragment comes from the outer shell and was baked hard. Being grogged, it contains coarse grit and coarse brick powder (**Figure 26**). On the inside of this hard layer, three fingertips are imprinted, resulting from a craftsman having pressed that layer with his fingers against the inner layer, which had been applied before. This middle layer dried and the imprints of the fingertips were filled with the next layer of clay and can thus be seen. This was possible only because apparently the middle layer had dried a bit longer at this point, which is why the two layers parted easily when the mould was smashed. At the same time, the

Figure 24: Experiment in Murlo, Tuscany: Wax model of the head with chaplets (photo by the author).

Figure 25: Mould fragment from the workshop at Amalias avenue (X 6/OM 3718a) (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Figure 26: Mould fragment from the workshop at Amalias avenue (X 2/336). Hard-baked exterior (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

spacers were shoved in that middle layer in a way that the heads of those chaplets or nails were level with the surface of the layer. This can best be seen at an experimental cast done in Aachen, where nails with round heads were used, but on the find itself physical imprints originating from the spacers can be discerned, as well (**Figure 27**).

A small fragment of the casting mould (length 7.7cm, width 2.7cm) from pit 4 (X 4/OM 3487a) is baked red on the outside and only consists of the outer layer. In the back, on the surface that bears on the middle layer of the casting mould, there is a square dent with lateral lengths of 9cm visible on the grey-coloured surface. Because of the brown colouring, it could be the imprint of a spacer made of iron, which was pressed through the first and second layer and rusted when the mould dried. To meet the needs, the clay for the second layer was grogged with hair, making it especially mouldable. When this layer had dried as well, the outermost finishing layer was applied. Its main function was to keep the investment-mould stable and to smooth its outside to prevent damage during firing. In some places,

Figure 27: Experimental cast, Aachen. Part of the lower leg of the 'praying boy' with chaplets (photo by the author).

the outer layer has been applied in two or three steps for that purpose, without changing the consistency, while always making sure that the investment stays consistent all over and does not become too thick, to avoid too much or too little heat in different places during firing. For that purpose, the clay used was grogged with relatively coarse material and contained fine grit as well as short pieces of straw which burnt during firing and ensured a certain porosity. The traces of work on the fragments of the investment-mould and the so-called technical ceramics in general turned out to be quite consistent in all the material found. For the description and interpretation, find-spots make no difference. Whether a fragment was found in pit 4 or pit 2 means only that it ended up there during cleaning or when the workshop was abandoned.

Funnels, through which the molten mass was poured into the mould, were among the most common findings in the area of the workshop. Their size varies, but they have one characteristic of construction in common: Most of them are connected to a vent, of which the opening was placed below the funnel. This was useful, because, when the molten metal flowed out of the vent, the artisans could see that the mould was full. Otherwise, they would only know that the mould was full when the funnel overflowed, entailing dangerous consequences. Today, metalworkers wear protective gear, whereas foundry-men in antiquity could only protect themselves through leather aprons.

The funnel-construction characteristic/typical of the workshop underneath Amalias avenue is also reflected in the finding of many funnels, which were baked hard, but not filled with molten metal, and thus they did not break.

One of the fragments belongs to a big funnel, of which the diameter we cannot exactly define (X 2/stroma 2/ OM 574a). The outer layer is grogged with small stones, baked red and partially covered with an adherent, thin yellow layer. The funnel is broken. On the inside, pressed folds are visible, showing how the outer clay was kneaded on (**Figures 28, 29**). On the outer side of the funnel, a support was added, which has broken off, but left traces of a piece of wood that was mantled with clay. By firing the mould, the wood burned, but by then the protective mantle of clay had become so stable that it could take over the supportive function. Such supports can be found among the waste from the foundry, but this is the first time we can prove a supportive function with regard to a funnel. The use of such supports makes sense, since high pressure could briefly be exerted on the walls of the funnel, while the molten metal was being poured and, in case of a break, the workers would have been in danger from spillage.

Figures 28, 29: Funnel fragment from the workshop at Amalias avenue (X 2/ stroma 2/ OM 574a), inside and outside (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

In the current state of research, we cannot determine whether this was a special safety measure of this particular workshop, given that it is evidenced here for the first time, or whether it was a common practice at the end of the fifth century BC.

A similar construction was found in the red-baked fragment of a vent. The air-hole obviously towered so high, that the mould-makers deemed it necessary to secure it with supports. Two imprints of wooden sticks testify to that (X 4/OM 3487 b/13.2.13 – **Figure 30**). One imprint runs parallel to the vent and can be followed to a depth of about 3.8cm. It is a flat but irregularly split wooden billet. One gets the impression that the wood was not completely split with an axe, but just torn apart at the end. A second imprint testifies to a billet measuring about 3 x 0.7cm, which was fixed horizontally. Its imprint can be followed to a depth of 2.5cm. On the inner venting pipe, two little drops of bronze are still stuck. At the broken lower end of the air-vent it is clear how carelessly the workmen worked on such subsidiary details: the venting pipe itself is round, but the layer of clay applied above is decidedly angled at one point. The casters applied the first layer a bit sloppily and did not spread the clay evenly, which was without risk at that point. When a vent projected so high that it had to be secured, we can assume that it was fixed at a certain distance from the funnel and that the cast object must have sloped slightly from the funnel towards the vent. If a vent was free-standing without protection, there was danger that it could be knocked off when the pit was heated and that foreign objects could get into the mould.

Unfortunately, no complete large funnel has been preserved. In casting pit 2 (X 2/OM 581-11) the

Figure 30: Fragment of a support from the workshop at Amalias avenue (X 4/OM 3487 b/13.2.13) (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Figure 31: Funnel fragment from the workshop at Amalias avenue (X 2/OM 581-11), inside (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Figure 32: Funnel fragment from the workshop at Amalias avenue (X 2/OM 581-11). Side view of the rim (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

significant fragment of a rim was found, yet, mended from two joining pieces. The funnel was built in at least two layers. The outer one of slightly fired clay is only grogged lightly and shows many drying cracks; the inner one was prepared with the addition of fine grit and was baked red (**Figure 31**). This archaeological finding can be explained if one assumes that, after the first firing phase, the funnel was smeared again with a layer of clay about 0.5-0.9cm thick, on the inside as well as the outside. Why exactly that happened remains unclear. 1.5cm below the upper rim, the original lip of the funnel can be seen clearly (**Figure 32**). Maybe it was only recognised when the mould was first fired that the funnel was too small or its wall too thin, and it was enlarged through another application of clay, as well as secured by supports. With an estimated diameter of 30cm, we are faced with a big specimen. It is probable that such a 'correction' can be ascribed to the intervention of the master of the foundry himself or a foreman.

A specimen of similar size, also from the casting pit 2 (X 2/OM 382) suggests that the diameter of 30cm, which would correspond to an Attic foot, was probably a standard size in the workshop. The funnels are characteristically built in many layers, which means that the artisans were able to give them a certain form and dimension, which they obviously did not achieve from the beginning (**Figures 33, 34**). Strangely enough, some lead got in between two layers and solidified. That could only have happened at the end of the casting

Figures 33, 34: Funnel fragment from the workshop at Amalias avenue (X 2/ OM 382). View and layer composition (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

process and is hard to explain. Maybe the casters pulled the funnel out of the waste, closed it at the bottom, and used it to melt lead that was needed to fix the statues on their bases but also to produce the so-called 'lead pencils'. Such pens could be used to record information on bronze, stone or marble. Here we can only speculate.[29]

The quality of the bronze cast was vitally dependent on the molten metal being able to reach all the cavities of the mould before solidifying. If this did not happen, small bubbles were formed inside the bronze.[30] This is why the gates for the bronze, as well as the corresponding vents, played an important role while building the mould. Placing the gates accurately is what determines the quality of a foundry, especially since throughout antiquity it was not possible to heat the molten mass far above the melting point, thus allowing relatively short time for the procedure of setting. Contrary to modern metallurgy, the ancient gating was based exclusively on the experience of the foundry master. The degree of perfection in the use of the gating technology in our workshop is

[29] Bankel 1984.

[30] On the problems concerning ancient casts, see Moeinipour *et al.* 1995; Ratka and Sahm 1997.

Figures 35, 36: Gate fragment from the workshop at Amalias avenue (X 4/ OM 3487c). Wax pipes/vents are merged, seen from below and under the junction below the opening of the flow gate (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

demonstrated by the fragment of the big opening of a gate from pit 4 (X 4 /OM 3487i – 15.3.2013). The vent was fixed to a funnel, which is now lost. In it, three vents are merged (**Figures 35, 36**). The fragment has conveniently broken, so we can observe the complex arrangement of the canals in three dimensions. We probably owe that find to a mould-maker who was especially cautious while building the mould and therefore located the gate with the pipe in a high position, so that the rising bronze would not reach the pipe. Of course, there are other possibilities, above all a faulty casting, at which point the mould broke and the bronze flowed out without filling the mould completely. As usual, the vent was constructed in three layers. First the canals formed out of wax rods were mantled with a facing of 5-7mm thickness. The spaces in between were then filled with grogged clay and spread all around. Finally, an approximately 1cm-thick grogged layer provided an evenly smooth surface. The two outer layers developed a red colour from baking. It is clearly visible how the workers were not able to press the malleable clay into all the cavities. This was not necessary, anyway, because this high up in the mould the rising molten mass could not cause much pressure and the vent lay above the cast piece. The craftsmen charged with moulding let layers dry one at a time, which is why they can be easily separated. The diameters of the three channels vary. While the two small ones have a diameter of 1.1cm, the bigger one measures 1.5cm. The opening of the gate was probably fixed a little below the corresponding funnel and joined to it with a clay sleeve. On the middle clay layer, which fixed this connection, the fingerprints of the foundry-man in charge of that job can be seen clearly. The diameter of the gate, through which the molten mass flowed from the funnel into the mould, is hard to estimate because of its bad state of preservation and must have been around 2-2.5cm, which would be quite a remarkable dimension. In any case, the complexity of the canals' arrangement in three dimensions is astounding. Never before has this been observed. This feature shows that, in our workshop, as early as the fifth century BC, an extensive knowledge of a refined gating technology was attained, based on experience. We are entitled to assume that the percentage of spoiled castings was very low in this workshop.

The finds in the dump of the workshop pose many new problems because craftsmen in antiquity had other priorities than what we would expect nowadays. One concern was the so-called supports. Those tools are always necessary when constructing a mould and they are normally built out of waste material. Finds from different workshops in Greece and from completely different places show that there was no fixed system. Often wooden sticks were used and mantled with clay, but chipped handles of amphoras were found as well, probably because in the surroundings of workshops they were generally at hand, in quantity. All have in common that they can be brought into the preferred shape quite easily, using an axe or some other tool. And, of course, they had to be cheap or costless. In no workshop-context have we found evidence of iron or bronze rods being used as building supports. However, a support of a hitherto unknown material was used in our workshop (X 2/OM 58-12.10.2011, S.17). The fragment is the lower part of a relatively wide support, which was formed very roughly in clay and baked red. As a stabilising element inside the support, a fragment of a casting-mould was used, which a worker took out of the dump from another casting process and used for building the new form (**Figures 37, 38**). This support did not rest on a flat surface, but on a slightly concave one. The clay was heavily grogged and malleable, which makes sense, since the support was added when the outer layer was set and the mould got its final shape. The recovery – for the first time – of such clay fragments in secondary use unequivocally suggests that this was a main, a master's workshop, where old mould fragments were kept; this would not be the case if the worksite operated on commission.

Figures 37, 38: Support with clay core from the workshop at Amalias avenue (X 4 / OM 3487,2), inside and outside (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

The heating and firing of a casting mould in large pits, such as numbers 2 and 4, required heating for days on end, with the firewood being stacked around the mould and stoked. At the current state of research, we cannot tell for sure to what extent charcoal was used, but that was probably linked to the practice and experience of the respective workshop. If we now imagine the mould inside a pit and a funnel with a diameter of about 30cm on top, it becomes clear that during heating, charcoal or little bits of wood will get into the form that can block the molten mass and might cause a spoiled cast. Even when stoking was very careful, particles could blow off and land in the funnel, due to the intense heat, which is why the opening had to be temporarily closed in any case. In other workshop contexts, lids have been found that can be connected to that step in the process.[31] One such specimen was among the waste in pit 2, as well (X 2/OM 838-11.4.2011, S.2). Its diameter is 11.5cm (**Figures 39, 40, 41**).

[31] Zimmer 1990: 139; Zimmer 2009: 218-223.

Figures 39, 40, 41: Three views of a lid from the workshop at Amalias avenue (X 2/OM 383) (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

A kind of handle has been pulled out of a lump of clay, with which the workers could put the lid on the opening, but remove it before pouring in the molten metal. The clay is lightly baked, on the lower side traces of smoke can be seen, which occur when the wax boils away and residual moisture from inside the mould wells up the runner. So far, the lid corresponds to finds from other contexts, except that it is not rounded, but slightly triangular. But three round openings with a diameter of about 2cm each are striking. The only good explanation for them is that the lid was put on a ventilation pipe. That would make the triangular form understandable, too, even though some questions of use still remain open. Maybe with the big funnels a lot of steam welled up and made the openings necessary to keep the lid

Figure 42: Lid with plug from the context of the workshop on the Acropolis south slope (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

from being pressed up or blown away from the opening. Plugs from the workshop on the south slope of the Acropolis point to such force effects expected by the workmen (**Figure 42**).[32]

Every time a bronze workshop is found, the question of how the craftsmen prepared the metal for the casting is asked anew. Now it seems likely that the melting process took place in big crucibles of clay, built in layers, much like the casting moulds. On the other hand, the low number of fragments from crucibles invariably poses a problem. In comparison to the fragments of casting moulds, heaps of which can be found, the number of fragments that can clearly be identified as belonging to crucibles is normally very low. One stray find from Olympia and a series of experiments with reconstructed crucibles following it helped us understand the situation.[33] The crucibles were built around a frame of iron rods, to allow for short transportation of the molten mass and pouring it into the mould.

Contrary to our first conjecture, this was possible with the crucibles modelled after the findings from Olympia (**Figure 43**). We have to assume, though, that the production of crucibles was a peculiarity of the workshop and there will be allusions to changed constructions in every context. For example, the iron rods may be stronger or weaker, sheet-like shapes might have been used, as well.[34] All crucible constructions have one thing in common: the combination of iron and clay results in a high degree of fragmentation, which surpasses even that of the casting moulds. Much like the casting mould, the crucibles were built in different layers of clay or loam, just without the differentiation/ fluctuation in grogging. This way, stress cracks should be avoided and the molten mass prevented from oozing out.

The melting process itself was carried out with the use of bellows, of which the mouths, also formed of clay, blew hot air at an angle from above onto the mixture of copper, tin and charcoal. Since high heat developed in the surroundings of the bellows-mouths, we find blown-open clay surfaces at the mouths themselves, as well as on the walls of the crucible. To reduce the tension built up, the crucibles were probably put on a bedding of smouldering charcoal that was fuelled from the side (**Figure 44**). A problem posed by the finds is that after smashing, fragments of crucible cannot be distinguished from mould fragments, and certainty can only be claimed for parts of the rim and pieces with at least partial slagging of the surface, with adherent bronze spills. It is unlikely that we will ever find an intact crucible, since they were shattered after use, to economise on the core iron necessary for further use.

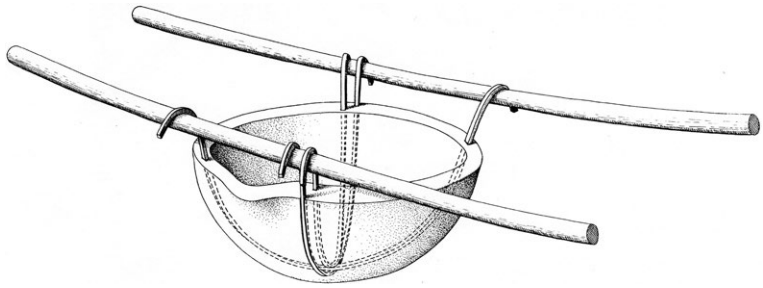


Figure 43: Reconstruction of a moveable crucible for melting bronze (drawing by Jörg Denkinger).

Figure 44: Successful melting experiment with a crucible of clay and three bellow-pipes at the foundry institute of the RWTH Aachen (photo by the author).

[32] Zimmer 2009: 218-223.
[33] Völling and Zimmer 1995; Zimmer 2006.
[34] In Roman times, metal cauldrons seem to have been used for making crucibles, as well. In any case, recent findings from Jerash (in Jordan) suggest so (Khalil *et al.* 2013: 37). In the Middle Ages, pans that were spread with clay were used for casting bells.

Figure 45: Fragment of a crucible from the workshop at Amalias avenue (X 2/ OM 581e) (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

A fragment of a crucible comes from pit 2 (X 2/OM 581e). It belongs to the rim of a steep-walled crucible (**Figure 45**). The clay used was grogged heavily with grit and probably impregnated against shrinkage- and stress-cracks by the addition of brick powder. The outer layer was baked red and has partially chipped off. On the slightly molten surface of the inside, bronze spills have been baked in. At about 10cm below the rim, the imprint of an angular object on the outside probably originates from the armouring of the crucible, made of iron, as inferred from the slight reddish-brown traces. Since the imprint suggests a minimum width of 1.5cm, the core iron was probably a beam/rod of rectangular cross section, comparable to those from Olympia.[35]

Regarding the size of the crucibles used in our workshop, we cannot reach any precise conclusions, because of the small size of the fragments. The rim fragments provide only rough estimations at best, for these vessels could not be formed on a potter's wheel and thus are not perfectly circular. Another fragment from pit 2 probably belongs to a crucible with a diameter of about 30-35cm. Its wall was steep, the rim fixed at a nearly right angle with a slightly rounded edge. The inside is blackened and shows cracks that testify to high-temperature. The clay material is heavily grogged. As concerns the size of the crucibles, taking into account their long existence over several years, we can assume that different formats were used in the same workshop, including big crucibles for casting the body of a statue, or smaller ones to produce small-part casts of toes and fingers. We may guess that the core grid had a certain, uniform size, which had proven fit for the workshop, so there could be several big crucibles, one medium-sized and two small ones. The production of core iron was always complex and therefore standardised.

[35] Völling and Zimmer 1995.

The high melting temperature, 1054 degree Celsius for pure copper, could only be reached by using bellows. Contact with the melt, which was covered in glowing charcoal, was made via tuyères (nozzles), which were formed using the ever-present loam, just like all the other tools in the bronze-casting workshop. The bellows were exposed to extreme tensions, since the mouths were exposed to extremely high temperature, at which the surfaces of the bellows began to melt and developed a glass-like consistency (**Figures 46, 47**). This could go so far that the clay began to drip and finally the mouth began to melt. On the surface, small droplets of bronze were sometimes baked in. By increasing/growing distance from the hottest point, the heat was soon reduced and thus the ends of the bellows were normally only baked very lightly. The difference of temperature between the entry and the exit point of the air explains the fact that basically we only have fragments of the mouth or nozzle, the end that was looking towards the bellows dissolved when stored in the ground or cannot be distinguished from the fragments of the investment-mould.

This state of foundry technology is documented by the finds from our workshop, mostly only small fragments of the mouths, of which the air-duct was 4.5cm wide. The measurements can only be estimated, but they fit well to the findings from Olympia with their diameter of 3.2cm.[36] The large number of fragments attests to a workshop that was in use over a long period of time; contrary to the evenly fired fragments of the investment-moulds, the vitrified mouths of the tuyères (nozzles) could not be ground down to brick flour/ powder, but were cast away with the waste from the foundry or trodden into the ground.

A typical specimen of the mouth of a tuyère with traces of the production was found in pit 2 (X 6/OM 3721 Kb). The fragment is only preserved at a length of 5.5cm (**Figures 48, 49**). It preserves the mouth and is heavily vitrified due to the strong heat it was exposed to, yet only at an early stage, so that the basic shape can still be seen clearly. The mouth is only slightly bigger than that of the tuyères from Olympia, which also come from the second half of the fifth century BC. Such tools were made on the spot in large quantities, because they were tasked heavily during use and had to be changed quite often. We know an example where the bellow's mouth had begun to melt but was stopped by applying fresh clay during the ongoing work process; yet, regardless of such repairs, their time of usage was limited.[37]

Tuyères were built in layers of clay, using a round rod as a core. A 10cm-long fragment containing

[36] Heilmeyer *et al.* 1987; Zimmer 1990: 183-187.
[37] Heilmeyer *et al.* 1987: 294, fig. 55.

Figures 46, 47: Fragments of tuyères from the workshop at Amalias avenue, showing the inside with remains of the air ducts and the outside, heavily vitrified (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

the whole curve of the mouth of a tuyère has been preserved from pit no. 2 (X 2/135). The air-duct has a diameter of 10cm on the inside, the diameter on the outside decreases from 9 to 7cm towards the air outlet (**Figure 50**). The wall consists of only one layer of clay, very coarsely grogged with small stones that measure 10mm at the most. At the mouth the surface begins to fuse and is blown. On our example we can see clearly how the clay was skimmed around the mouth with a finger that left a concave profile. After the clay had dried, the round rod was removed with a slight twist and left a regular air duct. Judging by the findings, the tuyères were air-dried or slightly baked before they were inserted. It was not easy to produce perfectly round rods in classical antiquity. If the bar was made of wood and not perfectly smoothed, it could not be twisted and removed without damaging the air-duct. Forging a round iron rod was difficult, whereas casting a bronze rod required much effort, too. There is a good chance that a wax rod was formed by rolling the wax between two boards, and then removing it from the tuyère by slightly heating it. Another possibility was a baked clay rod. Clay, just like wax, was ubiquitous in a workshop for casting

Figures 48, 49: Two views of a bellow-mouth from the workshop at Amalias avenue (X 6/OM 3721 Kb) (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Figure 50: Mouth of a tuyère from the workshop at Amalias avenue (X 2/135) (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

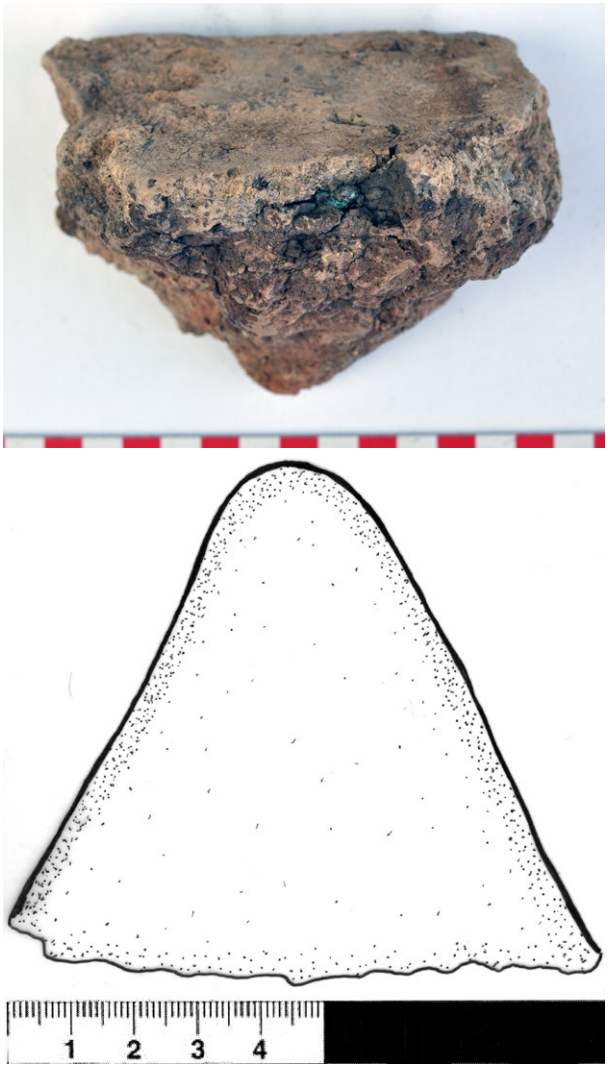
statuary bronze. Whichever solution was chosen, we have to assume that a workshop only had one or two such models that were used as a template for building the tuyères.

Thoughts on the form of the cast objects

The huge number of fragmentary investment-moulds in small pieces did not allow a particularly thorough search for joins. Neither was there workspace or workforce available for that. In addition to the fragments of moulds which provided information about the state of technology in the workshop at the end of the fifth century BC, some fragments suggested the appearance of the statues that were made there. A typical example comes from pit 4 (**Figures 51, 52**). It

Figures 51, 52: View and cross-section of a casting mould fragment from the workshop at Amalias avenue, mended of two pieces (X 4 / OM 2533st) (photo and drawing by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

is 13cm long and broken in two pieces. The preserved facing is coloured grey, while the outer layer was built using grogged clay, red-baked (X 4/OM 25333st). The cross-section clearly shows two convex folds, which are divided by a small concave one. Since the mould is relatively thin at that point and only measures 1.5cm at the fracture, we cannot tell for sure, whether the fragment comes from a mould for a statue or a smaller piece-mould. In any case, it appears that a peplos was cast from it. This form of drape is found beneath the flap of a peplos, where the long pleats of the garment are separated by small notches (Kerben), which widen into concave folds (Faltentäler) and finally end in hollow fluting (Hohlkehlen). Such draping of the garment is prominently shown in the group of Procne and Itys in



Figures 53, 54: View and cross-section of a mould fragment for casting a convex fold (Faltenrücken), from the workshop at Amalias avenue (X 4/ 3480a) (photo and drawing by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

the Acropolis Museum,[38] and less obvious in the Korai of the Erechtheum.[39] In any case, they occur in the late fifth century BC.

A mould fragment with a roughly triangular cross-section, rounded at the unbroken side, also comes from pit no. 4. The piece has been preserved at a length of 12.5cm, the maximum thickness being 8.5cm (**Figures 53, 54**). Both preserved sides show a fine, baked clay, but not the usual uniform grey colour. Some bronze has gotten into a crack on the surface and solidified underneath the surface. This greenish corroded rest of metal can be seen well in the fracture. Some parts of the clay appear light brown, as the mould only got little heat on the inside. There can be no doubt that the clay fragment resulted from casting a fold undulation, as we know them from the peplos. It was a long, straight fold that comes from the lower part of the garment. In theory, the fragment could also be part of the clay core that we have to assume for the inside; yet, experience has shown that the core clay does not come off easily but, instead, clings/adheres to the inside of statues, sometimes even until today.

An example from pit 4, of which the interpretation was difficult at first, can be included in the fragments discussed here. On the preserved surface the clay is baked quite hard. In the inner area stroke-lines can be seen at the fracture in longitudinal direction, which are then followed by the baked red clay (**Figure 25**). The length of the fragment is 18.5cm, its maximum width 6.5cm. The piece is broken on only one side, the other one ending in a kind of curvature, which indicates that we actually see the implementation of a concave fold (Faltental). It is the fold of a garment that ends in the form of a kind of depression or pipe. Such folds mainly appear at belly-height below the *apoptygma*/ overfold, when the peplos unfolds again after the constriction. The dents in the folds are mostly quite small, however, so the fragment with a width of 6.5cm is too big. We know, mostly from statues of the late fifth century BC, similar forms of folds at the level of the legs, where they can be of bigger dimensions. The difficulty lies in the fact that, apart from the Korai of the Erechtheum and Procne of Alcamenes, we have no original works, but only Roman copies. For the shape itself, however, such copies are also comparable. This form of draping, rendering dense but flat, compressed pleats (Staufalten), hints at the particularly fine fabric/textile.

The finds from the workshop contain an abundance of mould fragments from the convex vertical folds, but only a few are preserved well enough for us to describe them clearly. Only slightly baked for the most part, their contours are destroyed beyond recognition due to their burial and recovery. A fragment from pit 4 has been preserved to a length of 18cm (X 4/OM 3480a) and comes from a fold with a slight crease, that can be seen in the cross section and was probably intended to visually enliven the surface (**Figures 55, 56, 57**). This naturalistic detail of drapery was a strong point of bronze art, but the same acuteness can be seen on the Korai of the Erechtheum.[40] In this example, the clay in the deeper layers has gotten little heat, but also little oxygen. That is why it has a black colour, which is characteristic for this kind of heating conditions. From the fracture, fingerprints are visible, which testify to the effort to press the malleable damp clay of the second layer as deeply as possible into the fold to avoid the formation of cracks or hollows.

[38] Cf. https://www.theacropolismuseum.gr/en/statue-prokne-and-itys (last accessed 15 January 2024). Schuchhardt 1977: 1-21.

[39] Cf. https://www.theacropolismuseum.gr/en/erechtheion-karyatid-kore-b (last accessed 15 January 2024).

[40] Hiller 1971: no. 93.

Figures 55, 56, 57: Two views and cross-section of a mould fragment for casting a fold, from the workshop at Amalias avenue (X 4/ OM 3480 a) (photos and drawing by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

The above discussed fragments come from the moulds in which approximately life-sized statues were cast. The forms of the convex folds suggest garments like the peplos and can be compared with the details of preserved statues. Among the few published cross-sections of the folds in Roman copies of peplos-wearing

Figures 58, 59: Statue of Athena from the Hephaesteum, Athens, Agora Museum inv. 1232 (Hiller 1971: plate 6 fig. 14) with cross-section through the peplos (Hiller 1971: Attachment 8 fig. 90).

figures is a statue of Athena, supposed to reproduce the statue in the Hephaesteum (**Figures 58, 59**).[41] Admittedly, the conditions for finding such fragments are adverse, because the bronze can only be obtained by smashing the mould. Certainly, the foundry-men chose a method which allowed them to expose the finished casting with as little effort as possible. The preservation of single fragments naturally was not taken into consideration, much less the thought that people would try to reconstruct the casting-mould after 2400 years. If we have a look at a partly uncovered raw casting, like the one produced at the foundry institute

[41] Hiller 1971: no. 90.

Figure 60: Small piece-mould for the end of a fold, from the workshop at Amalias avenue (X 4 / OM 3487 ib) (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

in Aachen for didactic purposes, it becomes clear what the chipped loam lumps looked like (**Figure 23**).[42]

Research on preserved bronze statues has shown that many small parts of the garment, especially the projecting ones, were cast separately and then welded in place in a laborious procedure. These smaller moulds are usually preserved in a better condition, their small dimensions permitting harder and more regulated firing. From pit no. 4 comes the fragment of a piece-mould, for the end of a fold (X 4/OM 3487 ib). It measures 14.5cm in width and 7.5cm maximum thickness (**Figure 60**). The mould was built in the usual succession of layers. The innermost layer is grey, showing rough, grooved traces of application/spread with the fingers (Fingerverstrich). The middle layer is partly grey due to the absence of air, while the outer one is 5-8mm thick and red-baked. The cast object was curved, with a wall thickness of 6mm, increasing towards the edge. This is not certain, however, because the broken edges are a little unclear. The piece-mould has two openings, each with a diameter of 6mm and a kind of funnel. It is unclear whether one of the openings was for receiving the molten metal and the other for ventilation, or if both were gates. Small droplets of bronze, now corroded, were baked into the interior surface. We may assume that the mould comes from the end of a fold. When we look at peplos statues from the end of the fifth and the beginning of the fourth century BC, there are folds on the lower end of the *apoptygma*/overfold, that fall to the front, exhibiting a flat curvature. These could not be cast in one piece with the rest of the statue, because of the extensive undercutting; instead, they had to be added later.[43] Eirene of Kephisodotos, especially the copy in the Metropolitan Museum in New York,[44]

Figures 61, 62: View and cross-section of a mould fragment for a fold end, from the workshop at Amalias avenue (X 4 / OM 3492 B) (drawing and photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

sets a good example. This is as far as we can take our considerations, for the rest would be speculation.

Similar fragments of piece-moulds can be found in large numbers in pit 4.[45] A striking fragment (X 4/OM 3492 B) measures 15cm in height and 13cm in width (**Figures 61, 62**). The surfaces of the backs of two folds are preserved. Numerous bronze traces are baked into the surface, showing that the mould developed small cracks during heating. At first sight, it looks as if a vent-hole was preserved, but this was not the case. The foundry-man, instead, pressed the clay so hard while encasing the wax model that the form looks contracted from the outside. The inlet of the molten metal was carried out directly on the sloping ridge of the fold (Faltengrat).

A mould fragment with a length of 16cm and a thickness of 3cm comes from pit 4 (X 4/OM 3492 B, form no. 3). It is baked red and hard on the outside (**Figures 63, 64**). There are traces of spreading the clay with the fingers and pressed folds (Pressfalten) which developed by pressing the clay into the convex fold with particular intensity. The feature explains itself; the clear division of the layers suggests their dry application, and the pressed folds testify to the decreased plasticity of the clay being already at its limits. The facing is grey with the familiar brush-strokes in various directions. The fold ends at a right angle, therefore we must have a piece of what is the lower edge of the garment. From

[42] Cain 2012: 22-25, esp. fig. 25.

[43] Prove of the treatment of added folds at a later date comes from the so-called 'dancers from Herculaneum' (Mattusch and Lie 2005: 195-211).

[44] Cf. https://www.metmuseum.org/art/collection/search/247173 (last accessed: 15 January 2024).

[45] Within the scope of a bigger project, this might be undertaken at more convenient times/leisure, restorers could carry out joins with good prospect of success, as in the case of Gerasa, for example (Gerasa 35). Ideally, such part-casting moulds can be completely regained.

Figures 63, 64: View and cross-section of a mould fragment for a fold end from the workshop at Amalias avenue (X 4/ OM 3492 B form no. 3). View of the inside and cross-section (drawing and photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Figures 65, 66: Mould fragment from the workshop at Amalias avenue, and print in plasticine (X 6 / OM 3718a) (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

the preserved facing we can deduce a wall-thickness of the bronze of about 9mm. This is quite massive and points to a bigger panel of folds ending at the feet of the statue. The course of the outer layer also hints in this direction and, in combination with the preserved inner layer, it allows us to expect a convex fold approximately 12cm deep. If the fragment belongs to a partial mould, a long vertical fold to be welded on subsequently was cast with it.

Just how difficult it is to allocate mould fragments, even approximately, may be demonstrated by a small fragment, which seems strange in a context of casting statues (X 6/OM 3718a). It comes from pit 6, in which small parts seem to have been cast, having nothing to do with the workshop and pits 2, 3, and 4. As a plasticine print of the fragment (7.5 x 6cm) shows, the surface was subdivided by square bars with an edge length of about 5mm, that run nearly parallel, and have not been cast separately, but stand out from the background as protrusions (**Figures 65, 66**). We do not yet know what this fragment represents.

The small piece-moulds are hardly or not at all understandable. Apart from their fragmentary condition, this is due to the fact that the foundry-men chose to locate their joins at points that are barely visible. If, for example, a leather strap is allowed to slightly stand out from the background and then goes on top of the garment, the caster will cut off the outstanding piece from the wax model, coat it with clay and cast it separately.[46] If someone finds the smashed mould later – even if all the fragments of the form are preserved – one will have no idea, what part of a statue could have been cast in there.

A small mould for a life-sized, slightly bent finger is easier to interpret. The form is preserved to a length of 6.5cm and was found in the waste from pit 7 (X 7/ OM 3631b). Only part of the inside of the finger is preserved, but the section with the back of the finger is lost (**Figures 67, 68**). Nevertheless, one can put one's own finger into the imprint and be certain that the finger came from a life-sized statue. The question remains, why this finger was cast separately and not together with the rest of the hand, as was done with the

[46] Cf. shoe laces of the bronze Augustus from Lemnos, kept at the National Archaeological Museum, Athens, inv. X 23322. The statue was first published in Touloupa 1986.

Figures 67, 68: Mould fragment of a finger from the workshop at Amalias avenue (X 7/ OM 3631 b). Inside and print in plasticine (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

bronze warriors of Riace.[47] However, for the so-called youth from Salamis in the Berlin Antikensammlung, the index finger of the right hand was cast separately.[48] The reasons for that remain unclear. As likely as not, one could think that in our case the hand held an object or grasped the garment. Probably the finger could only be attached at the end of the working process.

A mould fragment that, at first glance, was assumed to be closely connected to the discussed mould for the casting of a finger, was found in pit 2 (X 2/stroma 4–OM 581). It is a strange, red-baked fragment of clay with an overall length of 8cm (**Figure 69**). It consists of two layers, both of which have been grogged with small stones and brick chippings and have adopted the same colour due to intense aeration. In the 'inner' layer, the imprints of four fingers can be clearly recognised next to each other. The fingers can also be discerned from the background by a grey colouring, which came from fine clay slip clinging to the workman's fingers, the fine creamy clay dispersing at his fingertips. This

Figure 69: Mould fragment from a working process from the workshop at Amalias avenue (X 2 / str. 4 – OM 581) (photo by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

must be a product of pure coincidence: it is not a mould fragment for casting a hand. The outer layer comes from a small mould that had an air-vent to the top, the beginning of which can still be discerned clearly. The mould fragment, broken after casting, was coated with a lump of clay as a stabilising element and was to be used as a support, but the workman's hand was still covered in clay slip while he was adding the lump of clay. For some reason, he did not use the piece after all and dropped it into the pit, where it was baked hard. The fragment serves as an example as to how complex the interpretation of a foundry dump can be.

In one of the last boxes with finds from the workshop beneath Amalias avenue (no. 59) there was a peculiar mould fragment. Like the mould for the finger, it comes from pit 7 (X 7/OM 3956i), where, it seems, detailed work took place. The red-baked clay fragment consists of a small, round funnel with a square hole in the middle and a bit of the investment below (**Figures 70, 71**). The measurements are 5 and 7.5cm. At the edge of the funnel, a small piece of the outer clay layer has chipped off and, underneath, a small corroded trace of metal is visible. The inside of the funnel is coated with a thin layer of clay, in which the fine little stones used for grogging left their traces. In addition, at one point one can clearly see the imprint of a finger, maybe a thumb. A glance at the lower side reveals something astounding: One can see the imprint of a mouth with two closed lips, the square opening in the middle (**Figures 72, 73, 74**). On the plasticine imprint, it can also be seen that the chin has been partially rendered. But what was the purpose of that mould and its function in the production process?

Since the research of Edilberto Formigli on Riace Warrior A[49] we know that an especially lifelike presentation of a head consisted in casting the lips from pure copper and then inserting them using the so-called outer-

[47] Formigli 1984: esp. 125.
[48] Heilmeyer and Born 1996: 25, fig. 3.
[49] Formigli 1984: 130-133.

Figures 70, 71: Fragment of a small mould from the workshop at Amalias avenue (X 7/ OM 3956i). View of the side and from above (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

Figures 72, 73: Lower side of small mould fragment with the imprint of a lip and the print of the mould in plasticine (photos by the author, courtesy of the City of Athens Ephorate of Antiquities, Hellenic Ministry of Culture).

layer casting (Überfangguss). The copper has a slightly different colour from the surface and was left a bit rougher than the smooth bronze surface of the flesh. Together they created a very lifelike representation of the lips, one that was also tactile.

The problem with this find is that pure copper has a melting point of 1054 degree Celsius and therefore the metal has to be heated to at least 1100 degree Celsius, which is the top potential/limit of a clay crucible. Several peculiarities of our mould speak against such a process of work. For one thing, the hole in the funnel was only inserted with a rectangular/square nail and is not fit for filling in the molten mass. What is more, actual evidence of firing is lacking. The baked-in metal particle may have gotten into the funnel during work with clay in the surroundings of the workshop – in any case, it was not deliberately poured under the thin clay layer. The question therefore remains: what was the mould used for? The insertion of the copper lips is complicated, since in the end, the mouth, like the eyes, affected – if not determined – the effect of the whole work. Intermediate steps were necessary to ensure accurate fitting.

Presumably our mould was generated when the lips were shaped from the outset with malleable clay. A

Figure 74: Plaster cast of the mouth of the Athena Lemnia (photo: private collection).

head may have been the model, but it is more likely that the mould was taken from an existing model in the workshop. As the models of feet on the wall of the so-called Foundry Cup show, foundries had such devices at hand (**Figure 13**). We cannot assume that closed lips of life-sized statues of the late fifth century BC present big differences. Thus, the clay was applied and a round handle was added, which looks like a funnel but is not. It is unclear why an opening was pressed into the middle before the clay was dry, but probably it facilitated the

circulation of air for drying. Afterwards the form was slightly smoothed on the outside and then baked. Thus, one had a master model with which one could form wax lips at will. With a hot knife the lips could be cut in a fashion that was ideal for the head in progress. Only the wax was shaped in this form: the casting of the copper lips required an investment-mould.

Summing up our results, we now know of a bronze-casting workshop, where, towards the end of the fifth century BC, life-sized statues were cast, of which at least one was female wearing a peplos. Considering the current political situation, in addition to the dating provided by pottery, the workshop's operation would have lasted until shortly after the end of the century, so work would hypothetically have ceased soon after the Peloponnesian War. However, in the absence of any traces of destruction, the foundry was active into the fourth century BC. Presumably, after the crushing defeat, commissions from the city declined. If we take into account the topographically advantageous and central location of the workshop, it is reasonable to assume that, rather than unknown sculptors, the artists more likely to have worked here over decades are famous masters of the late High Classical era.

One of the artists who worked in Athens during and shortly after the Peloponnesian War was Alcamenes, who worked for Thrasyboulos in the year 403 BC, wherefrom we infer that his workshop survived the changing times. His origins from the island of Lemnos made him a metic at the beginning, but he, undoubtedly, became an Athenian citizen later.[50] As a metic, he was not allowed to own land within the city-walls but, once granted citizenship, he was allowed to keep his workshop at any premises. Among the finds from the workshop are only a few fragments of investment-moulds, which differ from the workshop-debris of numerous other Athenian contexts. Above all, fragments which belong to fold panels that are divided by a notch and especially the big, tongue-formed lumps that testify to deep folds ending in a depression are unusual. Such folds are found throughout the Classical period, but they are particularly notable in the statuary-group of Procne and Itys, whose origins in the workshop of Alcamenes are beyond doubt.[51] There, this fold formula is not only found in a small format below the *apoptygma*, but also in the area of the legs, and at a size that definitely corresponds to that of our mould fragments.

Something similar can be said for a type of Athena called Ostia-Cherchel after the primary representatives among the copies. The original behind them was and is, time and again, equated with the Athena created by Alcamenes to be put up in the Hephaestaeum, next to the statue of the god of blacksmiths.[52] For both the reproductions of Ostia and Cherchel the fold forms discussed are evident and have often been used, although the work of the Roman copyists present some differences in details.[53] Especially for the Athena statue in the Louvre, which Vinzenz Brinkman brought to the forefront again at the exhibition in Frankfurt 2016, the fold formulas described are dominant, in spite of the mediocre sculpting quality.[54] It is not the place here to pursue the problems of attribution of Alcamenes' works, but it is still noticeable, that especially on statues like the peplos figure of Castelgandolfo, the same play with the folds can be found, which is so striking in the context of the finds from the workshop at Syntagma Square.[55]

The two rare finds, the finger and the form for casting lips, unfortunately do not bring us any closer to the owner of the workshop. At least the chin indicated at the lip form gives us a hint that the mouth probably belongs to a female figure. The mouth with its width of only 5cm is quite narrow, but such forms are found often in Classical times. Regarding the master, we can thus only hazard a conjecture based on the finds. Alas, a confirmation could only be reached, if, during the final publication of the rich ceramic finds, a graffito with the inscription ΑΛΚΑΜΕΝΟΥΣ ΕΙΜΙ (I am of Alcamenes) could be found.

Work processes as basis for norm and proportion

Workshops for statuary bronze-casting were centres of innovation during the first half of the fifth century BC. While in the sixth century BC, the stone sculptors were still leading in the production of statues, because they could create monumental figures, the development of large-scale hollow-casting and piece-casting changed the situation fundamentally. The statues of athletes in the Severe Style, that mostly have only been preserved as figurines, show us with what enthusiasm the bronze casters took up and used the new potential and liberties of shaping. Here the ancient Greek historian Thucydides helps us. In the first book of his *Historiae*, Thucydides refers to the events preceding the Peloponnesian War. To warn the Spartans of the danger of the Athenians, an envoy from Corinth gives a speech, naming the following reasons: '(1.70.2) The Athenians are addicted to innovation, and their designs are characterised by

[50] Schuchhardt 1977: 7-9.

[51] Raeder and Lehman 2014: no. 12 and Resumé. Luca Giuliani presented in a talk at Eichstätt university a convincing in-depth stylistic analysis of the statue, which is not yet in press.

[52] About the type and the state of research critically, see Altripp 2010: 93-107.

[53] Schuchhardt 1977: 43-46. Also see Altripp 2010: 293-301 with rich bibliography. However, Altripp speaks for a date later in the fourth century BC on stylistic grounds, even though she is aware of the problems of chronological classification based solely on stylistic elements (preface).

[54] Altripp 2010: 293-301, no. OC III 1; Brinkmann 2016: 40-41.

[55] Altripp 2010: 297-298, no. OC III 1; Brinkmann 2016: 40-41.

swiftness alike in conception and execution; you have a genius for keeping what you have got, accompanied by a total want of invention, and when forced to act you never go far enough. [...] (1.71.2) but in the present instance, as we have just shown, your habits are old-fashioned as compared with theirs. (1.71.3) It is the law as in art, so in politics, that improvements ever prevail.'[56]

Notable is the remark 'ἀνάγκη δὲ ὥσπερ τέχνης αἰεὶ τὰ ἐπιγιγνόμενα κρατεῖν' (it is inevitable in politics, as it is in art or craft, that new methods drive out the old ones).

We can well imagine how, in the surroundings of such bronze-casting workshops, work processes ruled both thoughts and intellectual discussions.

The casting of a statue in pieces plays an important role even during the development of the model, since the casting pits had to be made to fit the pieces in question. If the casting was done at the place of assembly, as we have to assume in many cases, because of the difficult routes of transport, the measurements had to be determined well in advance. The casting pits on the plot Mylonas Nasou in Rhodes allow us to presume that non-foundry local workers had already laid out the pits before the arrival of the foundry-men. At least the measurements of 1.5 feet in diameter of the hollows for gathering the out-flowing wax suggest so.

An interesting aspect of the technology in the bronze-casting workshops has been delivered indirectly by a study conducted by the team of Kyoko Sengoku-Haga from Tohoku-University in Honshu.[57] The group has examined Roman copies of statues attributed to Polycletus using a 3D scanner. In the process, it turned out that especially at the feet, but also at the heads, there are nearly identical matches. This result complies with Michael Pfanner's thoughts regarding the technology of stone masons when copying.[58] The greatest similarities could be observed in the area of the mouth and the nose, as well as the strands of hair above the forehead, because the measuring points were most dense there. The nearly perfect match of single details such as the lip area also means that the bronze originals of which the copies were made referred to uniform models. In fact, the clay mould for the lip area of a Classical statue in the context of the workshop underneath Amalias avenue perfectly fits the results of the 3D scanning, which also pointed out that the lips of male and female statues are completely identical, as the comparison of the mouth areas of the Doryphoros and the Amazon of Sosicles have shown.

Conclusion

Clearly, the discussion on normative beauty, chiefly concerning male statues, reached its peak in Classical times and led to an idea of man that, in its manifold repetition and assembly, gravely influenced the perception of the Greeks, and especially the Athenians. Questions of proportion and uniform models were discussed in Greek workshops regarding the bronze-casting of statuary, as early as the sixth century BC. The late notice in Diodorus Siculus (1.98) points to that. He reports that the sculptors Telecles and Theodorus from Samos produced in different places two halves of a statue, which could be fit together as perfectly as if the image had been made in one piece.[59] This discussion perhaps came up with the invention of the hollow cast, probably first practiced in the Greek world in seventh-century Samos for the production of griffin protomes for bronze-cauldrons.

The workshops for statuary bronze-casting surely were places where technical innovations were developed and discussed. Targets of discussion always were the qualitative improvement and new possibilities for achieving a perfect and beautiful image of man. Not without reason, we know the names of at least two masters working in one workshop, one being the forming master (the master artist) and the other (the master technician) being responsible for the foundry. The beautiful form and the technical know-how coalesced at an early stage, leading in the Classical times to a technology that could perfectly meet all the aforementioned requirements. For the forming artist thus nothing was unthinkable, and no material property could restrict the freedom of his design.

As humble as the context of findings of the workshop underneath Amalias avenue may seem, it helps us understand the construction of an ideal of beauty by means of measurement and proportion. Planning and daily work of the foundry-men was determined by the models of individual body parts like feet, hands, lips and their relation to each other, the assembling of partial casts of body parts enabled by to the increasing potential of casting and welding. Of course this work also influenced the thought-process and discussions of the foundry-men from the master to the apprentice, without having to be instigated by philosophical considerations. Instead, the stimulation worked the other way round, when philosophers visited such

[56] Thucydides 1.70.2-1.71.3 (accessed 14 November 2023, http://www.perseus.tufts.edu/hopper/text?doc=urn:cts:greekLit:tlg0003.tlg001.perseus-eng3:1.70.2): 'οἱ μέν γε νεωτεροποιοὶ καὶ ἐπινοῆσαι ὀξεῖς καὶ ἐπιτελέσαι ἔργῳ ἃ ἂν γνῶσιν: ὑμεῖς δὲ τὰ ὑπάρχοντά τε σώζειν καὶ ἐπιγνῶναι μηδὲν καὶ ἔργῳ οὐδὲ τἀναγκαῖα ἐξικέσθαι. [...] νῦν δ', ὅπερ καὶ ἄρτι ἐδηλώσαμεν, ἀρχαιότροπα ὑμῶν τὰ ἐπιτηδεύματα πρὸς αὐτούς ἐστιν. ἀνάγκη δὲ ὥσπερ τέχνης αἰεὶ τὰ ἐπιγιγνόμενα κρατεῖν'.

[57] Sengoku-Haga *et al.* 2017: no.10.

[58] Pfanner 1989.

[59] Kansteiner *et al.* 2014: no. 1; Mattusch 1988: 49-50.

workshops. Socrates' visits to the workshops have a real background. Moreover, we must not forget that on the Assembly's decision for the placement of a statue in Athens, a committee was appointed in charge of the assignment of material and the accounting. These so-called *Epistates* were full Athenian citizens. They inspected the workshops regularly and had a say on matters of material and execution.[60]

There are good reasons to identify the owner of our workshop as a metic who was under the protection of the city but not granted full civil rights by the time of the workshop's establishment. In the summer months he was often working at remote places and getting into contact with other bronze-casters there. If we bear in mind the agonal competition for contracts, and social as well as artistic recognition, the remark of Thucydides that the Athenians were 'innovators' is very much compatible with such workshops. The 'dynamic that inheres in their change of style' (meaning Greek art)[61] could thus well have developed in the workshops of statuary bronze-casting, where, because of the complex work-process, technical development was of utmost importance. The find-spot of the workshop is a punchline: it lies immediately next to the Parliament in Athens and might serve to point out to the delegates how important insights, since the Classical times, could not only be gained from theoretical discussions but also in the actual workshops.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[60] Zimmer 1993.

[61] Giuliani 2019: esp. 124.

Chapter 3

Craft production and nuisance in the ancient Greek city: Spatial and functional approaches to urban industrial activities

Giorgos M. Sanidas

Abstract

To what extent does the generation of nuisance affect the location of craft activities within the urban space of Greek cities? Were the artisanal activities that used fire or produced noise or smell systematically rejected outside the city walls? In fact, from the beginning of the Classical period, if not earlier, several cities took measures against nuisance. Nuisance undoubtedly was a concern, even if this was not explicitly stated in textual sources. However, a representative survey/review of artisanal installations on the basis of the available archaeological data shows a fairly nuanced picture. While ceramic/pottery kilns in Athens were often – yet, not always – located outside the fortification walls, metallurgy workshops tend to be located inside, regardless of whether they sheltered temporary or permanent activities. This pattern appears to be repeated in other Classical Greek cities, such as Corinth. This gives rise to the logical question whether nuisance was the salient factor that determined the installation of kilns and analogous/similar facilities away from urban centres. The embedding of metallurgy and other fire activities within the urban tissue only complicates the issue. Even in the case of other polluting activities, such as tanning or dyeing, which were often established outside the walls (extramural), this *peri-urban* (suburban) locality does not seem to have been the rule. An overall understanding of the allocation of space to craft activities cannot be reached solely on the grounds of nuisance. Even if nuisance inevitably played a significant role, it is far from being the only factor. Other elements must be taken into account, such as the supply of raw materials and water, the destination of production, the 'real estate' regime and the fiscal policy of the various cities. In this complex picture, the operation of workshops within an urban context is subject to various material and institutional conditions, which require thorough and multifocal examination before we are able to formulate general principles concerning the urban geography of Greek cities.

Περίληψη

Σε ποιο βαθμό η πρόκληση οχλήσεων επηρεάζει τη θέση των χειροτεχνικών/εργαστηριακών δραστηριοτήτων στον αστικό χώρο των ελληνικών πόλεων; Οι χειροτεχνικές δραστηριότητες που χρησιμοποιούσαν φωτιά ή εξέπεμπαν θόρυβο ή κακοσμία απομακρύνονταν συστηματικά εκτός αστικού χώρου, δηλαδή εκτός των τειχών της πόλης; Σίγουρα είναι γεγονός ότι από την αρχή της Κλασικής περιόδου, αν όχι νωρίτερα, αρκετές πόλεις έλαβαν μέτρα κατά των οχλήσεων. Οι οχλήσεις αντιμετωπίστηκαν αναμφίβολα ως πρόβλημα, ακόμη κι αν αυτό δεν εμφανίζεται με ξεκάθαρο τρόπο στα κείμενα. Ωστόσο, μια αντιπροσωπευτική εξέταση των βιοτεχνικών εγκαταστάσεων με βάση τα αρχαιολογικά δεδομένα εμφανίζει μια εικόνα σχετικά περίπλοκη. Έτσι, στην Αθήνα, ενώ οι κεραμικοί κλίβανοι βρίσκονταν συχνά εκτός των τειχών, αν και όχι πάντα, διάφορα εργαστήρια μεταλλουργίας βρίσκονταν κυρίως στο εσωτερικό, ανεξάρτητα από το αν στέγαζαν προσωρινές ή μόνιμες δραστηριότητες. Το μοτίβο αυτό φαίνεται να επαναλαμβάνεται και σε άλλες κλασικές ελληνικές πόλεις, όπως η Κόρινθος. Αυτό δημιουργεί το λογικό ερώτημα κατά πόσο οι οχλήσεις αποτέλεσαν έναν καθοριστικό παράγοντα ως προς την εγκατάσταση κλιβάνων και παρόμοιων εγκαταστάσεων μακριά από τα αστικά κέντρα. Η αστική ένταξη της μεταλλουργίας και άλλων δραστηριοτήτων που προϋποθέτουν χρήση φωτιάς περιπλέκει ακόμη περισσότερο το ζήτημα. Ακόμη και στην περίπτωση άλλων ρυπογόνων δραστηριοτήτων, όπως η βυρσοδεψία ή οι βαφικές τέχνες, οι οποίες συχνά εγκαθίστανται εκτός των τειχών, αυτή η περιαστική θέση τους δεν φαίνεται να αποτελεί κανόνα. Μια περισσότερο σφαιρική κατανόηση της χρήσης του χώρου από τις χειροτεχνικές δραστηριότητες δεν μπορεί να επιτευχθεί μόνο με βάση τη λογική των οχλήσεων. Ακόμη και αν αυτές έπαιξαν αναπόφευκτα, αν και κατά περίπτωση, έναν κάποιο ρόλο, απέχει πολύ από το να είναι ο μοναδικός παράγοντας που παρεμβαίνει στο τελικό αποτέλεσμα. Κατ' αρχάς, πρέπει να ληφθούν υπ' όψιν και άλλα πρακτικά δεδομένα, όπως η προμήθεια πρώτων υλών και νερού, ο προορισμός της παραγωγής, το καθεστώς του χώρου και των ακινήτων αλλά και η παρέμβαση των αρχών (π.χ. η φορολογική πολιτική). Η σύνθετη εικόνα δείχνει ότι η λειτουργία των εργαστηρίων μέσα στο αστικό πλαίσιο υπόκειται σε διάφορες υλικές και θεσμικές συνθήκες, οι οποίες απαιτούν μια πιο πολυεστιακή εξέταση ώστε να μπορεί κανείς να προτείνει γενικότερες αρχές σχετικά με την αστική γεωγραφία των ελληνικών πόλεων.

Keywords: Greek polis; urban space; crafts, artisans; nuisance

Introduction

The approach to the urban life of the largest Greek cities during the Classical and the Hellenistic period, primarily Athens, but also many others, such as Corinth, is based on various sources, both textual (*testimonia*) and archaeological (*realia*). In the former, however, it is necessary to apply an 'archaeological' perspective to the whole of the documentary corpus, in order to draw, as far as possible, a concrete picture of the material and practical aspects, namely of the overall organisation of production and its impact upon private and public life. At the same time, it is also important to combine this archaeological perspective with a historical one, that of the Greek *polis*, i.e. of the institutions and collective bodies, but also of the pace of life imposed overall by the socio-institutional system of the *polis*. Finally, in addition to the political and institutional structure, the Greek city-state as a socio-economic entity constitutes a complex and tiered community,[1] with a population belonging to various social classes and differing in legal status,[2] the impact of which cannot quite be traced in the textual sources and is most often impossible to detect among archaeological assemblages.

Consequently, the question of craft production nuisance[3] is fundamental within the ancient urban contexts and, despite its apparent specificity, it allows us to address the appearance of the most characteristic craft locations and their role in Greek urban settlements (ἄστυ) (**Figure 1**). Obviously, a full analysis of the issue is impossible within the frame of a paper. For this reason, by making a functional choice, we focus on a particular aspect, that of craft activities insofar as the generation of nuisance is involved in their location in relation to the urban and/or *peri-urban* (suburban) space.[4] At the same time, this viewpoint allows us to highlight collective experience and everyday life within different urban levels. What links existed between the perception of nuisance, the neighbouring with polluting crafts, particularly those involving fire or olfactory work, and the reaction of the city?

On the whole, rather than looking for categorical answers or theoretical schemes, it is necessary to consider a certain number of representative examples, where the documentation and the available bibliography provide sufficient information and especially by avoiding to generalise where the sources are neither abundant nor always eloquent. First of all, it is worth recalling, very briefly, to what extent the textual sources inform us about the situation in antiquity. Next, it is also necessary to make some observations about the ways in which craft workshops were established in the urban space. Finally, these considerations will allow us to address the question of material traces in Greek cities, based on a few examples, and to conclude with some elements for discussion about the place of activities within the urban and *peri-urban* (suburban) space.

What is the picture delineated by the ancient testimonies?

Contrary to a certain romanticism and idealism inherited from the nineteenth century, ancient writers often describe Roman cities as rather insalubrious and, in some cases, even unhealthy environments.[5] Recent archaeological research on Roman cities in the Mediterranean shows that the question of urban public health is particularly complex. The same was certainly true for Classical and Hellenistic urban settlements, especially when the *intra muros* space is more densely populated (see, for instance, Ephesus, Olynthus, Pergamon, Delos).

Polis communities seem to have been concerned from an early period with the maintenance of public order and attention to hygiene in clustered settlements and, in particular, with the protection of certain common areas, especially collective spaces and public buildings. This kind of concern can be documented in the 460s in Thasos with the 'Stèle du port', namely the protection of streets and sanctuaries from abuse and encroachment by local residents.[6] More specifically, as far as sacred spaces are concerned, the Athenians show concern, as early as before the Second Persian War, in 485/4 BC, about the protection of the Acropolis cult space against several abuses by the pilgrims but also by the officiants and priestesses in order to avoid fires and waste.[7] These concerns of the Athenian city came at a time when the Acropolis was a worksite, in particular due to the building of the Pre-Parthenon. Beyond the *polis* collective spaces, disputes between neighbouring individuals, within the clustered settlements, such as the questions of waste water, fire and smoke, are also referred to in a law of Gortyn in Crete, as early as in 480-450 BC.[8]

Testimonies of the Classical/Hellenistic period[9] are along those lines, often with more precision, specifically concerning the intervention of the *polis* through its public magistrates, namely the *agoranomoi* and particularly the *astynomoi*, primarily in Athens, as early as in the last quarter of the fourth century: Aristotle refers to their role regarding the evacuation of κόπρος

[1] Vlassopoulos 2007: esp. 147-155.
[2] Zurbach 2013: 653-657.
[3] See different contributions in Esposito and Sanidas 2012a, and also Sanidas 2013b and 2020.
[4] See Étienne 2013 and the other contributions in Darcque *et al.* 2013.
[5] Several works are devoted to the issue of waste and sanitation in Roman towns, including Ballet *et al.* 2003; Dupré Raventos and Remola 2000; Hanoune 2002.
[6] Duchêne 1992; Sanidas 2016: 136-137.
[7] *IG* I^3 4. Sanidas 2022: 23-25, with previous bibliography.
[8] *Boustrophedon* law *SEG* 28:736. Sanidas 2022: 21-23.
[9] On Greek urban regulations, see Hellmann 1999; Hennig 1999; Saliou 2003. On economy and law in Classical Athens, see Harris 2006: 143-162.

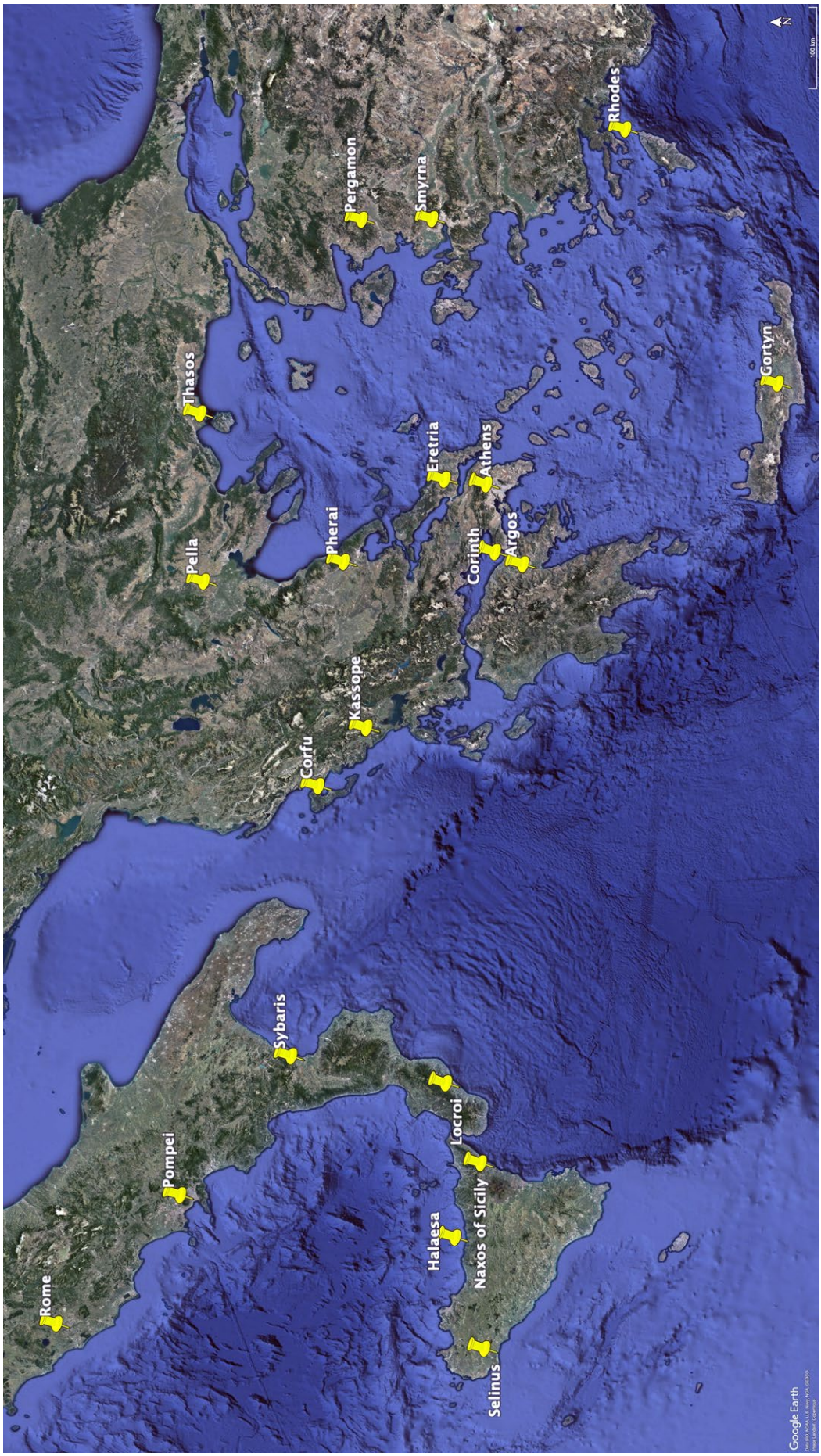


Figure 1: Map with the ancient sites referred to in the text (map based on Google Earth, modified by G.M. Sanidas).

(waste), the protection of public roads, the improper disposal of private drains.[10] The same applies to the decree about the *agoranomoi* of Piraeus of 320/19 BC,[11] where the *agoranomoi,* assuming also the duties of the *astynomoi,* have to supervise the building works of the Piraeus Agora (lines 8-10) and especially the state of the public roads surface along with their sanitation, particularly when the Agora was overrun with κόπρος from buildings or other working areas flanking main roads (lines 25-40). Other regulations concern specific places, like that of Paros concerning the cleanliness of the streets,[12] or another of Delos about the Minoa fountain,[13] to name but a few.

In the Hellenistic period, the 'Astynomoi Law of Pergamon'[14] provides a precise testimony concerning urban policing in a Hellenistic royal metropolis in which the old magistrates from the Classical cities, in this case the *astynomoi*, act within the framework of a royal political system. According to the 'Astynomoi Law', the authorities are empowered to protect public spaces, among other things, from craftsmen working clay on the road (lines 73-74), but also to settle neighbourhood disputes between individuals.[15] Similar concerns appear in an older text from Alexandria in Egypt, the *Basileus Dikaiomata*, which consists of compiled public order regulations, a version of which has been handed down to us by *P.Hal.* 1,[16] but where the issues of interest to us are less elaborate than in the law of Pergamon.[17] Several interesting passages come from the *politikos nomos* (civic law) which deals, on the one hand, with matters of planting, building and digging (lines 80-105) and, on the other hand, with the opening of ditches and their maintenance (lines 106-114).

As a whole, in Greek urban regulations, craft activities (*ergasteria*) are almost never explicitly named; instead, in several cases their presence is inferred among the sources of nuisance and abuse, especially when the occupants of *oikemata* (buildings in Thasos, Pireaus, Pergamon, etc.) and various premises near streets and other public spaces are mentioned. At the same time, some religious regulations specifically name *ergasteria* and craftsmen. Among the best examples are the Athenian law,[18] which aims to protect the waters of Ilissos river from the waste of the neighbouring tanneries, as also the Hellenistic decree passed by the *halia* assembly of Argos,[19] which aims to protect the sanctuary of Apollo Lyceus from the abusive establishment of *ergasteria* within it or any encroachment and excesses.[20]

A similar situation comes up in literary sources. Apart from questions of hygiene in general,[21] in the few mentions of the *polis* attitude to nuisance, craft activities are never explicitly specified in relation to other sources of nuisance and disorder. One of the few exceptions, a fragment of Timaeus of Tauromenion,[22] in which Sybaris is mentioned: 'First of all, the Sybarites passed a law aiming to banish from the city the craftsmen exerting a too noisy trade, like the blacksmiths, the carpenters, and other craftsmen of the same kind: indeed, they wished that nothing disturbed the peace of their sleep, and this in all circumstances. Even roosters were banned inside the city'. Still, one notes the anecdotal nature of the story, which serves to underscore the character of Sybaris and its perception of τρυφή (self-indulgence), with craftsmen being ranked at the same level of nuisance as... roosters.

In any case, in modern terms, the textually traced nuisance can be grouped in four main categories:

- material risks and fire hazards,
- water pollution, springs and fountains salubrity, and wastewater management,
- organic waste and other waste thrown away in collective spaces, and
- noise (which appears more explicitly in the Roman sources).

As mentioned above, the state's attitude to urban hygiene and public order problems evolved from Classical Greece to the Imperial Roman world.[23] A more explicit and analytical regulation, originating from the Roman East and written in Greek, with clear-cut provision for artisans settlements, appears in the Roman republic or Imperial legislation, later codified in the *Digest.*[24] Moreover, Julian of Ascalon's treatise[25] indicates the diffusion of this kind of regulation in the villages of the Roman Near East. At the same time, in all these cases, an overall study of the question highlights the gap between the recommendations in normative texts and the archaeological evidence, which is often impressive.[26] Indeed, textual sources focus mainly on the legal and financial aspects. On

[10] Aristotle, *Athenaion Politeia* 50.2.
[11] *IG* II^2 380 = *SIG* 3, 313.
[12] *IG* XII 5, 107, fifth century BC(?).
[13] *ID* 69 and *SEG* 22:497, fifth century BC.
[14] *OGIS* 483.
[15] See a new commentary by Saba 2012: 32-86. Cf. Saliou 1994: 10-11 and 287-289. The stele of the Astynomoi Law of Pergamon was engraved in the Antonine era, but the text dates rather from the second century BC.
[16] TM 5876, after 259 BC.
[17] Bechtel *et al.* 1913; Partsch 1913: 45-54; Saliou 1994: 70.
[18] *IG* I^3 257, lines 4-7, c. 440-420 BC.
[19] *IG* IV 557.
[20] Sanidas 2013a: 244-245; Sanidas 2013b: 181, 185. On 'sacred laws', see Lupu 2005: 21-30.
[21] Grmek 1989: 2-4, 175, 181-182, 324; Magdelaine 2002: 308-314; Magdelaine 2003.
[22] Quoted by Athenaeus 12.15 or *FHG* i 205: 'πρῶτοι δὲ Συβαρῖται καὶ τὰς ποιούσας ψόφον τέχνας οὐκ ἐῶσιν ἐπιδημεῖν τῇ πόλει, οἷον χαλκέων καὶ τεκτόνων καὶ τῶν ὁμοίων, ὅπως αὐτοῖς πανταχόθεν ἀθόρυβοι ὦσιν οἱ ὕπνοι. οὐκ ἐξῆν δ' οὐδ' χἀλεκτρυόνα ἐν τῇ πόλει τρέφεσθαι.'
[23] Hellmann 1999; Saliou 1994; Saliou 2003.
[24] Saliou 1994.
[25] Saliou 1996.
[26] Saliou 1996: 130-131 and footnote 365; Saliou 2012: 48-51.

the other hand, archaeological evidence set in a broad perspective can provide decisive insights, which are always complementary to the textual documentation, particularly with regard to the practical functioning.

Production in the Classical and Hellenistic ἄστυ: facets and questions of a 'productive city'

An overall material view of the Greek cities during the Classical and the Hellenistic period constitutes a facet of the whole question which, despite the significant progress in research, is still incompletely discussed. With regard to urban and *peri-urban* (suburban) production activities, the discussion about 'consumer city' or even the 'parasitic city' and the reaction[27] in the 1980s and 1990s to the emphasis on the 'productive city' had little impact on the view of Greek urban settlements, except that it launched the study of Greek craftsmanship in the 1990s. Despite this pessimistic observation, the archaeological evidence and textual sources illustrate the urban sites of the period and allow an overall approach to the spatial distribution of craft production.[28] At the same time, a holistic approach to the Greek urban sites would require an overall demographic vision, even if only approximate, but this possibility for ancient cities is practically non-existent.[29] Traditionally, calculations are based on the whole of a *polis* territory. But regardless of calculations and their relevance, assessing the population of a Greek city also comes up against the constant mobility of several population groups between town (ἄστυ) and countryside (χώρα), whether they were rentiers and other citizens, immigrants and/or dependent workers: routines and regular movements, seasonality of various economic activities, primarily agricultural but also artisanal, underline motion and flux of population that escapes assays for statistical quantification.[30] In addition, several Greek urban settlements, including Athens, still hosted *intra muros* agricultural activities in the Hellenistic period.[31]

Equally, a calculation of the density in urban planning, which is fundamental for the impact of nuisance generated by urban inhabitants including craftsmen, is also poorly established. Data on urban occupation deserve a detailed record in reliable chronological order. In any case, the segmented built space, even during periods of greatest urban development, is a feature attested to by several sources, both textual and archaeological. Towards the last decades of the fifth century, Athens was entering the period of its greatest floruit. During the Peloponnesian War, when inhabitants of the Attica countryside were confined to *intra muros* sectors, Thucydides mentions spaces free of buildings (τά τε ἐρῆμα τῆς πόλεως) that welcomed this population.[32] Although in theory this overpopulation was a short-term phenomenon, it actually lasted two to three years, from 429 to 426 BC. Urban infrastructure and medical prevention were not sufficient to sustain such a large population. The great murderous epidemic of these years (λοιμός),[33] a very violent salmonellosis[34] due to bacteria developed in the crowd squatting in the besieged city, caused the death of more than 50,000 people.[35] The practical and material limits of such a population influx were not taken into account when the Periclean imperial strategy was devised, with the abandonment of the campaign, and, as such, are part of its failure. Tragic as it was, this disaster was not exceptional, if only in terms of the scale of its impact. The health status of the population of Athens shows problems related both to diet and to an unhealthy environment.[36]

The lack of a sewage infrastructure is also part of the problem. Until the fourth century, few cities had them, and even from that period onwards, complete and efficient networks were practically absent.[37] According to Strabo, always in the Augustan period, the city of Smyrna, which was established on a pleasant site with a fairly advanced urbanism, still did not have a complete sewage system. During heavy rains, cesspools and sewers overflowed and the garbage flooded the streets.[38]

These few mentions in literary texts are indicative of the poor health of cities and their populations, an angle which is crucial in terms of the inhabitants' perception and experience of nuisance. This being said, the lack of decisive data, such as the number of inhabitants per block or sector, still needs to be overcome. On the other hand, archaeological research could be used to assess the density of the built space and its evolution, based on well-established data. The whole should be reinforced by systematic analysis of bone material.[39] What we have just briefly recalled here are the necessary elements that influence the understanding of the concrete effects of nuisance that could be compared or even opposed to their perception.

[27] For a historiographic review concerning the Roman West, see Bonsangue 2015: 387-390. On the Roman and Protobyzantine Egypt, see Alston 2002: 128-184.

[28] On southern Greece, see Sanidas 2013a. For more cases, see Esposito and Sanidas 2012b.

[29] Most recently on Athens, see Akrigg 2019, with previous bibliography. For an overall view, see Scheidel *et al.* 2008: 38-86.

[30] See, for example, some Archaic western Greek cities like Selinus or Megara Hyblaea, the fourth-century Athens with Piraeus, Olynthus and Priene, Hellenistic Ephesus, Pergamon, Delos, etc.

[31] Brun 2004: 97-98, 107.

[32] Thucydides 2.17.1. The existence of (desert) grounds *erema* in Athens is also attested later by Xenophon (*Poroi* 2.6), in agreement with the archaeological evidence.

[33] Among others, see Plage 1953.

[34] Papagrigorakis *et al.* 2008: 165-167.

[35] Thucydides 2.47-54 and 3.87; Hippocrates, *Epidemics* 25.

[36] On Thasos, see Agelarakis 2002: 18-19. On Abdera, see Agelarakis 2004: 335-336.

[37] Sanidas 2013a: 222-223; Sanidas 2013b: 181-183.

[38] Strabo 14.1.37.

[39] Buikstra and Lagia 2009: 14-17.

In sum, nuisance in Greek urban environments need be defined and assessed in historical perspective. It is important to take into consideration that modern approaches to the issue contain varying degrees of anachronism. What is considered as a nuisance to the 'sanitised' city dwellers of the twenty first-century western world was not necessarily so to our predecessors in antiquity. Even if, on certain occasions, the perception of nuisance coincides with modern attitudes, the reactions and remedies envisaged are not always of the analogous throughout the different pre-industrial periods.

In this respect, we should recall the image provided by Julian of Ascalon's treatise, even if this text is somewhat distant in time and space from Classical and Hellenistic Greece. This text, from the Justinian period, provides a concrete basis for understanding the perception of nuisance on the part of 'urbanists' in the small settlements of the Hellenised Near East towards the end of antiquity. It also provides the essential Greek vocabulary on the subject, as well as the possible sanitary provisions recommended in a built-up area. Nuisance is classified on the grounds of the concept of four basic elements: fire, air, water and earth. Craft works and other economic activities are by far the most frequent sources of pollution. Greek Classical-Hellenistic cities, on their part, have provided documentation that is discontinuous in time and space and partial with regard to the various problems treated as a nuisance.[40] What is the image of urban Greek craftsmanship?

The issue of craft activities' location has already been systematically addressed in a number of recent works. It turns out that, on the whole, the conditions of establishment were not governed by the principles of functional zoning and/or 'artisanal quarters' as was long believed.[41] In fact, it is pure anachronism to apply these modern notions to ancient realities. On the other hand, many factors, both material and institutional, intervene in the spatial configuration of urban crafts, whether they appear grouped or dispersed.

However, what is the role of nuisance in relation to other establishment factors?

Crafts causing nuisance and their locations: some archaeological cases

Amongst the craft generating nuisances, those that used fire provide relatively abundant data. Crafts such as tanning or dyeing are more difficult to identify[42] and are better illustrated by texts than by archaeological remains.

Crafts activities using fire

Among the activities using hearths, and mainly kiln and furnace installations, ceramic production is the one that provides the most remains in Greek cities. The example par excellence is that of Athens, where the location of activities shows a particular evolution from Archaic to the end of Hellenistic period. The presence of ceramists on the site of the Athenian Agora (American excavations) is attested from the Protogeometric to the Archaic period, which decreases during the sixth century.[43] What furnished the firing process and was consequently linked to the presence of a kiln (kiln debris, test-pieces, wasters and production discards, vessel firing supports, burnt clay) seem to practically disappear at the end of the period. Towards the end of Archaic period, potters and other ceramists' workshops would have been almost all 'rejected'/outcast outside the city wall, of which the exact outline is not known at the time. However, ceramic activities established within the walls included the sale of products and the production of small objects, such as figurines and small vases. The absence of kilns is often too emphasised. On the grounds of the extant kiln remains, potters must have worked *extra muros* in the area that Thucydides calls 'the outer Kerameikos' qualifying it as προάστειον (suburb).[44] Nevertheless, evidence of fire and other traces of manufacture have been recovered in the vicinity of the Agora, especially in the area of the Hephaisteion/Kolonos Agoraios towards the end of the fifth century, although their interpretation as workshop-remains is sometimes contradicted. In any case, from the mid fourth century onwards, and especially from the last decades of this century until Sulla's destruction, the traces of manufacturing processes closer to the wall increase beyond the side of the Pnyx and the Nymphs Hill.[45] Moreover, kilns remains are reported inside the city walls, while other traces (misfired vessels, wedges and firing supports) attest to the existence of further kilns.[46] At the same time, a certain number of clay working contexts, in particular for clay washing and moulding, are not accompanied by firing structures.

In several urban sites both in the Aegean and in the overseas colonies, the spatial clustering of ceramic activity on the outskirts of cities often coexists with dispersed production sites within the urban space

[40] Hellmann 1999; Saliou 1994: 10-13. On craft activities, see Sanidas 2013a: 241-245.

[41] Burford 1972: 80-82; Sanidas 2013a: 9, 195-196 and, mainly, 233-237. On one of the best illustrated Classical Greek urban settlements, see Cahill 2002: 264 'industry is not confined to the outskirts of Olynthus or to industrial areas.' On other settlements and/or periods, see particularly the contributions of C. Huguenot, A. Mazarakis Ainian, N. Monteix, J.-S. Gros and J. Zurbach, in Esposito and Sanidas 2012a.

[42] See Botte 2020; Katsonopoulou 2011b.

[43] Monaco 2000: 39-43; Papadopoulos 2003: 276-279.

[44] Thucidydes 2.34.5.

[45] Monaco 2000: 54-56 and 104-109; Sanidas 2013a: 108-109. Also see Kontopanagou in this volume.

[46] Papadopoulos 2003: 232-244 provides an annotated list of test-pieces and kiln wasters from the Classical and the Hellenistic period, especially from the Athenian Agora, while refuting, despite their presence, the functioning of kilns in these areas. On stacking rings from ceramic kilns, see Rotroff 1982: 93, nos 414-415, pl. 72; Rotroff 2006: 286, nos 379-381, 383, fig. 59, pl. 49. See also Sanidas 2013a: 79-102.

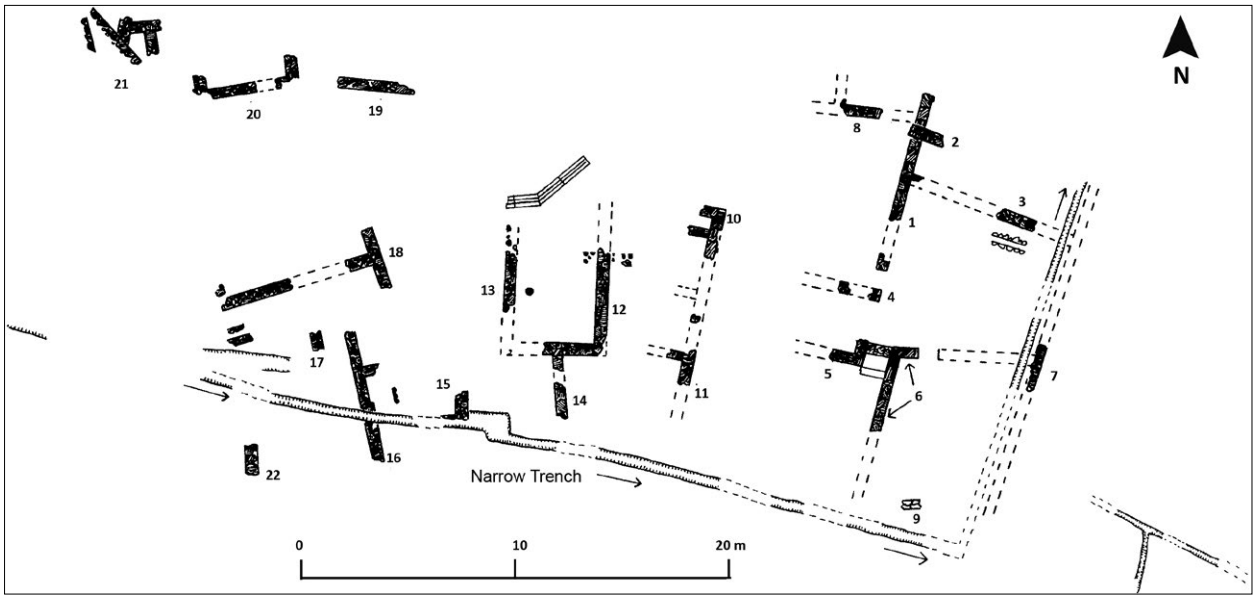


Figure 2: Athens, Agora: the 'Rubble Structures' with workshop remains east of the Panathenaia Street; fifth-fourth century BC (G.M. Sanidas, after Townsend 1995: fig. 5).

(Corinth, Corfu, Naxos in Sicily, Selinus, Locri, etc.).[47] Elsewhere concentrations are absent and the workshops seem to be rather dispersed in different sectors (e.g. in Argos, Eretria, Pherai, Pella, etc.).[48]

Among the other craft activities that use fire, metalworking provides considerable documentation. In Athens, as in other cities, two main types of establishments are attested: permanent workshops and temporary worksites. Other situations are possible but will not be discussed here. The first are manufacturing and repair workshops, notably polymetallic forges, but also workshops for goldsmiths, *toreutes*, jewellers, and others. The second category includes workshops set up for an exceptional achievement: the foundries for large bronze sculptures are the most frequent. In most cases, they were set up near or inside the place of destination (sanctuaries, public 'plazas', stadia and gymnasia, etc.). They use open spaces inside or around each monumental zone, sometimes also inside residential areas, as in the case of a small casting installation in House 8 of Kassope.[49] For example, works for the Athena Promachos of Phidias took nine years, with large combustion plants, judging from the quantities of charcoal and firewood ordered.[50] According to Gerhard Zimmer,[51] the Promachos statue was made on the south slope of the Acropolis with two large casting pits and various other facilities: this large foundry 'overshadowed' and 'polluted' the neighbourhood and the sanctuary of Athena Polias for about ten years, as did two other bronze foundries of the fourth century, established in the same area. At the same time, other foundries were located near private sectors and the Agora.[52] In contrast, forges and small workshops for luxury items require less space and equipped structures. In Athens, several contexts, especially from the fourth century, are located outside the private districts, in the vicinity of the Hephaisteion or in the eastern part of the Agora (**Figure 2**).[53] Other probable forges may have operated within individual houses (e.g. House D).

The Classical-Hellenistic ἄστυ of Rhodes constitutes another interesting example of urban settlement. The city of the Classical period, founded in 408/7 BC,[54] included in its urban and *peri-urban*/suburban space several crafts – some using fire (**Figure 3**).[55] The presence of various metallurgical activities here is impressive, ranging from blacksmiths and silversmiths' workshops, probably of small size, to the production of lead by *litharges*.[56] At least fifteen foundries for large bronzes operated mainly on the east slope of the acropolis, from the end of the fourth century until the first century BC, featuring some of the most important and sophisticated facilities throughout Greek antiquity.[57]

Glass production[58] is another craft that uses fire and that has known a great development in Rhodes. Since

[47] Esposito and Sanidas 2012b: 16-17; Pisani 2012: 319-321. See also Esposito 2013; Rizzo 2019; Sanidas 2013 a and b. On the Selinus large ceramic workshop, see Bentz *et al.* 2013 and 2016.

[48] Sanidas 2013b: 176-181. On Eretria, see Huguenot 2012. On Argos, see Sanidas 2013a: 155-161, pl. IX.

[49] Zimmer 1990: 85-90.

[50] *IG* I^3 435. Zimmer 1990: 68; Zimmer 2016. Also see Sanidas 2020.

[51] Zimmer 1990: 62-71; Zimmer 2009. A second bronze casting pit, contemporary with the Classical large western one and belonging to the same large workshop, was recently excavated and will be published by G. Zimmer and E. Kasapoglou.

[52] Mattusch 1977; Zimmer 1990.

[53] Thompson 1937: 14; Townsend 1995: 20, 137-139 (room VI), 107-111 (room A).

[54] Diodorus Siculus 13.15.

[55] Filimonos-Tsopotou 2004: 26 (footnote 31), 54, 115 and 123 (footnotes 572 and 628), 160 (footnote 688).

[56] Kakavoyannis 1984.

[57] Zimmer and Baïrami 2008, with previous bibliography.

[58] Triantafyllidis 2003: 132-135, nos 17-21; Oikonomou and

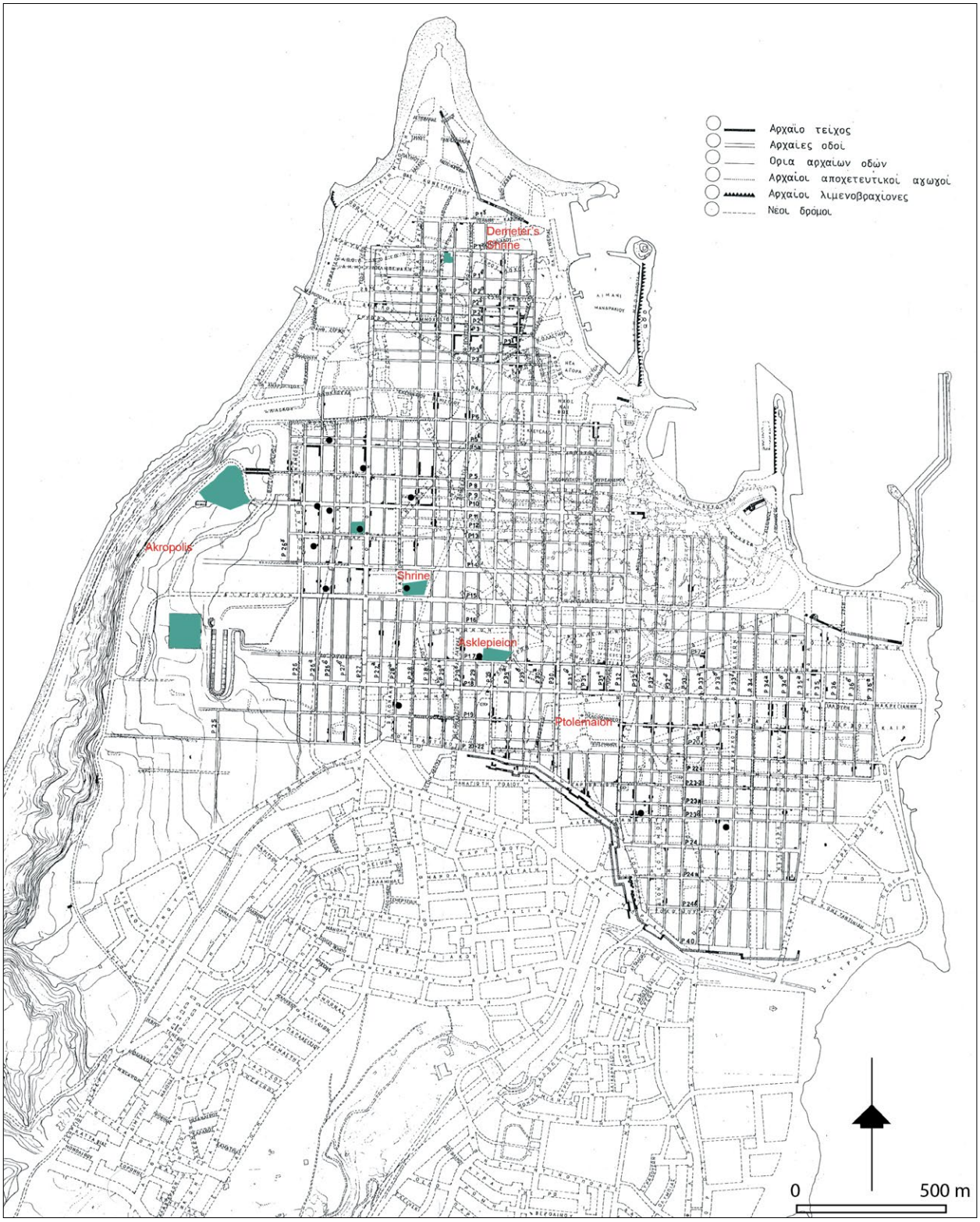


Figure 3: Rhodes, evidence of ancient bronze-statue foundries with casting pits, from the late fourth to the late first century BC (G.M. Sanidas, after Zimmer and Baïrami 2008).

the last decades of the seventh century and during the period in question, relevant activities take place in the city along with the manufacture of pigments. These various activities are documented both *extra* and *intra muros*. They are even more frequently located within the city walls, especially with the enlargement of the urban precinct after the earthquake of 228/7 BC. This change shows that activities of the kind were not performed outside the Classical wall, considered as outcast/rejected or a 'nuisance'. Instead, they took

Triantafyllidis 2018: 494-495.

place in a dynamic sector, which, being initially *peri-urban*, was included in the enlarged urban space, when the opportunity arose.

In all these examples, certain fire-using activities, and in particular the ceramic production, are rather restricted to the *peri-urban* space on the periphery of the rampart or even further beyond. In spite, the inclusion of (either temporary or permanent) installations housing primarily metallurgical but also ceramic, glassmaking and other fire-using crafts within the city walls persists, both in private space and in the vicinity of public premises.

Polluting activities: what space was reserved for tanning and dyeing?

Other nuisance-causing craft activities are also connected with air and water pollution. Concerning the interpretation of archaeological remains, the tanneries as well as the dyeing workshops are among the 'ghost' activities within Greek archaeology. Only the contexts related to purple pigment manufacturing are in some cases relatively well identified thanks to the remains of murex shells associated with tanks or basins.[59]

As concerns tanneries, whether in textual evidence or physical remains, few data are usable. Classical literature transmits the stereotyped image as a source of strong odour.[60] Their location in the *peri-urban* space is inferred explicitly or implicitly from two epigraphic texts, one from Athens and the other from Halaesa in Sicily. The law of Ilissos,[61] often quoted and commented on, dates in 440-430 BC: it forbids tanning activities and the disposal of waste in the river upstream from a sanctuary of Heracles. For the sanctuary, two identifications have been proposed: the Cynosarges and the Pancrateion. Ilissos river has always been frequented by tanners at various times (in the Byzantine period and until the nineteenth century). Marie-Françoise Billot[62] demonstrated that the Athenian *polis* takes care of the waters here in the vicinity of several sanctuaries – one could also underline the importance of pure water for the ephebes and the athletes who frequented the gymnasium of Cynosarges, but she very judiciously underlined the importance of water salubrity for other activities, like that of the *plyneis*, the washers present also in this *peri-urban* sector.[63] They are not only the *polis* and the cults which are opposed to nuisances of the tanners, but also other craftsmen who, in fourth century, thank the Nymphs for their gift, the clean water.

The second text,[64] of which the chronology, probably Hellenistic, is difficult to establish, prohibits the lessors of a sacred olive grove in Halaesa in Sicily to install there a βυρσοδέψιον (tannery) and a μαγειρικὸν (butchery or cook-shop). In this case, it would rather be the countryside close to the city, perhaps on the outskirts of the urban space and near water sources.

Compared to the *realia*, well-identified installations of tanneries are missing in Classical and Hellenistic Greece. None is recognised among archaeological remains, even though owners of tanneries, such as the demagogues Cleon[65] and Anytos,[66] are known from Classical Athens. The consecrations of *phialai*/bowls for libation by tanners show also that this activity was exercised in the Classical period.[67] Thus, even if the course of Ilissos at the level of the Cynosarges or the Pancrateion and its surroundings are a matter of dispute, the tanners did not disappear from Athens: they undoubtedly continued elsewhere, close to the rivers, as well as to the town. If Aristophanes makes fun of it, it is because he is familiar with the odour...

Two hypotheses for workshops identification concern, on the one hand, a workshop in the southwest of the Agora that has yielded remains of hydraulic installations[68] associated to carved bones and alkali traces, and, on the other hand, a hydraulic complex in Piraeus in a private building.[69] In both cases the installations are located inside the city walls. In Roman Italy, in Pompeii, the recent exploration of an *intra muros* tannery (Regio I 5, 2) confirms the previously rejected contemporaneity of the workshop with the *triclinium aestivum,* with the workshop located in front of this reception area. Tanneries have been excavated in Saepinum, in the area of Trastevere in Rome, and in other urban sites of the Roman period.[70]

Purple manufacture processes can be carried out just as well in extra-urban or *peri-urban* environment, as in Delos or in the Kerameikos district in Athens,[71] both of the late Hellenistic period but also in fully urban space, as in Corinth and Eretria.[72] Like tannery, these activities also require water and, therefore, hydraulic installations for both supply and draining. Private draining facilities and public draining infrastructure are important prerequisites for the workshops, especially when they are established in urban areas. In Athens, Corinth and wherever the urban infrastructure was slowly being built, the situation was more complex.

[59] Attempts to identify archaeological remains have not always been successful, notably in the cases of Rachi (Isthmus) and Hellenistic Mycenae. Cf. Katsonopoulou in this volume.
[60] Aristophanes, *Equites* 135-136; Theophrastus, *De Causis Plantarum* 3.9.3; Aesopus *Proverbia* 190 and 220.
[61] *IG* I^3 257.
[62] Billot 1992.
[63] *IG* II^2 2934.
[64] *IG* XIV 352, lines 70-71.
[65] Aristophanes, *Equites* 44, 136, 315-318; *Nubes* 581; *Pax* 270, 647-648.
[66] Xenophon, *Apologia Socratis* 29; Scholia, In Platonis *Apologia Socratis* 18b.
[67] *IG* II^2 1556, line 34; 1576, lines 5-6.
[68] Young 1951: 229-233, fig. 14. Also see Botte 2020: 291; Sanidas 2013a: 106-107.
[69] Spathatou 1980.
[70] Botte 2020: 292-294, with previous bibliography.
[71] On Delos, see Bruneau 1969. On the Kerameikos, see Stroszeck 1999.
[72] On Corinth, see Daux 1968. On Eretria, see Huguenot 2012.

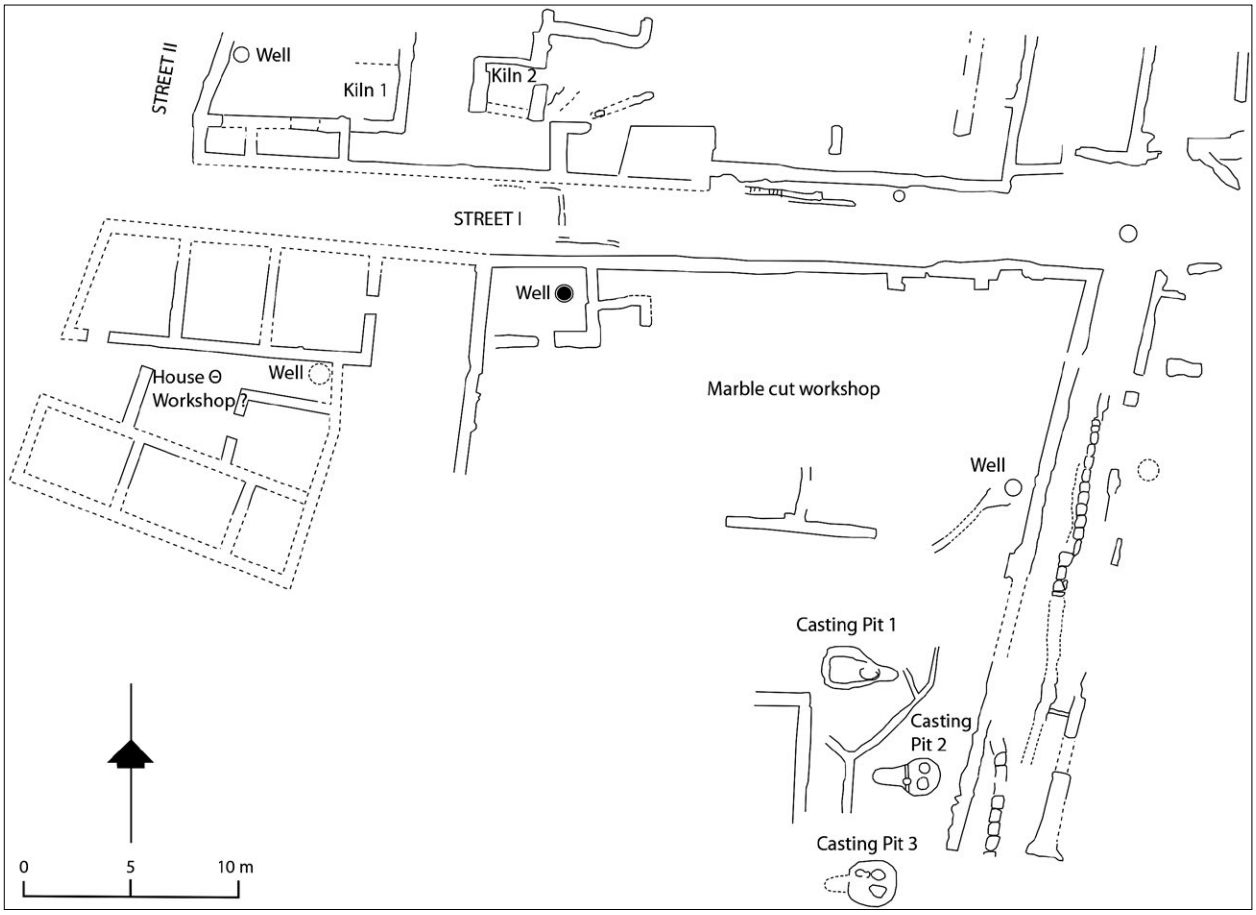


Figure 4: Athens, concentration of workshops south of the sanctuary of Dionysus (G.M. Sanidas, after Eleftheratou 2005: fig. 2).

Thus, in Athens, water supply is provided for by means of cisterns and wells, even after the establishment and slow development of Peisistratus' aqueduct. In the same way, in the Hellenistic times the city's water supply faced problems due to the disrupted springs on Mount Hymettus: in several places, facilities for rain water collection, wells, cisterns, tanks etc. have outlived the respective aqueduct.[73] On the other hand, even the Classical cities laid out in the Hippodamian system, such as Olynthus, were not furnished with a central sewage network, when founded.

As early as in the seventh century, purified clay in several contexts in the area of the Agora in association with the excavated hydraulic installations indicate a preference for establishment on hill slopes and bottoms of valleys. As for drainage, it is often problematic. Eridanos river is the only actual natural collector until the construction of the first branch of the great drain, in the sixth century, which runs along the western edge of the Agora. The establishment of water-based activities in the so-called industrial district, southwest of the Agora, was probably facilitated by the construction of the second branch of the great drain at the beginning of the fourth century or a little earlier.[74] Similarly, metallurgical and pottery-making activities on the north-western outskirts of the Agora, on the northern and eastern flanks of Kolonos Agoraios, are located in the immediate vicinity of the central sewer, not far from where it empties into Eridanos.[75] In the same way, Classical and Hellenistic ceramic production contexts are located near the other branch of the sewer towards Areopagus Street.[76] Activities using water and fire are documented, especially in the Hellenistic period, to the south of Dionysus theatre, within a residential sector (**Figure 4**).[77]

What is the rationale for the establishment of nuisance-inducing craft activities?

As shown above, the Greek urban settlements hosted various activities related to fire. Even though the ceramic kilns, also present in urban context, are more

[73] See Lyngouri-Tolia 2000: 212.

[74] Young 1951: 233-236, 238-249, 253-262.

[75] Sanidas 2013a: 50-51, 58-59.

[76] Primarily near of the so-called 'City Eleusinion': Rotroff 2006: deposits M21:1, N21:4, S19:8, 366, 369, 377. On the 'Dörpfeld Quarter', see Watzinger 1901: 229-232. In the vicinity of the shrine of Nymphe: Miliadis 1956: 264; Miliadis 1957: 25. Clay-working crafts have been practiced on the slopes of the Areopagus since the Protogeometric period: Papadopoulos 2003: 274-275.

[77] Kalligas 2000: 32-35; Sanidas 2013a: 60, 61, 101.

frequently *extra muros,* the metallurgical workshops of any kind are well-attested within urban space. Craftsmen providing emergency services are noted in large cities, such as Athens or Rhodes, but also in smaller ones, such as Kassope, to produce/create big bronze cast items, mainly statues, which required large-scale works and even larger installations: clay mould firing, alloys making and melting, bronze-casting pits, welding-brazing works. They operated over a long time-span, at least while the weather was mild. The latter artworks were rarely created on the initiative of individuals; instead, they were almost always commissioned by the *polis* civic administration including major sanctuaries.

To return to ceramic production, a contrast between small *intra muros* kilns and large *extra muros* workshops with several or even numerous kilns can often be explained by the prevention of fire risks inside settlements. However, a closer and spherical look at the issue suggests that other factors determined the installation, such as the ground surface, the destination of production or public taxation and, also, the real estate regime. Thus, Argos and Pella, two cities laid out in different urban planning systems, yielded a dense *intra muros* production of clay figurines and small ceramic goblets in the Hellenistic period. Beside their importance in terms of quantity, these small-scale products do not require extensive facilities and very large kilns. With regard to their location, they seem to be spatially dispersed across the city, and tentatively concentrated around the central Agora.

Similarly, when the *polis* intervenes in polluting activities, such as tannery, its intervention concerns particular, verbally specified urban sectors or spaces. However, this reaction should not be generalised as practiced in all urban settlements. Certainly, one notes the existence of magistrates and public officials in charge of public order and cleanliness within collective sectors, sometimes even well specialised; but no law, at least judging from the amount of evidence available so far, prohibits generally any activity, across the whole of an urban agglomeration or inside city walls. By contrast, archaeology often brings to light remains of polluting craft works in 'unexpected' sectors. Large streets and especially building-free grounds, including *temene* (in the sense of sacred land and estates), seem to be the most affected urban spaces by these abuses, because they are areas void of buildings. The aforementioned Hellenistic law of Argos,[78] containing incomplete words, difficult to read, and now lost, forbids a whole series of activities inside the Lyceum, including, most probably, the establishment of an ἐργαστήριον and a craft kiln. The establishment of a workshop is an encroachment and a nuisance source, among others next to the κόπρος, the felling of trees and the working of wood – perhaps another artisanal activity – or, according to another reading, the digging of canals.[79] The prohibition of an ἐργαστήριον in the Lyceum cannot be considered as a prohibition of nuisance-inducing crafts in the whole of urban space of Hellenistic Argos, because archaeological research yields numerous ceramic kilns and metallurgical hearths and/or furnaces in the urban and *peri-urban*/suburban areas (**Figure 5**).[80]

A common denominator among the Greek Classical *poleis* – and probably the pre-Classical ones, as well – is their monumental physiognomy, namely the amount of monumental buildings they are furnished with. However, this same culturally coherent and expansive world shows a sometimes-surprising socio-economic diversity which, when the documentation allows it, can be projected on the city-space organisation. Thus, from this point of view, it would not be wise to approach the questions about the organisation of production throughout the whole Greek world as if it were standardised and uniform. Nevertheless, one better follows the craftsmen in certain urban contexts, in particular of the Classical and the Hellenistic periods and above all in Athens. In these cases, it would be fair to say that, although the Greek city only circumstantially deals with nuisance, it is interested in any revenues that may come from the process of craft production, at least on certain occasions. At the same time, the craftsmen, who according to Xenophon are often tenants and seldom owners,[81] must face, in either case, the real estate cost, in particular when they wish to install their workshop in highly frequented sectors of large urban settlements.[82]

According to another passage of Xenophon,[83] fire craft plants, in this case metallurgical furnaces,[84] can be a source of tax revenue for the *polis*. In the same passage, the author mentions the economic and urban development of the Laurium mining district, which could have led to the increase in the land price. It is interesting to note that, in this case, the urban development program of an area would go hand-in-hand with its productive exploitation. Other literary and epigraphic texts mention taxes on artisans[85] and their rented stores.[86] In fourth-century Athens, both the public fund and the landowners could therefore possibly benefit from the development of productive activities in the urban and *peri-urban* space. Moreover, Xenophon's proposal implies the existence of this kind of fiscal practice, which was probably not unknown to his fellow citizens. Certainly, the Athenian context presents during the fourth century with a particular

[78] *IG* IV 557.

[79] See Sokolowski 1962: 96 and Charneux 1990: 397-398 footnote 19.

[80] Sanidas 2013a: 155-161.

[81] Xenophon, *Symposium* 4.4.

[82] For an overview of real estates in Classical Athens, see Harris 2006: 163-206 and, more recently, Maillot 2020.

[83] Xenophon, *Poroi* 4.49-50.

[84] Sanidas 2016: 24, with previous bibliography.

[85] Aristotle, *Oeconomica* 1364 a4. On Delphi, see Jacquemin *et al.* 2012: 201-203 no. 110, 205-206 no. 113, with many examples.

[86] *IG* II^2 2496.

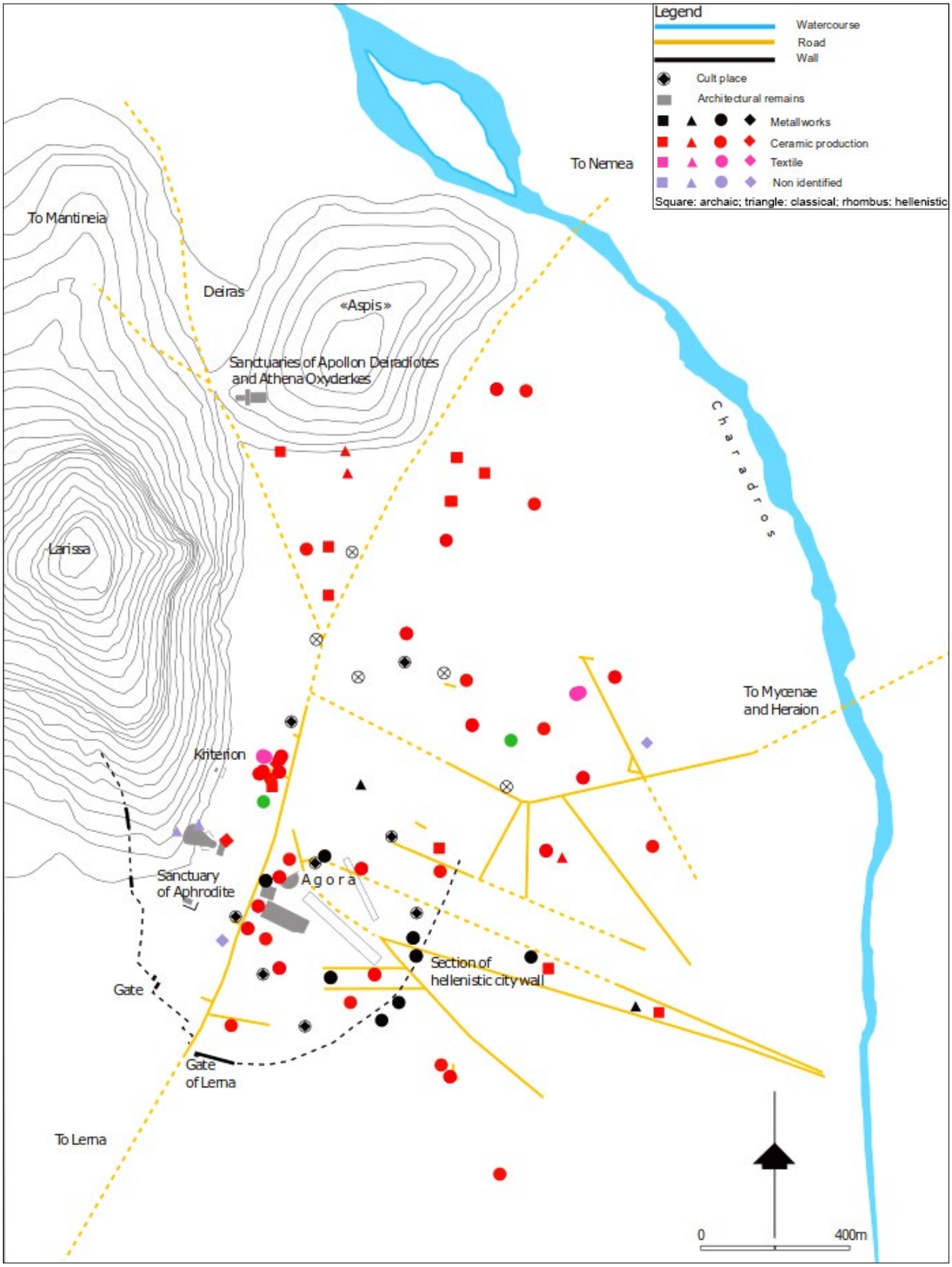


Figure 5: Argos, evidence of ancient craft activities from the Archaic to the Hellenistic period (Sanidas 2013: 38 pl. IX).

development speculative business: the craft production profits from it and the *polis* draws incomes from it. However, taxes on the craftsmen are known also from the Hellenistic times. Whether they were free or dependent – in which case, they worked in the premises of their master's *oikos* – craftsmen faced these

problems regardless of whether they were legal owners or not. Such circumstances, relevant to real estate and taxation, although difficult to detect in both textual and archaeological sources, did affect to a certain extent the set-up of craft activities, and consequently, indirectly, their place within or outside the urban space.

Craft production in Greek cities had both urban and *peri-urban*/suburban character. In neither case was the extra-mural location due solely to nuisance, without excluding the possibility that in the long term it may be one of several modalities. The choice of the suburban area refers to more complex conditions that may vary according to the nature of the respective activities, their spatial extent, their temporal intensity, and in general a series of technical, economic, and institutional factors.

The foregoing brings us back to the issue of the spatial placement of craftsmen in the Greek city. The city is often seen as excluding and marginalising small-scale manual workers, most of whom are slaves, freedmen or poor foreigners.[87] Their rudimentary and precarious production facilities are persecuted if they get in the way or encroach on a protected space. On the other hand, great creators (artists, architects, engineers, builders, etc.),[88] whether citizens or foreigners, are welcomed and often honoured. The State, depending on its needs, employs the work of some and others at different levels; it values that of the latter, who realise its monumental policy and major projects (building, infrastructure, navy, etc.), but the official ideology, expressed notably through the texts of philosophers or orators, often devalues that of the others. As for the former, even if we do not accept that they were completely marginalised, their at least secondary and subordinate place in various Greek civic systems is also reflected in official regulations. At this stage of the discussion, we only need to recall the different degrees of Greek legislation: the law, i.e. the official regulations of the city, the norms applied within the framework of any given collectivity (namely, any official collective body, whether political, religious, or professional), and the customs that intervene within a more restricted group, parental or other.[89] Even if this parameter is not easy to fit into the overall conception of the issue, for lack of usable sources, it must be taken into account.

All these complementary elements allow us to place the subject at two different levels: on the one hand, the existence of a varied regulation on nuisance in general, which, if it even existed, is not the same today as it was in the past; on the other hand, the framework within which nuisance was generated in important urban settlements. The pre-industrial agglomerations in Europe and the Mediterranean were not very healthy and often too noisy settings.[90] Production activities are among the most important sources of pollution. Even if the effects upon people and nature were proportionately the same, for historical and cultural reasons among others, this nuisance was not treated in the same way as today. Greek cities are no exception, even if they do not all proceed in exactly the same way.

Thus, in addition to the urban nuisance generated by basic activities, the situation worsens during large-scale public projects. As concerns the Greek cities, even if they disposed of organic waste and ensured the hygiene of certain neuralgic sectors, and even if they did wish to implement a global policy concerning urban order – which is not at all obvious from the available documentation – they came up against two factors, of different orders, which in any case, if only indirectly, are complementary. Indeed, despite the genuine concerns that may have been expressed, the material conditions of urban settings only partially ensure access to hygiene, salubrity and sanitation. At the same time, strict regulation of nuisance would be a flagrant contradiction, since it would ultimately mean that the *polis* authorities would have to turn against the monumental politics of the city itself.

Also, strict regulations like those advocated by urban planners a millennium later, following the example of Julian of Ascalon, have proved equally unenforceable. In between, it is possible to note a qualitative evolution in the Hellenistic period, during which the royal authorities applied more general regulations concerning the urban *astynomoi*, as in Pergamon and Alexandria. However, the relevant normative texts contain no direct reference to artisanal activities. In any case, the Classical *polis*, especially during its boom phases, went to great lengths disposing enormous means to its propaganda policy, with the setting up of large building and sculptural projects, but apparently without any measure of precaution concerning the impact upon the environment.

In sum, in the idea that craft activities have been the most frequent source of nuisance, it is not the institutional framework and official action that will bring a better knowledge/understanding of the quality effects upon the urban context and the life of individuals. It is true that texts and archaeology allow us to better assess the role of the city, but we should be able to take the investigation further, with broader and more in-depth archaeological study protocols.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[87] Vlassopoulos 2007: 225-226; Zurbach 2013: 625-628. About Athens, see Akrigg 2019: 89-138.

[88] Cf. Zimmer in this volume.

[89] On the various legal levels governing the relations between master and freedman or slave in the liberating acts of Delphi, see Mulliez 2016: 29-30.

[90] Fournier and Massounie 2001.

Chapter 4

Dyeworks network around the Gulf of Corinth: A specialised seaside textile workshop in Late Classical-Hellenistic Helike

Dora Katsonopoulou

Abstract

Geoarchaeological research and excavations of the Helike Project in the Helike Delta on the southwest shore of the Gulf of Corinth, under the direction of the author, have brought to light the remains of an unknown Late Classical-Hellenistic settlement in the western part of the Helike coastal plain, implying the city's revival after the catastrophic earthquake of 373 BC.

Among the excavated buildings, the excellently preserved remains of a dyeworks stand out. The workshop consists of a central four-tank unit of pebbled floors connected with an admirable system of plastered channels, surrounded by a number of stone, clay and plastered basins associated with dyeing activities. Heating facilities, working and storage spaces flank the main workshop area occupying the southern part of a major building complex at this location.

The discovery of specially constructed equipment and specialised production areas, and the presence of implements and mordants/detergents used in textile industry suggest that a number of activities related to textile production took place in the workshop besides dyeing itself. The dyeworks seems to represent a large-scale production industry, its products intended primarily for consumption outside Helike's region and operated most probably under the management of a private association.

Given the advantage of Helike's location on the southwest shore of the Gulf of Corinth and its key role in cultural exchange of goods and ideas since early times, the workshop in Helike, being the only one located near the sea among a network of Late Classical-Hellenistic dyeworks around the Gulf of Corinth, demonstrates the importance of coastal places in textile manufacture.

Περίληψη

Οι γεωαρχαιολογικές και ανασκαφικές έρευνες του Ερευνητικού Προγράμματος Αρχαίας Ελίκης (The Helike Project) στο Δέλτα της Ελίκης, στη νοτιοδυτική όχθη του Κορινθιακού κόλπου, υπό την διεύθυνση της συγγραφέως, έφεραν στο φως τα ερείπια ενός άγνωστου υστεροκλασικού-ελληνιστικού οικισμού, στο δυτικό τμήμα της παραλιακής πεδιάδας της Ελίκης, γεγονός που υποδηλώνει την αναβίωση της πόλης μετά τον καταστροφικό σεισμό του 373 π.Χ.

Από τα ανεσκαμμένα κτίσματα ξεχωρίζουν τα άριστα διατηρημένα κατάλοιπα ενός εργαστηρίου βαφής και παραγωγής υφασμάτων. Το εργαστήριο αποτελείται από μια κεντρική μονάδα τεσσάρων δεξαμενών με βοτσαλωτά δάπεδα που συνδέονται μεταξύ τους μέσω ενός αξιοθαύμαστου συστήματος επιχρισμένων με κονίαμα αγωγών και περιβάλλονται από μια σειρά κατασκευών από πέτρα, πηλό και κονίαμα, οι οποίες συνδέονται με δραστηριότητες βαφής. Εγκαταστάσεις θέρμανσης, χώροι εργασίας και αποθήκευσης, πλαισιώνουν τον κύριο χώρο του εργαστηρίου που καταλαμβάνει το νότιο τμήμα ενός μεγάλου κτιριακού συγκροτήματος σε αυτή τη θέση.

Η ανακάλυψη ειδικών κατασκευών και εξειδικευμένων χώρων παραγωγής, όπως επίσης η παρουσία εργαλείων και στερεωτικών ουσιών/απορρυπαντικών που χρησιμοποιούνται στην βιομηχανία του υφάσματος, υποδηλώνουν ότι στο εργαστήριο λάμβαναν χώρα μια σειρά από δραστηριότητες που σχετίζονται με την παραγωγή υφαντουργικών προϊόντων εκτός από την ίδια την διαδικασία της βαφής. Το συγκεκριμένο εργαστήριο στην Ελίκη φαίνεται να αντιπροσωπεύει μια βιομηχανία παραγωγής μεγάλης κλίμακας, της οποίας τα προϊόντα προορίζονταν κυρίως για κατανάλωση εκτός της περιοχής της και λειτουργούσαν πιθανότατα στο πλαίσιο ιδιωτικής διαχείρισης.

Δεδομένης της πλεονεκτικής θέσης της Ελίκης στη νοτιοδυτική ακτή του Κορινθιακού κόλπου και του ρόλου-κλειδί που η πόλη κατείχε στην ανταλλαγή πολιτιστικών αγαθών και ιδεών από τα πρώιμα χρόνια, το εργαστήριο στην Ελίκη, που είναι και το μόνο που βρίσκεται κοντά στη θάλασσα ανάμεσα σε ένα δίκτυο υστεροκλασικών-ελληνιστικών εργαστηρίων βαφής γύρω από τον Κορινθιακό κόλπο, καταδεικνύει την ιδιαίτερη σημασία που είχαν οι παράκτιες πόλεις στη βιομηχανία του υφάσματος.

Keywords: Gulf of Corinth; dyeworks; Classical-Hellenistic Helike; textiles; crafts

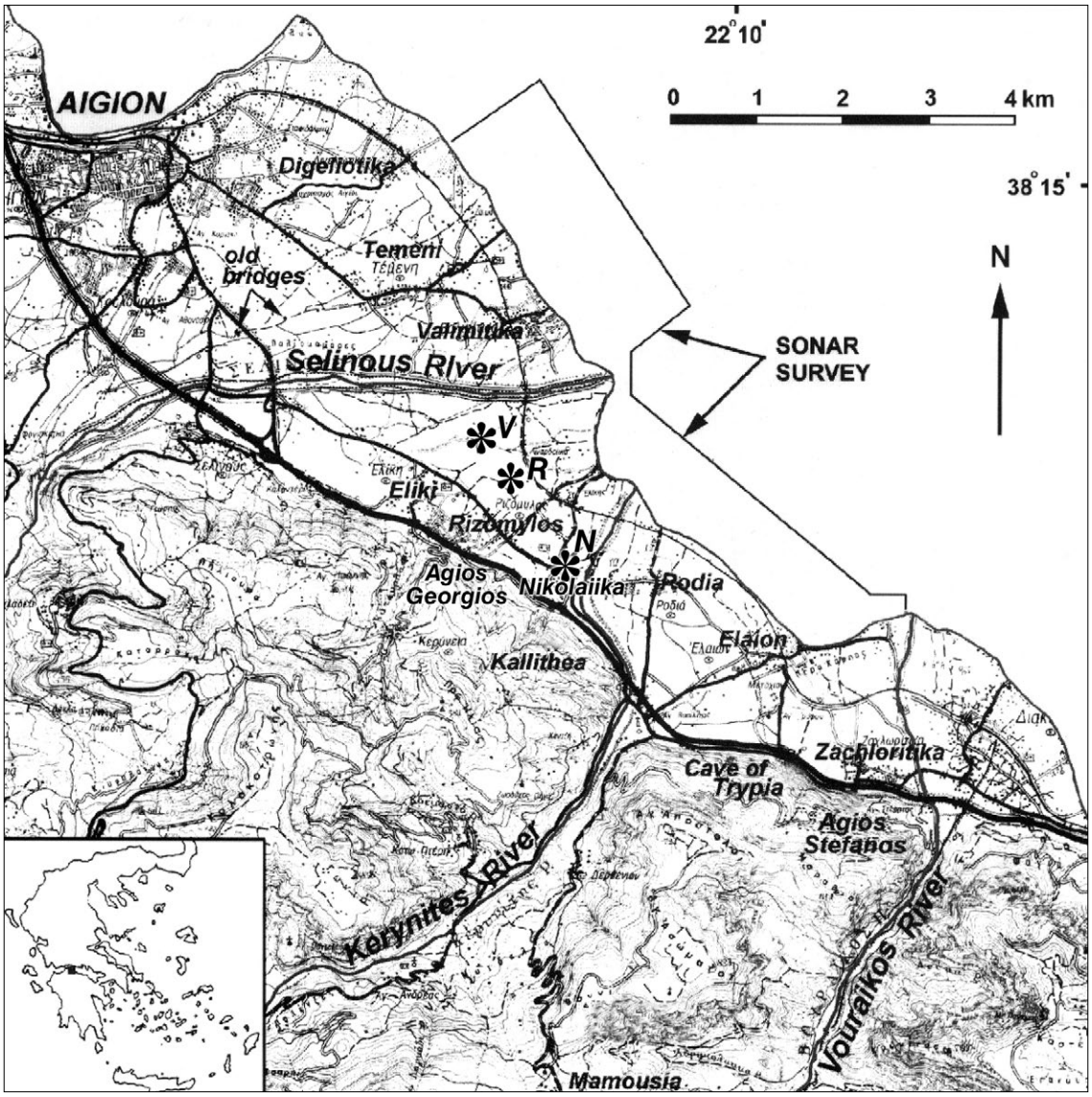


Figure 1: The environs of the Helike search area including the 1988 sonar survey. Asterisks indicate the principal Helike sites: V stands for the Late Classical-Hellenistic site in Eliki/Valimitika and R for the Early Bronze Age site in Rizomylos. Adapted from the Greek Army Geographic Service 1:50,000 map (after Katsonopoulou 2011a: 64, fig. 1).

Introduction

Helike, the capital city of ancient Achaea on the southwest shore of the Gulf of Corinth was founded in the Bronze Age, and destroyed by an earthquake and tsunami in 373 BC.[1] Since Helike was reportedly submerged by the combined earthquake/tsunami phenomenon, most of the previous efforts to locate it concentrated on the sea, with inconclusive results.[2] To resolve the question of whether the ancient site lay in the sea or on land, the Helike Project launched a long-term multidisciplinary research program in 1988.

First, a systematic sonar survey of 8sq.km of the seafloor southeast of Aigion, to a depth of 100m, was conducted (**Figure 1**). The results showed no ruins of a city on or under the seafloor, so we shifted the search to the adjacent broad coastal plain between the Selinous (west) and the Vouraikos (east) rivers.[3] A re-examination of ancient sources[4] suggested that the city was submerged in a lagoon, not in the sea. Accordingly, extensive bore-hole drilling in the Helike Delta yielded evidence of ancient occupation within an area of about 2sq.km, ranging in date from the Neolithic to the Late Byzantine times.[5] The results also suggested that a lagoon intermittently occupied part of the delta during the Holocene.[6]

[1] Katsonopoulou 2005a.
[2] Katsonopoulou 1991; Marinatos 1960.
[3] Katsonopoulou 1991; Soter and Katsonopoulou 1998: 82-88, figs. 8-10; Soter and Katsonopoulou 1999.
[4] Katsonopoulou 1995.
[5] Maniatis *et al.* 1995; Soter and Katsonopoulou 2005.
[6] Soter and Katsonopoulou 2011.

Since 2000, the systematic excavations of the Helike Project have brought to light in the zone between the Selinous and Kerynites rivers, architectural remains and associated finds dating from the Early Bronze Age, the Mycenaean, Geometric, Classical, Hellenistic, Roman, and Late Byzantine periods.[7] Among them, the discovery of an unknown settlement revived a few decades after the catastrophic earthquake of 373 BC, was most unexpected. Excavations carried out in the western part of the Helike plain, revealed remarkable architectural remains and a cemetery site of the post-earthquake Helike settlement. In one of the excavated sites (**Figure 1: V**), the unique remains of a dyeworks installation were unearthed.

Dyeing in antiquity

Textiles played an important role in Classical and Hellenistic Greece, used not only to provide warmth and ornament but also to indicate wealth and status (coloured textiles, in particular). Especially for women, textiles were a valuable form of property since they were produced by them within a household[8] intended for household use, but also serving as parts of dowries or for festivals and other events. In fact, textiles were second only to metals in value, and sometimes they may have been prized over metals.

The widespread use and importance of coloured clothing indicate that dyeing was socially and economically important. Papyrus texts and inscriptions provide information on the occupation and the active role of the dyer (βαφεύς, βάφισσα for a female dyer mentioned in two papyri of the fourth century AD) and of the dye workshops (βαφεῖα) in ancient economy. There is even reference to the professional occupation of the linen specialist – λινεψός/λινοπλυτής – associated with flax/linen processing.[9] The whole industry of dyeing includes a number of other elements on which it was depended: additives such as mordants/detergents, dye recipes, specification of hues, sampling, thus demonstrating the importance and complexity of the craftsmanship.

Literary sources provide a great deal of information on dyeing activities in Classical and Hellenistic Greece although they cannot be considered specific sources about the dyeing technology. For example, the scientific works of Aristotle and his pupil Theophrastus contain references to dyes and dyeing processes; Herodotus occasionally hints at specific elements relating to dyeing and textile production; similar references are found in plays and poetry. Two other later sources of the first century AD, relying though heavily on earlier Greek sources, should be considered as providing further information about dyeing: Pliny's *Natural History* and Dioskourides' *Greek Herbal*. These literary sources are supplemented by epigraphical and papyrological data, principally the *Papyrus Leidensis* and the *Papyrus Holmiensis* of the third century AD.

The picture of dyeing technology drawn from historical sources is complemented by evidence from modern comparative information and from the archaeological record. Natural dyeing processes are the same today as they were in Classical and Hellenistic Greece, and modern accounts on the availability of dyestuffs are very useful, since a number of plants used by ancient dyers still grow in Greece nowadays. In terms of archaeology, since evidence of dyes and textiles in the archaeological record is difficult to find, due to environmental conditions, excavation of sites related to dyeing activity (especially sites where the specially constructed equipment used for dyeing is preserved) can shed light on dyeing processes and the organisation of dyeing industry. In general, dye workshop areas have been mostly neglected until recently, with some exceptions, such as the settlement areas at Isthmia and Mycenae.

The Helike dyeworks

The architectural remains

The first indications of a dyeworks site in Helike came to light during the 2003 excavation campaign of the Helike Project, when parts of two pebbled-floor tanks were unearthed in the Romanos Field, on the borders of the modern villages of Eliki/Valimitika near the Selinous River, in the western part of the Helike plain (**Figure 1: V**). The discovery led to a systematic excavation of this site from the next season (2004) onwards. The ongoing work brought to light, at a depth of 2.5-3m below ground, the well-preserved remains of a dyeworks installation and associated structures.

The Helike workshop consists of a central four-tank unit (**Figure 2**) surrounded by well-made stone walls, preserved at a height of about 0.50-0.55m. Two large shallow rectangular tanks and two deep cisterns, all with pebbled floors, are connected via an admirable system of plastered channels used for emptying liquids from the shallow into the deep tanks (**Figure 3**). The deep cisterns are built of impressive plastered walls, 1.80m high, and they contain circular sumps at one corner to collect significant quantities of liquids.[10] A low partition element, originally plastered, divides the shallow tanks into two different activity spaces, thus accommodating different processes running in parallel. In one of the rooms east of the four-tank unit, another

[7] Katsonopoulou 1998; 2002; 2005b; 2011a; 2016; Katsonopoulou and Katsarou 2017; Katsonopoulou and Koukouvelas 2019.
[8] Foxhall and Stears 2000.
[9] Ruffing 2008; Wipszycka 1965.
[10] Kormann and Katsonopoulou 2024.

Figure 2: Drone photo of the four-tank unit and surrounding structures
(© The Helike Project, Dora Katsonopoulou).

Figure 3: Plastered channelling, detail
(© The Helike Project, Dora Katsonopoulou).

shallow pebbled-floor tank of smaller size, and a small square room attached to its eastern side were excavated (**Figure 2**).

A large array of specific equipment related to dyeing technology set around the main unit, are worth mentioning. A conical plastered vat, 0.70m deep, open on top and framed by a broad flat plastered rim, partly preserved, was revealed close to the edging of the southern deep cistern (**Figure 4**). Nearby, two basins bordered with cobblestones and a small hearth of round shape,

constructed of fired clay and flat terracotta tiles (**Figure 2**), were found. In this area, a unique element rarely preserved in dye workshops came to light: a large amount of hydrated lime stored in a small room, near the tank unit. In close proximity, another rare plastered structure was uncovered, consisting of two semi-elliptical shaped basins equipped with round sinking holes in their centre, apparently for collecting residues (**Figure 2**). Between this structure and the related northern deep tank, a square-shaped platform with raised plastered edges, paved with terracotta tile fragments, may have served for the placement of device related to the dyeing processes. Two other platforms of the same type have been

Figure 4: Plastered conical immersion vat
(© The Helike Project, Dora Katsonopoulou).

Figure 5: Drone photo of the dyeworks building complex (© The Helike Project, Dora Katsonopoulou).

preserved in the middle of the central unit, along the tanks.

The four-tank unit and surrounding spaces form the southern part of a building complex excavated to date in an area of 1000sq.m (**Figure 5**). Excavations in the northern part revealed more rooms, as well as working and storage spaces. In one of these rooms, another unique clay structure was discovered. It consists of two parallel clay partitions framing a deep clay basin, connected on the west side to a flattened area made of clay that served as a heating place for the activities that took place here (**Figure 6**). With these activities was probably associated a large storage area next to the clay structure room, where three big *pithoi* (storage jars – one of gigantic dimensions) were unearthed (**Figure 7**). One of them preserves an impressive number of repairs in antiquity, implying a specific function of the

Figure 6: Clay basin north of the four-tank unit (© The Helike Project, Dora Katsonopoulou).

Figure 7: Storage area showing the pithoi arrangement (© The Helike Project, Dora Katsonopoulou).

Figure 8: Pithos with ancient repairs, details (© The Helike Project, Dora Katsonopoulou).

transport vessels (including stamped amphorae handles (**Figures 11, 12**), and spindle-shaped perfume bottles/*unguentaria*. A special category of relief decorated pottery (**Figure 13**) represents scenes from Greek mythology and religion. Other clay finds include oil lamps (black and red glazed), and loom weights of conical, pyramidal and disc-shaped types. Metal finds contain iron, lead and bronze items such as nails, needles, and jewellery. Exceptional finds include a headless Tanagra figurine, gold and lapis lazuli beads, and some fragments of coloured glass pottery.

The same chronological spread as indicated by the pottery is suggested by the corpus of bronze coins found in the building complex,[11] representing a large

Figure 9: Hellenistic pottery from the excavated building complex (© The Helike Project, Dora Katsonopoulou).

vessel probably related to storage of exceptional dyeing materials (**Figure 8**).

Dating the dyeworks

The large amounts of pottery recovered from the excavated building indicate that the workshop was in use for a period of over two centuries, from *c.* 340/30 to 100/80 BC. The rich assemblage includes plain, black and red glazed, West Slope and relief decorated vases (**Figures 9, 10**), cooking, serving, storage and

number of places from the Peloponnese, Attica and the Saronic Gulf, to Macedon, the Cyclades and Ptolemaic Egypt. Finally, the same dating is suggested by the architecture[12] of the site using polygonal masonry in the earliest construction phase of the building, confined to the eastern part of the workshop's installations (**Figure 14**). Furthermore, the long-lasting use and gradual expansion of the workshop is evidenced by a number of

[11] Weir 2016.
[12] Katsonopoulou and Partida 2023.

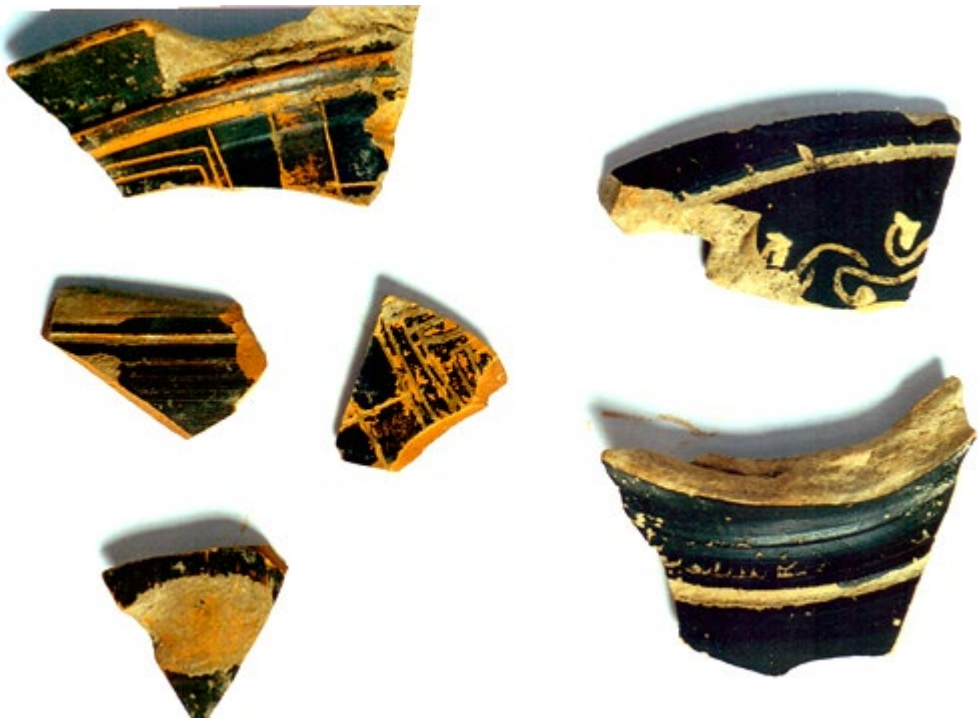


Figure 10: Black-glazed, West Slope and ivy-decorated pottery sherds from the excavated building complex (© The Helike Project, Dora Katsonopoulou).

Figures 11, 12: Stamped amphora handles from the excavated building complex (© The Helike Project, Dora Katsonopoulou).

Figure 13: Relief pottery with figural scene (© The Helike Project, Dora Katsonopoulou).

amendments, additions and modifications required by the growing activities of the facility.

Special finds, implements

A most rare find related to mordanting in the process of dyeing was discovered in the Helike dyeworks. A large quantity of lime, used as mordant by ancient dyers to make dyes colourfast and to attain the desired hues in colour, was found stored in a room with a small entrance near the western wall of the central tank unit (**Figures 2, 15**). Other mordanting substances found include large quantities of potash recovered from the central unit areas, and halite (NaCl) detected in mortar samples taken from the deep tanks and analysed by physicochemical methods.[13] Alum was a widely used basic mordant in textile industry, available only in certain parts of the ancient world. The Cycladic islands, Melos in particular, were well-known sources of alum in the Classical and Hellenistic periods.[14] Other sources of

[13] Troumpouki, Facorellis and Boyatzis 2024.
[14] Pittinger 1975.

Figure 14: View of the dyeworks complex from the east, showing the polygonal stone footing of the walls (© The Helike Project, Dora Katsonopoulou).

Figure 15: The room where stored lime was discovered, a consolidated sample remaining in situ (© The Helike Project, Dora Katsonopoulou).

alum or otherwise 'the fuller's earths' were the islands of Kimolos and Samos. Further afield, alum was also produced in Cyprus, the Near East and Egypt.[15]

Of particular interest are fragments of big terracotta roof tiles, found in the destruction layer covering the floors of the shallow basins of the tank unit. A few among them preserve some substance of blue green colour in their inner surface (**Figure 16**). Chrysoula Kardara reports the finding of big tile fragments in the dyeworks at Rachi near Isthmia, used as pressing implements to squeeze the dye out of the dyed material for reuse.[16] Squeezing out the excess dye solution was an important stage of the dyeing process, especially when expensive dyes were involved. The process required a surface for the dyed textile to be squeezed on, implements to squeeze out the liquid, and the equipment where the

[15] Forbes 1955.
[16] Kardara 1961: 265.

Figure 16: Fragment of a big terracotta roof tile preserving traces of blue-green colour (© The Helike Project, Dora Katsonopoulou).

drying of hung-up dyed material. This method required firstly the use of weights to hold the dyed fabric taut, so that it would not wrinkle, and secondly a floor appropriate to catch the water from the drying textile.[17] Drip-drying could have taken place in designated plastered areas of the shallow basins floors (**Figure 18**), the channel arrangement used to collect the liquid in a way similar to the process of squeezing out the excess dye from the dyed fabric.

Furthermore, the discovery of a significant number of loom weights in the Helike building complex suggests that weaving was an activity combined with dyeing. The different places where the loom weights were discovered within the building, along with their types (conical, pyramidal and disc-shaped), suggest that weaving was intended to cover the textile needs of the household but also that specialised textile production was performed in this workshop, as shown especially

Figure 17: Conical and pyramidal loom weights from the excavated building complex (© The Helike Project, Dora Katsonopoulou).

squeezed-out liquid would be collected. Besides using simple containers linked to squeezing areas to collect excess dye, it appears that, at organised sites, equipment was constructed especially for this purpose. In Helike, the arrangement of shallow/deep tanks with related channelling apparently served this process; after being dyed, the textile was spread out on the shallow tank floors with big tiles laid upon it, to press the excess liquid out; the liquid was subsequently collected into the deeper basins.

A number of conical or pyramidal clay loom weights (**Figure 17**) found in the excavated areas around the four-tank unit, may have been related to a significant after-dyeing activity. Besides being a tool for weaving, loom weights were probably used in the process of drip-

by the stamped examples (**Figures 19, 20**). The absence of tools for spinning indicates that this activity, being a portable process, took place elsewhere, and that spun fibres of wool or linen were brought into the workshop ready-made for weaving and dyeing.

Dyeing and cleaning processes

Materials to be dyed should first be cleaned from impurities, especially the grease contained in large quantities in wool, or the colouring impurities and wax in flax (for linen). Wool, usually dyed before spinning, was the commonest fibre used in dyeing, produced from the hairy covering of sheep and occasionally of goats.

[17] Monaghan 2013: 70-71.

Figure 18: Specific plastered areas of the shallow tanks floors
(© The Helike Project, Dora Katsonopoulou).

Figures 19, 20: Stamped disc-shaped loom weights from the excavated building complex
(© The Helike Project, Dora Katsonopoulou).

After it had been removed from the animal in a number of ways (moulting, plucking, shearing), it was cleaned from impurities and then washed. Fulling, the process of cleaning, involved washing the fibres or textiles in hot water, usually by adding detergent substances ('fuller's earths').[18]

Linen produced from the fibres contained inside the long stems of the flax plant (*linum usitatissimum Linaceae*) **(Figure 22)** was the most widespread plant fibre. Flax, either as raw material or as yarn, or even as processed (spun and woven) linen fabric, constituted a valuable commodity, which was in high demand in antiquity. Although generally believed to have been imported into Classical Greece primarily, if not exclusively, from the Black Sea and Egypt, the island of Amorgos in the Cyclades is associated with flax and linen in literary sources. In the case of Achaea, it is noteworthy that the neighbouring land of Elis is mentioned as a place of flax cultivation of both the finest and coarser fibres (Pausanias 6.26.6). To obtain the fibres from the flax plant, an intensive laborious process was required, the most important stage of which was 'retting'; this involved the immersion of stalks in water to facilitate the removal of stems attached to the fibres.[19] This method was faster than the much slower process of

[18] Forbes 1964.
[19] Monaghan 2013: 35.

'dew retting', which involved the exposure of stalks to the dew by spreading them out on the ground.[20]

In Helike, the presence of specially constructed equipment, implements, and mordants/detergents suggests that, besides the dyeing process, which was mainly operated by immersion (vats), fermentation and boiling methods, cleaning/bleaching processes also took place here. The tank unit arrangement was appropriate for both the fulling of wool and the 'retting' of flax. The same areas were suitable for a number of important after-dyeing processes, such as squeezing the excess dye out for reuse, rinsing, and drying including the drip-drying of hung dyed fabric. A further activity combined with dyeing and cleaning was the weaving.

Organisation and management

The Helike workshop meets most (six out of eight) of the criteria that characterise a site as a dyeworks;[21] in fact, some hold a top position on the scale of importance. The most solid, however, indication that dyeing activity did take place here emerges from the combined presence of more than one features clearly related to dyeing, considering that some of the equipment and ingredients might also be associated with other activities, such as fulling, tanning, wine or oil production, which also involve large quantities of liquids.

In the organisation of the dyeing activity, the availability of dyestuffs (plant or animal based), fibres, and mordants/detergents was a factor that could have a key influence on the dyeing process of the workshop. As concerns dye-producing plants, certain dyes required the supply of dyestuffs from areas outside the immediate region, over a wide range of distant places. To obtain them, weather conditions and the time of the year suitable for travel should be taken into account. The problem of availability of dyestuffs could be solved in some way, as in most cases it was not necessary to use them as soon as they had been produced; the majority of them was dried and could be kept for later use. As concerns fibres, once produced they could be used by dyers at any time of the year. Finally, the substances used in the dyeing process would have been produced at any time but their availability could be affected by seasonal factors. Access to sources of exotic dyestuffs or the acquisition of 'earth' and other ingredients from the islands for a dyer in the Peloponnese, for example, was heavily dependent on the trading season between spring and autumn, when the weather was most suitable for sailing or travel over long distances. The same period was suitable for dye production, as well, since the majority of dye-producing plants but also some animal (especially kermes) were harvested and processed between spring and early autumn. On the other hand, the busiest periods for agricultural activities were between late May and early July (harvest), and from September to November (vintage, ploughing).[22] High-summer season (July-August) being the least busy time for agriculture, was apparently the best time for dyeing activity, inasmuch as warm weather is beneficial to dyeing and drying and more people would be available to carry out the various tasks involved.

The potential of a dyeworks' facilities to be used at different times or seasons for other activities, besides dyeing, is another factor to be considered in the overall organisation of a textile production site; all the more so, because the multi-functionality eventually links the organisation of the workshop with the issue of craftsmen specialisation, namely with the availability of dyers, fullers, laundrymen, tanners, as well as of the implements, tools and equipment used by these specialists.

This kind of an industrial site most probably operated under the control of a private union/association, i.e. the type of enterprises that flourished in the Hellenistic period, especially in the years after Alexander the Great. Adequate evidence on how such an enterprise was managed is provided by the famous Kafizin texts inscribed on pottery vessels found in the Nymphaeum of Kafizin, in the region of ancient Idalion in Cyprus. Apart from the inscriptions, human heads and the flax plant are depicted on some vessels (**Figure 21**). The inscriptions dated to the late third century BC[23] are of great importance. They record a flax and linseed company operating under the authority of a man named Zenon, and another man named Onesagoras as the general manager. The company's main occupation was the cultivation of flax, exploitation on an industrial scale, and probably the production and trade of linen.[24] This commercial model may apply particularly to flax processing, as fibres collected from various cultivation places could be brought into a central retting place, where skilled craftsmen in the appropriate installations would carry out the necessary process. In the case of our workshop, flax cultivated in the neighbouring land of Elis could reach the Helike facilities to be processed for obtaining the fibres and/or dyeing in the form of spun thread or as a woven fabric.

Other contemporary dyeworks in the Gulf of Corinth

A number of sites around the Gulf of Corinth, contemporary with the complex of Helike and with

[20] Hill 1952.
[21] Monaghan 2013: 74.
[22] Foxhall 1998: 109-113.
[23] Mitford 1950: 1980.
[24] Nosch 2014.

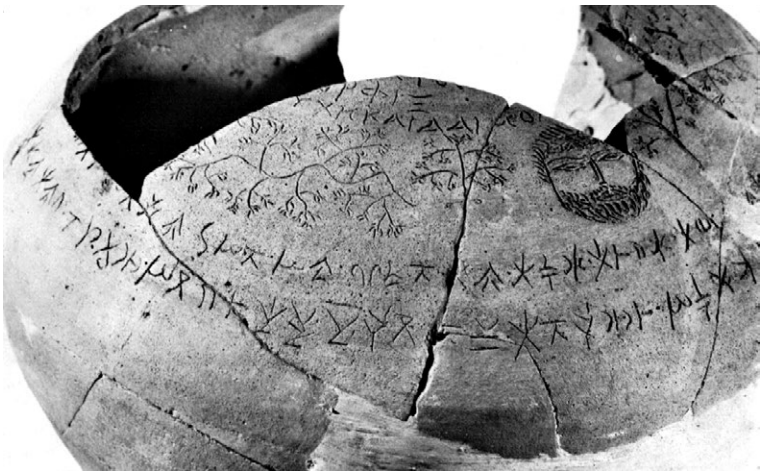


Figure 21: Depiction of the flax plant on an inscribed vessel from the site of Kafizin in Cyprus (after Mitford 1980: pl. VII, inscr. no. 266K20).

comparable features, have been identified as dyeworks: Mycenae and Rachi near Isthmia in the neighbouring Corinthia, and Khostiai in Boeotia, on the other side of the Gulf. The existence of a dyeworks network around the Gulf indicates the flourishing of textile production industry in this region, in the Late Classical/Hellenistic times.

Rachi

The settlement on the Rachi hill, overlooking the sanctuary of Poseidon at Isthmia, dates from *c.* 360 to *c.* 240 BC,[25] thus coinciding with the earliest phase of the Helike dyeworks. Evidence for dyeing activity was found in a number of the settlement's houses, which contained rectangular tanks coated with plaster, vats, rock-cut cisterns, circular basins, semi-elliptical plastered and terracotta basins with sumps, and channels cut out of the bedrock leading from rectangular tanks to circular basins. Rachi displays common features with Helike in terms of facilities and equipment but also in terms of implements used to squeeze out liquid from dyed textile for reuse.

A brief report on another site near Corinth, at the location of Anaploga, mentions 'an industrial establishment' dated to the fourth century BC and comparable to the dyeing works at Isthmia.[26] The site has but briefly been reported and therefore cannot be compared with the identified dyeworks sites discussed here.

Mycenae

Building remains in the Citadel House Area and the North-West Complex on the southwestern slopes of the acropolis of Mycenae, dated to the Hellenistic period and specifically the second century BC, have been interpreted as dyeworks on account of the site's construction arrangements, which suggest textile-making activities. Evidence for dyeing processes was found in a number of buildings containing cement tanks and channels leading to drains, hearths, pebble and plastered floors sloping toward sumps at corners, basins of cement floors laid on a cobble foundation and sides made from tiles covered with cement.[27] These installations chronologically coincide with the later phase of the Helike establishment and share many similar features in terms of equipment and tanks arrangement.

Khostiai

The dyeworks excavated in a terraced area outside the southern wall of the ancient acropolis of Khostiai in Boeotia, consists of one building containing three rooms facing onto a courtyard. The special equipment related to dyeing activities includes a number of vats and channels cut into the bedrock, several circular pits and a deep cistern.[28] Especially some structures coated with plaster and an arrangement of shallow and deep cisterns recall the Helike specialised areas for squeezing liquid out of dyed material and/or drip-drying.

A type of construction that seems to have been used in similar ways in all four dye workshops identified within the region of the Gulf is the type of basins with raised edges and sumps.

Repercussions on economy and further conclusions

Generally, craft production in Classical and Hellenistic Greece is considered to have been small-scale, intended for local consumption and lacking central organisation. Small-scale production was carried out within the domestic premises by domestic personnel (family members and domestic slaves), aiming primarily at a household's subsistence and not intended for sale outside it. Archaeologically, this type of production cannot be easily identified, as it does not require specialised equipment or production areas. The same applies to the category of household industry, which again is mainly house-oriented; any sale for profit outside it would be limited to a very small market, thus providing no appreciable income for the house. The difference becomes obvious, when we turn to the

[25] Kardara 1961: 263.
[26] Robinson 1963: 79.
[27] Bowkett 1995.
[28] Fossey 1981; Fossey and Morin 1986.

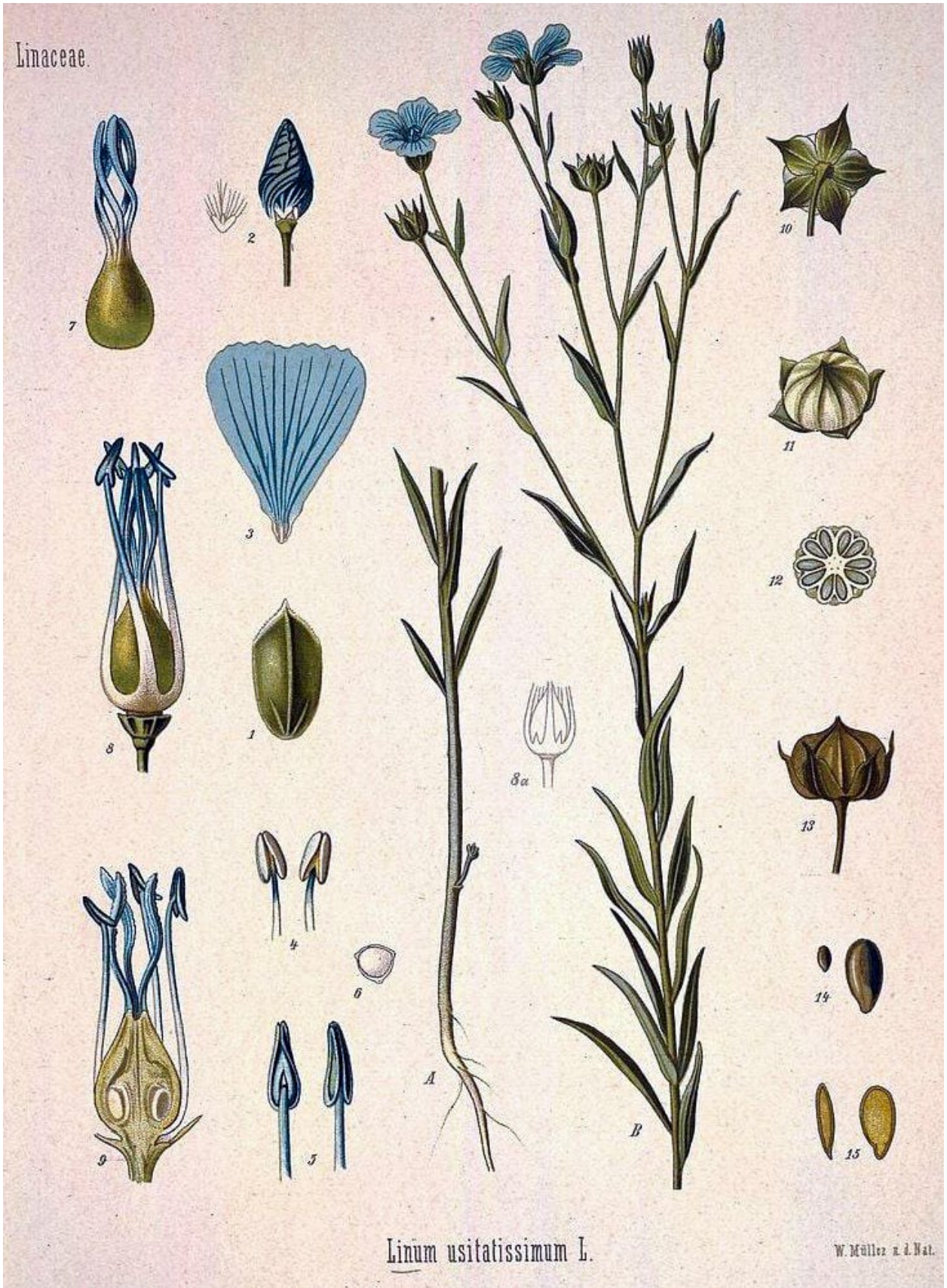


Figure 22: The flax plant *linum usitatissimum Linaceae* (https://www.biodiversitylibrary.org/pageimage/303594).

model of workshop industry and its two categories of medium or large-scale production type. In this kind of industry, levels of craft production could be differentiated according to specific features, such as the size of the production areas, and the presence of specially constructed equipment. Medium-scale production could be carried out in a domestic setting by domestic personnel (as in the case of small-scale production) but would require a specialised production area and equipment, and most probably specialised labour. The workshop's products would not be limited for consumption within the household alone, but would also be intended for sale, thus providing substantial income for the house economy.

Almost primarily for off-site sales were intended the products of a large-scale production workshop, the operation of which would require an organised location with permanent facilities, specially constructed equipment and production areas, a larger workforce and highly skilled craftsmen. This production model was intended for a larger number of consumers, and it would be a major source for a household's subsistence, operated by central management responsible for the overall planning of the workshop, as well as for the production of a certain product or a range of products, including their promotion into the markets. Such a type of a dyeing industry is easier to identify in the archaeological record.

The textile workshop unearthed at Helike seems to belong to the category of a large-scale production site; its products were intended for consumption outside it, aiming at wider markets. The presence of this model at Helike is suggested by a number of features revealed in the excavated areas of the building: (a) the specially constructed equipment and specialised production areas, (b) the presence of mordants/substances including rare ones (lime) related to dyeing activities, (c) the presence of pressing/hanging implements related to after-dyeing processes, (d) the large size (tanks and cisterns of large volumetric capacity) and specific arrangement of the installations to attain higher productivity and transaction of simultaneous production processes on an industrial scale, (e) the permanent character of the facilities, (f) the long-lasting use and gradual expansion of the workshop's premises.

The intended consumption outside the workshop is probably evidenced by the large corpus of coins found in the excavated site, representing a great number of cities from the neighbouring regions of Sicyon and Corinth, Messenia in south Peloponnese, Megaris, to the Saronic Gulf, Attica, the Aetolian League, Macedon, Ptolemaic Egypt and the Cyclades (Delos). Furthermore, the presence of luxury items (gold, lapis lazuli, coloured glass) and of a large number of commercial amphorae suggests trade relations and contacts with a wide network of regions both to the West (Italy and Magna Graecia), and to the Aegean and further to the east.

The advantageous location of Helike, on the southwest shore of the Corinthian Gulf, favoured maritime travelling and trade already since the prehistoric times. Contacts with the East date as early as the middle of the third millennium BC, as indicated by the pottery including the unique *depas amphikypellon* cup and luxury items from the excavations of the Early Helladic settlement at Helike (**Figure 1: R**).[29] In the early historical times, before the end of the eighth century BC, the foundation of a colony at Sybaris in South Italy opened up new maritime trade routes and contacts with the western markets. Through Helike, the oldest coastal commercial centre in the area, Corinthian products reached the interior of Achaea as early as the second half of the eighth century BC; the same is suggested for products from the east Mediterranean, as shown by the early seventh-century Phoenician metal models of clay vessels recovered from a number of Achaean sites.[30] In the early Classical period, the presence of the most celebrated marble of the ancient world, the Parian, in the highland territory of Helike (modern Mamousia, **Figure 1**) for the construction needs of a sizeable temple and its sculptural decoration,[31] suggests that Helike continued to be the principal commercial centre in the region of northwestern Peloponnese and the Gulf of Corinth. Thus, its location is placed along the maritime routes network for the export and diffusion of the Parian marble to the West.[32]

Naturally, coastal towns and harbours are the places where travellers and traders usually meet, exchanging goods and attaining connections and contacts. The Helike dyeworks, being the only one positioned near the sea among its contemporaries around the Gulf of Corinth, apparently played a key-role in the economy of the region and over a wider area, thus demonstrating the importance of coastal locations in textile manufacture and cultural exchange.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[29] Katsonopoulou and Katsarou 2017.
[30] Papadopoulos 2001.
[31] On the temple's sculptures see Katsonopoulou 2018: 108-109; Kanellopoulos and Kolia 2011: 152-157; Mastrokostas 1985.
[32] Katsonopoulou 2018: 107-110.

Chapter 5
Workplaces in the southern sacred area at Olbia Pontica

Alla V. Bujskikh

Abstract

The article discusses the finds from the excavation of the open-air workplace, which existed for almost two hundred years in the territory of the South *Temenos* at Olbia. It consisted of three workshops, which successively replaced each other on the same spot. Different handicraft activities were involved, all of which required high temperature. The earliest phase of the workshop was related to metalworking, whereas the subsequent ones to pottery production.

The metalworking workshop was demarcated to the south by a shallow fence, which was built along the transverse street and separated the sacral from the production space inside the *temenos*. Its original dimensions, prior to its destruction, are estimated to have reached nearly 5m from north to south and 10m from east to west. Approximately 2kg of bronze slag were found. The workshop consisted of small and shallow pits dug in the ancient humus, separated into different sections by adobe bricks. In between these cavities/depressions, the floor was levelled, of beaten earth also covered in adobe clay.

The pottery workshop was separated from the new temple built to the north of the early one, which no longer existed, by a Γ-shaped fence. The pottery workshop, which replaced the metallurgical installation around the mid-fifth century BC, included a 1.25m x 0.85m pottery kiln and two cisterns with water-proof stucco. This kiln functioned until the late fifth/early fourth century, when the two cisterns were filled in and the kiln was obliterated. In the place of the kiln and the cistern located to its north, two new, successor kilns of smaller dimensions were installed and remained in function until the Early Hellenistic period.

In Olbia Pontica this is the first workshop associated with different types of handicraft discovered *in situ* within a cult zone. So far, the presence of bronze/metal production at other cult sites was implied, but not proven archaeologically. The small size of the workshop at the South *Temenos* may indicate that it served the cult rituals practiced there, so, it was related to the worship of Aphrodite.

Περίληψη

Στο παρόν άρθρο συζητούνται τα ευρήματα από τις ανασκαφές του υπαίθριου εργαστηρίου που υπήρξε ενεργό για τουλάχιστον δύο αιώνες στην περιοχή του Νοτίου Τεμένους στην Ολβία. Αποτελείτο από τρία διαδοχικά εργαστήρια στο ίδιο σημείο, τα οποία εξυπηρετούσαν διαφορετικές χειροτεχνικές δραστηριότητες, που όμως όλες απαιτούσαν υψηλές θερμοκρασίες. Η πρωιμότερη φάση του εργαστηρίου σχετιζόταν με μεταλλουργία/μεταλλοτεχνία, ενώ οι ακόλουθες με κεραμική.

Το μεταλλουργικό εργαστήριο οριοθετούνταν στα νότια από ένα αβαθές περίφραγμα, κατασκευασμένο κατά μήκος του εγκάρσια διερχόμενου δρόμου, ώστε να διαχωρίζει την ιερή από την παραγωγική ζώνη του τεμένους. Οι αρχικές διαστάσεις, πριν τη μετέπειτα καταστροφή του, υπολογίζονται σε περίπου 5μ σε άξονα βορρά-νότου και 10μ σε ανατολής-δύσης. Βρέθηκαν περίπου 2 κιλά σκωρίας. Ο εργαστηριακός χώρος περιελάμβανε μικρούς ρηχούς λάκκους σκαμμένους στο επίπεδο του αρχαίου μαυροχώματος, με χώρους διαμορφωμένους με χρήση αργιλοπλίνθων. Μεταξύ των λάκκων/κοιλοτήτων, το δάπεδο ήταν επίπεδο, από πατημένη γη επίσης στρωμένη με οικοδομικό πηλό.

Με τη βοήθεια ενός περιφράγματος σε σχήμα Γ, το εργαστήριο κεραμικής διαχωριζόταν από τον νέο ναό, κτισμένο στα βόρεια του πρώιμου ναού, ο οποίος πλέον δεν υπήρχε. Το κεραμικό εργαστήριο, που αντικατέστησε το μεταλλουργικό περί τα μέσα του πέμπτου αιώνα π.Χ., περιελάμβανε έναν κεραμικό κλίβανο διαστάσεων 1,25μ x 0,85μ και δύο δεξαμενές στεγανοποιημένες με υδραυλικό κονίαμα. Ο κλίβανος λειτούργησε μέχρι τον ύστερο πέμπτο/πρώιμο τέταρτο αιώνα π.Χ., όταν, μαζί με τις δεξαμενές, παροπλίσθηκε. Στη θέση του, και της δεξαμενής προς βορρά, εγκαταστάθηκαν δύο νέοι, διάδοχοι κλίβανοι μικρότερων διαστάσεων, που λειτούργησαν ως την πρώιμη Ελληνιστική περίοδο.

Στην Ποντική Ολβία αυτό είναι το πρώτο εργαστήριο που σχετίζεται με διαφορετικούς τύπους χειροτεχνικής παραγωγής και αποκαλύπτεται κατά χώραν σε μια ζώνη λατρείας. Μέχρι σήμερα, η παρουσία μεταλλευτικής παραγωγής σε άλλες λατρευτικές θέσεις συναγόταν, όμως χωρίς να τεκμηριώνεται αρχαιολογικά. Το μικρό μέγεθος του εργαστηρίου στο Νότιο Τέμενος ίσως υποδηλώνει πως εξυπηρετούσε τις τελετουργικές πρακτικές που ασκούνταν εκεί και, άρα, συνδεόταν με τη λατρεία της Αφροδίτης.

Keywords: Olbia Pontica; Aphrodite; sacred zone; workshop

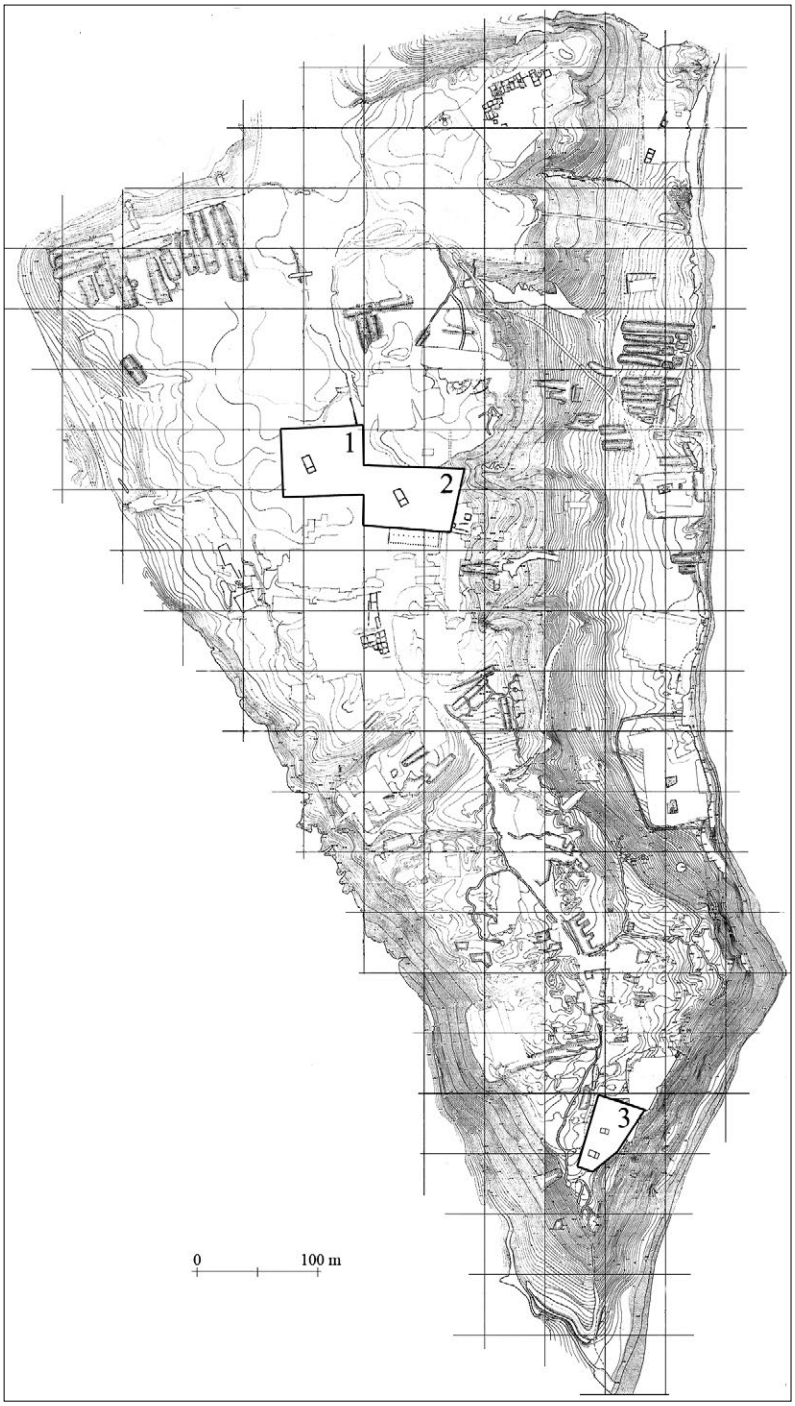


Figure 1: Olbia plan showing the three sacred zones location: 1. Western *temenos*; 2. Eastern *temenos*; 3. Southern *temenos* (drawn by Dmitri Belenkii in 1989, kept in the archive of the Institute of Archaeology, National Academy of Sciences of Ukraine).

Olbia Pontica was founded at the turn of the seventh to the sixth century BC, as a result of the Milesian exploration of the northwestern Pontic region. Its location near the mouth of two rivers, Borysthenes, the largest river of Scythia, and Hypanis river, facilitated the establishment of tight contacts with the indigenous population from the inner territories.[1] The Olbian *polis* preserved the cultural and religious traditions transplanted here from the *metropolis* of Miletus; it consisted of two city-centres, Borysthenes and Olbia. In the first century of its existence, the territory of Olbia-city included nearly 50 hectares, occupying two terraces, an upper and a lower one with a harbour.[2] In the pre-Roman period, Olbia comprised three sacred zones, all located at the upper terrace: the West *Temenos* with Apollo Hietros and the Mother of Gods being the main cult recipients, the East *Temenos* dedicated to Apollo Delphinios and Athena, and finally the South *Temenos*, devoted to the cult of Aphrodite (**Figure 1**).

[1] Borysthenes was in the middle of the coastal line of Scythia: Herodotus 4.17-20.

[2] New information about the spatial development of the inner-city territory at Olbia: Fornasier *et al.* 2022; Buiskikh and Fornasier 2022; general view to the Olbian harbour: Kozlovskaya 2008.

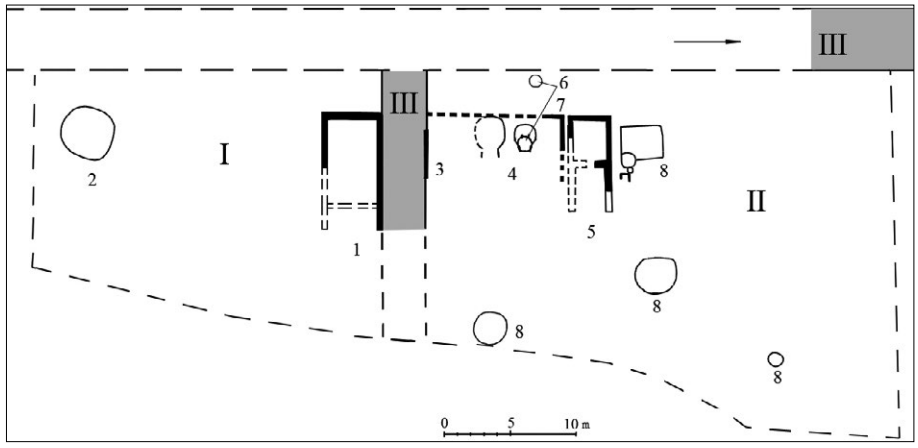


Figure 2: Southern *temenos*: I. Late Archaic times. 1. Temple of Aphrodite; 2. *Bothros*; 3. Precinct; 4. Working place; II. Classical times. 5. Temple of Aphrodite; 6. Cisterns; 7. Precinct; 8. *Bothroi*; III. Preserved parts of the city-grid (drawing by the author).

Despite their rather poor preservation and the lack of archaeological records, the last sanctuary, where archaeological research is still in progress **(Figure 2)**,[3] has yielded the remains of a production-site alongside the foundations of cult buildings. What is suggested by the area's geology, with clayish soil and lack of locally quarried stone, has been verified archaeologically, that is, reflected in the ancient building practices, since a lot of buildings were constructed of adobe clay in this region. That is why the entire earliest building phase is represented by the primitive single-roomed houses, the so-called dug-outs. Their multi-functional use (not only for habitation purposes) and simplicity of design, accompanied by the local peculiarities, new geology and climate conditions, promoted their wide and quick spread. The lifespan of dug-outs in Olbia covered nearly a century; they started being replaced by the normal multi-chambered houses in the last quarter of the sixth century BC. These houses were constructed of adobe bricks on stone socles.[4]

The sacred zone, dedicated to Aphrodite, appeared in the southern part of the Olbian upper terrace after 500 BC, when all the primitive buildings and pits were closed simultaneously. The particular building material allowed the demolition of all the buildings down to their bases after the end of their exploitation. Within the sacred zone, a permanent workplace was excavated and investigated (**Figure 2: II-III**); it had existed continuously for nearly two centuries, from the beginning of the fifth up to the last third of the fourth century BC. Three workshops, succeeding each other, were located in the same region (**Figure 2: 2-4**). They were related to different handicraft activities, having the use of fire as a common denominator. The earliest level yielded traces of metalworking, whereas the other two represent the local ceramics production. Although the destruction caused in the Late Roman times, when the site was used mainly as a waste-disposal area with garbage pits, makes exploration completely impossible, the proposed attribution of certain functions to the excavated constructions seems to be verified.

The *temenos* located in the southeastern part of the Upper City was bordered by (set within) a longitudinal street and two transversal ones (**Figure 2: III**) in accordance with the new, regular grid-pattern in town-planning that was applied here.[5] It is noteworthy that the earliest workshop appeared simultaneously with the establishment of this sacred zone and was laid directly upon the natural clayish soil. A thin fence on a stone footing (**Figure 2: 3**) served as a boundary wall separating the *temenos* from the transversal street, as suggested by a line of flat stones set along the street and preserved for more than 2m in length. Thus, the street ran outside the site of the main cult buildings, the temple and the *bothros*/repository preserved (**Figure 2: 1-2**), and it fringed the *temenos*. The preserved square measures 2.3-3.8m from north to south, 2.4-2.8m from east to west, but perhaps its original dimensions were larger, perhaps nearly 5m from north to south and 10m from east to west.

As aforementioned, the earliest workshop was connected with bronze/metal production. No complete items were found except for the small bronze items, not possible to reconstitute. During the excavations, nearly 2kg of bronze slag were found, amidst numerous tiny pieces of burnt clay and charcoal. The working-place included a number of small pits and depressions in the pavement made of adobe bricks and pressed yellow (subsoil) clay (**Figure 3**). The floor-level of the workplace is almost smooth and had probably been artificially levelled because of the whole territory's slight inclination eastwards. The excavated area between the pits was covered with pressed adobe clay, thin layers of river sand and small river-shells. The abundant traces of reed

[3] For preliminary information about the *temenos*, see Bujskikh 2015: 226-246.

[4] The building practice with the use of adobe clay became the cross-cultural tradition in the northwestern Black Sea region. About the earliest single-chambered houses in Olbia: Bujskikh 2017.

[5] Buiskikh 2021: 682-690.

Figure 3: Central part of the Late Archaic bronze/metal workshop. On the right, a Classical cistern (© Institute of Archaeology, National Academy of Sciences of Ukraine / photo by the author).

that filled the place between the pits probably denote that the surface of the working area was covered in fresh reed, as a sort of mat. The bronze/metal workshop falls in the so-called 'open type', being installed in the open-air. All the depressions were filled with ash and burnt pieces of adobe clay, bronze slag and small, hardly diagnostic ceramic sherds dating to the end of the sixth/beginning of the fifth centuries BC, in accordance with the overall archaeological context.

While studying the rest of the bronze workshop, it became clear that this installation had not collapsed unexpectedly but was deliberately demolished prior to a later remodelling of the area. It was covered in a thick layer of clay with no finds inside; a deliberate filling justifies the total absence of any kind of raw materials, tools, or finished products. This artificial levelling occurred no later than the middle of the fifth century BC and was connected with the later enlargement, the northward expansion of the sacred territory, re-directing the function and production-line of the workshop.

First of all, the workshop changed in terms of general specialisation: a large ceramic kiln appeared here, while two water cisterns were cut in the vicinity, north and northwest of the kiln. These installations enjoyed a lifetime of nearly half a century, up to the end of the fifth/beginning of the fourth century BC; afterwards they, too, were levelled and covered with a layer of clay. The kiln was installed on a flat surface coated with adobe clay. The remains of the kiln were destroyed almost completely in the Late Roman times. Only the northern contour (preserved height is nearly 5-15cm) and the furnace mouth have been preserved at the level of the bottom row.

The excavated remains of the kiln demonstrate that it was built from yellow and brown adobe bricks of identical dimensions, while individual complete and broken bricks were found inside the kiln (**Figure 4.1**). The preserved part of the kiln shows that its construction was very simple. The kiln had an oval form with calculated dimensions *c.* 1.25 x 0.85m and a trapezoidal mouth open to the east (**Figure 4.2**). The floor of the mouth, at the border between the mouth and the firing chamber, was paved with two flat limestones. Nothing was found of the kiln's foundations, except for a plastic vase of South-Ionian fabrication in the shape of a water-bird (**Figure 4.3**). Lekythoi shaped after water-birds are well-known in the iconography of Archaic plastic vases.[6] Similar vases were found in the Olbian *emporion*, Borysthenes,[7] as well as in the nearest sister-*polis* (twin town), Histria.[8] The bird-shaped lekythos falls within a range of attributes related to Aphrodite[9] and fits well in the general context of finds from the sacred zone dedicated to the goddess. It was perhaps brought here from another building prior to the workshop's re-organisation. In other words, this vessel could be a sort of 'sacrifice' or ex-voto, placed at the bottom of the kiln before the workshop was re-organised.

The rest of the northwestern water-cistern (**Figure 5.1**) was also destroyed by the Late-Roman pit, the original filling preserved partly in its southern part and in the lower part of the 1.4m depth. The cistern overall depth is 2.25m; the upper diameter is 1.1m and the bottom diameter is 1.03m. The walls were cut in the clay subsoil and coated in 3-5cm thick waterproof stucco with greenish spondyloid clay. Representative of the finds is a Chian amphora of the last third of the fifth century BC with a swastika-*dipinto* on the neck (**Figure 5.2**) and a Herakleian amphora bearing the stamp of the fabricant Διονύσιος I, which falls in the 'Early Fabricant' group, end of the fifth century – 390 BC.[10] Attic black-glazed cups were also found, including the stemless forms of the 'Delicate class' with stamped decoration.[11] Particularly noteworthy is the bottom of an Attic red-figured cup, accurately broken into four pieces, with the tondo depicting a seated Aphrodite receiving a necklace from a small flying Eros and the dedicatory *graffito* '[A]ΦΡΟΔΙΤ[ΗΙ]' on the bottom exterior (**Figure 5.3**).[12]

The northern water-cistern was preserved intact; it was discovered at a distance of 1.1m east of the first one and less than 1m north of the kiln. The overall cistern depth is 2.75m, the upper diameter is 1m and the diameter of the bottom is 1.75m (**Figure 6.1**). The walls were coated in the same waterproof stucco that

[6] Ducat 1966: 91-92, pl. XII. 1-2.
[7] Cf. Hermitage State Museum 2005: cat. 186.
[8] Cf. Alexandrescu 1978: cat. 249-250.
[9] Delivorrias 1984: 14-15.
[10] The stamp was identified by the late Dr V. Katz (†) and Dr M. Ivashchenko.
[11] Cf. Sparkes and Talcott 1970: cat. 490-497.
[12] For an overview of other *graffiti* dedications to Aphrodite, found at the South *Temenos* see: Rusyaeva 2015: 252, fig. 1.

Figure 4: Early Classical ceramic kiln: 1. Level of destruction; 2. Foundation level; 3. South-Ionian bird-shaped plastic lekythos (© Institute of Archaeology, National Academy of Sciences of Ukraine / photos by the author).

was used in the first cistern. Worth mentioning among the finds is an Attic black-glazed 'Delicate class' cup with stamped decoration,[13] broken into small fragments (**Figure 6.2**), and a complete shell of a swamp turtle, *Emys orbicularis* (**Figure 6.3**).[14] Lots of pieces of bronze slag were also recovered and they apparently belong to the predecessor workshop. It is reasonable to assume that they were dumped into the cistern, which was afterwards closed, in the course of a thorough clearing operation, before the last phase of the working-place's operation.

At the beginning of the fourth century BC, a large kiln was superimposed upon the demolished one and the closed/obsolete northern cistern. This workshop enjoyed a lifespan up until the Early Hellenistic times,[15] representing the third and last phase of its operation within the *temenos*. The territory of the *temenos* was enlarged; it expanded twice as much northwards and a new temple was built. Since the workshop still occupied its previous location, it had to be bordered by a walling that demarcated and separated it from the new temple erected nearby.

As aforementioned, the new ceramic kiln was superimposed upon the closed/obsolete northern cistern. As if sealing the cistern's previous function, a large piece of an amphora-body was placed on top of the

[13] Cf. Sparkes and Talcott 1970: cat. 486.

[14] I owe this piece of information to Dr E. Yanish. Whether the turtle accidentally appeared in the cistern or was brought to the *temenos* as a sacrifice, is still under debate.

[15] In the local Olbian chronology, a new phase in historical and cultural development (Vinogradov and Kryžickii 1995: 17) begins with the lifting of the siege of Zopyrion (Macrobius, *Saturnalia* 1.11.33) in the last third of the fourth century BC.

Figure 5. 1: Western water cistern from the North; 2: Chian amphora; 3: base of Attic red-figure cup with dedication to Aphrodite (© Institute of Archaeology, National Academy of Sciences of Ukraine / photos by the author).

cistern filling, before the new installation was planted (**Figure 7.1**). The lower level of the kiln is trapezoidal, with external dimensions 0.8-1.53m (eastern) x 1m (northern) x 1.05m (southern side), and preserved height 12cm. The inner plan is also trapezoidal, with the western wall rounded. The walls were built of yellow adobe clay and small rubble stones. Adobe bricks, varying in dimensions (10cm x 8cm, 20cm x 8cm, 21cm x 12cm, 30cm x 17cm), were used only on the northern side. The preserved height of the constructions reaches

Figure 6. 1: Northern water cistern; 2: Attic black-glazed cup of the Delicate class; 3: shell of *Emys orbicularis* (© Institute of Archaeology, National Academy of Sciences of Ukraine / photos by the author).

1

2

Figure 7. 1: Amphora body at the top of the northern water cistern and under ceramic kiln, from the west; 2: Ceramic kiln and oven from the latest period of the workshop's lifespan, from the east (© Institute of Archaeology, National Academy of Sciences of Ukraine / photos by the author).

nearly 0.25-0.27cm. Some adobe bricks were found laying flat inside the firing chamber. Perhaps these are the remnants of the (broken) supporting pillar inside the chamber. At the mouth of the kiln, two flat limestones echo the construction mode of the kiln of the previous building-phase.

To the south of this kiln, on the site of the demolished earlier one, a successor-kiln was constructed (**Figure 7.2**). Its northern part has been preserved, measuring 0.8-0.9m x 1.1m. The kiln borders were made of adobe bricks, preserved burnt. In the eastern part, the cover, made of densely spaced amphora sherds was excavated.

The clay surface under the sherds was also burnt. The narrow space between the two new kilns was filled with ash.

The prolonged operation of the workshop in exactly the same location and defying the territorial expansion of the *temenos* in the late Classical period, as well as its close proximity to the newly erected temple, demonstrate that this site continued to operate as a working-place serving additional or secondary building activity within the sacred zone. The area retained its role and function as a productive centre – a 'profane activity'[16] that nevertheless met the needs of cult practice. The three workshops with different specialisation, one for bronze/metal and two others for ceramic production, have not yet offered much information about the development of local handicrafts. However, they provide evidence for the metal production and processing not only in the late Archaic but also in the Classical period.[17] The stone moulds used for the casting of lead votive objects, such as double-axes and herms (**Figure 8.1-2**) found within the area of the *temenos*, date to the Classical period. In addition, numerous complete lead pieces were found, including those from the mixed later levels (**Figure 8.3-13**).[18] The specific stratigraphic sequence reflects the constant remodelling of the area – unfortunately generating also a mixture of soil and artefacts from different *strata*.

Of the three Olbian sacred zones, the South *Temenos* provides the most eloquent traces of local handicraft production. Of course, this should not be taken to imply that the other two sacred zones were free of such activity. In the West *Temenos*, the remains of bronze/metal working were interpreted as such, on the grounds of a multitude of small bronze pieces including waste/slag and defective ones, spread across the entire *temenos*.[19] Moulds for casting bronze arrowheads, lead *bucrania*, and double-axes were also recovered there.[20] Recently a 'new' workshop was identified as possibly related to the processing of antlers. The identification was proposed after studying the collection of horn cuts (cuttings on antlers) that reflects different stages in their working.[21] But none of these workshops need be localised necessarily within the sacred territory. Two buildings were excavated near the border of the East *Temenos*, exactly where two workshops, including the nearby water-cistern, were expected to be located: one for bronze/metal, dated to the Classical times, and another one, for terracotta figurines production, dated to the Hellenistic period.[22]

Summing up the evidence for working-places located in the Olbian *temene*, it is necessary to clarify that the only workshops of which the production was connected with the place of their installation were those in the East *Temenos* – the youngest among the excavated ones. The analyses of product-range testify that all of them, especially the bronze details of weapons (arrowheads) and the numerous lead items, including double-axes, belong to the nomenclature of votive offerings that were customary, for Ionian sanctuaries in particular, since the Archaic times.[23]

Productive activity in the Olbian *temene* can be compared with its counterpart in the *temenos* at Borysthenes, connected with the worship of Aphrodite (?).[24] A blacksmith's workshop was excavated there – enclosed by compact adobe walls.[25] As yet, it cannot be determined whether it was spatially laid out as a special room or building in the *temenos*, or demarcated by simple fences, instead of walls, with the processing of products and the casting procedure taking place in the open air. Besides the workshop within the *temenos*, another productive district, outside the *temenos*, which appeared after the middle of the sixth century BC, was explored at Borysthenes. It was related to ceramic production; five ceramic kilns with the rest of complete, broken and defective ceramic production, lamps and tableware, reflect the rise of the local colonial economics.[26] Such a mass production in various forms undoubtedly addressed both internal and external customers. If we compare the productive centre at Borysthenes with the workshop excavated at the South *Temenos* of Olbia, their different aims become obvious.

The described examples of the arrangement of working-places in the urban sacred zones at Olbia and Borysthenes allow me to discuss some further questions, relevant to the overall organisation of handicraft production, and also to the customers and consumers of the ready-made products. The *temene* workshops, as can be inferred, produced items that firstly met the needs of sacrifices as both votive gifts to the Gods and accessories used in collective offerings and sacrifices (for example, to carve the meat during sacred meals, etc.). There are no grounds for supposing that the end-products would be used outside the *temene*, in the citizens' everyday life. The famous Greek sanctuaries offer sufficient information on metal-

[16] Bergquist 1967: 114.
[17] The study of local ceramic production in Olbia has started: Fornasier *et al.* 2017: 48-54.
[18] More detailed information on the votive gifts of different materials found in the South *Temenos* is given in Bujskikh 2022.
[19] Rusyaeva 2006: 90-91.
[20] Krutilov 2006: 213-220, pls. 222, 225.
[21] Semenova 2021.
[22] Karasev 1964: 36; Levi 1985: 71, fig. 54.
[23] Simon 1986: 253-259, 405-407.
[24] Nazarov 2007: 542-545, fig. 4-5.
[25] Krutilov 2007: 118-124.
[26] Krutilov and Bondarenko 2015: 206-215. On architectural analyses, see Bondarenko and Chistov 2021. For recent information about the local Borysthenes ceramic production: Krutilov *et al.* 2021.

Figure 8: Stone moulds for the casting of lead votive objects: 1: Double-axe; 2: Herms. Lead items: 3: Female herm; 4: Male herm; 5-9: Bucrania; 10: Quadriga; 11: Earring; 12: Sword; 13: Nike and Heracles (© Institute of Archaeology, National Academy of Sciences of Ukraine / photos by the author).

working ateliers installed within their territories.[27] It is at least possible to assume that the organisation of the metal-working process both in the Olbian *temene*, and at Borysthenes would not differ in principle from those known in the *metropolis*. Nevertheless, the details of the preparatory work, raw materials supply (not locally available in the Steppe region), the origins of the craftsmen employed in the *temene*[28] are questions still waiting to be answered. The permanent working-place excavated at the Olbian South *Temenos* adds new information to the organisation of cult and handicraft process within the frame of colonial life.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[27] Risberg 1992. The workshops discovered in the sacred zones of Olbia and Borysthenes fit the general practice of placing such production centres within the sacred territories of other *poleis* of the Mediterranean and the Black Sea: De Cazanove *et al*. 2023a: 10-12.

[28] With regard to metalwork in Olbian *poleis*, barbarian travelling craftsmen from the Forest-Steppe zone are supposed to have worked in both cities since the sixth century BC and to have produced bronze artefacts, such as armour/weaponry, mirrors, horse trappings in the so-called Scythian animal style (Ol'govskii 2011: 95-96). The discussion and counter-arguments to this hypothesis are beyond the scope of this paper. Nevertheless, there are no grounds for adopting such a proposal in the case of the artisans in the urban *temene* both at Olbia and Borysthenes.

Chapter 6

Handicraft activities in the small town of *Fanum Martis* (Famars, northern France): Analysing and interpreting spatial organisation and production size

Raphaël Clotuche, Sonja Willems, Jean-Hervé Yvinec, Marie Derreumeaux, Jennifer Clerget, Nicolas Tisserand, Bérangère Fort and Gaëtan Jouanin

Abstract

Recent excavations (from 2011 to 2020) in the western part of the Roman small town of *Fanum Martis*, have enabled an overall understanding of its urban layout. The town developed economically from the second half of the first century AD onwards, when the nearby *civitas* capital Bavay decentralised its handicraft activities, retaining their administration. The small town expanded to 200 hectares, with a broad range of handicraft and agricultural activities dispersed within the urban tissue, rather than confined in a particular area. This includes, alongside pottery activities, a tannery, bronze and glass production, glue manufacturing and processing of cereals. These activities, sometimes lacking clear architectural features, have been evidenced by extensive sampling of artefacts and raw materials, using petrography, carpology, archaeozoology or micro-morphological studies to sustain hypotheses. Differences in the production volume can be noted with regard to pottery manufacturing, under two types of organisation: simple workshops with a repertoire of cooking-wares destined to be sold within the town and the *pagus,*[1] and worksites where a range of kilns and buildings suggest an extensive activity for a large distribution of *mortaria* and flagons to the north of *Gallia Belgica*. This production probably cannot be viewed separately from the nearby agricultural activities, flagons being exported for their contents.

This paper aims to illustrate this rich variety of handicrafts, their architectural features but also their position within the urban layout and the analysis of their production volume, using the first results of distribution data. Finally, analyses of the artefacts themselves suggest a list of professions possibly practiced within the same living space (goldsmiths, doctors, horners etc.). Thus, a composite image is yielded of a flourishing town where living and producing went hand in hand.

Περίληψη

Οι πρόσφατες ανασκαφές (2011-2020) στο δυτικό τμήμα της μικρής ρωμαϊκής πόλης *Fanum Martis* συνέβαλαν στην γενικότερη κατανόηση του πολεοδομικού της σχεδιασμού. Η πόλη αναπτύχθηκε οικονομικά από το δεύτερο ήμισυ του πρώτου αιώνα μ.Χ. και εξής, όταν η κοντινή πρωτεύουσα Bavay αποκέντρωσε τις χειροτεχνικές της δραστηριότητες, διατηρώντας τη διαχείρισή τους. Η μικρή πόλη επεκτάθηκε, φθάνοντας τα 200 εκτάρια, με ένα ευρύ φάσμα εργαστηριακών και αγροτικών δραστηριοτήτων, μάλλον διάσπαρτων μέσα στον πολεοδομικό ιστό παρά περιορισμένων σε έναν συγκεκριμένο τομέα. Το φάσμα αυτό, επιπλέον της κεραμοπλαστικής, περιλαμβάνει βυρσοδεψείο, παραγωγή χάλκινων και γυάλινων σκευών, παρασκευή κόλλας και επεξεργασία δημητριακών. Οι δραστηριότητες αυτές, που μερικές φορές δεν είχαν σαφές αρχιτεκτονικό πλαίσιο, τεκμηριώθηκαν δια εκτεταμένης δειγματοληψίας από τέχνεργα και πρώτες ύλες, δια πετρογραφικών αναλύσεων, καρπολογίας, αρχαιοζωολογίας και μικρομορφολογικών μελετών προκειμένου να ελεγχθούν υποθέσεις. Διαφορές στον όγκο της παραγωγής παρατηρούνται όσον αφορά την κεραμοπλαστική, με δύο τύπους οργάνωσης: απλά εργαστήρια με ρεπερτόριο μαγειρικών σκευών προοριζόμενων προς πώληση εσωτερική, εντός της πόλης και στους ντόπιους, και εργαστήρια όπου μια σειρά κλιβάνων και κτισμάτων υποδηλώνουν εκτεταμένη δραστηριότητα με αντίστοιχα εκτεταμένη διανομή ιγδίων/λεκανίδων και λαγύνων στα βόρεια της βελγικής Γαλατίας. Η παραγωγή ετούτη δεν μπορεί να διαχωριστεί από τις πλησίον αγροτικές δραστηριότητες και την εξαγωγή λαγύνων για το περιεχόμενό τους.

Η παρούσα εργασία έχει στόχο να σκιαγραφήσει αφ' ενός την πλούσια ποικιλία χειροτεχνικών δημιουργιών, το αρχιτεκτονικό τους πλαίσιο και τη θέση τους στον πολεοδομικό σχεδιασμό, αφ' ετέρου την ανάλυση του όγκου παραγωγής, βάσει των πρώτων αποτελεσμάτων από τα δεδομένα κατανομής της. Τέλος, οι αναλύσεις των ίδιων των τέχνεργων υποδηλώνουν μια λίστα επαγγελμάτων που πιθανότατα εξασκούνταν στον ίδιο τον χώρο διαβίωσης (χρυσοχόοι, ιατροί, κατεργαστές κεράτων κ.ά.). Έτσι προκύπτει η σύνθετη εικόνα μίας ακμάζουσας πόλης, όπου ζωή και παραγωγή προχωρούσαν χέρι-χέρι.

Keywords: Roman small town; handicrafts; spatial organisation; urban layout; dynamics of commercialisation

[1] A *pagus* is formed by related people forming a tribe, denoting in Medieval Europe a basic unit of land (Encyclopedia Britannica s.v. pagus, accessed 8 November 2023, <https://www.britannica.com/topic/pagus>). During Roman times, it indicates a district within the larger borders of the *civitas*, probably formed by a tribe.

The *Civitas Nerviorum* (8000sq.km), in the north of the Roman Empire, stretches out east of the river Scheldt and up northwards to its mouth. Its frontiers coincide with the rivers Dyle and Heure, which form the boundary with *Germania Inferior*. Its southern limits are drawn by the Arrouaise forests, the Thiérache and the Fagne (**Figure 1**).[2]

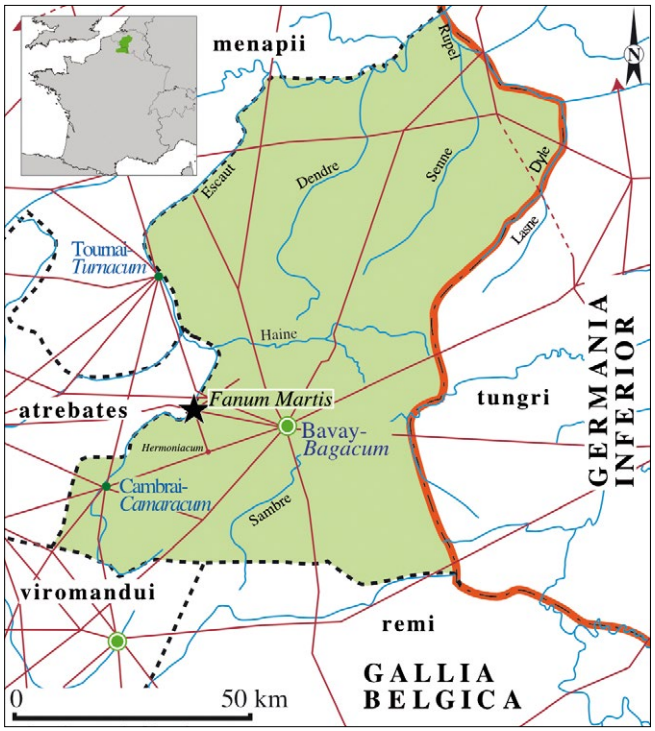


Figure 1: Location of *Fanum Martis* in its Roman context (© Raphaël Clotuche, Inrap).

At the southwestern corner of the territory, the small town of *Fanum Martis* (Famars) was founded on a plateau with rich soils, at the foot of Mont Houy, a small tertiary hill that dominates the Rhonelle and Scheldt valleys. The town was set up at about twenty kilometers from the capital cities of Bavay (*Bagacum Nerviorum*) and later, in the Late Roman period, Cambrai (*Camaracum*), along a *diverticulum*[3] joining *Hermoniacum* (Bermerain) to Pommerœul, not far from the Roman roads Bavay-Cambrai and Bavay-Tournai.

The founding of the town on rich muddy soils, suitable for agricultural activities, and its situation amidst important roads and two navigable waterways empowered the distribution of local products, as well as the acquisition of imported goods.

There is no tangible evidence for an occupation of the site prior to AD 40. From the third quarter of the first century onwards the small town expanded consistently, reaching its apex by the end of the third century, when it covered over 150 hectares. In circa AD 320 the town was reduced to a Late Roman fortification, barely encircling two hectares, but housing the headquarters of the prefect of the Nervian *Laeti* (*laeti nervicani*), the *praefectus laetorum Nerviorum Fanomantis Belgicae Secundae,* as it is indicated in the *Notitia Dignitatum*.[4]

Research on *Fanum Martis* has largely benefited from sequential archaeological observations during field survey (more than 20 hectares have been surveyed), as well as several advanced analyses of material sampled or collected in the course of trial trenches prior to the area's development. This newly gained understanding of the general organisation of local production proves to be more complex than initially thought.

The various production activities were established so as to meet the contemporary needs, also depending on the practicality of the chosen location. As needs evolved, the installations could relocate, except of course for the sites wherefrom raw materials were extracted. At first sight only, the pottery production seems to have occupied a specific district, but when looking more closely, we note the complexity of the situation, with different groups of potters being shifted to different zones at different times, thus producing a variety of categories following the demands of the market.

The construction of the town

The sandstone banks and blocks of the Mont Houy hill have been exploited since the Neolithic period, but its use was intensified during the Roman period for the construction of the buildings of the small town. The quarrying activities, noticed over more than 10 hectares stretching out at the foot of the hill, are reflected in the presence of tens of pits, measuring 1m by 2m and several metres deep.[5]

Given the distribution of stone chips and blocks still in place, the cutting and finishing was clearly executed on the spot where the blocks themselves were extracted. The smallest quarrying pits were filled up with the unused chips. Rejects of considerable size were not discarded but, instead, employed in the building of foundations or walls, but also in the construction of roads, along with flint and crushed tiles. The shards have variable dimensions, with the biggest weighing

[2] Fayder-Feytmans 1952: 348.
[3] The Latin word for a diversion, leading away from the main road.
[4] *Notitia Dignitatum Imperii cum Orientis tum Occidentis*: Occidentis: book XLII. This fifth-century document, known from Mediaeval copies, illustrates the different administrative regions of the Western and Eastern Empire (see <https://archivesetmanuscrits.bnf.fr/ark:/12148/cc776514>, accessed 8 November 2023).
[5] Clotuche 2016.

up to 2kg and measuring 20cm in length by 8cm in thickness. The shards preserve traces of a rough mantle indicating that they had been hewn off the blocks at an early stage of shaping. Close observation of the surfaces and analysis of the blow impacts reveal the use of iron percussion tools (chisel, pick?) suggested by the presence of residual rust traces outlining the impact area.

The blocks were destined for the construction of the majority of the town's private and/or public buildings. After their first cutting, they were refined and adjusted on the spot of the construction, as shown by the presence nearby of several small pits containing stone chips. The size of the finished rectangular blocks (ashlars) ranges from 10cm to 30cm.

A producer's town

The small town has often been presented as a predator of the neighbouring countryside, monopolising raw materials, whether to transform them for local use or to sell them for regional or long-distance trade.[6] The recent opportunity of conducting large-scale excavations has permitted a reassessment of this assumption, observing that the town itself was also a producer of nutriment – an idea already suggested in the 1980s[7] and illustrated by numerous cities, for instance Tongeren.[8] Alain Ferdière, in the aforementioned article, had already noted the presence of a large variety of handicraft activities within small towns. Contrary to widespread postulations,[9] it is now evident that these activities were not relegated to the town's suburbs on the pretext of the pollution they generated. On the contrary, they were disseminated within the town's layout, embedded in the urban tissue,[10] but also near religious and administrative buildings (**Figure 2**).[11] Due to their particular requirements, some of the activities, such as the tanneries, called for a particular location. Other activities clustered up in an area, in order to facilitate transport or to join a manufacturing chain.

Over the past few years not only has knowledge of the production of manufactured objects advanced, but also that of crafts concerning construction or production of nourishment.[12] Crafts related to wood and other fibres, using common tools that are part of daily life, are not easily identifiable, but specific analyses (i.e., micromorphology, chemical analyses) make their recognition possible.

[6] Ferdière 2006-2007, mainly following Finley 1973.
[7] Leveau 1983.
[8] Vanderhoeven and Ervynck 2007.
[9] Guyon *et al.* 2009: 58.
[10] Clerget and Clotuche 2017; Meylan-Krause (in press); Weinkauf (in press); Barral *et al.* (in press).
[11] Lepetz 2008.
[12] Mauné *et al.* 2013; Monteix 2010a.

Animal products

Even if on the surveyed 20 hectares there is no evidence for livestock farming, the processing of animal products has been identified, principally beef or oxen, which need specific infrastructure for slaughtering and processing.[13] It is, at the moment, impossible to pinpoint the exact location where culling took place, but related activities concerning the end-products were gathered within the same area, suggesting that the entire procedure took place on the same spot.

Glutinarius

This type of activity (**Figure 3**) is typical of urbanised areas, which can manage huge quantities of raw material, although some examples are known from the countryside, too.[14] In order to avoid bone transport, the workshops were installed close to the cutting area. Most of the bones come from oxen and they mostly comprise the long bones (humerus, radius, femur, shinbone), as well as some fragments from bovine pelvic girdles and some rare jawbones. The bones are highly fragmented and are essentially found in the form of diaphysis splinters 10-15cm long. The evidence suggests an advanced selection of long bones, completed by their epiphyses, while fragments from the lower limbs (metatarsal bones) were totally absent. The crushing is probably supposed to expose as much bone surface as possible to the boiling water, which will enable the extraction of its collagen. This craft took place during the third century AD until the beginning of the fourth century AD, when the district was occupied by a fortification.

Bone and horn object manufacturing

Assemblies of horn-cores bear witness to the processing of horns from the end of the first century AD onwards. This processing was not restricted to a specific area but relocated during the following centuries, as this type of activity needs little infrastructure, often part of small-scale domestic production.

Tannery

Bones showing skinning marks are already present from the middle of the first century AD onwards, before the installation of a concerted tanning activity by the end of the century, developing during the second century AD and probably ending during the beginning of the third century AD. It is not clear whether this production stopped altogether or was simply relocated. The considerable extent occupied by the town during the third century suggests that Famars would have been

[13] Lepetz 2008.
[14] Bak and Yvinec 2013.

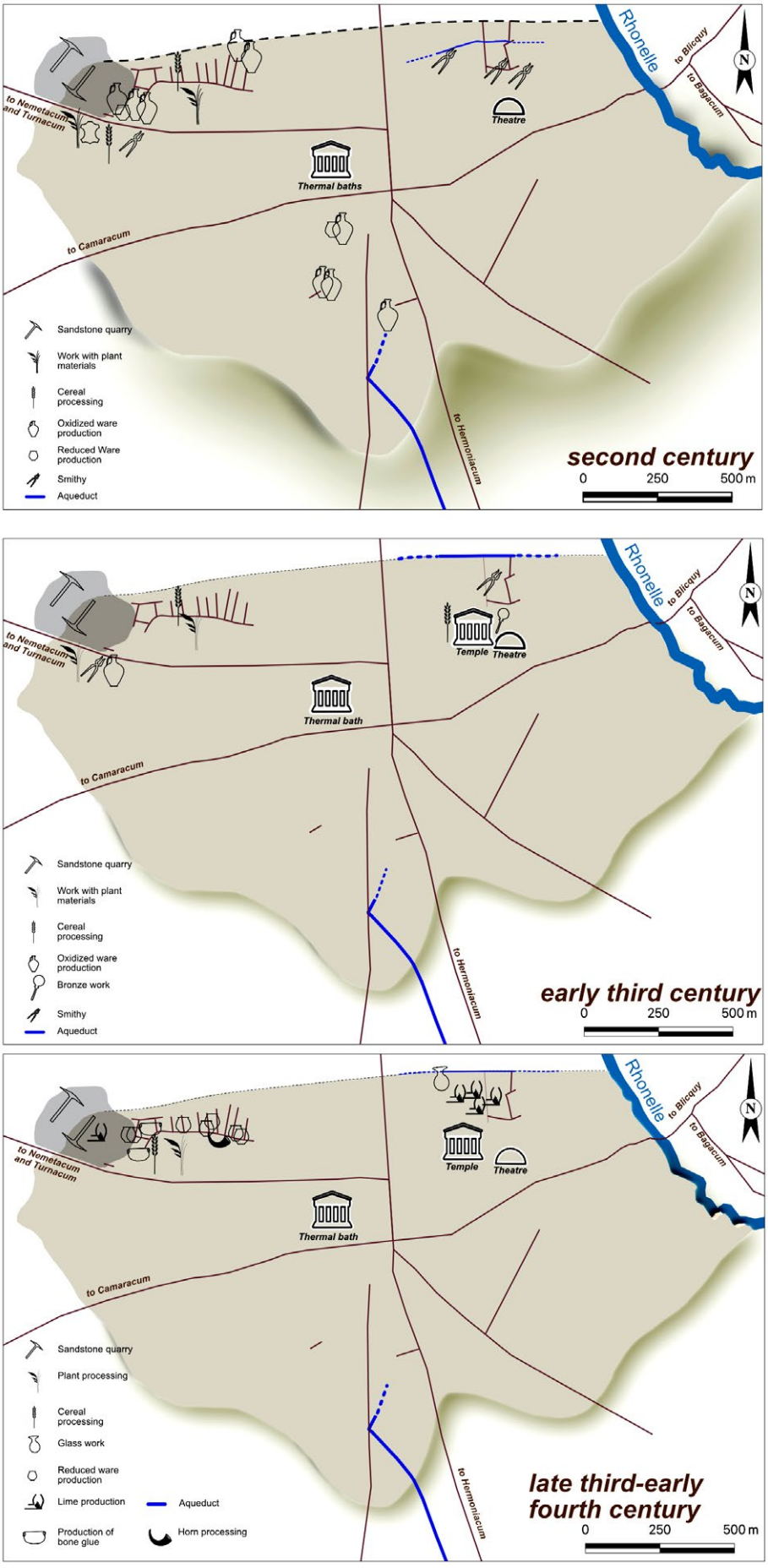


Figure 2: Localities of various handicraft activities spread in the small Roman town during the second and up to the beginning of the fourth century AD (© Raphaël Clotuche, Inrap).

Figure 3a: Crushed bones discarded in a pool (© Rudy Debiak, Inrap); 3b: Close-up view of the crushed bones (© Arnaud Tixador, SAMV).

an important marketplace for leather commerce.[15] As the *glutinarius* was still in operation during the third and the fourth centuries AD, one can suppose that the tannery, using the same raw material (animals), was also still functioning, although its locality in this period is yet unidentified.

The processing of animal hides, attested by groups of quadrangular pits, was set up in the lowest parts of the western district of the town, close to a canal intended for water draining, thus facilitating water-based crafts.

The quadrangular pits were probably used for the first stage of the hides' processing. Chemical analyses and micromorphology of organic fillings have shown the presence of lime, ashes, and hairs,[16] as well as organic elements such as coprostanol,[17] suggesting perhaps unhairing and scudding,[18] or bating, a process meant to clean and soften the skin by adding an acid solution of excrements, minced pancreas, or bran.[19]

As the pits are of variable size, hides of different animals could have been processed at the same spot, although evidence of cutting has only been noticed on equine and bovine bones.

[15] Very few solidly documented, mostly supposed examples of Roman tanneries are known from northern Gaul, e.g. Liberchies (Brulet *et al.* 2001).
[16] Cammas 2017.
[17] Coprostanol is a stanol resulting from the biohydrogenation of intestinal cholesterol and thus a biomarker of the presence of faeces. This product is used in leather production to process the animal hides.
[18] Grira 2013; Plessis 2013.
[19] Chahine 2005; Mann (1962) 1978: 40-46.

Plant products

Cereals

Apart from private vegetable gardens alongside the houses, not intended for market sale, farming activities are represented by the storage and processing of cereals. The few granaries show the preservation of cereals within the town, even if they had probably been produced by the inhabitants in the surrounding countryside. Fragments of billhooks or sickles confirm the harvesting of plants in the proximity. Residues from threshing and dehusking of emmer, spelt and wheat[20] also indicate agricultural activities of cereal processing in the western part of the small town. Analogous evidence, for the processing of cereal is provided by a drying kiln in the eastern part of town.

In the light of these observations, it would be appropriate to question the identification of such agricultural activities. Contrary to the feeble evidence for farming tools, abundant evidence is offered by the occurrence of certain constructions or yielded by carpological remains. A few harness and cattle prod fragments indicate the presence of animals used for transport or field-labour. They were kept and nourished within the town, where traces of fodder have been noticed, whereas evidence for breeding is lacking in the current state of research, but its presence can be implied, as only 10% of the town's extent has been excavated.

Grindstones, unfortunately in secondary contexts, suggest the processing of cereals on the spot, also implied by the discovery of husks(?), residues of the dehusking of cereals.

The discovery of an iron ring with intaglio gemstone in a third-century pool (**Figure 4**) highlights the particular significance of cereals for this small town. Made of red jasper[21] the gem is flat and oval-shaped, featuring a finely incised pattern: a pedestaled *modius* (a measuring device to weigh grain) crowned by weighing scales, one on either side of the *modius*. The scales themselves carried four wheat cobs and two *cornucopiae*. This could mean that the gem belonged to an imperial officer with responsibilities concerning the *annona*, maybe intervening at *Fanum Martis*. Such intaglio rings with *modius* and scales pattern, attributes of goddess Ceres

[20] Clotuche *et al.* 2017b: 196.
[21] i.e. silicon dioxide and microscrystalline quartz.

Figure 4: Intaglio in red jasper representing a *modius* with scales and bundles of wheat (© Stéphane Lancelot, Inrap).

and distinct symbols of prosperity, could well have been offered to imperial officers in charge of controlling the grain supply or members of the *cura annonae* at Rome or in the Roman army.[22]

Therefore, it is possible that grain production at Famars was partially reserved and destined for export. In that case, cereal production becomes a real agricultural activity, as opposed to private food production for individual subsistence.

Plant fibres

The processing of plants is noteworthy in the Late Roman period (third century / beginning of the fourth century AD). Several reservoir tanks with organic material remains have been identified, without us being able to define the exact species.[23] The processing of wicker, flax or nettle might have been developed at the heart of the neighbourhood.

Metal

Two areas have yielded important quantities of forge slag, with characteristic smithing slag (scoria, forge base) being the result. The first area, in the western part of the town and dating from the end of the second or the beginning of the third century AD, is represented by slag being used in the construction of the road. Moreover, the presence of half-finished products in the course of being forged confirms the presence of a smithery in proximity, even though hearths have not been found.[24] The second area, dated to the same period, is located in the eastern part of town. The spatial distribution of the slag suggests the simultaneous functioning of several workshops and the quantity of waste emphasises the handicraft's importance. The recovery of smithing slag weighing over 7kg attests to the production of large objects, and several associated crucibles indicate the working of bronze within the same workshops.

Lime production

In order for the Late Roman fortifications to be erected, the town was demolished: all of its public, private and religious buildings were taken down. The nearby quarried sandstone blocks, which had been used for the expansion of the small town, were now systematically retrieved from the buildings. The components that could be used for the production of lime were burnt, in order to serve the building of the Late Roman fortification (**Figure 5**). Two construction phases have been identified, which could respectively indicate two campaigns of demolition, but for the moment all the excavated limekilns date from the first recovery period, approximately around AD 320. The smallest kiln, located in the western part of town, has a diameter of about 2.50m and a preserved depth of about 1m. It is situated within the quarrying zone where no other important construction seems to justify its installation. However, on the other side of town, four limekilns had been set up close to the temple of Apollo, of which the architectural elements, capable of yielding lime, were thrown into the flames (including marble statues, pillars in calcareous stone, and Tournai blue stone). These combustion chambers have a diameter of about 5m and a still preserved depth of about 3.50m.

Pottery

Although pottery production has been identified since the 1970s,[25] recent excavations in the western part of *Technopôle* (name of the excavation site) have raised the number of discovered kilns to 28 (phase 1: 2011-2014 and phase 2: 2019-2020).[26] Microscopic and petrographic characterisation, as well as the creation of a typo-chronology, has enabled the identification of the Famars products on consumption sites situated in the North of Gaul. This has allowed the drawing up of distribution maps for most of the categories produced. Moreover, several pottery tools offer additional insight into the production processes. As a result of an integrated approach, considering raw materials, fabric variants, types, tools, kiln types, not forgetting the production site's internal organisation, we are able to comprehend the potters' choices, as well as the importance of each category and its level of commercialisation.

[22] Clotuche *et al.* 2018.
[23] Cammas 2017.
[24] Fort and Tisserand 2017.
[25] Beaussart 1976b; Herbin *et al.* 2005; Tuffreau-Libre and Vanbrugghe 1994; Vanbrugghe 1989.
[26] Borgers *et al.* 2020; Favennec *et al.* 2019; Willems and Borgers 2016; Willems *et al.* 2019.

Figure 5: Lime-kiln situated in the eastern part of town (© Raphaël Clotuche, Inrap).

Different categories and types were produced, using specific fabrics adapted to the function of the vessel. The main categories include oxidised preparation or storage wares, oxidised table wares with a mica-dusted covering, grey cooking wares and grey table wares. These categories are classified according to differences in the production techniques, such as the use of oxidised or reduced firing atmosphere or a surface covering. Each category is represented by different shapes, and different fabrics could have been used. In general, the oxidised preparation and storage wares include *mortaria* to prepare dishes and jugs for the storage of liquids. There is a wide variety of jug shapes and *mortarium* rims. The grey cooking wares comprise plates, bowls, lids, pots, and some rare forms such as bottles or funnels, with every form represented by typological variants. The grey table wares mainly consist of imitations of different types of drinking vessels, which is also the case for the oxidised table wares, represented by drinking or mixing vessels or cult vases. Each category uses a range of fabrics, which results from the potter's choice of raw materials and their treatment (clay washing, mixing, tempering and so forth).

Internal organisation: adapting to demand and supply

New excavations in the *Technopôle* in 2019-2020 offered insight into a much more complex and adapted organisation of the pottery production than was initially thought. Whilst the *Technopôle* phase 1, as well as the oldest excavations from the 1970s up until the 1990s, show a disparate localisation of the kilns, the latest digs delineate a totally different picture. All of the kilns were dispersed within the southern and the western part of the Roman town.

General description

Even though 27 out of 28 kilns are circular or oval sunken up-draught kilns, we notice an enormous variety of oven floors and supports. One kiln was rectangular,[27] and, on the *Technopôle* phase 2 dig, a single-chambered sunken kiln with two fire-tunnels was discovered. Most of the potter's misfires were either thrown or carefully placed in the kiln or its work-pits at the moment of its abandonment. Special closing rituals sealed this important moment in a potter's working cycle (**Figure 6**).[28]

The majority of the twelve kilns from *Technopôle* phase 1, and six others, excavated between 1976 and 2005, were used for the production of coarse cooking-ware with a grey surface or for small one-handled jugs with a cream surface, from the middle of the second century AD onwards. Production seems to end in about AD 320, at least in that part of town, which was demolished for the building of the late Roman fortification.[29] The *Technopôle* phase 2 kilns were mainly used for the production of cream-ware jugs, *mortaria* and amphorae, but three kilns yielded coarse grey ware. Although it is too soon to have a good insight into the chronology of the production in this part of the town, the jug production seems limited mainly to the second century AD, whereas the grey-ware production seems datable to the end of the third century AD in at least one kiln (kiln 12200).

Interpretation of the layout of the kilns

The kilns from *Technopôle* phase 1 (2011-2014)[30] were all situated on separate plots of land, in a part of the town where all sorts of handicraft, agricultural and agro-pastoral activities were carried out without discrimination (**Figure 2**). Most kilns were placed next to a building, whether beside, in front or behind it, and the waste was managed within the plot itself. The locality of the kilns on separate plots, bordered distinctly by aligned postholes, suggests that production was organised by individual potters, maybe combining this as a seasonal labour with other activities, such as small-scale cattle keeping or growing cereals. Even if petrographic and chemical analyses indicate that the potters share identical techniques and raw materials,[31]

[27] Vanbrugghe 1986.
[28] Willems and Favennec 2019.
[29] Clotuche 2019.
[30] Willems *et al.* 2017b.
[31] Borgers *et al.* 2020; Willems and Borgers 2016; Willems *et al.* 2019.

Figure 6: Ritual obliteration (sealing) of a kiln flue by the deposition of a pot (© Raphaël Clotuche, Inrap).

it is clear that there was no division or allocation of working tasks among the potters, so we cannot speak of nucleated workshops or an 'industry'.[32] Moreover, distribution maps of the coarse grey cooking-ware show that mostly local and regional markets were supplied (**Figure 7**, in black: grey ware). This means firstly that demand and supply was less important than for products with a long-distance/far-reaching trade pattern, and secondly that individual potters could produce in sufficient quantities, without requiring a centralised organisation and division/allocation of tasks.

This decentralised pattern changed abruptly with the new excavations conducted on occasion of the extension of the *Technopôle* (phase 2, 2019-2020). Since research has started recently, only a preliminary overview can be given based on our *in situ* observations. Three out of the ten new kilns show the same isolated locality within probably separate plots of land and, to no surprise, they were used for producing coarse grey cooking-ware. The seven remaining kilns demonstrate a different and more complex arrangement. The kilns fall into two groups, one in the westernmost part of the quarter, in the zone of the Mont Houy sandstone quarry, and one more centrally placed. The first group comprises three kilns, of which one is stratigraphically cutting through the stokehole of an earlier kiln. All of them seem to have been used for cream ware, namely one and two-handled jugs, but further research should specify the categories produced. In any case, the group is clearly positioned on the same plot of land and thus, suggests a more extended activity, as opposed to the individual kilns we mentioned before. The second group is characterised by a very complex sequence of kilns (**Figure 8**). What seemed at the surface to be an ensemble of four kilns, of which maybe three were in use during the same period, was in fact a complex succession of kilns at different levels and with several changes of orientation. A first very deeply situated kiln (kiln 12547) was re-arranged by a later one (kiln 12125) installed in the still standing open-topped superstructure or dome, which was reused as a combustion chamber for the latter. The new kiln cuts through a small kiln (kiln 12127) placed at the same level to its left. Later on, the orientation of kiln 12125 seems to have changed from east to west, giving out into the stoke pit of another kiln placed to its west (kiln 12123). To the east of this cluster of kilns a large one (kiln 12129) opens from a huge shared stoke pit. While dismantling the kiln structure, the base of another hearth was found enclosed within the central kiln support, opening to another pit to the east. Stratigraphic analysis showed that kiln 12129 probably destroyed an earlier smaller kiln, of which only the hearth remains. So, no less than six kilns, of which one changed orientation, were placed on a surface of 10sq.m. Clearly some of the kilns were in operation simultaneously, and the installation of this cluster demanded a well-thought organisation. The deeply situated kiln 12547 descends to a quaternary level of carbonated loess containing calcareous concretions, a level that is nowhere else reached on the site. Its installation at least 2.20m underneath the Roman walking level means that potters had to think about facilitating access into an enormous stokehole, as well as to consider strengthening the pit walls with wooden boards. And why dig this deep? Does that mean that potters had beforehand planned an intricate series of kilns to be placed on the same spot? While looking at the surrounding structures, seemingly on the same plot of land, we noticed several waster pits, and even a heap of wasters placed on the Roman walking level, as well as a nearby huge rectangular building (47sq.m). We hoped for traces of potter wheels, but solely a concentration of clay, probably stored for later processing, was noticed in the far corner of the building, confirming its link to the potting activity.

The complex arrangement of that many kilns, in use over a longer period, may signify a group of potters facing an advanced level of demand and supply, and having pottery production as their sole or main

[32] Peacock 1982: 9.

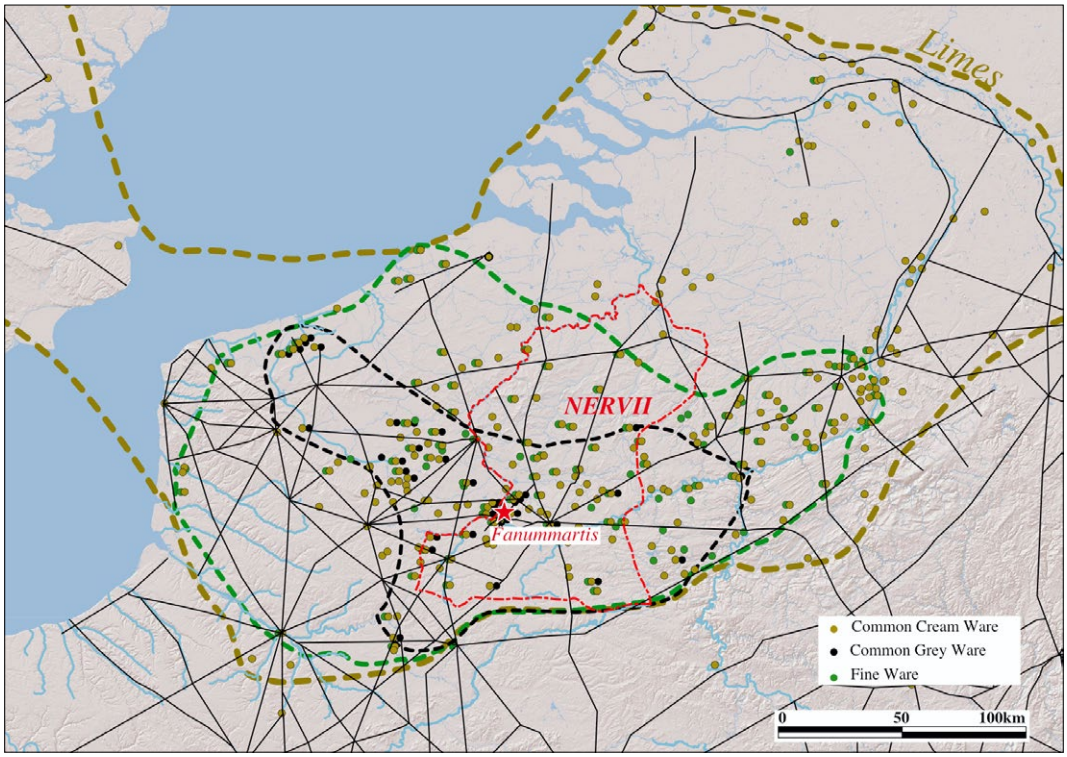


Figure 7: Distribution of the Famars pottery production (© Sonja Willems, Inrap).

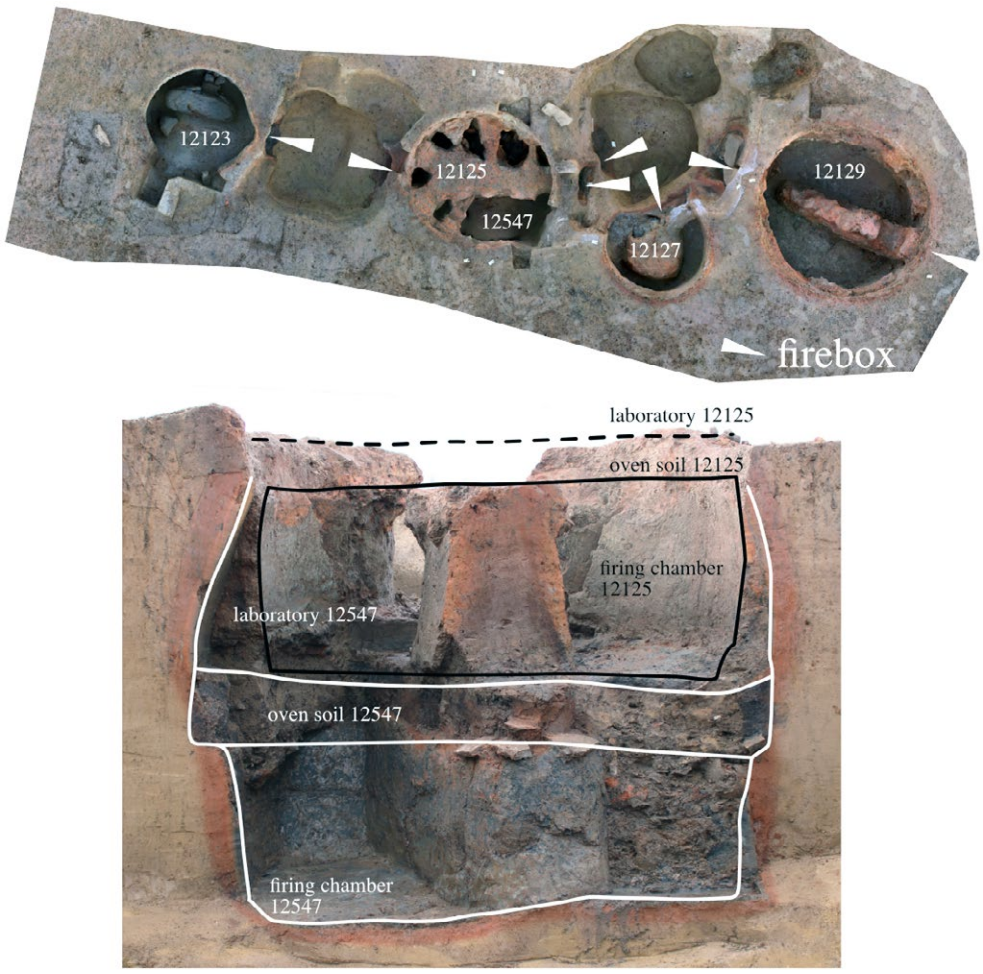


Figure 8: Spatial arrangement of pottery kilns (© Rudy Debiak, Inrap).

sustainable activity and not just a seasonal additional one. It certainly reminds us of the organisation of the potters' district at the city's capital Bavay, where kilns were installed on different levels and located in a rather restricted zone of the town.[33] Bavay was one of the main regional and extra-regional suppliers of *mortaria* and of one- and two-handled jugs in cream ware, before Famars took over this part of the production.[34] Consequently, it comes as no surprise that the aforementioned six kilns were actually used for the production of two-handled jugs in cream ware. Distribution maps of *mortaria* and jugs show that they were supplied to the entire Rhine *limes hinterland* (**Figure 7**, cream ware: in yellow), which would require an organisation of an 'industry' or nucleated-type workshops to meet the intense demand.

Categories and forms produced: a complete range of what the romans needed

Evolution and chronology: to search or not to search... for suitable fabrics

As mentioned above, grey coarse cooking wares and jugs with a creamy surface were the main types produced, but other categories supplemented the repertoire, to meet the local demands. The actual beginning of production remains vague. Phillippe Beaussart suggested a starting point in the first century AD, which would be reasonable, considering the shifting of Bavay potters to the small towns of Pont-sur-Sambre and Famars.[35] It is, however, necessary to reassess this information in the light of new data and our better understanding of the production's typo-chronology. Production in the *Technopôle* phase 1 district does not seem to begin before at least AD 120, if not later, and continues until the beginning of the fourth century AD, when all infrastructure was abandoned for the construction of the Late Roman fortification.[36] The production of grey ware seems to have had a difficult start, as we can tell from the wasters. The first identified fabrics (clay preparation) from kiln 1335 (archaeomagnetic dating: AD 120-190), containing impermeable clay pellets that tend to cause the pottery to crack when fired, are not used in other kilns and are also absent from consumption contexts, which indicates a period of experimentation or testing. This testing/trial period does not surprise us: the analysis of consumption material from the *Technopôle* district shows that during the first and the second century AD most grey ware was imported from the Cambrai region, at about 30km south of Famars.[37] We have to wait until the very end of the second century AD before the local ware even begins to compete with these imports. A long experimentation and evolution of fabric variants is then noted, before resulting, by the end of the third or the beginning of the fourth century AD, in a high-quality production, with only two fabric variants used by all the potters. This long evolution remarked as concerns the grey ware does not apply to the cream ware – a contrast that be explained by the relocation/shift of potters from Bavay to Famars.[38] Specialised in the manufacture of jugs and *mortaria* in calcareous clays, the potters used the same sort of raw materials at Famars and therefore did not need any testing/trial period. They knew exactly how to treat the clays and continued with the same repertoire, without being rivaled by any other production site; after all, their excellent-quality products were exported in the whole of northern Gaul. Therefore, only two contemporary fabric variants are observed from the beginning to the end of the production period, as the potter did not need to alter an already perfect product. These two variants were used by all the potters producing oxidised preparation and storage wares.

Repertoire: Nervian fashion

Reduced coarse wares

The pottery produced at Famars is thus embedded within a larger repertoire, typical of the south of the Nervian *civitas* (**Figure 9**). Even if grey and cream coarse ware formed the main part of production, other categories accompanied them.

The local grey ware comprises a repertoire of cooking plates, bowls, pots and lids, as well as some rare forms, such as a two-handled strainer and funnels. Notwithstanding small variations, few types seem to have been produced exclusively at Famars. The range of forms can therefore be directly compared to the Cambrai-region products, of which the imports to Famars never stopped, but were gradually competed with by the local production. Types persist over several centuries but an overall change is noticeable in their profile (sides), which tends to become more bulging.

Oxidised coarse ware

The oxidised ware consists mostly of small one-handled jugs and larger two-handled storage jugs, as well as two-handled storage jars. The development of a large variety of jugs of different volume/capacity extends up to a volume comparable to the Gaulish 13 amphorae.[39] The wide distribution and complex organisation of production suggest that they were not commercialised on the grounds of their quality as jugs, but probably made on demand for victuals or for producers who

[33] Labarre and Willems 2019.
[34] Willems and Borgers 2017.
[35] Willems and Borgers 2017.
[36] Clotuche 2019.
[37] Willems *et al.* 2017a.
[38] Willems and Borgers 2017.
[39] Baudoux *et al.* 1998.

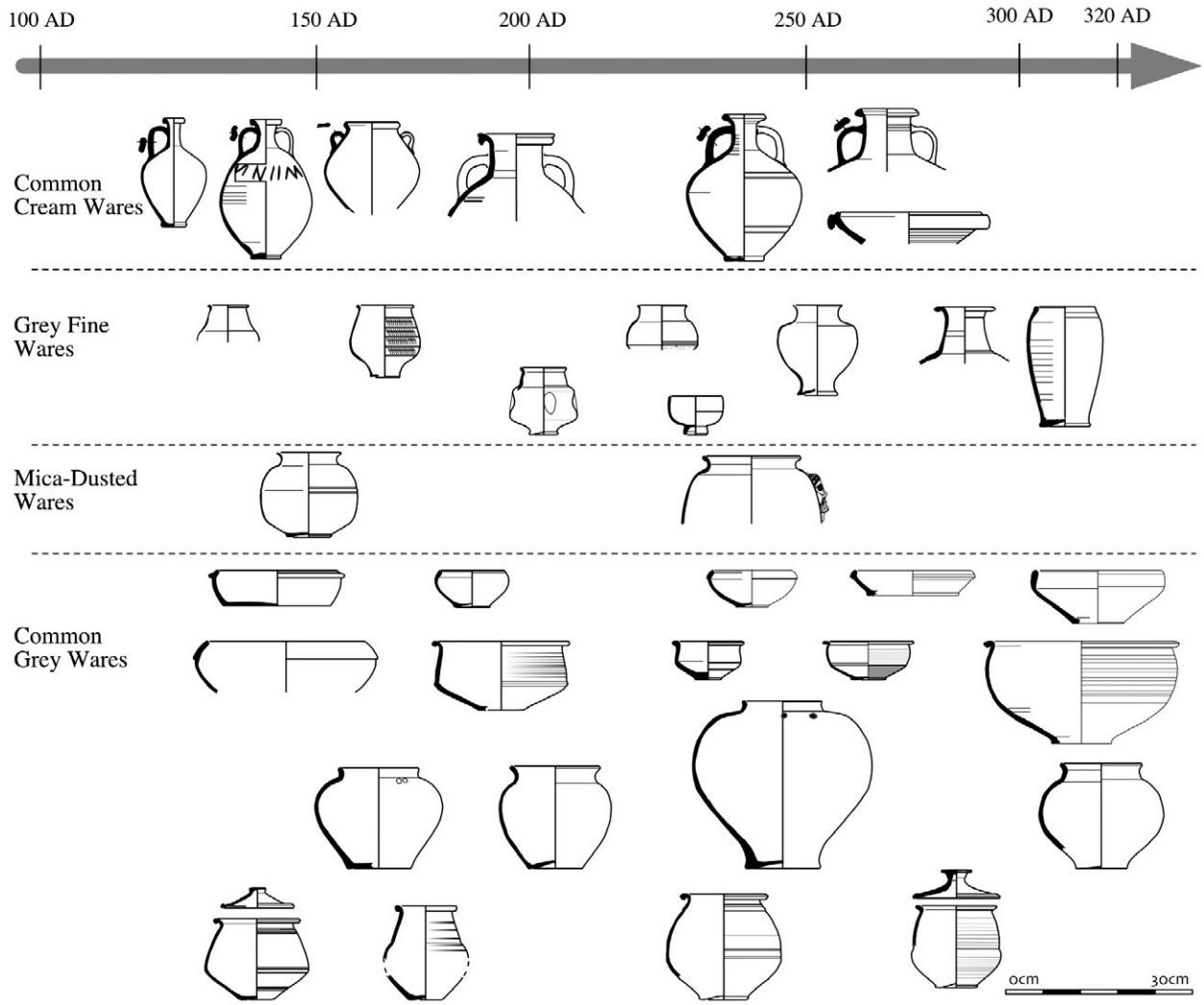


Figure 9: Chart of the locally produced main pottery types (© Sonja Willems, Inrap).

needed storage containers to sell their products. One jug, for example, bears a *graffito* VINIIM, indicating the storage or transferring of wine.

From the end of the second century AD, we see also the development of grinding bowls. This is a result of the probable close-down of the *mortarium*-production at Pont-sur-Sambre, a small town 30km to the east of Famars, and main supplier for the second century of this utensil in the North of Gaul. A potter's stamping device from the potter *Nericcvs*, known from Pont-sur-Sambre has been found in one of the *Technopôle* phase 1 contexts, indicating his possible shift to Famars (**Figure 10**). Even if several sites in this area produced these grinding utensils, such as Bourlon[40] or Petit-Enghien,[41] only products in the calcareous clays – like those from Bavay, Pont-sur-Sambre, Famars and Noyon – were intended for long-distance trade. This seems to

Figure 10: Potter's stamp reading *Nericcvs* (© Stéphane Lancelot, Inrap).

[40] Chauwin and Tuffreau-Libre 1973; Tuffreau-Libre 1976.
[41] Ansieau *et al.* 1995; Frébutte 1996.

be the result of the settling of Mediterranean potters, who installed new kilns in important places, such as the freshly founded *civitas* capitals, in order to control the new markets quickly developing after the Roman conquest.[42]

Tableware

From the second half of the second century AD onwards we note the local production of oxidised mica-dusted tableware, mainly large beakers with probably mixing function, as well as small grey fine-ware imitations of slipped drinking vessels using calcareous fabrics. During the third century AD, these tableware evolved, in terms of typology, but both surface treatments persisted until the beginning of the fourth century AD. Nevertheless, after AD 260 tableware was progressively produced as grey ware, in harmony with the rest of the Nervian style. These later productions comprise bottles and beakers in the same fabric as the cooking vessels, fired in the same kilns as, in fact, one of the loads of kiln 2995 illustrates. This coarser tableware, sometimes decorated with polished zones or lines, are accompanied by fine grey imitations in soapy fabrics of typical 'metal-glazed' forms (cups and beakers; not actually glazed but burnished so as to achieve the effect of a metallic finish).

At the same time, we notice the development of oxidised ritual vessels with mica-dusted slip. These are easily recognisable by the same soapy fabric and their decoration, consisting of moulded faces of deities, probably a combination of Mercury and Cernunnos.[43] Their provenance was, up until recently, sought somewhere in the Bavay region. The finding of a mould in one of the *Technopôle*'s phase 1 contexts, as well as the presence of the soapy fabrics, linked to several kilns, indicate that Famars was one of these ritual vessels production-sites. Their distribution can be compared to that of the specialised forms, *mortaria* and jugs, widely spread across the hinterland towards the *limes*.

Distribution patterns and specialisation

A last word concerns the different distribution patterns and axes showing that the small town was linked to a wide range of close-by, intermediate and long-distance markets. Since Famars produced a wide range of categories and forms of vessels of different function, it was therefore adapted to local but also regional and extra-regional demands. This is not exceptional; important production-sites such as the Central Gaulish Lezoux, known for its production of Samian Ware, also disposed a local production-centre/workshop of coarse ware for local and regional use.[44] We notice that, most of the time, coarse cooking-ware remained at a local or regional level, but of course, there were exceptions, which included specialised forms such as baking plates, or cooking pots commercialised for their contents. In the case of Famars, the coarse cooking-ware and the late third century AD grey fine-ware beakers were only sold on local and regional markets. In the light of the current data, this ware seems to have been exported mainly towards the west, but this could be a biased picture due to the lack of identifications in the present area of Belgium. In contrast, even when a lot of identifications are lacking, a whole different picture is drawn by the jugs and *mortaria*, as well as by the mica-dusted fine-ware and ritual vases, which are more readily identifiable thanks to their typical fabric, their moulds or their stamps. Both categories supplied the whole of the North of Gaul, eastwards towards the Rhine *limes*. Famars' geographical position, close to the Scheldt river, but also to the Boulogne-Bavay-Cologne road, and the Sambre river, facilitated a wide distribution (**Figure 7**).

This long-distance trade reflects a high degree of specialisation and standardisation, resulting first of all from the shifting of Mediterranean potters to the North, bringing along their tradition of a calcareous-based oxidised repertoire. The fashion of cream surface colors and calcareous clays for *mortaria* and liquid containers, such as jugs, seems to have never stopped; instead, it led to the dominance of the Bavay, Pont-sur-Sambre and Famars productions in this part of the market. A good example comes from Tongeren, *civitas* capital of the *Tungri*, where local *mortarium* production was nearly absent. Even if the nearby small town Tienen was an important grinding-bowl producer, it was in stiff competition with Nervian producers.[45] 35 percent of these utensils were regionally imported, from Tienen or the Rhine and Meuse valley, but no less than 55 percent came from the Bavay, Pont-sur-Sambre and Famars region. It is clear that a combination of demand (fashion?) for specialised products and specific marketing relations played an important role.

Conclusions

In the recent years, new research has enlightened us about the importance of this production-site on the North of Gaul. Two production levels can be noted, adapted to the demand and supply needs. The production of grey coarse cooking and tableware was organised by individual potters and sold on the local and regional markets only. Using the same techniques, clays and repertoire, their kilns were dispersed in the southern and western parts of the small town, on separate plots of land and mixed with other handicraft

[42] Willems and Ledauphin 2019.
[43] Flahaut *et al.* 2014.
[44] Alfonso *et al.* 2013.
[45] Martens and Willems 2002: 341 fig.15.

and agro-pastoral or agricultural activities. This incites us to think that the potter's activity might be a seasonal and not his main occupation. An entirely different picture emerges from the production of cream ware, including jugs, amphorae and *mortaria*. The kilns, in this case, seem to be concentrated on two major plots, demonstrating a complex succession of kiln structures with repairs, change of orientation, etc. This corresponds to a higher level of production control, specialisation and standardisation, which was the result of a long tradition brought to the north by Mediterranean potters and adapted to the high demand of the North Gaulish markets.

Profiting from the importance of local distribution and supply networks, as well as the region's rich soils, *Fanum Martis* turned to a leading actor in the economy of northern Gaul, thanks to its variety of productions.

Handicraft activities spread across all districts of the town, sometimes associated to domestic premises, but also close to public buildings. There seems to have been no particular sector allocated to a specific craft, given that all of them were juxtaposed in the same area. Only the extraction of sandstone, the raw material, set a constraint upon the choice of location. The diversity of agricultural activities (animal and plant exploitation) suggests the management of foodstuffs from the surrounding countryside, with the small town thus becoming the centre of processing and distribution of raw or semi-finished products. Certain cereal-processing activities could have depended on local farmers living in town, since processing primarily took place within the urban zone. This means that the town was not a predator of the nearby countryside, but, instead, it participated fully in production and distribution. Production methods were diverse. An analysis of the pottery-kilns distribution shows two arrangement patterns applied simultaneously and within the same district. In the first pattern, the kiln seems to represent an additional or extraordinary activity for one or several potter-farmers who operated a single kiln situated within a separate plot of land for occasional firings. In the second pattern, several kilns were associated, thus corresponding to a mass-production unit. Pottery, more easily traceable by means of macroscopic, petrographic and chemical analyses, indicates the supply of raw clays from the vicinity, but a long-distance distribution (for their contents?), reaching several hundreds of kilometers away, up to the Rhine *limes* or *Britannia*. Therefore, it would be legitimate to assume that other productions, not so easily identified, took place here in parallel to pottery manufacture. Such a production could relate for instance, to plant remains, since their export from the Nervian region is testified by the gravestone of *Marcus Liberius*, a Nervian cereal trader, found at Nijmegen (in the Netherlands).[46]

The data from *Fanum Martis* clearly show that a stereotyped organisation was not the case for any of the crafts; instead, they continually adjusted to topographical, organisational or economic conditions and constraints, as well as to the needs or aspirations of the town's inhabitants: a management as efficient as possible addressed both the local/regional and the long-distance markets.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[46] *CIL* XIII, 8725.

Chapter 7

Evocations of Apollo in northern Gaul and craftsmen engaged in his representation: The example of *Fanum Martis*

Raphaël Clotuche and Damien Censier
with the collaboration of Sabine Groetembril

Abstract

Paintings, sculptures and bronze objects discovered at *Fanum Martis* are a reminder of how important Apollo must have been in the Gallo-Roman settlement. In the eighteenth century, a small bronze statuette of Apollo was the first object from Famars to reach Count de Caylus, instigator of the Cabinet des Médailles in Paris.

During the twentieth century, wall-paintings depicting the divinity with his lyre, accompanied by maenads, were discovered in a building with a hypocaust. At approximately 50m from this building, near the theatre, the remains of an octagonal podium temple destroyed in the first quarter of the fourth century AD were excavated. The temple was dedicated to Apollo, worshipped in the guise of *citharoedus* (cithara-playing), as suggested by the preserved parts of his statue representing a lyre, of Carrara marble.

In the western part of the town, fragments of a limestone statue representing Apollo and a satyr, destined to be burnt in lime kilns, were discovered in a basement. The complex calls to mind the musical duel between Apollo and Marsyas. One of the fragments belonged to a head six times larger than life-size, indicating the importance of the building it must have belonged to. Excavation of a limestone quarry close to the town has enabled us to identify both the chaîne opératoire that brought limestone to *Fanum Martis*, as well as several important sites in northern Gaul. References to divinities linked to trade or agricultural production are numerous in the urban centre; but what was the particular importance of Apollo, a deity associated with the renewal of nature, in a settlement of which the name evokes a link to Mars?

Περίληψη

Έργα ζωγραφικής, γλυπτικής και χαλκοτεχνίας που έχουν αποκαλυφθεί στο Fanum Martis υποδηλώνουν την σημασία του Απόλλωνα για τον Ρωμαϊκό Γαλατικό οικισμό. Στον 18ο αιώνα, ένα χάλκινο αγαλμάτιο του Απόλλωνα ήταν το πρώτο αντικείμενο από την Famars που έφθασε στα χέρια του Κόμη de Caylus, εμπνευστή του Cabinet des Médailles στο Παρίσι.

Κατά τη διάρκεια του 20ου αιώνα, τοιχογραφίες που απεικόνιζαν τη θεότητα με λύρα, συνοδεία Μαινάδων, αποκαλύφθηκαν σε ένα κτίριο με υπόκαυστο. Σε απόσταση περίπου 50μ από το κτίριο, κοντά στο θέατρο, ήρθαν στο φως δι' ανασκαφών τα κατάλοιπα οκταγωνικού ναού πάνω σε πόδιο, ο οποίος είχε καταστραφεί στο πρώτο τέταρτο του τέταρτου αιώνα μ.Χ.. Ο ναός ήταν αφιερωμένος στον Απόλλωνα, λατρευόμενο στον εικονογραφικό τύπο του κιθαρωδού, όπως υπαινίσσονται τα σπαράγματα της λύρας από το άγαλμά του σε μάρμαρο Carrara.

Στο δυτικό τμήμα της πόλης, θραύσματα ενός ασβεστολιθικού αγάλματος που αναπαριστά τον Απόλλωνα και έναν Σάτυρο, αποκαλύφθηκαν σε ένα υπόγειο με προορισμό να απασβεστωθούν σε ασβεστοκάμινο. Το σύμπλεγμα ανακαλεί στη μνήμη τη μουσική μονομαχία μεταξύ Απόλλωνα και Μαρσύα. Ένα από τα θραύσματα ανήκε σε κεφάλι έξι φορές μεγαλύτερο από ανθρώπινο, υποδηλώνοντας αντίστοιχα την σπουδαιότητα του οικοδομήματος από όπου πρέπει να προέρχεται.

Η ανασκαφή λατομείου ασβεστολίθου κοντά στην πόλη κατέστησε δυνατό να ταυτοποιήσουμε τόσο την αλυσίδα διεργασιών που έφερε τον ασβεστόλιθο στο Fanum Martis, όσο και αρκετές σημαντικές θέσεις στη βόρεια Γαλατία. Αναφορές σε θεότητες σχετικές με το εμπόριο και την αγροτική παραγωγή αφθονούν στο αστικό κέντρο. Όμως ποια ήταν η ιδιαίτερη σημασία του Απόλλωνα, ενός θεού συνδεδεμένου με την ανανέωση της φύσης, σε έναν οικισμό τού οποίου το όνομα παραπέμπει στον Άρη/Mars;

Keywords: Apollo; quarry; craftwork; sculpture; paint

Introduction

Since surveyed and excavated, the town of Famars has yielded several testimonies relating to Apollo. Very early on, Anne Claude de Caylus (1692-1765), in volume 3 of his 'Collection of Egyptian, Etruscan, Greek and Roman Antiquities' (Recueil des antiquités égyptiennes, étrusques, grecques et romaines), in which he presents

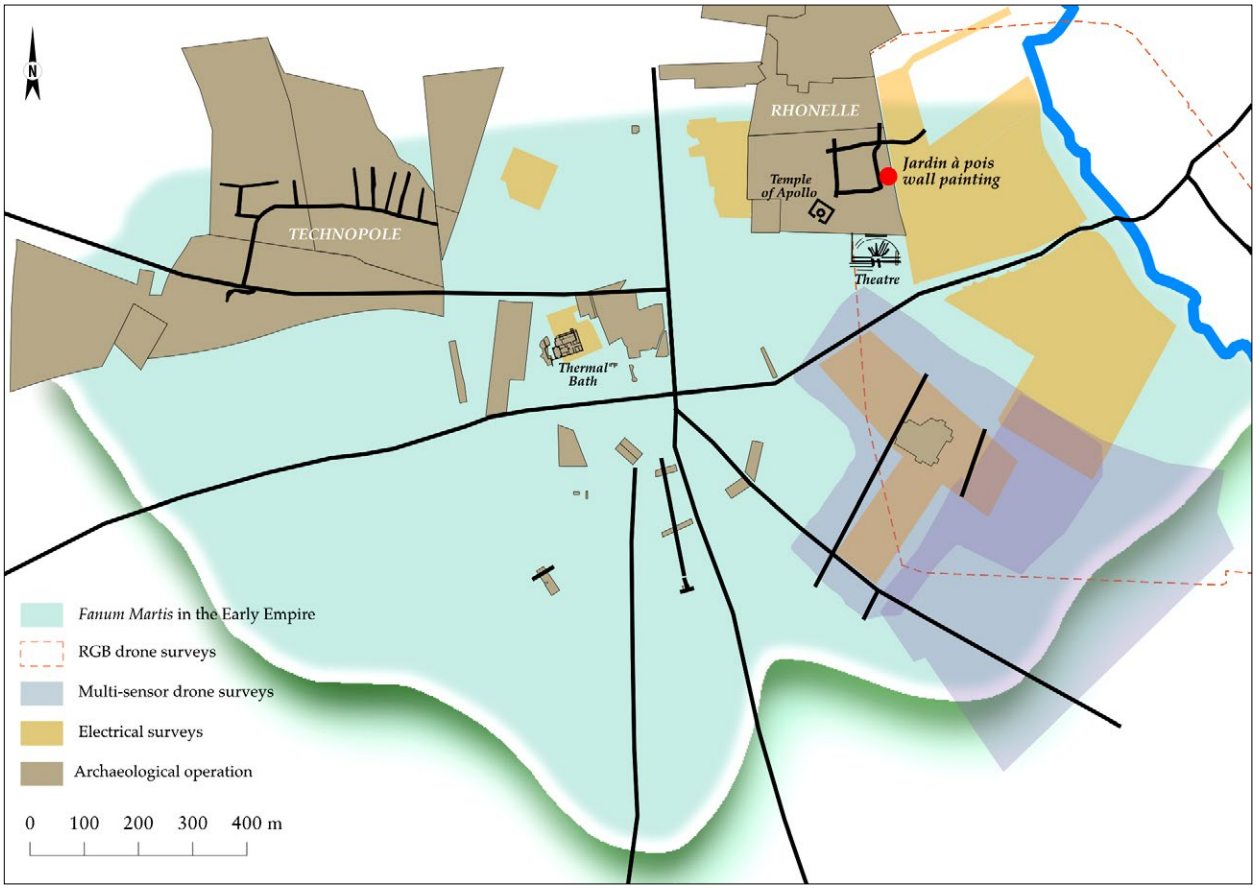


Figure 1: Location of the excavations (*Technopôle* and Rhonelle) at *Fanum Martis* (© Raphaël Clotuche, Inrap).

the 2890 objects of his collection, illustrated the ancient curios sent to him from Famars.[1] The first object he received from this village was actually a depiction of Apollo, nowadays kept at the Paris Cabinet des Médailles (inv. 52.6051). During the late nineteenth and early twentieth-century excavations, paintings and sculptures related to this deity were recovered. They were originally located in the area of rescue/preventive fieldwork carried out by the Institut national de recherches archéologiques préventives (Inrap) (**Figure 1**).

To the west, the *Technopôle*

From 2011 to 2014, and then in 2019 and 2020, several seasons of excavations were conducted at the *Technopôle*, revealing an area that combined domestic settlement and craft installations (see the previous article in this volume). During the first phase of fieldwork, the infilling of a basement originally built in opus vittatum mixtum in the third century AD, and filled in the early fourth, yielded several elements of statuary made of local limestone (described below). This structure was situated a little beyond 100m to the south of a lime kiln, destined in all probability to calcine limestone from the adjacent area (**Figure 2**). This kiln is smaller than those discovered in the La Rhonelle sector to the east of the town, no doubt because here fewer fragments were available for combustion.

Elements of high-quality statuary

Pieces of large size were broken, but two heads in a very good state of preservation have survived. They belong to a scene carved in relief. On each one of them, the still visible traces of tooling attest to the use of chisel and gradine or claw-chisel.

A satyr

The head of a satyr is recognisable thanks to his pointed ears (**Figure 3**). It measures 12cm in height. The quality of work of the left profile is better than that of the right, indicating that the creature is looking to the right. His eyes are well marked with very clear eyebrows. Hair appears in the form of locks extending backwards, which, remarkably, are better drawn on the left side than on the right one. The right ear is absent, suggesting that this part of the face was not

[1] Caylus 1759: 436-439.

Figure 2: View of the lime kiln at the *Technopôle* (© Coralie Favero, Inrap).

Figure 3: Head of a satyr (© Stéphane Lancelot, Inrap).

visible to onlookers. The rear of the head is carved in the shape of a rectangular hook that would interlock with a mortise, suggesting carving separately from the rest of the satyr's body and the main scene.

Apollo

The second head depicts Apollo wearing a laurel crown (**Figure 4**), recalling the myth of Daphne. His hair is curled and reaches his shoulders. The nose and left eye are missing. The right eye is worked in the same fashion as those of the satyr, and the clamping mode at the back of the head is identical. The left part of the face demonstrates less diligent workmanship than the right side, indicating that Apollo was looking to the right.

The size of the heads suggests that these two figures were carved approximately at half life-size. The rest of the statuary pieces are completely broken. They include a piece on which two figures can be discerned but not identified (**Figure 5**), and fragments of hairdo/hairstyle with laurel leaves (**Figure 6**). The workmanship of the latter, as well as attributes equivalent to those on Apollo's head, suggests that we are dealing with the same god and artistic school. The size of the curls and leaves show that this sculpture was six times larger than the small head. The statue, had it been standing, would have measured some six metres in height.

The sculptures were associated with a piece of fake spear, made of poor-quality bronze (**Figure 7**), which belonged to the relief scene and offers testimony to a group of carvings that show certain aesthetic qualities. These elements seem to have formed part of a monumental sculptural composition referring to the contest between Marsyas and Apollo, in accordance with other clues discovered to the east of the town. The very few available fragments make the identification of the building quite difficult. Was it a mausoleum or a temple consecrated to Apollo?

The provenance of materials

The set of limestone fragments unearthed during excavations at *Fanum Martis* (conducted prior to 2015) were inventoried within the framework of a Master's

Figure 4: Head of Apollo (© Stéphane Lancelot, Inrap).

Figure 5: Unidentified life-size figures (© Raphaël Clotuche, Inrap).

Dissertation written by Louise Hardenne, student at the Catholic University of Leuven.[2] It appears that all the elements show identical petrographic characteristics, also similar to those of debris of statuary retrieved during the 2019/2020 excavation seasons. Marine Revenu, in her PhD dissertation, had already noted that the Bavay and Famars limestones originated from the first plateaus of the Cambrésis region. These beds of soft limestone, still exploited during the Middle Ages, spread over some tens of square kilometres (**Figure 8**).

A location for extraction

Fieldwork as part of rescue/preventive archaeology conducted at Douchy-les-Mines, some twenty kilometres to the south of Famars, resulted in the discovery of limestone quarries. Although exploitation of this stone in underground quarries is well attested between the Middle Ages (first written reference/

Figure 6: Fragments of a colossal statue of Apollo (© Raphaël Clotuche, Inrap).

[2] The statues discovered during the 2019/2020 seasons were not registered in this inventory. Hardenne 2015.

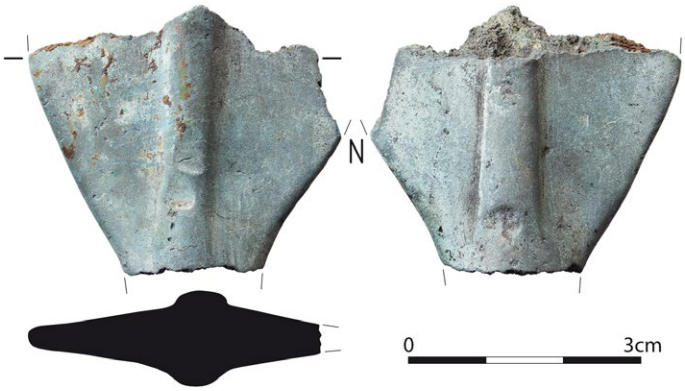


Figure 7: Fragment of a dummy spear cast in bronze (© Stéphane Lancelot, Inrap).

Composed of two dug-out depressions, the quarry was created on the southern flank of a shallow valley through which the Selle river, a tributary of the Scheldt river, winds its way.[4] Although it was slightly older than the carved elements discovered at Famars, it provided the same type of materials as the extraction sites of the following centuries. Nevertheless, it could have supplied the town during its expansion phase, from the late first to early second century AD.

Prior to the opening of these quarries, three settlements with an agro-pastoral economy were identified here, dating to the first and the second Iron Age (800-450 BC and 450-50 BC). Following a brief period of abandonment, quarries were established during the second half of the first century AD. They were associated with a surface settlement (**Figure 9**) necessary for the proper operation of the extraction site. Production seems to have reached its peak in the first quarter of the second century, then to have retracted during a phase of intermittent activity, before being permanently abandoned in the mid-third century.

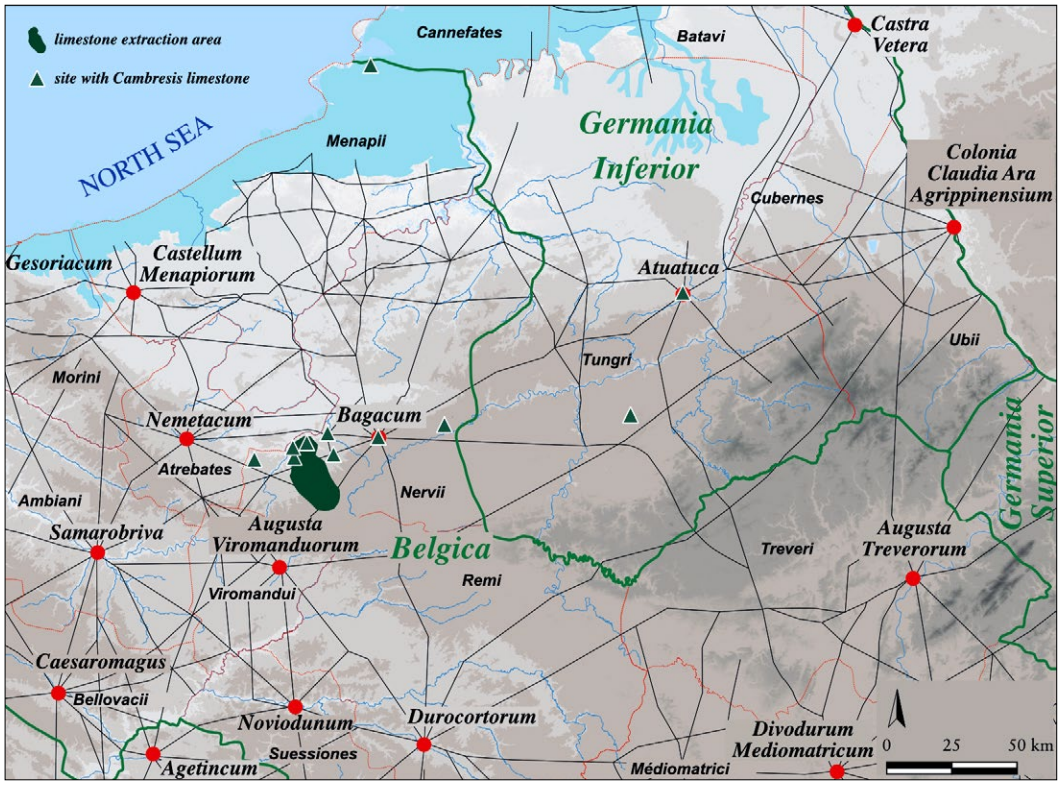


Figure 8: 'Valenciennes Good-Stone' mining zone and diffusion area (© Damien Censier, Douaisis Agglo and Raphaël Clotuche, Inrap).

testimony in 1425)[3] and the First World War, the excavation of the Douchy quarry has for the first time revealed an ancient site for the open-air extraction of this type of stone.

Founded during the last quarter of the first century AD, it developed considerably until around AD 125. Later on, exploitation became restricted, and was no doubt partly abandoned or became episodic. Extraction seems to be resumed on a far more modest scale during the last quarter of the second century, lasting until the quarry's final abandonment in the mid-third century.

[3] Hausbuch der Mendelschen Zwölfbrüderstiftung, Band 1. Nürnberg 1426–1549. Stadtbibliothek Nürnberg, Amb. 317, Mendel-1, fol. 36v.

[4] Excavation was carried out by the rescue/preventive archaeological service of Douaisis-Agglo (Douaisis-Town), between October 2017 and mid-February 2018, Douchy, ZAC des Prouettes.

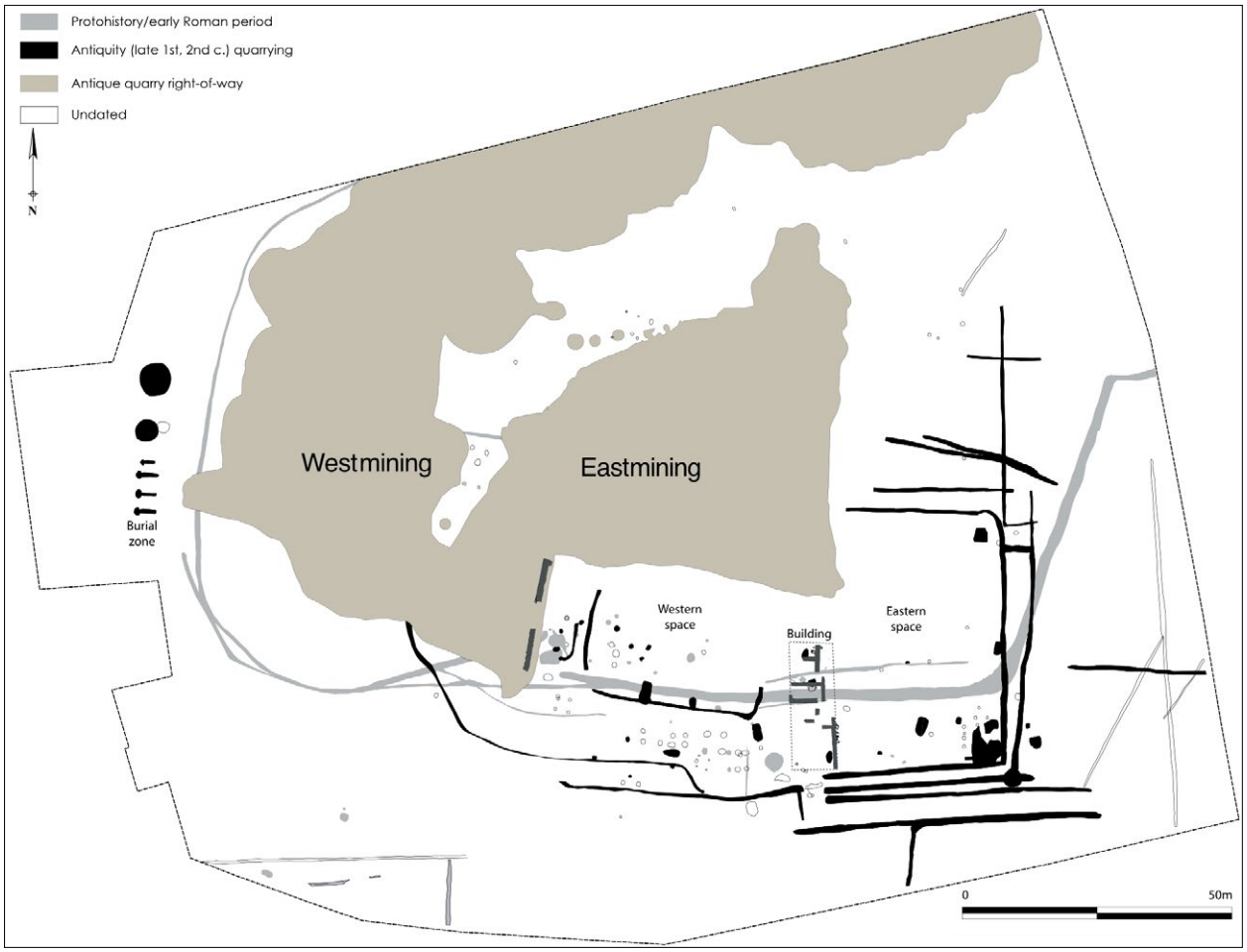


Figure 9: General plan of the excavation at Douchy-les-Mines (ZAC des Prouettes) (© Damien Censier, Douaisis Agglo and Raphaël Clotuche, Inrap).

The material

The exploited stone is a glauconious chalk of the upper Turonian, with a geological basis of *Micraster breviporus*.[5] It is more or less greenish depending on its glauconitic content, and includes some flint nodules (**Figure 10**).[6] In the locals' jargon, this stone is designated as 'Avesnes stone'[7] or – in older times – as 'Good-Stone of Valenciennes' (*Bonne-pierre de Valenciennes*).[8]

The stratum/vein at Douchy is far from homogenous and massive to facilitate extraction of blocks of a particular shape and dimensions. Quite the opposite, it seems like a heavily fractured chalk bed with too many fissures (**Figure 11**), with only the deepest levels, located between 4 and 7m, being actually exploitable. Throughout a 6m-thick limestone bed in the quarry, only the two last metres (at a depth of 4 to 6m) can provide good-quality stone. This ratio of 2/3 of waste to 1/3 of exploitable stone seems relatively high, since it is commonly accepted that the estimated extracted rock in a limestone quarry in antiquity was approximately 50%.[9]

Open-air quarries

Surprisingly, despite the dimensions and depth of the quarries, no clue in the area's topography points to the existence of such installations. On the slope of the Selle valley, exploitation undoubtedly began with the observation of an outcrop of the stone band at the level of a riverbed outline (talweg) incising slightly the surface silts.

In ground-plan the quarry delineates a triangle with a rectangular appendix on its south-western side. The total surface reaches approximately 3300sq.m. By associating the data collected by mechanical soundings to a series of corings, one can estimate the mean depth of the quarry at 6.10m. Once this mean is obtained, the minimal estimation of the

[5] Cornet 1919; Desoignies 1967: 5.
[6] Censier *et al.* 2023.
[7] Groessens 2002; Mégnien 1980.
[8] Desoignies 1967.
[9] Gaillard 2011: 332.

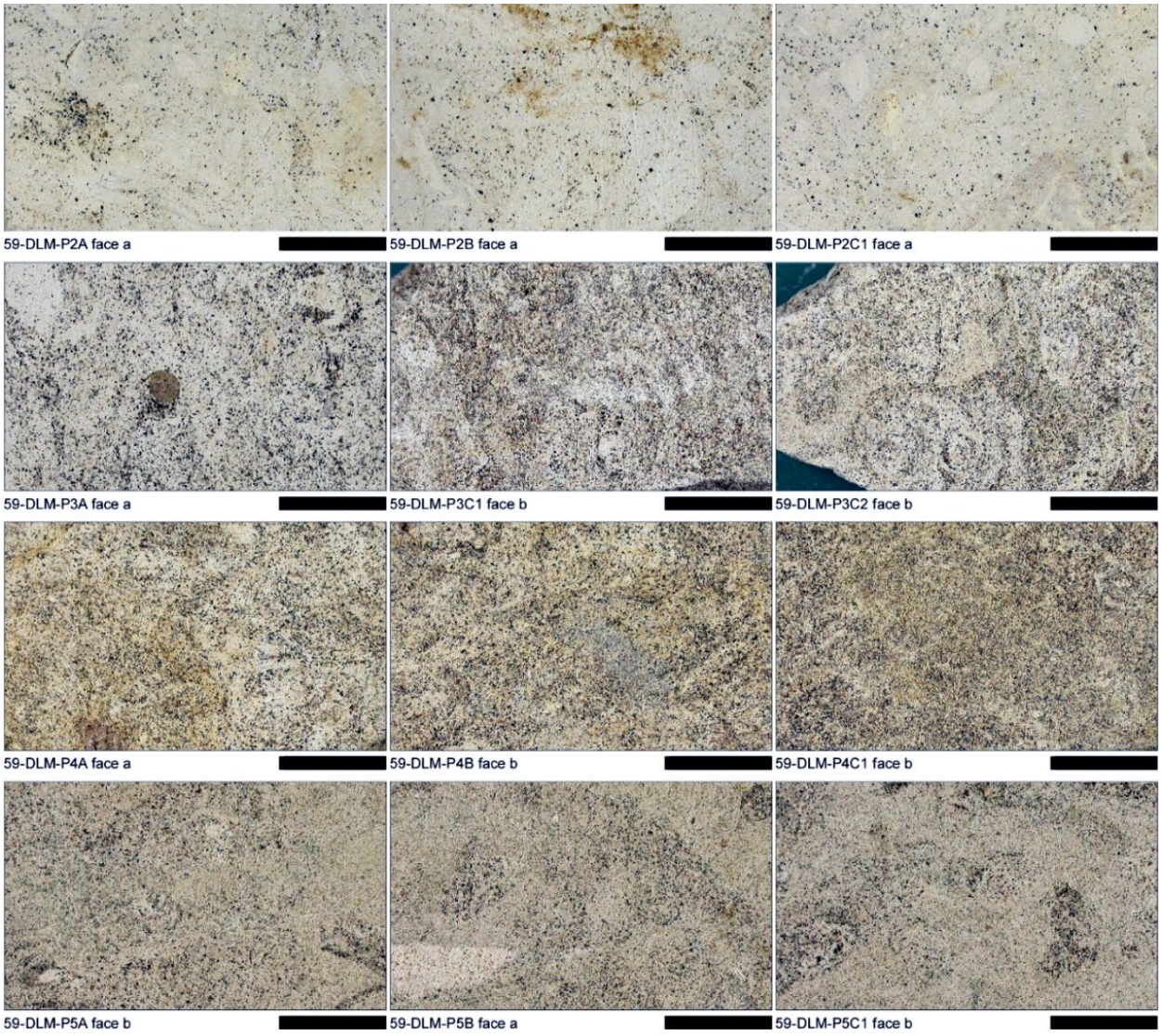


Figure 10: Macroscopic view of limestone quarried at Douchy-le-Mines (© Xavier Drothière, Gilles Fronteau, University of Reims).

volume of displaced material[10] equals to about 20,000cbm.

The second quarry developed to the west and north of the first. Its surface, with curvilinear edges, marks a poly-lobed plan. The total extension from north to south reaches a length of 250m, while its width varies between 70m in its larger section and 20m is its narrower one. The total area covered by this second quarry is estimated to be just below 10,000sq.m. If, as we believe, the depth of 6 to 7m was reached over the major part of this quarry's total area, the global/total volume of excavation could be of between 60,000 and 70,000cbm. One is therefore dealing minimally with a volume of some 90,000cbm of stone and rock displaced during the period of exploitation, with 30,000cbm adequate for commercial purposes.

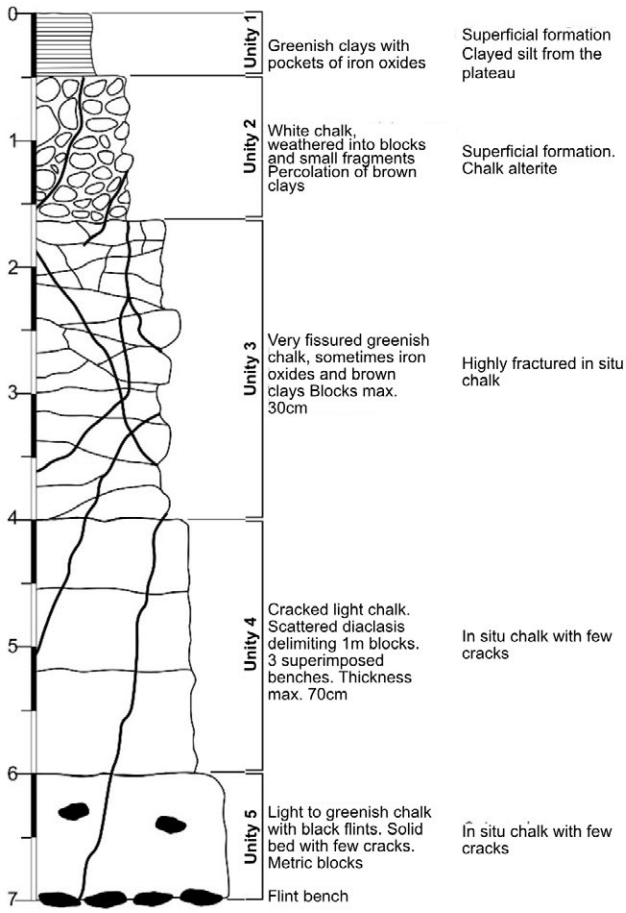
Extraction techniques

Two diachronic/age-old models of extraction were implemented. In the southern part of the eastern quarry, workers would cut the rock according to a precise geometry/layout, which should probably be interpreted as resulting from a blueprint for the exploitation of the quarried stone.[11] The rectilinear cuttings and the geometry/volume of the remains in these early open-air workshops indicate a methodical planning of the activity, undoubtedly credited to the participation of experts with a certain experience in this kind of work.

The technique then changed with the setting up of workshops following a new model. The cutting

[10] By multiplying the quarry's surface (3300sq.m) by the estimated mean depth (6.10m).

[11] By 'extraction blueprint' we mean that a grid pattern of the intended extraction trenches on the quarry's 'floor' outlines the blocks to be extracted. Such a grid pattern was applied on various production sites. Gaillard 2011: 337.



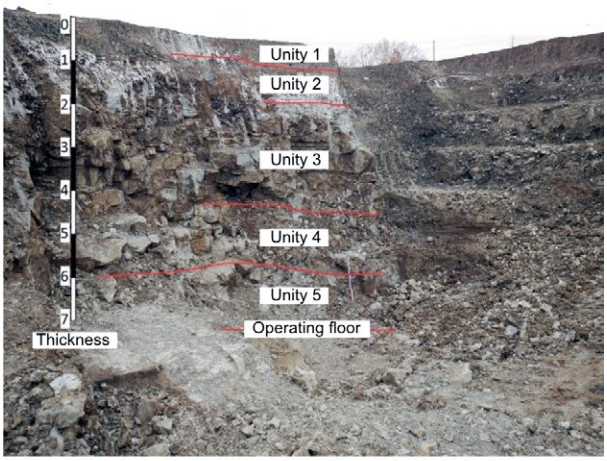


Figure 11: Stratigraphic section of the Douchy-les-Mines quarry face (© Damien Censier, Douaisis Agglo and Gilles Fronteau, University of Reims).

faces did not develop in a rectilinear but, instead, in a semi-circular plan (**Figure 12**). The quarrymen worked at different levels, resulting in the formation of various floors or cutting-faces in the vein/stratum of the usable stone. The rigour of the method implemented at the early stages was replaced by a rather random exploitation method. The creation of various floors enabled them to pinpoint and extract blocks of desired dimensions. This strategy was faster and required less effort to maximise production. Apparently, it was more practical than the previous one, since it was used until the quarry was abandoned.

The surface settlement

The settlement, extending over 5000sq.m and, later, over 6000sq.m, is located in a rectangular space enclosed by a network of ditches (**Figure 9**). Although deeply eroded, the remains outline several areas. The area is divided into two distinct zones on both sides of permanent structures. Their purpose was undoubtedly specific and dependent on the progress of stone production, from extraction to transportation to the construction site.

Differing from some exploitation sites of antiquity, where several workshops would follow the same stone bed independently and on their own individual account,[12] the quarries at Douchy seem to have been used by a single group endowed with strong organisational will and tested skills. This makes one think of municipal administration by the adjacent towns and cities, which depended on the finances of some of their fellow citizens who were at this time the main corporate sponsors of this type of production. Urban centres in the vicinity, such as Bavay and/or Famars and perhaps even Cambrai, may have taken charge of the stone supply.

The nature of production and its diffusion

Production, traceable through cases of manufacturing failure, mainly consisted of carving column-drums (**Figure 13**), architectural blocks and rubble. The carving of stone vats of variable dimensions, as well as fishing weights, is perhaps more anecdotic. A sort of standardisation of the proportions of architectural pieces can be made out. Craftsmen would start by carving a raw block[13] to create one 1.5 feet wide (*Sesquipedales*), which was then subdivided into three cuboid rectangles, themselves sometimes worked into blocks of smaller module.

[12] As is perhaps the case in the Kriemhildenstuhl quarries, in the Bad Dürkheim region in Germany. Dagmar 2002: 159-160.
[13] 0.70m x 0.50m x 0.32m.

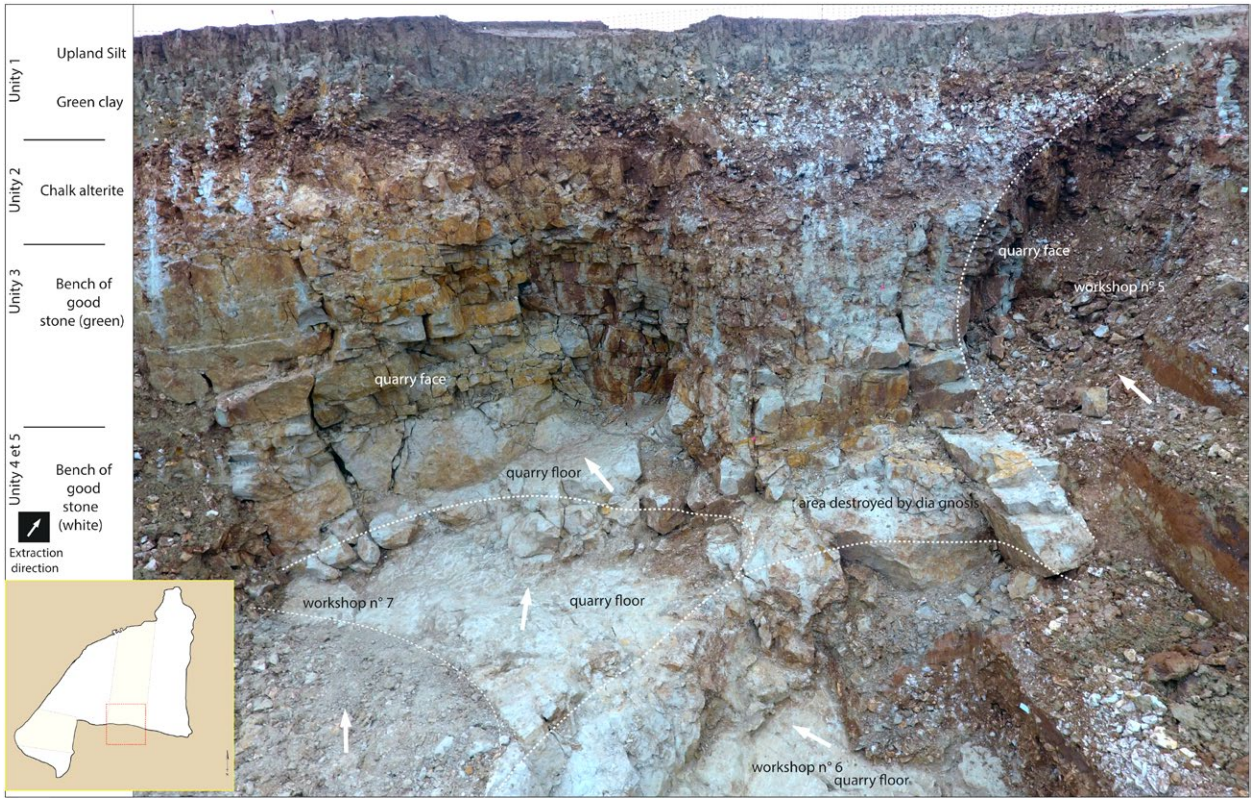


Figure 12: Limestone quarrying systems and location of workshops (© Damien Censier, Douaisis Agglo).

Figure 13: Quarried blocks and failed or aborted pieces (© Damien Censier, Douaisis Agglo).

The diffusion of production from the Douchy quarries, well-attested for the neighbouring cities of Bavay and Famars, served a much broader geographic area, essentially localised in territories further north (**Figure 8**). Transported via the Scheldt river, such finished or semi-finished blocks have been found in various locations of modern-day Belgium (Champion villa, city of Tongres), and even reached the river mouth at the North Sea, at the site of Colijnsplaat (Netherlands). In this location, several small statues of the goddess Nehalennia were carved in 'Avesnes stone'.

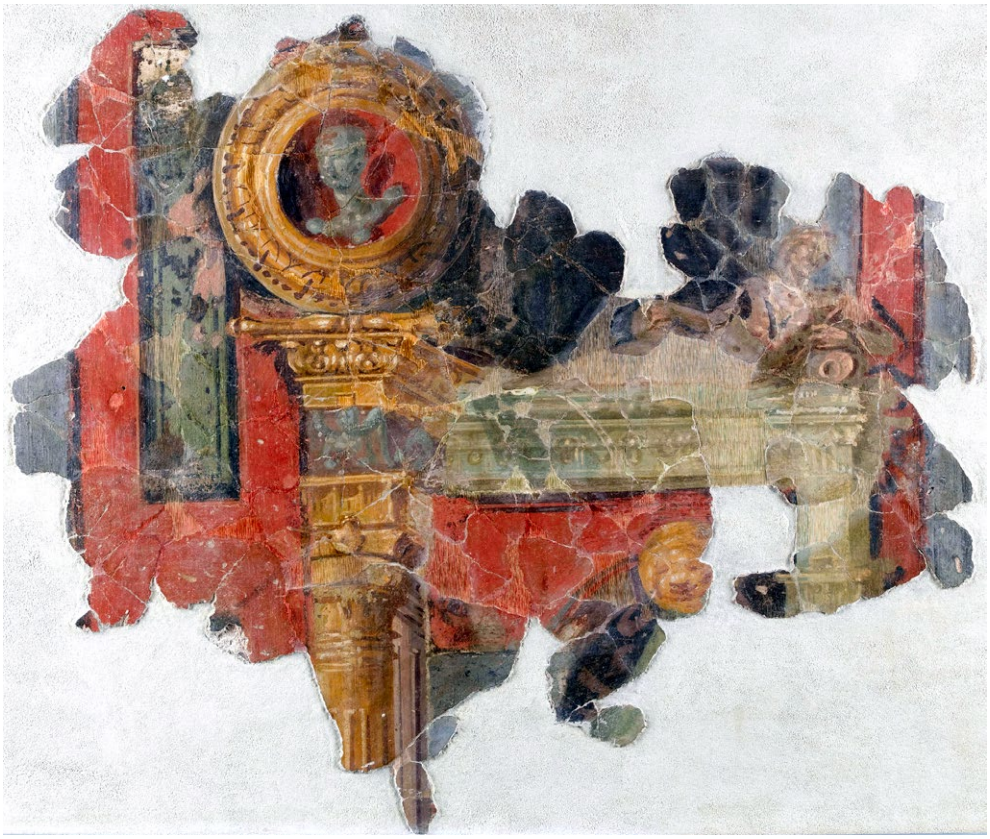


Figure 14: Wall painting depicting architectural elements (© Valenciennes Museum).

To the east, the La Rhonelle housing estate (previously the 'pea garden') (Plot AC69)

The old excavations (1980-1983)

The results of four excavation-seasons in the 1980s on Plot AC69 in the eastern part of the town, in the 'pea garden' (**Figure 1**), were the subject-matter of publications in the *Revue du Nord*. The first article dedicated to these archaeological works involves a road network and two buildings in succession.[14] In 'room 5', a built space over a hypocaust uncovered between 1980 and 1983, archaeologists made remarkable finds of painted plastering. Apart from fictitious architecture and imitations of marble, the paintings' partial restoration yielded depictions of Apollo *citharoedus*, a maenad and a typical Roman prostyle temple in the Corinthian order, standing on a podium. The bright colours of these figures, shown in the photographs taken when they were unearthed, have somewhat faded in the meanwhile.

The first results of the study of these paintings were published in 1984 and 1985.[15] The author was interested merely in the fictitious architecture (**Figure 14**). He saw in these drawings archaizing depictions of the second and third centuries AD, but did not suggest a precise date for the strata in which they were found. He compares them to other images of the same type in Gaul and Italy. In his 1984 publication, however, Philippe Beaussart puts forward a destruction date of the building in the third quarter of the third century AD, due to an Antonianus coin of Saloninus (259/260) associated with the paintings.

Excavations of the La Rhonelle housing estate in 2008/2009, which included the areas cleared during the seasons in the 'pea garden', have allowed these abandonment-strata to be related to the early fourth century AD, and to date the building's construction (where these abandonment strata were located) in the course of the third century. Despite the plausible hypothesis of the plastering having being brought into this room from elsewhere, the discovery of large connected pieces allows one to conclude that all the plastering came from this very building, perhaps from several spaces decorated in various ways.

A general dismantling of the neighbourhood to obtain rubble of sandstone and fragments of limestone for the construction of the fortification, as well as the creation of a glacis to access the Rhonelle river, allowed workers the choice to dispose/dump the waste wherever it suited them. Stratigraphic units/contexts containing plastering are similar to the sector's early-fourth-century destruction levels. They are made up of elements originating from demolished buildings not deemed useful for the construction of the *castellum*, of

[14] Beaussart 1984.
[15] Belot 1984; Belot 1985.

Figure 15: Representation of Apollo *citharoedus* (© Valenciennes Museum).

which the first planned phase was completed between AD 320 and 323.[16]

Apollo citharoedus

Apollo is depicted in three-quarters view (**Figure 15**). He leans on a construction (?) or object (?), but is not seated on it. He holds a cithara in his left hand, and his right one is about to play. His curled hair falls on his shoulders. A drape covers his left thigh. The cithara has ten strings and two curved arms at its upper end.

A maenad or nymph at the fountain

The bacchant is standing, turning slightly to the left **(Figure 16)**. She is wearing a drape with tinges of purple, which covers her legs; she has a piece of fabric resting on her left arm, while her left hand is resting on a rock. To her left, an overturned vessel is apparently a cantharus. This perhaps represents the amorous pursuit between Apollo and Daphne, although no trace of laurel is visible on the restored fragment.[17] With this in mind, the author also suggests the hypothesis of an image of the courtship between Poseidon and Amymone, who has just spilt her golden jug.

The naked female characters leaning on an urn are frequent in iconography, and in general they represent a nymph or nereid, with the vase symbolising a water source. Such a representation can also be occasionally interpreted as the personification of a river, an important element for the economic development of Fanum Martis. The association of two figures could likewise recall the Castalia fountain, a symbol of Daphne[18] with Apollo citharoedus, akin to the vessel kept in the Hermitage Museum in St Petersburg.[19]

The temple on a podium

A quadrangular prostyle temple in the Corinthian order (**Figure 17**) was centred on top of an octagonal

[16] Clotuche 2019.

[17] Barbet 2008: 282.
[18] Cabouret 2020.
[19] Palagia 1986.

Figure 16: Representation of a maenad
(© Valenciennes Museum).

podium decorated with engaged half-columns. An undefined installation is attached to each angle of this platform.

This typical Roman temple includes a front porch, as suggested by the extension of its roof, supported by four columns, which fronted the cella. The exterior walls of the cella were decorated with three, slightly protruding engaged half-columns. The tympanum (gable) was left undecorated, as was the frieze.

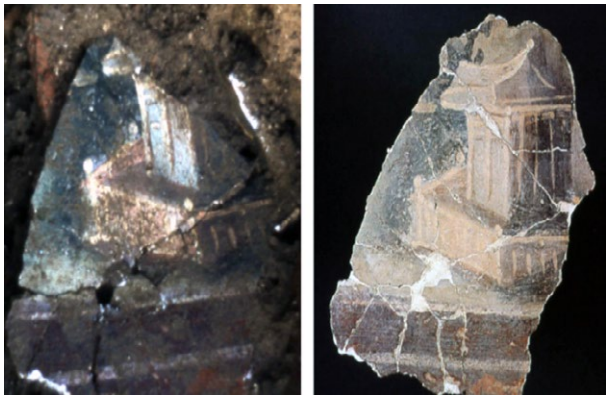


Figure 17: Representation of a temple in plaster
(© Valenciennes Museum).

The excavation of the La Rhonelle housing estate (2008/2009)

This rescue/preventive excavation includes fieldwork carried out in the 1980s. It brought to light a quarter of the city where the domestic settlement mingled with forging activities and what appears to have been a livestock market during the third and early fourth centuries, judging from the number of ponds surrounding a large open building that yielded many coins.

A peculiar construction

In the course of the third century AD, an architectural complex, of which the elements discovered in the ruins indicate its sacral function, impinged on this space. It is located a few tens of metres to the west of the sector that in 1980 yielded the painted plaster. Its walls and decorations were entirely sacrificed to the construction of the Late Roman Empire defences. The foundation trenches, however, in addition to the debris of the collapse, have allowed an approach of the sacred character of this architectural complex.

A wall encloses an area of 680sq.m. (28m x 24.25m) where a single octagonal construction was established. Only the eastern part of this enclosure was traced, the western portion being reconstructed on the basis of symmetry, with the only building occupying the centre of this space. Its foundation stops to the south of the construction, forming an angle and allowing for an entrance into the monument. The central construction's foundations reach a depth of 7.50m, suggesting that they carried/supported imposing superstructure (**Figure 18**). The excavation shows a slightly funnelled-shaped cross-section, to prevent the collapse of the earthwork in which the building was founded. Towards the south, two trenches 1.10m deep, resulting from stone quarrying, mark the base of a staircase which enabled access to this construction's upper part, which in all likelihood was situated higher than the ground level, on a podium. The scarce portions of walls that survived demolition indicate that the building was – at least in part – constructed of hewn and carved blocks, like most architectural remains at Fanum Martis.

The building appears to have collapsed towards the north, in the direction of four lime kilns, installed for the manufacture of concrete. Their imposing size (**Figure 19**) reveals that a substantial number of elements rich in calcium carbonate were destined

Figure 18: Reconstitution of the Temple of Apollo based on archaeological data (© Frédéric Vrevin, Fodere et visum).

Figure 19: View of the lime kiln on the Rhonelle (© Raphaël Clotuche, Inrap).

to supply these kilns – especially pieces of marble and blue stone from the temple's architecture. The gravel and rubble not usable in the fortification consisted of many fragments of blue-stone flooring and marble lintels. Amidst them, two fragments of Carrara marble were found: the arm of a cithara and its yoke painted in red (**Figure 20**). In these strata of collapse, the leg of a piece of furniture was uncovered together with fragments of drapes and twenty fragments of a bronze cymbal (**Figure 21**). A marble finger (**Figure 22**), of identical origins as the cithara parts, was associated with the paintings unearthed in 1980, which could be a clue for the removal of the painted plastering and its deposition in the hypocaust building. A quick projection of the size of the finger allows one to induce that it belonged to a statue approximately twice as tall as a human.

An evocation of Apollo

Ancient references to a cithara relate to Apollo and allude to his contest with Marsyas, won by the former. After musical jousting, the defeated was flayed alive and Midas, an adjudicator who had bet on Marsyas was given the ears of a donkey.

One cannot but assume a connection between the paintings of the building superimposed upon the hypocaust and the statuary parts belonging to the temple, both associated with Apollo citharoedus.

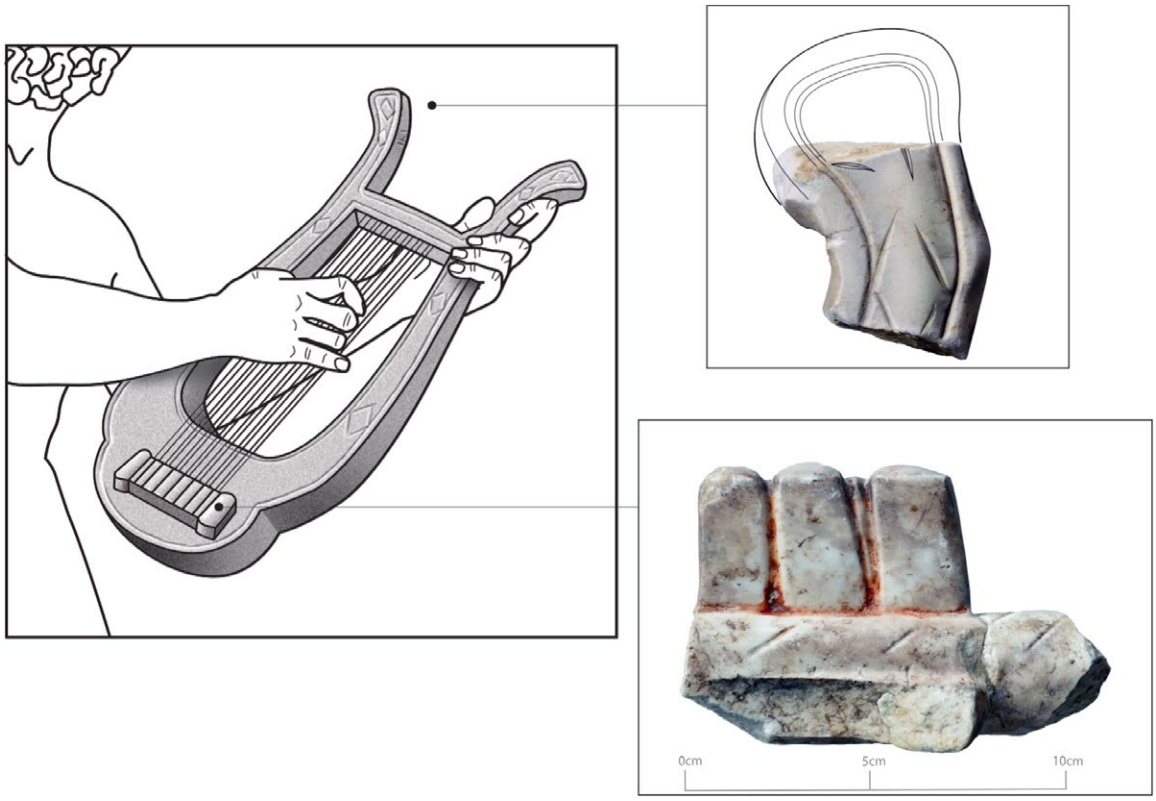


Figure 20: Drawn reconstruction of the cithara based on finds amid the temple debris (© Stéphane Lancelot, Inrap).

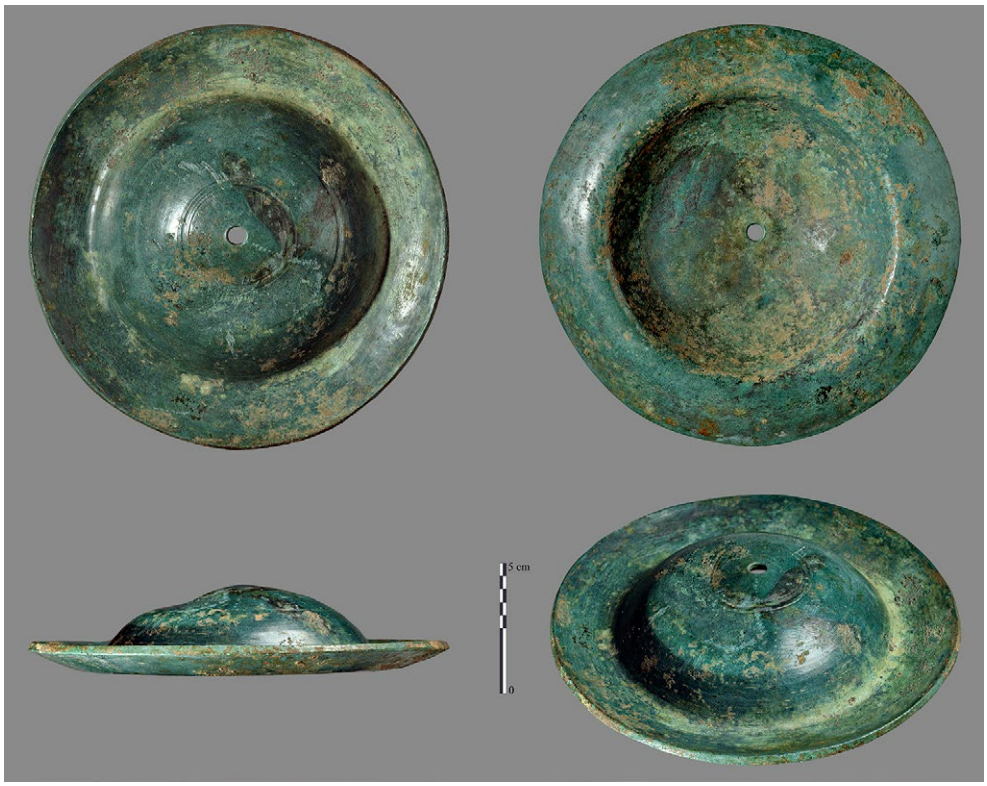


Figure 21: Bronze cymbal (© Dominique Bossut, Inrap).

The depiction in plaster of a temple on a podium (**Figure 17**) recalls the actual construction unearthed some metres to the west. This would be a unique example in the ancient world, where the image on an artwork illustrates components of the surrounding landscape.

Figure 22: Statue finger of Carrara marble (© Stéphane Lancelot, Inrap).

A domestic unit with specific functions?

Seeing the collected evidence, one wonders about the precise purpose of the building where the painted plastering was discovered. Although it has all the features of a house with a central courtyard, are we indeed dealing with a domestic unit that was used as a dump for the revetment of walls of another construction (despite the frailty of mortars), or was it meant to shelter different activities, and the retrieved decoration was actually in its place of origins, from its own walls?

The absence of any material collected during the old excavations does not permit the interpretation of the function of this particular space. All early-fourth-century destruction levels, however, have yielded very few furnishings, since they were not meant to turn to dumps after their abandonment. Artefacts present in these levels or structures are items forgotten or damaged by inhabitants upon their departure, taking with them personal wares and objects of value to them. Therefore, the stratigraphic units/contexts which can be associated with the phase of abandonment contained no furnishing pertinent to a specific activity; instead, what was found was mainly reddened wattle and daub originating from the building's upper wall faces.

In the courtyard adjacent to the room with the hypocaust, an appliqué piece of furniture was discovered, depicting Cybele and Attis (**Figure 23**). This adds to the religious connotations of this sector. This type of object is known in the Civitas nerviorum, with several examples having been discovered at Famars, Bavay, and even Nouvelles. They all display the same scene and an identical composition, yet, each one comes from a different mould.[20]

Conclusions

These statuary fragments were found more than one kilometre away from the octagonal podium. It would be far-fetched to assume that they originate from the La Rhonelle sanctuary. Some other construction must have been dedicated to this deity and its myth. Yet, why would two sets of constructions invoke the same deity and myth in the same town?

Figure 23: Furniture applique representing Attis and Cybele (© Stéphane Lancelot, Inrap).

Taking into account the quite substantial size of the restored plaques, it seems that the paintings enlivened the building where they were found, most probably the room with the hypocaust. This hypothesis could easily be verified through the observation of supports and reverse surfaces.

What was the role of Apollo at Fanum Martis? The most frequently represented god was Mercury, identified by several bronze elements and, above all, by vessels with faces manufactured in the workshops

[20] Veymiers 2010.

of local potters. The qualities of Apollo and Marsyas (or Pan) relate to the domain of nature and protection of flocks. Famars, or at least the fertile lands of Nervia, played an important role in the distribution of cereals in northern Gaul and the Roman Limes.[21] Could this be the reason for the reference to deities related to vegetation?

Was the town under the protection of deities linked to commerce (Mercury), agricultural production, and renewal of nature (Apollo, Marsyas, Attis, ...), besides being under the protection of Mars? The town's name originates from that of the god of war, who was also associated with the cycle of vegetation and nature's regeneration. Being increasingly attached to military activities, the army that levelled the city and occupied the castellum from the early fourth century AD perhaps favoured Mars. The spoliation of images of other deities seems, therefore, of lesser importance when one takes into account the men newly in charge of this region populated by Nervians.

The discovery of the location dedicated to Apollo to the west of the town but also of other cult places allows a better understanding of the religious profile of this city, of which only the link with Mars has survived. It appears, however, that Mars was not the only god worshipped there.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[21] Clotuche 2022; Hoët-Van Cauwenberghe 2015.

Workshops related to quarries and sculpture

Chapter 8

Ancient Greek quarries: Installations and workshops – extraction and sculpture techniques

Georgia Kokkorou-Alevras

Abstract

The provenance, extraction techniques, transportation and ancient trade networks or marble, the most valuable material in ancient architecture and sculpture, are topics that have received systematic attention in the disciplines of archaeology and geology from the second half of the twentieth century onwards. As a consequence, a considerable number of studies have illuminated many related aspects, which are of great interest, thus requiring again and again an overall and updated revisit. This paper aims to collect and present in a concise and compositional manner the available evidence, by documenting the methods and techniques of quarrying, the installations along with the technical means and facilities for the extraction process, the personnel, the working conditions, the dwellings and cult places/shrines, as well as the cemeteries in the premises of quarries. In addition, the possibility of sculptural workshops operating *in situ* is explored. We focus primarily on the numerous and thoroughly studied unfinished archaic Naxian sculptures – the largest number of unfinished statues found so far in quarries – and on their different carving stages. Their correlation with unfinished archaic sculptures abandoned in other ancient quarries, similarly in various carving stages – along with recently found significant architectural remains in Naxian quarries –, enables the formation of groups or 'series' of unfinished statues, regardless of their date. The outcome of this procedure confirms the presence of specialised sculptors (*γλύπται, λιθογλύπται*) on the site of ancient quarries of the Archaic period, as well as the existence and operation of workshops of sculpture *in situ*, albeit of a probably makeshift and provisional character. On this occasion, the stages of sculpting statues, architectural elements and everyday stone objects in general on the quarry site is revisited.

Περίληψη

Η προέλευση, οι τεχνικές λατόμησης, η μεταφορά και τα αρχαία εμπορικά δίκτυα διακίνησης μαρμάρου, του πιο πολύτιμου υλικού για την αρχαία αρχιτεκτονική και γλυπτική, είναι θέματα που έχουν απασχολήσει συχνά και συστηματικά την αρχαιολογική και γεωλογική έρευνα από το δεύτερο μισό του εικοστού αιώνα και εξής. Συνακόλουθα, ένας μεγάλος αριθμός συναφών δημοσιεύσεων έχει φωτίσει πολλές σχετικές παραμέτρους που όλες έχουν πολύ μεγάλο ενδιαφέρον και επιβάλλουν συνολική και επικαιροποιημένη επανεξέταση. Στο παρόν άρθρο επιχειρείται η συγκέντρωση και συνοπτική, συνθετική, παρουσίαση των μέχρι σήμερα δεδομένων της έρευνας για τα αρχαία λατομεία, όπως οι μέθοδοι και τεχνικές λατόμησης, οι εγκαταστάσεις και τα τεχνικά μέσα υποστήριξης εργασιών λατόμησης, το προσωπικό και οι συνθήκες εργασίας, οι κατοικίες, τα ιερά, τα κοιμητήρια και η πιθανότητα λειτουργίας, έστω και προσωρινής, εργαστηρίων γλυπτικής, στα αρχαία λατομεία. Ειδικότερα, η παρούσα μελέτη έχει ως αφετηρία τα αρχαϊκά ναξιακά λατομεία, τα οποία έχουν μελετηθεί διεξοδικά με βάση τον μεγαλύτερο σε σχέση με άλλα αρχαία λατομεία αριθμό ημίεργων γλυπτών που έχουν βρεθεί σε αυτά αλλά και τα σημαντικά αρχιτεκτονικά κατάλοιπα που εντοπίστηκαν σχετικά πρόσφατα. Κατ' αρχάς παρουσιάζονται τα διαφορετικά στάδια λάξευσης, στα οποία είχαν εγκαταλειφθεί στα λατομεία τα ναξιακά αρχαϊκά αγάλματα και ακολουθεί συσχετισμός τους με άλλα εγκαταλελειμμένα σε αρχαία λατομεία αρχαϊκά αγάλματα με βάση τα παρόμοια στάδια λάξευσης. Με τον τρόπο αυτό προκύπτουν ομάδες, 'σειρές' ημίεργων γλυπτών ανεξαρτήτως της ακριβούς χρονολογίας τους, γεγονός που πιστοποιεί την παρουσία εξειδικευμένων γλυπτών στα λατομεία των αρχαϊκών χρόνων και οδηγεί αναπόφευκτα στο συμπέρασμα της ύπαρξης και λειτουργίας εργαστηρίων γλυπτικής σε αυτά, προσωρινού ίσως χαρακτήρα. Με την ευκαιρία αυτή επανεξετάζονται τα στάδια δημιουργίας και λάξευσης γενικά των αγαλμάτων, καθώς και αρχιτεκτονικών μελών και λίθινων εν γένει αντικειμένων καθημερινής χρήσης επί τόπου στα λατομεία.

Keywords: ancient quarries; installations; quarrying and carving techniques; workshops; Naxos

Introduction

The study of the various kinds of raw material used in ancient stone-carving and the archaeological investigation of ancient quarries from which these were extracted are two of the most discussed and fascinating topics in modern research on the ancient world. This is not an unreasonable situation: the identification of the provenance of the raw material for architecture, free-standing and relief sculptures, as well as of ancient artefacts – tools and vessels of daily use – in combination with their stylistic, typological and iconographic analysis, provides a reliable criterion for the determination of the place – sculptural centre or 'school' – in which they were created. Consequently, one may deduce the volume of production of the various

centres of stone products in antiquity, so contributing decisively to their cultural and economic evaluation. Furthermore, the determination of origin facilitates tracing the circulation and trade networks of stone and stone products in antiquity. All in all, such research promotes the exploration of the economic life and of the relevant political and cultural relations between the various cities concerned. It is, moreover, an important factor in reaching a more accurate assessment and interpretation of stone-carved works within specific cultural contexts.[1] Finally, quarries as places of daily and arduous manual labour by specialised craftsmen, humble workers and slaves stand as undisputable testimonies to the contemporary social reality in which they operated.

From the second half of the twentieth century onwards, numerous studies have been published on topics related to ancient quarries, such as the kinds of stone and their extraction techniques, the manner of transport of stone blocks, their levels of productivity and main networks of transport. Far fewer and more scattered is the information on the installations themselves, if we exclude the comprehensive sketch reconstruction of an ancient quarry by Tony Koželj and Manuela Wurch-Koželj (**Plate 1**),[2] on which all the facilities and equipment required for quarrying are depicted. Here are shown machines for lifting/moving quarried and carved stones, that for practical reasons would have been installed most probably near the spot where quarrying and carving took place; anvils and fire for readying the tools and their edges; water basins for cooling (quenching) the same.[3] Necessary also were transport roads and, in the case of coastal quarries, also small quays and ramps (slipways) for loading the sculptures and stones onto ships.[4] Somewhere close to the quarries must have been situated the dwellings of various categories of workmen, as well as the guard posts, such as towers.[5] Common also were the sanctuaries that covered the cult needs of the workmen,[6] and, of course, cemeteries for those who lost their life in fatal accidents due to the dangerous working conditions.[7]

Most of these amenities would have certainly been shared by the *λατόμους / λιθοτόμους* (quarrymen / stone cutters) and the *λιθοξόους / λιθουργούς / γλύπτες / λιθογλύπτες* (stone masons / stone craftsmen / sculptors / stone carvers),[8] since all of them were working in the quarries. However, a topic that has not been satisfactorily resolved is the existence or not of installations of stone-carving/sculptural workshops, even temporary ones, which were necessary for the on-site carving of stone works. A large number of unfinished statues, architectural members and artefacts, found earlier and/or lying still today in ancient quarries, show the existence of such. Despite the occurrence of unfinished carved works that attest to the labour of stone masons / stone craftsmen / sculptors / stone carvers at quarry sites and the related views that have been put forward since the last decades of the twentieth century,[9] research has not yet firmly established the presence and work of experienced stone masons / stone craftsmen / sculptors / stone carvers in the quarries, nor the operation of organised stone carving workshops within their confines.

Nevertheless, in any systematic investigation of this topic the detailed observations already published[10]

[1] Cf. Kokkorou-Alevras 2015.

[2] Koželj 1988a: 23, 25, pls. 6, 7. Cf. Kokkorou-Alevras *et al.* 2010: 63-64.

[3] Generally, Goette 1991: 208, pl. 40.1; Koželj 1988a: 19, pl. 4a, b; Orlandos 1994: 100-116 (lifting machines); Papageorgakis1964: 267, 270 (basins).

[4] For the transportation of stone products from quarries, see Hochscheid 2015: 137-142; Nolte 2006: 230-234; Orlandos 1994: 88-98, figs. 31-37; Papageorgakis 1964: 268-269, 271, figs. 9, 12; Wurch-Koželj 1988: 55-64. For the Naxian quarries, see Kokkorou-Alevras 1992: 110, 120 no. 61; Korres 2021: 318, 333-334, figs. 3, 10 (possible transport roads at Melanes). An impressive transport road is preserved at the quarries of Penteli: Korres 1994: 13-18 and at the quarries of Platyvouni in Laconia (better known as quarries of Sochas): Kokkorou-Alevras *et al.* 2006: 115-116, figs. 7, 12; Kokkorou-Alevras *et al.* 2010: 52. Also in Dimaristika of Mani: Moschou *et al.* 1998: 282-283, fig. 2. For ship-loading ramps (slipways), see Kokkorou-Alevras *et al.* 2009b: 182, fig. 7; Kokkorou-Alevras *et al.* 2019: 120, fig. 2.

[5] For quarrymen's houses or guard towers, or even summer dwellings of shepherds, see interpretations for *Drakospita* (Dragon Houses) in south Euboea and at Styra of Karystos: Kokkorou-Alevras *et al.* 2013: 118; Poupaki and Chidiroglou 2017: 449 no. 72; Reber 2010: 56-59 with bibliography. At Apollonas of Naxos: Philaniotou 1988: 496-497. More uncertain is the use of a 'room-like' space in Euboea: Papageorgakis 1964: 267; further of a tripartite building on Kos: Poupaki and Chatziconstantinou 2004: 114-115.

[6] As regards sanctuaries at quarries: for Melanes of Naxos see Lambrinoudakis 2005; for Apollonas of Naxos see Kokkorou-Alevras *et al.* 2013: 109-125; for Avlemonas of Kythera see Kokkorou-Alevras *et al.* 2009b: 179-180, fig. 5, pl. I, 9.4); for Plytra (of Asopos) in Laconia see Kokkorou-Alevras *et al.* 2009a: (of Roman times) 171-173, figs. 17.4-17.6; for Hymettus see Kokkorou-Alevras *et al.* 2019: 128, figs.11-12); for the quarry of Marmari (sanctuary of Apollo Marmarinos) and Kylindroi in southeastern Euboea see Papageorgakis 1964: 264; Poupaki and Chidiroglou 2017: 443 (with bibliography). As regards reliefs of Heracles at ancient quarries, see Doulfis in the present volume and also Holtzmann 1994: no. 54, pl. 16; Koželj 1988a: 10, pl. 4.6; Kokkorou-Alevras *et al.* 2009a: (Plytra/Asopos) 173-177, figs. 17.7 and 17.9. As concerns cult niches in quarries see Kokkorou-Alevras *et al.* 2009b: (Avlemonas of Kythera), 178 (Plytra of Asopos); Poupaki and Chidiroglou 2017: 450 (on southeastern Euboea).

[7] Kokkorou-Alevras *et al.* 2009a: (Plytra/Asopos) 173-77, figs. 17.7 and 17.9; Kokkorou-Alevras *et al.* 2014: 317, index (τάφοι); Papageorgakis 1964: 265.

[8] For these terms, see Hesychius s.v. λιθουργός (stone craftsman), Suidas s.v. λιθουργός (stone craftsman); also *IG* I,2 788 (= I,3 980); *IG* I,2 374 (= *IG* I,3 476); 355 (= IG I,3 458); Liddel Scott Jones s.v. λιθοξόοι / λιθουργοί / γλύπτες / λιθογλύπτες (stone masons / stone craftsmen / sculptors / stone carvers); Orlandos 1994: 116, 121-122 (citing further ancient sources).

[9] Kokkorou-Alevras 1992: 125, nos 87-88; Kokkorou-Alewras 1995: 45-46; Nolte 2006: 215-222, 242-243, 296-297; Hochscheid 2015: 121-122; Schilardi 2000: 169-170. Cf. Papageorgakis 1964: 277.

[10] Kokkorou-Alewras 1995: 40-46. In Nolte's catalogue, the description of unfinished sculptures does not include any comparative assessment within the assemblage, so as to indicate the degree of progress of carving a sculpture; therefore, it does not contribute decisively to the discussion of the topic. For a brief mention of unfinished sculptures that are on the same carving level, see Nolte 2006: 202. For the sake

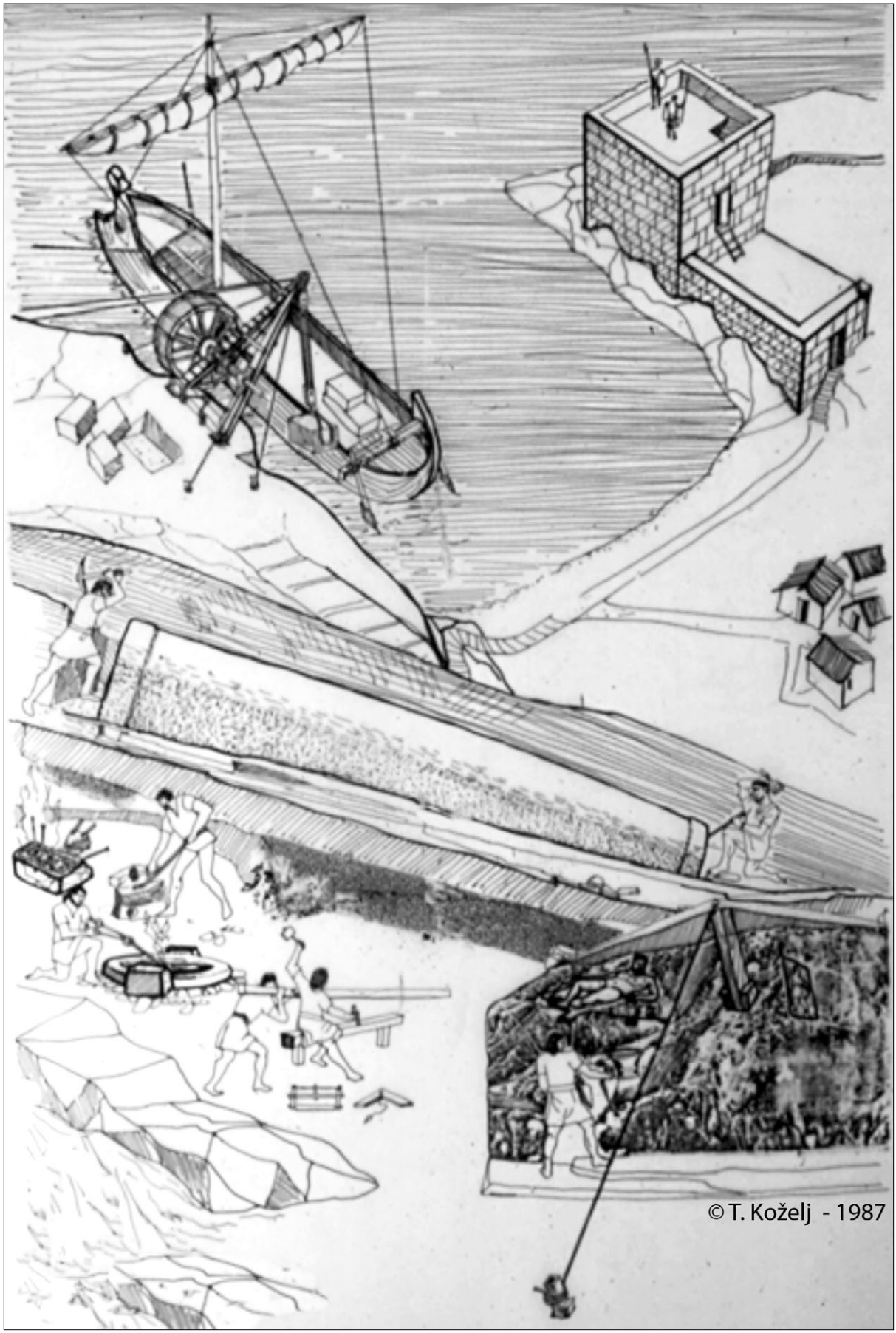


Plate 1, Figure 1: Reconstruction of an ancient quarry by T. Koželj
(after Wurch 2017: 379, fig. 736).

on the various stages of work are extremely helpful. An excellent example is the existence of the largest known series of unfinished sculptures that were found and still lie in the ancient quarries of Naxos and date to the Archaic times. First the stage of carving on each one of these sculptures is assessed here, and then the results are compared to the same or similar stage of carving seen on other known unfinished statues of the Archaic period. These latter examples are, as a rule, isolated finds from other quarries of the wider Greek and Asia Minor area, so documenting how essential was the presence of sculptors in the quarries. Finally, based on the evidence that emerges from this comparative examination, an attempt will be made to put together an overall, albeit concise, presentation of the installations and devices necessary in the ancient quarries of the Greek world, taking also into account the data of recent research.

Carving processes as attested by archaic unfinished sculptures

As it is well-known, the earliest preserved Greek marble life-size sculptures were carved out of local marble on Naxos, the biggest and central island of the Cyclades in the Aegean. Trading in marble and finished or unfinished stone-carved works played an exceptionally important role in the Naxian economy.[11] The development of the archaic Naxian sculpture certainly presupposes the operation of extensive quarries on the island. On Naxos, two large areas (**Plate 2**) – one in the interior of the island, known as the area of Melanes (with the villages Melanes, Myloi, Ano/Mesi/Kato Potamia) and another at its northeast tip, at the modern village at Apollonas (area of Koronis/Komiaki) – preserve extended traces of ancient quarrying and, most importantly, unfinished statues of various sizes, as well as architectural members and artefacts.[12]

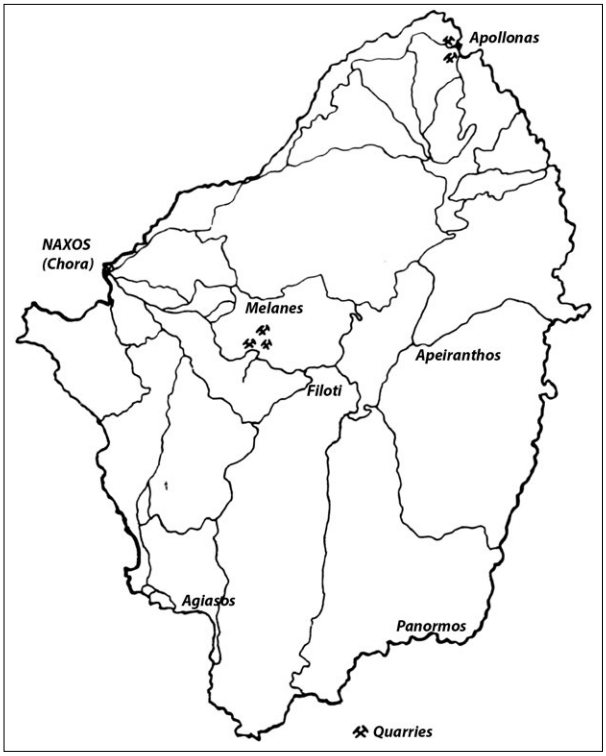


Plate 2, Figure 2: Map of Naxos with the main quarry sites (Image editing by G. Doulfis. Author's photo archive).

From the Naxian quarries come the largest number of unfinished statues of Archaic times, ten in total, each one by good fortune representing a different stage of the work process, allowing us to follow step by step the carving of the works of sculpture, up to a very advanced stage, on the quarry sites. At the outset, however, it is worth noting that the stage in the carving process and the dating of each sculptural work are two aspects that have no sequential or internally related relationship. This means that a chronologically earlier work can be found to display a more advanced stage of carving than a later one, and vice versa.[13] Nor does the size of a sculpture play a decisive role. The following presentation opens with the statue which shows the earliest stage of carving and ends with those abandoned just a little before the final treatment of the surface. Notwithstanding the argumentation and doubts that have been raised by some researchers about the possibility of fixing a date to an unfinished sculpture, it should be stressed that these can indeed be dated, for the most part, with precision, mainly on the basis of typological, structural and sometimes stylistic criteria.[14]

of clarification, let us note that, in this paper, the carving stages have nothing to do with new methods, new techniques or carving tools (this took place from the Late Hellenistic period onwards). Here, instead, we concentrate on the degree of progress and completion of the shaping and modeling of the figures as a whole and in part, actually on the site of the quarry. Since the beginning of monumental stone sculpture, the same tools have been used consistently: pick, light pick, points of different size, claw-, flat and rounded chisels, abrasive means, such as emery and rasps for smoothing out the surface. With claw chisel being used already from the middle of the seventh century BC, its traces do not define a decisive criterion for dating in architecture, as was erroneously assumed until recently (cf. Kissas 2008: 100-104; Palagia 2006: 252). What changes in the course of time is the successive (in the early times) or simultaneous (from the Hellenistic period onwards) use of these tools on each side of the sculpture, at each stage of carving.

[11] Kokkorou-Alewras 1995: 37-40.

[12] Kokkorou-Alevras 1992. For the unfinished sculptures that still lie or were found in the Naxian quarries, see Kokkorou-Alewras 1995: 40-46. On that detailed study of the unfinished Naxian sculptures and its catalogue is also based, to a large extent, the present publication, enriched however with new evidence and bibliography. For a catalogue of unfinished sculptures from the Archaic to the Hellenistic period, in which the archaic unfinished Naxian sculptures are included, see Nolte 2006 (with older bibliography).

[13] Kokkorou-Alewras 1995: 40.

[14] For example, a typological trait, such as the rendering of the hair on the statues of kouroi, provides a basic criterion for their chronology. More specifically, in the early times (fourth quarter of the seventh century BC – first quarter of the sixth century BC) the long hair of kouroi often falls down onto the shoulders, on either side of the face, as well as behind (Richter 1988a: nos 11, 12A-B, 14, 15, 18A, 18B, 19). Hair that hangs down only at the back appears for the first time solely on the Naxian kouroi of the first half of the seventh

The earliest carving stage represented in the Naxian sculptures is that of a smaller than life-size kouros statue (K 21 in Kokkorou-Alewras 1995, after Nolte 2006: K 17), which had been abandoned in the area of Melanes and is now kept in the Museum of Naxos (**Plate 3, Figures 3, 6**). On the front side of the statue there can be faintly discerned the limbs of a male figure of the kouros-type, as is indicated by the perpendicular row of point-traces for separating the figure's limbs. Furthermore, the face is only slightly divided off from the neck, while the hair clearly fell only down the back, since no provision was made for leaving the mass of marble required for the carving of the frontal locks. A small horizontal line, exactly above the lump of marble that has been left for shaping the genitals, is probably a measuring mark, namely it seems to delineate the middle of the figure, when subtracting the – about 10cm high – plinth. If this assessment is correct, then it constitutes the only known measurement point from a Greek archaic statue.[15] In contrast, on the lateral sides of the statue the carving is more advanced, since the upper and lower body, the hands, the face, the hair, and, finally, the curve of the buttocks are clearly outlined. The kouros is dated, mainly on the basis of the hair falling only down the back and not on the front, between the end of the first and the beginning of the second quarter of the sixth century BC.[16] The tool, by which the statue had been worked up to that stage, was a very thick point or a light pick, a well-known tool of the quarryman.[17]

At the same stage of carving[18] were abandoned in the quarries the following works, approximately contemporaneous with K 21, except for the statue of a lying lion from Samos of the middle of the sixth century BC (**Plate 5, Figure 18**) and two Late Archaic lion statues from Penteli (**Plate 5, Figure 17**).[19] The largest group is that from Penteli: an over life-size kouros without inventory number (**Plate 3, Figure 4**),[20] the kouros statuette in the British Museum, inv. B 472,[21] the lower part of an archaic seated, larger than life-size figure from the quarry of Spilia on Penteli,[22] and finally a lurking lion.[23] To the same stage of carving belong the abandoned smaller than life-size kouros from the coast of Stageira, now in the Archaeological Museum of Polygyros in Chalcidice, inv. ΜΠ 301 (**Plate 3, Figures 5, 9**),[24] an unfinished kore from Eretria,[25] the torso of a kore from Halicarnassus (Bodrum).[26] An unfinished sphinx from the sanctuary of Melanes on Naxos, just published, belongs to same stage of carving, as Vassilis Lambrinoudakis suggests, but it should rather be dated in the Classical-Roman period.[27]

Chronologically earlier is another, larger than life-size kouros from Melanes, stored in the Museum of Naxos (K 17, **Plate 3, Figures 7-8**). The small depth of the statue and the comparatively old-fashioned hairstyle, with the locks falling also down onto the

century BC (Richter 1988a: figs. 21-24) and on kouroi of Richter's Sounion group (Richter 1988a: nos 1-3, 6, 9, 10: in the first quarter of the sixth century BC), but it prevails from the second quarter of the sixth century BC, namely from the middle to the late Archaic times, when the shorter hairstyle becomes the rule: Richter 1988a: 18, Table 22, nos 31–188, apart from rare exceptions, which are to be associated with the figures of the god Apollo: e.g. Richter 1988a: no. 41 (Kokkorou-Alevras 1993: 20-22 with lower chronology than that proposed by Richter), 69, 71, 101, 107, 130, 159, 168. The same can also be suggested for the statuettes of kouroi, and so forth. Cf. Ridgway 1993: 77-79, 94.

[15] Measurement points are often encountered from the Early Hellenistic period onwards. See Nolte 2006: 179-182 and, indicatively, nos K 72, K 102, K 106.

[16] Nolte 2006: K 17 holds onto the old identification of the figure by Lambrinoudakis, as a dressed male figure, overlooking the series of perpendicular point strokes in the middle of the lower part, for dividing off the legs, as well as the fact that the right side of the sculpture's lower part is vertically broken off, a state of preservation that conveys a false impression about the type of the sculpted work. Further, she offers no interpretation of the lump of marble left for carving the genitals, which, as a rule, were not rendered on a dressed kouros. For a detailed description and documentation of the kouros' chronology to the transition from the first to the second quarter of the sixth century BC, see Kokkorou-Alewras 1995: 69-70, 87 footnote 289 (K 17), 91 (K 21).

[17] For the tools of quarrymen and sculptors and their use, see Kokkorou-Alevras *et al*. 2010: 46-51; Korres 1994: 76-77, pl. 10, drawing 10; Nolte 2006: 153-166, pl. 117; Orlandos 1994: 116-144.

[18] Although no detailed research, similar to that on the Naxian ones, has been carried out on all unfinished sculptures of the Archaic period, which were found or are still lying in other quarries (such as the unfinished sculptures found in the quarries of Penteli and elsewhere), it is still possible to make fruitful comparison.

[19] The Samian one should be dated to the middle of the sixth century BC, mainly on typological grounds, namely the lying pose of the animal and its corporeal mass. Cf. Freyer-Schauenburg 1974: 166, no. 82. For the Penteli lions, see here footnote 23.

[20] Height: 2.10m. Nolte 2006: K 2, pl. 2a. I could not find the museum or magazine in which this statue is kept today.

[21] Nolte 2006: K 8, pl. 5b.

[22] Nolte 2006: K 27, pl. 17c.

[23] Nolte 2006: 202, pl. 93a-b to be dated in the Late Archaic period: the pose of a lurking lion, with the hind part of the body raised and the fore part lowered, in the posture just before pouncing on its prey (*Sprungstellung* in German) is typical of the Late Archaic times: see Gabelmann 1965: 97-100, nos 146-149. Nevertheless, it is encountered very often in the Classical-Hellenistic period, too.

[24] Nolte 2006: K 13, pl. 11a-c (local museum); Sismanidis 2003: 17-18, figs. 10-11: preserved height 88.7cm, width 29.8cm, depth 17.5cm. Despite the intense weathering of the surface of this statue, it is clear that the kouros hair falls only down the back, a feature indicative of its dating after the first quarter of the sixth century BC: see footnote 15 in this paper.

[25] Eretria Museum inv. 1809. Nolte 2006: K 22, pl. 14a.

[26] Nolte 2006: K 21, pl. 17a-b.

[27] Lambrinoudakis 2021: 375-378, fig. 1a-z, there dated to the end of the seventh century BC. However, the comparison of this sphinx with another one from the same sanctuary but left in a more advanced stage of work, published also in 2021 and dated in the Roman period (Lambrinoudakis 2021: 388-390, fig. 12), shows that the sphinx under discussion could be also dated in the same period. Indeed, the cubic-orthogonal structure, as well as the pronounced perpendicular axis of the sphinx figure are to be found already in Classical and further in Roman sphinx statues (Katakis 1997: 1169-1170, figs. 268, 272; Raftopoulou 1997: 1156-1157; 1163-1164, figs. 102, 106, fifth century BC) but not in Archaic ones. On Early Archaic sphinx statues, the horizontal axis prevails (Richter 1961: figs. 1-3, 12-13,19-20) and later (ripe and Late Archaic times) the diagonal one, together with the erect back part of the sphinxes which remains discernibly apart from the front part of the figures (Richter 1961: figs. 34-35, 51, 53, 64-65, 94-95, 99,119-122). Cf. also at this point the sphinx statues in the Metropolitan Museum of Art: Lazzarini and Marconi 2014: figs. 24, 25.

chest in the manner of the Early Archaic period,[28] date it most probably before the end of the seventh century BC. On this statue the traces of the point or pick are somewhat finer, and the main forms are more precisely outlined, albeit still at a very early stage of work. Again, compared to the front and back side, the lateral sides of the statue show a more advanced stage of carving. This is obviously due to the commencement of carving from these sides to optimise the raw material and labour input. Prior to that, either incised or drawn in colour[29] by the head-sculptor or even by a quarryman according to the former's instructions, the figure's contour on the rock would have been indicated for the stone carvers, probably apprentice sculptors, to follow as a guide. The priority given to the lateral sides is most probably to be associated with the fact that fixing these sides first helped determine the required thickness of the stone block to allow for the carving the protruding parts, such as the nose, the genitals and other anatomical details.

At an even more advanced stage of carving than the previous two statues is an unfinished one of a small kouros from the same area (K 24, **Plate 3, Figure 10**): the point-traces on it are finer and the forms of the body on all sides are better rendered. Its comparison with other Naxian kouroi statues indicates its most probable dating to the decade before the middle of the sixth century BC.

The next stage of work is represented on another smaller than life-size statue of kouros, found in the quarry at Apollonas and now on display in the National Archaeological Museum of Athens (K 37, **Plate 3, Figure 11**).[30] On this kouros the traces of the point are even finer, confirming Carl Blümel's view that, while carving his figures, the Archaic sculptor used successively thinner points almost up to the final stage of work, when he turned to the claw chisel (*ξοΐς*) and to the rest of the tools. Here, the rendering of the body forms is more precise and more anatomical details are depicted. Most importantly, *the latent movement* of the figure, namely the deviation from frontality, has already been defined.[31] Indeed, on this kouros the asymmetries are quite obvious, for instance the right shoulder is set lower than the left one, while the corresponding muscle of the chest and the corresponding bone at the hip, plastically rendered, project more pronouncedly than those of the left side, suggesting a slight turn of the torso to its left. In contrast, as indicated by the tilting of the face and the more voluminous mass of hair on the left side, the head is turned to the right and downwards, in keeping with the well-known *double latent movement*.[32]

At a slightly more advanced stage of carving, with fine traces of point-work all over the surface and the rough rendering of the facial features, but also partially with traces of claw chisel in the stomach area, is the upper torso with head of a kouros statuette from Miletus,[33] which appears to be contemporaneous with the Naxian unfinished one (K 37, **Plate 3, Figure 11**). At the same stage of carving seems to have been transported to Chalcidice the under-life-size kore from Stageira in the Archaeological Museum of Polygeiros inv. ΣΤΑ 1051 (**Plate 4, Figure 16**).[34] A similar stage of work has been reached on a Late Archaic lion statue abandoned in the quarries of Dionysus, today in Archaeological Collection of Kifissia (earlier in the Museum of Piraeus, inv. 5760).[35]

Two colossal statues of kouroi that lie in their original place of quarrying in the area of Melanes, Naxos, have been abandoned at almost the final stage of work. One

[28] See footnote 15.

[29] Incised contours have been preserved on unfinished sculptures, for example, on a column-drum at the quarries of Miletus (Peschlow-Bindokat 1981: 187, 188, 190, fig. 48); the right hand of Dionysus from Naxos (K 60); a limestone statuette of horse and rider from the sanctuary of Artemis Orthia in Sparta (Nolte 2006: K 37, pl. 21a, dated generally to the sixth century BC; however, the clear typological similarity to the horses on the metope of the Athenian Acropolis of the second quarter of the sixth century BC (Brouskari 1974: 45, 577, fig. 79), in addition to the similarity to Delian horses (Kokkorou-Alewras 2008: 434, fig. 4a and 4b) of the second quarter of the sixth century BC, points to a date at the same time. On the other hand, no painted contours have been recorded, although it cannot be ruled out that this technique was also used for drawing the outlines of figures.

[30] Also see Kokkorou-Alevras 2014: 176, 188-190, pls. 614-617, where it is mentioned inadvertently that there is a turn of the torso to the right instead of to the left.

[31] On frontality, see Floren 1987: 79-80; Kleemann 1984: 15-21, 79-80, 110-120; Ridgway 1993: 12-13.

[32] To determine with precision the turn of the torso and the head on the Archaic sculptures is not an easy task, considering that meticulous measurements are required: see Kleemann 1984: 123-199. On the double latent movement of Archaic statues, see Kleemann 1984: 96-98, 113-114; Moustaka 2014: 96, pl. 261.

[33] Today in the Museum of Constantinople, inv. 2336: Nolte 2006: K 7, pl. 5a.

[34] Sismanidis 2003: 17-18, figs. 10-11; Stephani *et al.* 2019: 248, catalogue no. 173: preserved height 53cm, width 32cm, depth 20cm. The kore statue should be dated in the second half of the sixth century BC because of her long diagonal mantle running between and not above the breasts: Richter 1988b: group IV-V, second half of the sixth century BC. Quite seldom is further the fastening of the diagonal mantle on her left instead of the right shoulder, to be also found on the kore of Lyon, the kore of the Siphnian treasury at Delphi, Acropolis kore inv. 672, Kyrene kore inv. 14008 and on a bronze statuette in New York inv. 35.11.4, Fletcher Fund, 1935 and some others. Cf. Richter 1988b: figs. 275-281; 317-320; 373-376; 536-537; 647-648. Karakasi 2003: pls. 130, 132, 101r., 87, 150 respectively, also of the second half of the sixth century BC. The *epidermis* ('skin' surface) of this kore is also heavily weathered obscuring its original appearance, so that no traces of carving can be observed.

[35] Chatzidimitriou 2018: 16, fig. 15, of the Late Archaic period; for the date see above, footnote 23. The identification of this lion statue with a Molossian hound of the end of the fourth century BC, proposed by O. Palagia (2011), is not convincing; the pronounced mane, the cuboid structure, rigid posture and contour of the figure surely do not correspond to a sculpture of the Late Classical period, even in an unfinished stage: cf. Kokkorou-Alewras 1993: fig. 25.1-2 (Archaic) and 3 (Early Classical). Furthermore, for carving the elongated and pointed muzzle of a Molossian hound, a longer block of marble would have been required: cf. Kokkorou-Alewras 1993: 21, 23, 25, figs. 1-2 respectively. In any case, as it is well known, in ancient Greek art lions are fashioned after hounds.

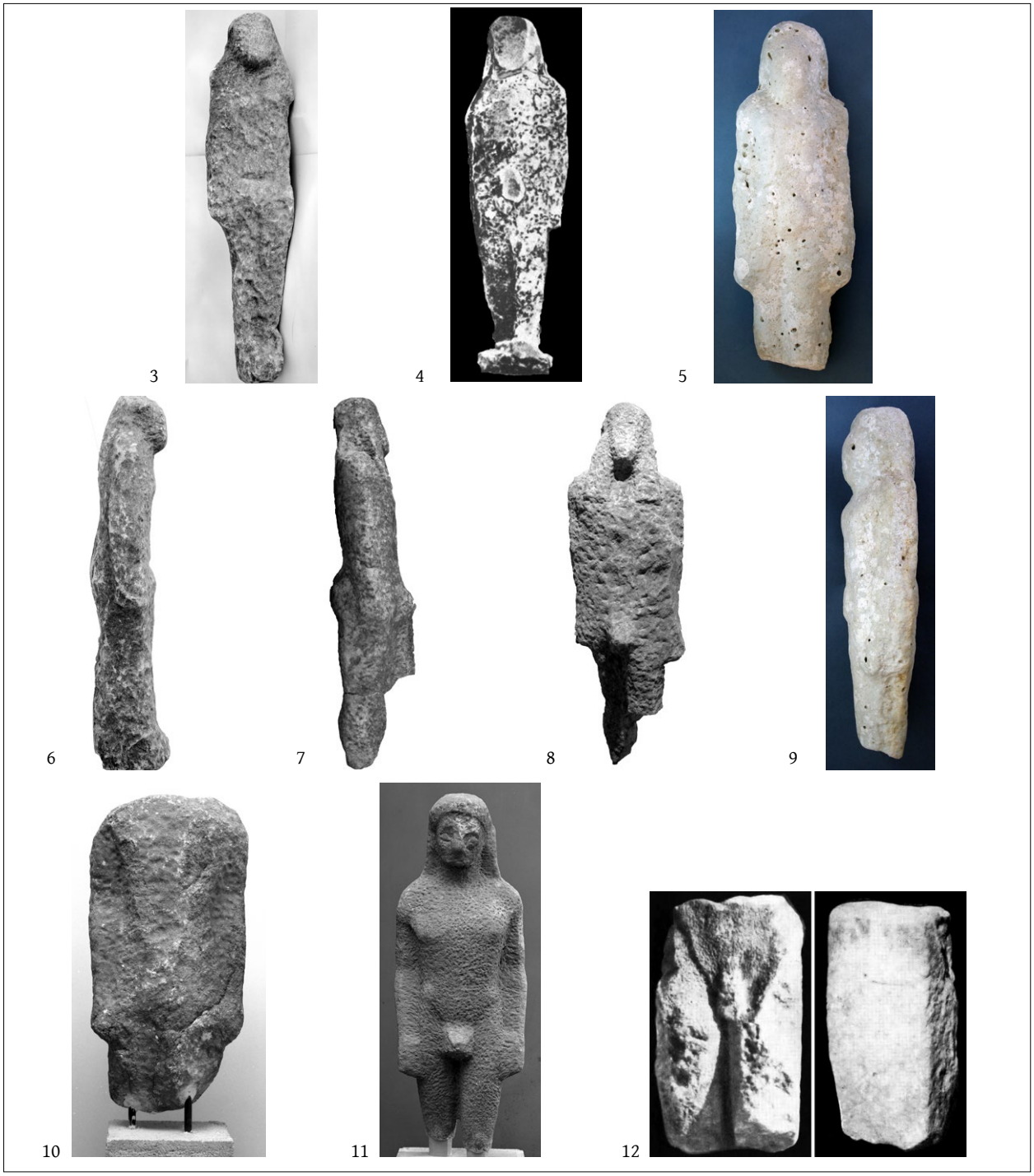


Plate 3, Figure 3: Smaller than life-size, unfinished kouros K 21, Archaeological Museum of Naxos. Front view (D-DAI-ATH-77/623, photo by Gösta Hellner. Photo editing by V. Schiza). Figure 4: Unfinished kouros of Penteli (after Blümel 1941: fig. 10. Photo editing by G. Doulfis and V. Schiza). Figure 5: Unfinished marble kouros inv. ΜΠ 301, Archaeological Museum of Polygyros. Front view (© Hellenic Ministry of Culture, Ephorate of Antiquities of Chalcidice and Mount Athos - Hellenic Organisation of Cultural Resources Development, photo by Spyros Vasileiou). Figure 6: Smaller than life-size unfinished kouros K 21, Archaeological Museum of Naxos. Right side view (D-DAI-ATH-77/624, photo by Gösta Hellner. Photo editing by V. Schiza). Figure 7: Unfinished kouros 17, Naxos Archaeological Museum. Right side view (D-DAI-ATH-1990/1387, photo by Elmar Gehnen. Photo editing by V. Schiza). Figure 8: Unfinished kouros 17, Naxos Archaeological Museum. Front view (D-DAI-ATH-1990/1391, photo by Elmar Gehnen. Photo editing by V. Schiza). Figure 9: Unfinished marble kouros inv. ΜΠ 301, Archaeological Museum of Polygyros. Left side view (© Hellenic Ministry of Culture, Ephorate of Antiquities of Chalcidice and Mount Athos - Hellenic Organisation of Cultural Resources Development, photo by Spyros Vasileiou). Figure 10: Unfinished kouros K 24, Naxos Archaeological Museum. Front view (D-DAI-ATH-1990/1375, photo by Elmar Gehnen). Figure 11: Unfinished kouros K 37, Athens, National Archaeological Museum inv. 14. Front view (D-DAI-ATH-NM-4887, photo by Eva-Maria Czakó). Figure 12: Unfinished lower torso of a pillar-kouros inv. 5521, Naxos Archaeological Museum (after Kontoleon 1960: 261, pl. 199a-b. Photo editing by G. Doulfis).

of them, 5.55m. in height (K 23, **Plate 4, Figure 14**), lies at the site of Phlerio, almost intact; only the right leg, broken off at knee-level, is preserved *in situ* together with the right foot; of the left leg, the lower half of the shin is broken off.[36] The entire surface of the sculpture is covered with traces of the point, which are even finer that those on the statues already described. The parts of the body have not only been shaped very clearly, but have also acquired a high degree of plasticity, while the basic anatomical details like the *linea alba* of the abdomen, the navel, clavicles (collarbones), groin and abdominal grooves, are plastically modelled, too. The long hair falls only down the back, a trait that, along with the manner in which the anatomical details are rendered, favours a date of the statue around the end of the first quarter of the sixth century BC.[37] All the same, the facial features have not been even sketched in, something that shows that the sculptor did not complete the carving of all body parts to the same degree in each stage of work, as was previously thought; instead, he proceeded depending on the requirements of the work or his own inspiration, in some parts advancing more and in others less.[38] This is also shown by the headless kouros inv. 1377 in the Archaeological Museum of Paros, where parts of the body are in the same carving stage as the Naxian Kouros K 23 while other parts, already plastically-formed, were left in the final stage of work with a thin and fine point.[39] Quite interesting from the viewpoint of technique is the lower part of an unfinished kouros from Lesbos: here one limb of the figure was already carved with a claw chisel and a flat chisel, while the other one has been left at the stage of carving with a point; moreover, the section between the thighs had not yet been excised out. It was at this point that it was realised that the material was not suitable for completing the carving of the right leg.[40]

At a similar stage of work the Ram-bearer of Thasos[41] had also been abandoned, but the kore from Taranto, today in the Museo Nazionale inv. 20923,[42] represents a somewhat more advanced stage of carving. Nevertheless, on the whole, in each stage of work the Archaic sculptures present a relative homogeneity; nowhere is it documented that the sculptor continued the carving process to the final stage on one side of the figure and then turned to deal with the other, as is usually testified to on sculptures from the Hellenistic times onwards.[43] In this way, the Archaic sculptor had an overall appreciation of the figure in each stage of his work, something that ensured the coherent and organic rendering of the figure/statue.

The other colossal statue that is preserved in the quarry at the site of Pharangi (Pelekania), another part of Melanes, and ten minutes away on foot to the south of the Phlerio kouros, is the kouros of Pharangi, with a preserved height of 4.04m, the broken feet not included (K 20, **Plate 4, Figure 13**). This statue is even more advanced in the plastic rendering of its forms than the previous one; moreover, the process of detaching the right arm from the torso had already begun by the time the statue was abandoned. However, the kouros of Pharangi is a chronologically earlier work, as is indicated by the old-fashioned hairstyle with the locks falling also on the front down the chest, as well as by the representation of fewer anatomical details.[44]

Finally, an even more advanced stage, just before the final smoothing of the statue's skin, is seen on a smaller than life-size kouros today in the Benaki Museum, Athens (K 64a).[45] Here, the arms are completely detached from the torso, the traces of the point are the smallest we have seen so far, and the latent movement is more apparent: characteristic is the asymmetrical arrangement of the abdominal grooves of the pointed thoracic arch. On the reverse, however, and mainly in the area of the division of the thighs, it is evident that the carving of the sculpture had not been completed. Closely related to this is the stage of work on the torso of a male figure in motion of the Early Classical times in the Archaeological Museum of Aegina inv. 710.[46] As a matter of fact, the comparison of the two works readily shows their chronological difference, although they were aborted at the same stage of carving.

The *latent movement* is furthermore documented by means of precise measurements on the colossal statue of God Dionysus that lies *in situ* in the quarries at Apollonas of Naxos (K 60,[47] **Plate 4, Figure 15**) dated in the Late Archaic period.[48] The bearded god, clad in a

[36] For technical details on the working process in the quarries, accompanied by impressive sketches, see Korres 2021: 40, fig. 11; for reasons of abandonment of statues in the quarries, Korres 2021: 41 no. 11. Nevertheless, the procedure of carving in the quarries is more complex and varied, as has already been described: Kokkorou-Alewras 1995: 40-46 with extensive bibliography.

[37] See footnote 15.

[38] Cf. the Ram-bearer of Thasos (Nolte 2006: K 16, pl. 12a-c with bibliography), kore and statue of lion from Miletus (Nolte 2006: K 19, pl. 13a-c [Balat Museum], K 28, pl. 18b [Berlin Antikensammlung inv. 1790]. See also below footnote 41.

[39] Kourayos 2012: 121, fig. 17.

[40] Leka 2012: 76-77, figs. 3-6.

[41] Ram-bearer of Thasos: Nolte 2006: K 16, pl. 12a-c.

[42] Nolte 2006: K 24, pl. 16a-d.

[43] See, for example, Bruneau and Ducat 1983: 63-64 D (group of Parian statues – '*Agora' of the Gods*) with intentionally unfinished reverse. Cf. Marcadé *et al.* 1996: nos 14-19 (for the Archaic period); Nolte 2006: 140-141 no. 203 (for the Classical and Hellenistic period); Richter 1988b: no. 123, figs. 394-397 and no. 148, figs. 472-475.

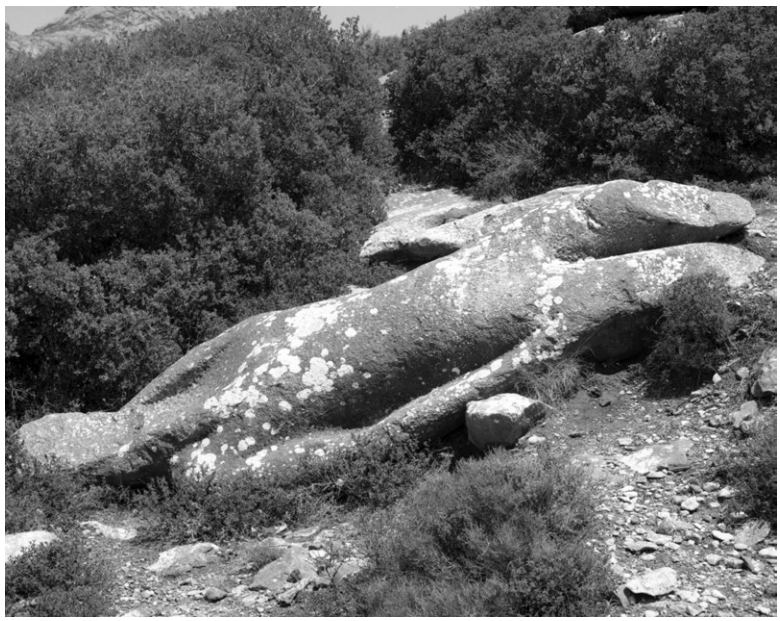
[44] Parts of the right leg and, later on, of the feet with the integrate plinth were found in the 1990s by M. Korres. See Lambrinoudakis 1991: 94, figs. 143-144; Lambrinoudakis *et al.* 2010: 11-12, figs. 23-24 (where it is evident that their carving was less advanced in relation to the torso) and 13 (for deviation from symmetry, obviously manifesting latent movement). More recently, see Korres 2021: 317, 328, 333.

[45] Nolte 2006: pls. 36-37.

[46] Nolte 2006: K 41, pl. 23a-b.

[47] Nolte 2006: figs. 50-52, pls. 31-33.

[48] More recently Korres 2021: 326-327, 6α, 6γ, fig. 8; Nolte 2006: K 37, pl. 21a.



13

14

15

16

Plate 4, Figure 13: Unfinished colossal kouros *in situ* at Pharangi, Naxos. Front view (D-DAI-ATH-1990/1407, photo by Elmar Gehnen). Figure 14: Unfinished colossus *in situ* at Phlerio, Naxos. Front view (after Zapheiropoulou 1988: 22. Photo editing by V. Schiza). Figure 15: Unfinished colossal Dionysus *in situ* at the Apollonas quarries, Naxos. Front view (after Zapheiropoulou 1988: 24. Photo editing by V. Schiza). Figure 16: Unfinished kore inv. ΣΤΑ 1051, Archaeological Museum of Polygyros (© Hellenic Ministry of Culture, Ephorate of Antiquities of Chalcidice and Mount Athos - Hellenic Organisation of Cultural Resources Development, photo by Orestis Kourakis).

long chiton and himation, with sandals on the feet and his arms bent at the elbow, would have been holding in his hands a kantharos and probably a thyrsus, his typical attributes, which would have been of metal.[49] Although the work is not as advanced as on the previous statue, and the body forms lack any degree of curvature and plasticity, the main parts of the figure have already been determined and are easily recognisable: facial features, outline of short hair, garment, footwear etc. A particularly interesting piece of evidence is the incision that outlines the god's closed right hand, even more so as it is a double incision. This evidence confirms that figures were sketched by incision before the carving process commenced.[50]

An additional very important piece of evidence that the statue of Dionysus offers us is that on the preserved original side of its extraction trench the rough outline of the figure is recognisable. More precisely, with an aerial photo of the statue[51] it is obvious that the extraction trench follows a sketchy outline of the head, as well as of the left shoulder and arm. This demonstrates that the figure was first drawn on the flattened rock surface and subsequently quarrying work began for extracting only the absolutely necessary volume of marble for carving out the statue. We may assume therefore, that the extraction trenches were not always rectilinear in outline, producing rectangular stone blocks, as it was generally thought until now, but most probably they followed more or less precisely the outlines of the figures that were to be carved. This practice is also encountered on the unfinished columns that have been abandoned *in situ* in the quarries of Melanes.[52] The approach was dictated mainly by the need of sparing raw material and labour input, something that was even more essential for works of colossal dimensions. A similar attitude is evoked by the more advanced stage of work given to the lateral sides in relation to the main two faces, as observed on the two very roughly worked kouroi in the quarries of Melanes, K 21 and K 17 (**Plate 3, Figs. 3, 6-8**), as has already been mentioned.

These observations about the determination of the proportions and basic forms of the statues in the quarries, as well as the very advanced stage of work – almost just before the final smoothing – on some abandoned in the quarries,[53] where the structure and style are already determined, along with the *latent movement,* all attest that the sculptors themselves with their teams must have been working in the quarries and must have set up their workshops, even if of a temporary character, nearby.[54] Particularly revealing, in the same context, is the fact that these observations hold true not only for *colossi* but also for small-sized unfinished statues that were found at an advanced stage of work in the quarries, such as kouros K 24 (**Plate 3, Figure 10**) at Melanes and kouroi K 37 (**Plate 3, Figure 11**) and K 64a from the quarries at Apollonas.[55]

Nevertheless, one cannot overlook the fact that two more unfinished Naxian sculptures were recovered in the capital of the island, far away from the quarries. One of them, a small part of the upper torso along with the wings of a sphinx (K 88, **Plate 5, Figure 19**), is a random find that perhaps had been transported to the capital of the island in later times. The other one, though, the lower part of a 'relief' kouros (K 50, **Plate 3, Figure 12**), was uncovered in the excavation of Grotta in the city of Naxos and must have been transported to the location where it was to be erected – a necropolis near Grotta of Naxos, but in an unfinished state for the final carving to be carried out on site. It is thus demonstrated by the Naxian sculptures, too, that in the last stage of work the sculptors often accompanied their works to the place of their destination, where the finishing treatment took place and where the sculptures would have been set up under the supervision of the head-sculptor, the one responsible for the creation of the work. On the other hand, from the area of Melanes also come two lion-head waterspouts in their final form (K 89,[56] K 90[57]). These lion-head waterspouts are dated to the end of the sixth century BC and they either were ready for exportation or belonged to the roof of some local monumental temple, which has not yet been located, in the area of Melanes.

At least four architectural members, in different stages of workmanship, have been located in the quarries of Melanes, namely, a lintel of huge dimensions, known as 'trunk or chest of the queen',[58] a very large stone block,

[49] Nolte 2006 (K 18) holds the view that the unworked mass of marble, which appears exactly under the right forearm of the figure, at a later stage of carving would have been turned into some divine attribute – something difficult to accept, given its position exactly under and parallel to the forearm. It seems more probable that this chunk of marble would have been carved into a bundle of drapery folds under the hand. For an analytical description, typological comparison and documentation of its dating to the end of the Archaic period, see K 60.

[50] For this detail see Kokkorou-Alewras 1995: pl. 31. Cf. Nolte 2006: K 37, pl. 21a; Peschlow-Bindokat 1981: 187, 190 figs. 48-49 (column drums of the Classical period).

[51] Kokkorou-Alevras *et al*. 2010: 43 (fig.).

[52] Kokkorou-Alevras 1992: 112; Kokkorou-Alevras *et al*. 2010: 24; Nolte 2006: 197, pl. 87c. Cf. Peschlow-Bindokat 1981: 187, 190, figs. 48-49 (column drums).

[53] Cf. Papageorgakis 1964: 277; Peschlow-Bindokat 1981: 188.

[54] D'Onofrio 2008: 242-244; Hochscheid 2015: 121-122, 206-209; Kokkorou-Alevras 1992: 125; Kokkorou-Alewras 1995: 45-46; Nolte 2006: 215-222, 296-297; Cf. Schilardi 2000: 169-170.

[55] The unfinished kouros from Polygyros of Chalcidice and the ram-bearer of Thasos (Nolte 2006: K 13 and K 16) were unfortunately not discovered *in situ* and, therefore, they cannot shed light on the topic, while the unfinished marble sculptures in the quarries of Penteli were abandoned at a very early stage of carving: Carpenter 1968: 279-280; Korres 1994: 88-89, drawings 17 and 18; Nolte 2006: K 27, K 29 pl. 17c-d; Wiseman 1968: 75-76.

[56] Nolte 2006: figs. 91-93.

[57] Nolte 2006: figs. 94-95.

[58] Kokkorou-Alevras 1992: 109-110, fig. 5. Lambrinoudakis 2005: 8 fig. 10.

Plate 5, Figure 17: Unfinished crouching lion-statue from Pentelicon (D-DAI-ATH-Athen Varia-1290, photo by José Dörig). Figure 18: Unfinished lion-statue, from Vathy, Samos (after Freyer-Schauenburg 1974: no. 82, pl. 69: D-DAI-ATH-Samos-1087. Photo by Hermann Wagner). Figure 19: Unfinished sphinx-torso inv. 6529, Naxos Archaeological Museum. Left-side view (D-DAI-ATH-77/625, photo by Gösta Hellner). Figure 20: Part of a building above the inscription Ὅρος ἱεροῦ Ἀπόλλωνος, Apollonas quarries, Naxos. (Author's photo archive.)

two unfinished columns, whose extraction had begun vertically, in an upright position, and a basin.[59]

A large number of monumental columns abandoned at various stages of work are reported in the quarries of southeastern Euboea (at Karystos, Styra and Marmari). In the Roman times, they demonstrate a very different way of quarrying, i.e., worked horizontally, 'lying down', surely because of the huge (massive) dimensions of the columns.[60]

In addition, unfinished perirrhanteria, basins, and other uncompleted objects have been found in the quarries at Platyvouni (Sochas) of Taygetos,[61] at Koukounaries of Paros,[62] in the sanctuary of Piges at Melanes of Naxos,[63] in the quarries of southeastern Euboea in the area of ancient Karystia.[64]

Quarrying and carving stages of sculptures

The systematic and thorough examination of the ten unfinished sculptures that lie until now or were found in the Naxian marble quarries have been instructively compared with Archaic unfinished sculptures from

[59] Kokkorou-Alevras 1992: 112, figs. 8 and 9. Cf. Nolte 2006: pl. 87c.
[60] For the quarrying process of columns at the Karystia quarries; Papageorgakis 1964: 266-269, 276 figs. 3, 16; Chidiroglou 2012: 268-270 (Karystia, Roman period). For the quarries of Miletus, Classical period: Peschlow-Bindokat 1981: 187-193.
[61] Kokkorou-Alevras *et al.* 2006: 118, 132 fig. 17.
[62] Schilardi 1982: 265, pl. 160.
[63] Lambrinoudakis 2005: 85, pl. 14a-b, e; Lambrinoudakis *et al.* 2010: 15, fig. 36a-b.
[64] Papageorgakis 1964: 70; Chidiroglou 2012: 268-271, pl. II 147, 148b.

other quarries. The following successive stages of quarrying and carving can be reconstructed as concerns kouroi, korai, lions, sphinxes, but also architectural parts and artefacts.

- The first *(a) stage, 'extraction of stone block – figure's contour sketching*', comprises first the choice of a suitable stone face without obvious serious flaws to bedevil the carving process, and second the flattening of its surface. There follows the determination of the dimensions of the stone block to be extracted by incising or drawing with colour a rough contour[65] of the figure's front and then of its lateral side. In doing this, extra is added on for the extraction process, making the profile bigger than the final desired length, width and thickness/depth of the piece. In particular, drawing the profile of a figure's lateral side even at this stage of work, at least in the Archaic times, was of great importance. By and in doing this, thought and care were taken to roughly define the thickness/depth of the figure's parts – head and hair, buttocks, feet, arms and their position (bent, brought to the chest etc.) along with any potential complementary attributes and such depending on the type of the figure. The contour of the figure so created on at least two – the front and a lateral – faces of the stone would have constituted the draft first for the definition by the quarrymen of the width of its extraction trench from the parent rock and second for the carving of the figure by the head-sculptor – who would have taken on the commission and would have been responsible for the final outcome – and his assistants, probably apprentice sculptors. The more or less precise determination of the figure's proportions was necessary for removing quickly and without particular caution the surplus volume of stone, so as not to waste valuable work time.[66] The relevant process for a column, a basin or some other artefact would have been comparable. Consequently, already from the first stage of work the presence of the stone carvers and indeed of the head-sculptor was crucial, as much for inspecting the suitability of the material[67] as for the determination of the dimensions and proportions of the figure. Different sizes of the block were required for a compressed, 'short and stocky' figure as opposed to an elongated, 'tall and slender' one**;** therefore, an overall mental perception of the figure, including the incision of its contour, was important already from the start.
- In the next *(b) stage, 'first phase of carving*', trained stone masons / stone craftsmen / sculptors/ stone carvers undertook the roughing out of the work. Now, the basic forms of the sculptures were shaped with greater precision: the head with hair, torso, legs, hands, while lumps of stone were left protruding, on which the genitals for example or other additional forms such as complementary attributes – flowers, birds, smaller or bigger animals, various objects – would have been later rendered in detail;[68] moreover, the facial features were not yet carved, not even sketched by incision. All these are demonstrated by the unfinished Archaic Naxian statues K 17 and K 21, which were abandoned at a very early stage of carving and show no facial features but did have more advanced carving of the lateral sides, as opposed to the two main ones – front and back. The same is true with the unfinished kouroi of Penteli (**Plate 3, Figure 4**) and Stageira in Chalcidice (**Plate 3, Figures 5, 9**) which have been left at the same stage of carving.[69] In any case, at this stage, too, the presence of an experienced sculptor and his assistants was needed for the performance of work on site as *inter alia* the light bending of the arms to be seen in all these kouroi manifests.
- In the following *stage c,* '*completion of carving*', the personal participation of the head-sculptor was even more necessary. Indeed, it was in this stage that plasticity of forms and the anatomical details were modelled with greater precision, such as facial features, garments and ornamental elements. Nevertheless, on the monumental kouros K 23 (**Plate 4, Figure 14**), left in the quarry at a very advanced stage of carving, just a little before the final treatment and smoothing, the facial features have still not yet been designed, something that indicates that the carving of sculptures did not proceed with absolute uniformity. To offer a glimpse into the

[65] See above, footnote 30. Cf. Korres 2021: 330-333, fig. 12a with excellent sketches and significant comments in which the priority of the front and the rear sides of the sculpture at the beginning of carving (fig. 12a, stage 1-4) is proposed. In my opinion, the carving of the back (Korres 2021: fig. 12a, stage 4-5) should follow his stages 5-6 (carving of the lateral sides), especially in the case of colossal sculptures. For the necessity and significance of contour sketching on the stone before quarrying, see Blümel 1941: 10. Generally on blocks extraction see Koželj 1988b: 31-39.

[66] That the ancient sculptors attached great importance to the saving of time and 'labour input' is attested by many Archaic statues. The rear side of some was eventually meant not to be seen, because they were going to be erected for instance in front of a wall, so, that side was left sometimes unfinished, and sometimes without the final finishing treatment: either way it lacked details depicted on the front side. Cf. footnote 44.

[67] A similar practice was applied in more recent times: Nolte 2006: 208-209.

[68] Cf. Korres 2021: fig. 12a, 5-6. On the carving of the sculptures up to a very advanced stage in the quarries, see Korres 2021: 328.

[69] Nolte 2006: K 2, K 13. The more elaborate lateral side of the unfinished sphinx at the sanctuary of Piges, in Melanes of Naxos, which was published recently, is in fact the main one of the monster: Lambrinoudakis 2021: 375-378, fig. 1α-ζ.

advance of *chaîne opératoire* in the course of time, let us note that, from the Hellenistic period on, the sculptor proceeded from the often-completed front side to the lateral ones or the rear, rather than working all around the statue simultaneously.

- In *stage d,* '*smoothing*', the final smoothing and polishing was carried out by the sculptors possibly in the vicinity of the location where the statues were going to be erected, and probably by the auxiliary staff.
- Finally, in *stage e, 'painting – addition of attributes*', the painting and attachment of any attributes made of different materials took place.[70]

Installations / workshops in the Naxian quarries

The above evidence constitutes irrefutable evidence that the sculptors and their teams worked for considerable periods of time at the quarries[71] and, therefore, they must have had their workshops established there, even if in temporary sheds. The probably temporary nature of the sculpture workshops may be surmised from the likelihood that more than one team of stone workers worked successively or simultaneously in the quarries. Their aim was to economise on the work effort and reduce the weight of sculptures when transported. By working on site, the teams avoided the fruitless, time-consuming, and costly transportation of a raw block of stone to some other location for its carving. Furthermore, it minimised the risk of having to discard the same block because it had got worn or accidentally cracked or broken in transit. The work of the carving itself quite evidently started in the open air, on the spot where the suitable rock was to be retrieved.[72] Of all the other necessary workshop installations in or near the ancient quarries, as briefly presented in the introduction – stone lifting/moving machines, small metalsmith's workshops for repairing, sharpening and whetting tools and water basins for quenching the same tools, transport roads, guard posts, small quays and ramps ('slipways') for loading the stones on ships at the coastal quarries, dwellings of quarrymen, sanctuaries and finally cemeteries – only two sanctuaries have been identified in the Naxian quarries. One of them is assumed, for good reasons, to lie at a location high above the quarries of the area at Apollonas (Koronis/Komiaki): it is known from the preserved on the rock inscription of the Classical period *Ὅρος χωρίου ἱεροῦ Ἀπόλλωνος*.[73] This inscription makes it most probable that the quarries were the property of an Apollo sanctuary. The remains of a rectangular edifice on a terrace above the rock with the inscription might have been the simple cult space of the god (**Plate 5, Figure 20**).[74] The other one, known as 'Sanctuary of Piges', was excavated fairly recently in the area of the Melanes quarries.[75] This is a group of sacred *oikoi* and small 'auxiliary' rooms at a short distance, which have been identified by the site's excavator Lambrinoudakis as a sanctuary of the quarrymen. In this extended place of worship at least three building phases are to be distinguished and certain related *oikoi*, structures for the cult of a female chthonic deity and the twin giants Otos and Ephialtes, according to epigraphic evidence found in the area.[76] Of particular interest are the numerous unfinished sculptures, often of small dimensions and of various types and uses, at first believed to be votive offerings of the quarrymen at the sanctuary.[77] However, these offerings were found scattered across the place either as building material in second use or in destruction levels, in any case not in their original position,[78] and they included sphinxes, vases, basins, a lamp etc. Furthermore, it is very rare that unfinished statues and artefacts have been found in quarry sanctuaries, not to speak of typical sanctuaries: examples include the unfinished herm with a ram's head in a niche in the quarry of Avlemonas at Kythera[79] or a few roughly carved basins and perirrhanteria in a number of others. They could nonetheless have been used in the context of occasional local acts of worship.[80] It is therefore quite likely that here we are not dealing with the dedication of unfinished and actually rejected or broken sculptures to the deities, something that would anyway appear to be rather an odd thing to do. Perhaps these unfinished and displaced statuettes and artefacts[81] may have been waste, discards from workshop spaces where small-sized sculptures were carved. The larger-sized ones, as already presented, remained outdoors in the quarries.

[70] Korres 2021: 336, fig. 12b with comments. Cf. the four (4) stages into which the process of carving is summarised by Nolte 2006: 139. See also Palagia 2006: 243-279; Poupaki 2011b: 180-182 with analytical bibliography.

[71] Cf. Papageorgakis 1964: 277. Recently Korres 2021: 328.

[72] Kokkorou-Alevras 1992: 125; Kokkorou-Alewras 1995: 45-46; Schilardi 2000: 169-170. Cf. Boardman 2006: 22-24, who assumes that 'Blocking out part of the figure in the quarry, probably under the supervision of the sculptor, would also require rough measurement for width of shoulders and waist, height of head, placing of hips' though 'it is difficult to imagine at what, if any, stage there was a worked flat surface which might have taken any detailed drawing or grid' on the blocks in the quarries. More extensive discussion of the topic, including that of the Classical-Hellenistic times in Nolte 2006: 215-222, 242-243, 296-297, who accepts the carving of the sculptures in temporary open-air installations at the quarries, but also in buildings of no specific typology in the cities or the places where the works were to be erected, as was the case in later times. For a sculpture workshop of the Hellenistic period on Paros, see Detoratou 2013: 59-64.

[73] Kokkorou-Alevras *et al.* 2013: 116, figs. 12-15. For a different view see Lambrinoudakis 2013: 104-105.

[74] Kokkorou-Alevras *et al.* 2013: 116, fig. 16.

[75] See Lambrinoudakis 2005: 81-85; Lambrinoudakis *et al*. 2010: 14-15.

[76] *IG* XII, 5,56; Kokkorou-Alevras 1992: 25 no. 83; Lambrinoudakis 1980: 262; Lambrinoudakis 2005: 84.

[77] Lambrinoudakis 2005: 85, pl. 14B, E.

[78] I warmly thank Dr A. Sfyroera for the relevant information.

[79] Kokkorou-Alevras *et al*. 2009b: colour pl. I. 11, fig. 6.

[80] Kokkorou-Alevras *et al*. 2009b: 180, colour pl. I. 11, fig. 7; Kokkorou-Alevras *et al*. 2019: 128, figs. 11-12.

[81] I warmly thank Dr A. Sfyroera for the relevant information.

Taking this for granted, then the series of auxiliary rooms uncovered in the south part of the sanctuary that according to the excavator were used either for daily activities, for the accommodation of the staff or for the preparation of sacred meals,[82] could constitute the workshop premises for the carving and storing of the small-sized sculptural works, whose failures were found scattered in the sanctuary area in secondary use.[83]

As regards the dwelling-places of those working in the quarries of Naxos, it has been suggested that some buildings in the Naxian quarrying area of Apollonas, as well as in other ancient quarries, served that purpose.[84] These are smaller or bigger rectangular constructions, which have not been systematically excavated and, as a result, it is not possible to securely identify whether they include living quarters. No burials have been mentioned at the Naxian quarries, although they occur relatively often in other quarrying areas, documenting the fatiguing and dangerous work of unskilled and skilled workmen alike, some of whom were not able to cope with the exceptionally harsh work conditions.[85] Finally, still visible today are the remains of a quay constructed of marble blocks from the adjacent quarry, in the harbour of Apollonas.[86]

Installations in other ancient quarries

In conclusion, on the basis of the up-to-date available evidence yielded from the constructions and installations we come across in ancient quarries, frequently encountered elsewhere are the vital transport routes with retaining holes (*οπές ανάσχεσης*) at various spots to control the speed of the descent: such have not been located as yet with certainty in the Naxian quarries.[87] Also common elsewhere are sanctuaries set up in room-like spaces that were formed from the extraction and removal of quarried blocks, as at Avlemonas of Kythera, at Asopos (modern Plytra), in the quarries of Hymettus etc.[88] We also often encounter simple, small and roughly-shaped cult spaces and representations – mainly niches or reliefs carved in the rock.[89] Far fewer are the built sanctuaries, usually simple *oikoi*, such as those that have been preserved on Naxos and the southeastern Euboea.[90]

The secure identification of simple buildings used as dwellings for the workmen is uncommon, though it has been suggested for the remains of some edifices in the quarrying area of Apollonas (Koronis/Komiaki) on Naxos,[91] as well as in other ancient quarries of much later date in the Greek territory, e.g. the 'Dragon Houses' of southeastern Euboea, referred to in the introduction.[92] In contrast, burials in various quarrying spots are numerous enough.[93] Finally, quays and ramps (slipways) for transporting sculptures and stone-blocks by sea such as the remains of an ancient quay at Apollonas of Naxos, albeit of indefinable date of construction, are not seldom.[94]

Very few, too, are the blacksmith's installations known for the making or repairing of tools: such have been located only in a small number of quarries of the Roman period. One very interesting installation of this kind was uncovered in a quarry in southeastern Euboea, in the area of Animborio, which was published by Ioannis Papageorgakis in 1964, but it is not widely known.[95] This is a metalsmith's workshop: a built room in which a built square hearth is preserved for heating and subsequently working the tools on site, something necessary since they were blunted from intensive daily use. Along with them, there were found two fragments of a water basin that was needed for the immersion and cooling of the hammered tools. Arguably similar was the re-use of a monumental unfinished vase of cipollino in the quarries of Myloi in southeastern Euboea, which was recently presented in detail, although certainty is not possible here.[96] Basins of the same kind have been found in many ancient quarries together with unfinished vases and utensils of other categories alongside statues and architectural members. These are simply abandoned on site, outdoors, without any building remains or other traces of a construction in their vicinity to indicate the occurrence of closed workshop spaces in which the carving of sculptures was probably undertaken.[97]

[82] Lambrinoudakis 2005: 83; Lambrinoudakis *et al.* 2010: 8, figs. 12-13.
[83] Cf. the sculpture workshop at Paroikia of Paros (Detoratou 2013: 59-64) and in Athens (Hochscheid 2015: 197-206).
[84] Kokkorou-Alevras *et al.* 2013: 118, fig. 17 (measuring 8.10 x 5.40m); Philaniotou 1988: 496-497, fig. 302b. See also above, footnote 5. Ancient sources record the accommodation not only of the quarrymen but also of their families at the quarries over a very long time: Dworakovska 1975: 50.
[85] See footnote 7.
[86] Kokkorou-Alevras *et al.* 2013: 119-120. For ship-loading ramps (slipways): Kokkorou-Alevras *et al.* 2009b: 182, fig. 7; Kokkorou-Alevras *et al.* 2019: 120, fig. 2; also see above, footnote 4.
[87] See footnote 5. See also Korres 2021 for the Melanes quarries. Retaining holes (οπές ανάσχεσης) are big, usually square holes, in which poles/pegs were inserted. Ropes were attached to them and to the block. In this way, the speed of descent from the quarries of the quarried stones or unfinished sculptural works could be controlled.
[88] At Avlemonas of Kythera (Kokkorou-Alevras *et al.* 2009b: 179-180, fig. 5, pl. I,9); at Plytra, ancient Asopos (Kokkorou-Alevras *et al.* 2009a: [of Roman times] 171-173, fig. 17.4-17.6.5); on Hymettus (Kokkorou-Alevras *et al.* 2019: 128, figs. 11-12). See also footnote 6.
[89] See footnote 6.
[90] For built sanctuaries at quarries, see Kokkorou-Alevras *et al.* 2013: 116, fig. 16 (quarry at Apollonas of Naxos); Lambrinoudakis 2005 (at Melanes of Naxos).
[91] See footnote 85.
[92] See footnote 5.
[93] See footnote 7.
[94] See footnote 87.
[95] Papageorgakis 1964: 270.
[96] Poupaki and Chidiroglou 2017: 444-448, no. 21, 451-452 (catalogue of other vases in cippolino).
[97] For unfinished vessels, see for example, quarries of Platyvouni: Kokkorou-Alevras *et al.* 2006: 118, 132, fig. 17. Quarries of Melanes and Apollonas of Naxos: Kokkorou-Alevras 1992: 112. Cf. the

Taken all in all, the systematic exploration of the ancient quarries remains a desideratum of research, as only thus is there a chance to locate the installations and workshops required to meet the full range of needs of the operations on site.

Acknowledgements

I would like to thank warmly Dr E. Partida and Dr C. Graml for inviting me to participate in this volume, as well as Dr K. Manteli and Dr D. Evely for the translation of my Greek text and its polishing into English, respectively. Further, I would like to express my thanks for their invaluable help in supplying me with information and photos to Dr T. Koželj and Dr M. Wurch-Koželj, the archaeologists D. Aktseli of the Ephorate of Antiquities of Chalcidice and Mount Athos, D. Moullou and M. Gialleli of the Ephorate of East Attica, and finally to the archaeologists Dr G. Doulfis and V. Schiza for the editing of photos.

Credits

The rights to the depicted monuments inv. ΜΠ 301 and ΣΤΑ 1051 belong to the Greek State and the Hellenic Ministry of Culture. The monuments are under the jurisdiction of the Ephorate of Antiquities of Chalcidice and Mount Athos. © Ephorate of Antiquities of Chalcidice and Mount Athos, Hellenic Ministry of Culture – Hellenic Organisation of Cultural Resources Development.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

sanctuary of Piges at Melanes on Naxos: Lambrinoudakis 2005: 83-84; Lambrinoudakis *et al.* 2010: 8-9, figs. 11-13. Further, Asopos (of Plytra): Kokkorou-Alevras *et al.* 2009a: 171-173, figs. 17.4-17.6. Quarries of Karystos: Chidiroglou 2012: 268-269, 271. Poupaki and Chidiroglou 2017: 444-448 and no. 21.

Chapter 9

New evidence about the exploitation of Nisyrian millstone lava and its use in Nisyrian workshops in antiquity

Eirene A. Poupaki

Abstract

The results of the geochemical methods applied to samples of Classical and Hellenistic 'Olynthian' querns (hopper-rubbers) from the excavation of the University of Athens at Kardamaina (ancient Halasarna, Cos) by the Geological Department of the University of Athens proved that the rock they were made of was extracted from Argos (Nisyros). These artefacts are considered to be the high-quality products of a local Nisyrian workshop, subsequently exported to Halasarna, in a close distance to the south. According to Strabo (*Geographica* 10.488-489), Nisyros provided its neighbours with rock suitable for mills. Other types of mills had also been manufactured in Nisyrian volcanic stone, apart from 'Olynthian' mills, such as the 'Delian' mills or rotary querns, as well as beds of oil-presses, big mortars etc. The above-mentioned evidence sheds light on the – until recently – unknown issue: the existence of a Nisyrian stone-carving workshop, where humble implements for everyday use were manufactured in antiquity. In the present paper, new data about the ancient quarries of that rock will be presented, as well as the archaeological remains detected at various sites of the island, which attest to the existence of a local workshop specialised in the carving of mills and similar industrial implements. The dating and the documentation of the historic circumstances of its activity will also be attempted.

Περίληψη

Τα αποτελέσματα των γεωχημικών αναλύσεων σε δείγματα από 'ολυνθιακούς' χειρόμυλους κλασικών και ελληνιστικών χρόνων της πανεπιστημιακής ανασκαφής της Καρδάμαινας (αρχαίας Αλάσαρνας) της Κω, που πραγματοποιήθηκαν από το Τμήμα Γεωλογίας του Πανεπιστημίου Αθηνών, απέδειξαν ότι ο λίθος κατασκευής τους προέρχεται από το Άργος Νισύρου. Αυτά τα τέχνεργα θεωρούνται προϊόντα υψηλής ποιότητας του εργαστηρίου της Νισύρου, που εξάγονταν στην γειτονική Αλάσαρνα. Σύμφωνα με τον Στράβωνα (*Γεωγραφικά* Χ 488-89), στη Νίσυρο οι γειτονικές περιοχές έβρισκαν τον κατάλληλο ηφαιστειακό λίθο για μύλους. Στον ίδιο ηφαιστειακό λίθο της Νισύρου λαξεύονταν εκτός από τους 'ολυνθιακούς' και άλλα είδη μύλων, όπως οι 'δηλιακοί' και οι περιστροφικοί χειρόμυλοι, αλλά και βάσεις ελαιοπιεστηρίων, όλμοι κλπ. Αυτά τα στοιχεία φώτισαν ένα άγνωστο – έως πρόσφατα – θέμα: την ύπαρξη ενός νισυριακού εργαστήριου λιθοξοΐας, όπου ταπεινά σκεύη για καθημερινή χρήση κατασκευάζονταν κατά την αρχαιότητα. Στην παρούσα εργασία παρουσιάζονται νέα στοιχεία για τα αρχαία λατομεία εξόρυξης του λίθου αυτού, καθώς και τα αρχαιολογικά κατάλοιπα που εντοπίστηκαν σε διάφορες θέσεις του νησιού και μαρτυρούν την λειτουργία ενός τοπικού εργαστηρίου λιθοξοΐας μύλων και ομοειδών εργαστηριακών τέχνεργων. Θα επιχειρηθεί χρονολόγηση και τεκμηρίωση του ιστορικού πλαισίου λειτουργίας του εν λόγω εργαστηρίου.

Keywords: 'Olynthian' mill; 'Delian' mill; rotary quern; volcanic lava; Nisyros

Introduction

Nisyros (**Figure 1**), one of the islands of the Dodecanese complex, is situated between Cos and Telos. Nisyros and Cos constitute the easternmost part of the South Aegean Volcanic Arc. Nisyros is dominated by volcanic rocks and the island is famous for the wide caldera of its volcano. The geological substructure of the island had been created by the eruptive products of the volcano and it is composed of various rocks (andesite, rhyolite, rhyodacitic lavas etc.).

The wide variety of hard and resistant rocks of the island had been remarked on since antiquity. Strabo states that Nisyros is round and high and rocky, endowed with millstone; its neighbours sought here rocks suitable for querns.[1] According to Michalis Skandalidis, the name of the island may have derived from the Sumerian word *naesiur*, which means millstone.[2]

Within the scope of this paper, our aim is to present our thoughts concerning the occurrence on Nisyros of specialised workshops for mills, which exploited the local volcanic rock and were active for many centuries. Their products, the Nisyrian querns, were renowned in antiquity, as suggested by other ancient sources, too.

[1] Strabo, *Geographica* 10.488-489: 'Νίσυρος δέ...ἐστὶ...στρογγυλὴ δὲ καὶ ὑψηλὴ καὶ πετρώδης τοῦ μυλίου λίθου. τοῖς γοῦν ἀστυγείτοσιν ἐκεῖθεν ἔστιν ἡ τῶν μύλων εὐπορία.'

[2] Skandalidis 2015: 24.

For instance, the epigram of Antipatros, dated in the late Hellenistic period, reads 'heavy concave millstones of Nisyrians'.[3] Another text by an anonymous author mentions the weight of Nisyrian rock.[4] Our paper is based on the case-study of finds from the Kardamaina excavation on the neighbouring Cos Island, as well as the field surveys conducted on Nisyros during the past years.

Provenance studies of querns from Halasarna

The aforementioned information was the steppingstone for our research, which goes back to the 1990s and was initiated by the provenance study of the rock used for the numerous hand-mills, which came to light during the excavation at Kardamaina of Cos (ancient Halasarna) by the University of Athens. All these querns, dating from the prehistoric to the Byzantine period, were products of specific workshops active in various periods, which based their production upon the exploitation of certain types of local rocks. In particular, these hand-mills, dated in the Late-Classical/ Hellenistic and the Late-Roman/Early Byzantine period, were generally carved in two different rocks: in black or dark grey vesicular lava and in reddish or greyish well-consolidated volcanic rock. A survey in the countryside of Cos revealed outcrops of rock similar to those used for the querns of Halasarna, that is, the reddish or greyish rhyolite on the Kefalos peninsula, quarried from Peleketa and Kastelli.[5] The rhyolite of Cos was preferred mostly for rotary querns[6] and rarely for 'Olynthian' mills[7] recovered in the excavation of Halasarna.[8] The dark-gray porous volcanic stone of the hand-mills from Halasarna was traced on Nisyros. However, little was known until then about the use of Nisyrian lava for the manufacture of querns. So, an immense effort began for the location of the ancient quarries of the island, wherefrom that rock originated.

The exploitation of volcanic rocks from Nisyros and the neighbouring Gyali islet, since prehistoric times, is corroborated by the systematic archaeological research of Adamantios Sampson in that part of the Dodecanese.[9] Following his experience, we observed that even the prehistoric saddle-querns[10] and grinders[11] from Halasarna were carved from dacitic and rhyodacitic rocks of Nisyros and Gyali.[12] Later on, the occurrence of grinders in Cos made of volcanic material from Nisyros and Gyali[13] has been interpreted as a result of 'the participation of ancient Halasarna to the exchange networks of the Early Bronze Age'.[14]

The recent archaeometric methods[15] applied to samples of the archaeological material from Halasarna and possible extraction sites of Nisyros proved that these querns were carved in volcanic rock from the Argos region of Nisyros (**Figure 2**). Samples for the analyses were collected from an open-air quarry and the area where the underground quarry lies. Specifically, the results of the provenance studies proved that the Classical and Hellenistic 'Olynthian' querns[16] (hopper-rubbers) and the 'Delian' mill[17] (**Figure 2: A-C**), a

[3] *Anthologia Graeca* 9.418: 'Νισυρίων κοῖλα βάρη μυλάκων'.

[4] *Anthologia Graeca* 9.21: 'βάρος πέτρης Νισυρίτιδος'; Paton 1915.

[5] Poupaki 2001: 62-65; Poupaki and Chatziconstantinou 2001: 543-544.

[6] Rotary querns are round-shaped, and they are used for the grinding of cereals through the circular movement of the upper (ὄνος) on the lower quern (μύλη). The upper quern is pierced in the middle, in order to enable the spindle to pass through the stone and allow the upper stone to move smoothly. The upper stone is hollowed into a hopper around the hole, so that the cereals can be funneled into the space between the two querns. The lower millstone is fixed on a board (e.g. a table) beneath the querns, a structure which permits the steady rotation of the upper millstone. The spindle is held tight by a wooden frame fixed on the upper stone, while a wooden or metal handle is fixed on its circumference, through which the circular motion of the quern is achieved: Poupaki 2014-15: 20-21; Poupaki 2017: 84-86 (with bibliography).

[7] 'Olynthian mills', also known in bibliography as hopper-rubbers, are rectangular friction grain mills, with a movable upper part (ὄνος ἀλετῶν) and a fixed lower one (μύλη or τράπεζα). The upper stone part was hollowed out as a hopper, to receive and funnel the cereals onto the grinding surface of the lower mill, through a slot cut out at the bottom of the hopper. Grinding is performed by the back-and-forth movement of a rectangular grinder on the rectangular quern, by means of a long lever (κώπη) fixed on slots at each end of the upper millstone and held firmly in place by iron rods; finally, at one end of the upper millstone the lever was fitted over a pivot. The grinding surfaces may feature diagonal parallel striations, forming a herringbone pattern, or alternating series of diagonal and horizontal striations. Chronologically, they may be placed approximately in the Classical to Hellenistic period, but in some cases their use may date as late as in the Roman period: Poupaki 2014-15: 17-19; Poupaki 2017: 81-82 (with bibliography).

[8] Poupaki 2011a: nos 32-33 ('Olynthian' hand-mills), 39-58, 60-62, 89, 91, 93-96 (rotary querns); Poupaki 2017: nos 38-51, 56-64 (rotary querns).

[9] Sampson 1988.

[10] Saddle-querns were the simplest devices for hulling grain; they were long oval slabs of stone, on which the grains cracked open through the multi-directional movement of a grinder, usually a simple pebble, small enough to fit in one' s hand, or a similar slab with one flat side: Poupaki 2014-15: 13-15; Poupaki 2017: 79-80 (with bibliography).

[11] Poupaki 2011a: nos 70-71.

[12] Poupaki 2011a: nos 25-28.

[13] Georgiadis 2012: 104.

[14] Georgiadis 2020: 33, footnote 98; Poupaki 2011a: 30, footnote 53; Sampson 2001.

[15] Several geochemical analyses on volcanic rocks of Cos and Nisyros, as well as on samples of hand-mills had been conducted. V. Kylikoglou, of the 'Democritos' National Centre for Scientific Research, applied Instrumental Neutron Activation Analysis (I.N.A.A.) on samples of querns, but the results were insufficient (V. Kylikoglou, in: Poupaki 2011a: 113-119). That is why, many years later Athanassios Katerinopoulos, Professor Emeritus of Petrology, and Konstantinos Mavrogonatos, Assistant Professor in the Department of Earth Sciences at Pisa University, applied different provenance-tracing archaeometric methods (Inductively Coupled Plasma-Mass Spectroscopy – *ICP-MS*, X-Ray Diffraction – *XRD* and Scanning Electron Microscopy- *SEM*), and managed to identify certain provenance sites: Katerinopoulos *et al.* 2016; Katerinopoulos *et al.* 2017.

[16] Poupaki 2011a: nos 30, 34, 35, 86; Poupaki 2017: nos 21-30.

[17] Poupaki 2017: nos 65-71. The 'Delian' mill is named after the place where the first related find was discovered, that is, the House of the Seals on Delos Island. This type of mill consisted of two cylinders, made of small plinths fastened together by metal joints. The inner cylinder was taller and it rotated, whereas the shorter one remained stable. Cereals were crushed through the rotation of the inner

Figure 1: Map of Nisyros island (<http://www.ika.ethz.ch/studium/weitere_arbeiten/Lab_FS13_WildiMelanie_TopoKarte-Nisyros_erh2013-04-21.pdf>, viewed 22 November 2023).

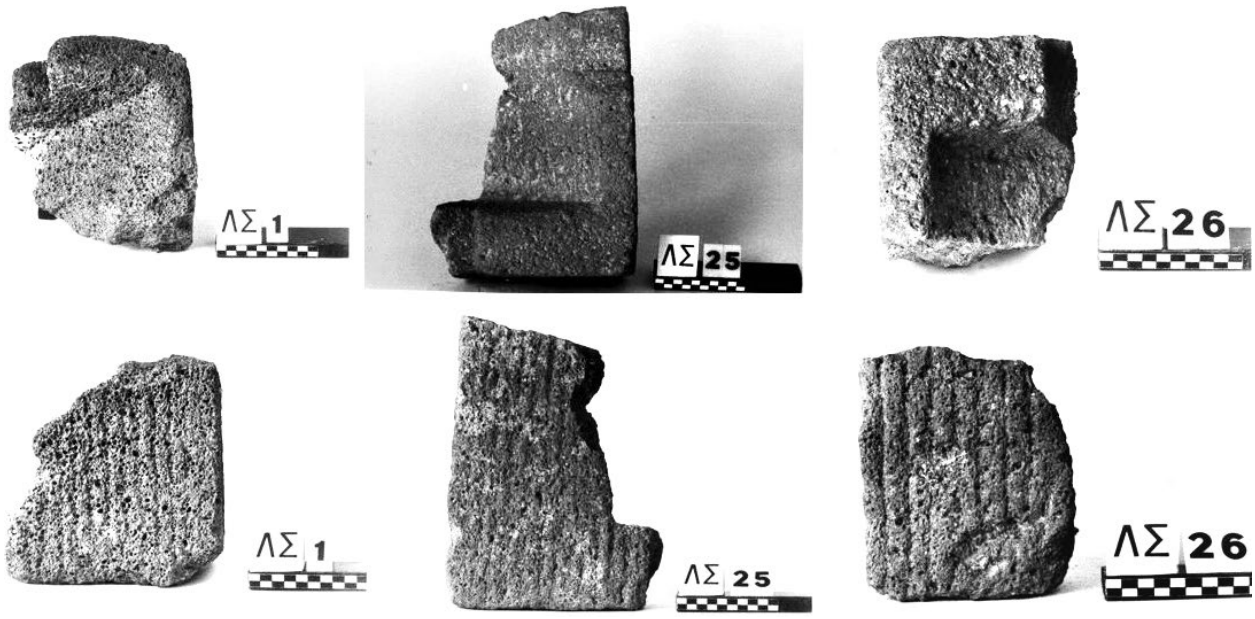


Figure 2: Fragments of 'Olynthian' handmills from Halasarna, carved in Nisyrian lava (photo by Nikos Antoniadis, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

significant number of Late Roman and Early Byzantine rotary querns,[18] as well as a few household implements (e.g. big mortars, *holmoi*)[19] from Halasarna were carved in Nisyrian lava. The applied methods showed that the Olynthian mills, in particular, were divided into two subgroups: one comprised the samples which were identical with the rock of Argos' area (open-air quarry) (**Figure 1: 1**), whereas the other comprised those which originated from Stavros' area (**Figure 1: 2**).[20]

Quite important is the fact that the archaeometric results from the Halasarna material confirm the existence of rotary querns carved in Nisyrian lava, mentioned in an anonymous author's epigram: 'νῦν δέ βάρος πέτρης Νισυρίτιδος ἔγκυκλον ἕλκω, λεπτύνων Δηοῦς παρπόν ἀπ' ἀσταχύων.'[21] The phrase 'ἔγκυκλον ἕλκω' (rotate) clearly means that a man rotated the quern.

Based on these data, the exportation of Nisyrian products to Halasarna, lying immediately opposite across the sea, is well-documented. In many scientific papers the Nisyrian hopper-rubbers are quoted as the cargo of stone-carrying boats, which travelled across the Mediterranean, such as those found at the Majorca and Mahdia shipwrecks.[22] Moreover, hand-mills carved in rocks identical to the Nisyrian lava have been recorded from various sites, such as Athens,[23] Cos[24] etc. Even though the exact location of the ancient quarries of rock appropriate for mills has been unknown, several scholars mention Nisyros as the place of origin of millstones of the Roman period.[25] The lack of adequate archaeometric research on samples from these archaeological finds leaves some doubts about the extent of the Nisyrian millstone trade. However, it seems plausible that the Nisyrian millstone industry was well-organised, at least during the Late Classical and Hellenistic periods, and for this reason the Nisyrian millstones gained supremacy in the Aegean trade.

Ancient quarries of Nisyros

The traditional occupation of the stone-carver is well-attested in Nisyros during the nineteenth century.[26] The volcanic rocks of the island had been an essential means for training local craftsmen, whereas additional volcanic products have been exploited until modern times. Pliny reports that the finest quality of pumice occurred on the island, the quarrying of which remains the main occupation for the island's inhabitants even nowadays.[27] Indeed, the quarry of pumice between Loutra (**Figure 1: 3**) and Paloi (**Figure 1: 4**) has been active until recently,[28] whereas many Nisyrians are workers at the pumice quarries of the Gyali islet.

cylinder, effectuated by a wooden ring, which encircled the inner cylinder and was removable, for the grinding surface to be cleaned: Poupaki 2017: 82-84 (with bibliography).

[18] Poupaki 2017: nos 31-37, 52-55.

[19] Poupaki 2011a: no. 15.

[20] Katerinopoulos *et al.* 2016: 271.

[21] *Anthologia Graeca* 9.21.

[22] Arribàs 1987; Baatz 1994; Williams-Thorpe and Thorpe 1991.

[23] Poupaki 2014-15: 19, no. 69.

[24] Poupaki 2020: 175, fig. 20.3.

[25] Runnels *et al.* 1995: 121-123; Williams-Thorpe 1988; Williams-Thorpe and Thorpe 1990; Williams-Thorpe *et al.* 1991.

[26] In Nikia, Marinos, the stone-carver ('ο λιθοξόος'), was famous for his sculptures ('τα πετροσκαλίσματά του'). Sakellaridis 1993: 203.

[27] Pliny, *Naturalis Historia* 36.42.1.

[28] The abandonment of the quarry was due to impurities: Dietrich 2018: 8.

Figure 3: Traditional stone-built cottage ('*spiladhi*'), Argos (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

Additionally, the use of sulfur, the basic product of the volcano, had been exploited and exported since the medieval period.[29] Its exploitation remained popular until the end of World War II; Alexandros Rallis' company[30] owned the sulfur factory on the way to Agia Eirene (**Figure 1: 5**), which is preserved until nowadays, albeit in a bad condition. On the road to Emporios (**Figure 1: 6**), at Mastichari, there is a modern quarry of hard, resilient stone, *sideropetra*, which was used for building activities, especially pavements. Temporary quarrying of the dark-grey consolidated rock had also taken place at the rocky coast of Agia Eirene (**Figure 1: 5**).

Ancient quarries of Nisyros are partly known. Although the remains of the significant ancient *polis* at the site of Mandraki (**Figure 1: 7**) with its acropolis located at Palaiokastro have been thoroughly investigated by the Ephorate of Antiquities over the past decades, yet, little is known about the local quarry of basaltic andesite, which provided material for Palaiokastro[31] or the quarry reported at Krios hill[32] above the modern port, where the wind-mill of Parthenis is situated.

Most appealing were the underground quarries of the island, which had been explored by scholars of the nineteenth and the twentieth century. Ludwig Ross was the first to visit the ancient tunnels/galleries of millstone quarries. He browsed through the ancient remains underneath Nikia (**Figure 1: 8**) and visited these quarries.[33] The information about the quarries was re-assessed at the beginning of the twentieth century by Richard Dawkins and Alan Wace,[34] who were aware of another quarry at Argos (or Stavros), other than the one visited by Ross. Indeed, Ross had disembarked at Argos, somewhere close to Stavros coasts[35] and visited Stavros at the southern border of caldera, where a monastery had been erected by the hospitallers in the fifteenth century.[36] However, the map included in Ross' *Reisen auf den griechischen Inseln*[37] indicates that the quarry actually visited was the one at Avlaki (**Figure 1: 9**). Following this information, George Bean and John Cook in the late 1950s mentioned 'a millstone quarry on the beach below Nikia',[38] without further specifying its location. The rarity of the subterranean quarries in Greece had been commented by Angelina Dworakowska, who mentioned among them a Nisyrian underground quarry in her monograph *Ancient quarries of Greece*,[39] published in 1975. In the early 1980s, Curtis Runnels visited the island and tried to explore the quarry mentioned by Ross at Avlaki, for the needs of his doctoral dissertation about millstones and the origins of their material.[40] He had visited a subterranean tunnel/gallery at Avlaki, which must have been a cave that was enlarged some day. He visited the main tunnel, *c.* 600m long, which was closed with a wooden door

[29] Logothetis 2017: 550. It is worth noting that the exploitation of sulfur is also mentioned by Ross (Giannidis 1987: 120).
[30] Logothetis 2017: 552.
[31] Charitos 2005: 327-328; Kokkorou-Alevras *et al.* 2014: no. 86 (with further bibliography).
[32] Kokkorou-Alevras *et al.* 2014: no. 88 (with further bibliography).
[33] Ross 1843: 79.
[34] Dawkins and Wace 1905: 170. Argos, where the ancient sanctuary of Poseidon Argeios is considered to be located (Filimonos 1993: 141), was inhabited also in the medieval period, wherefrom a fortified settlement is attested (Tsirpanlis 1990: 22-30). The site, known as Palisia, is identical to the site of the ancient acropolis of Argos (Giannidis 1987: 121; Koumentos 1994: 46; Ross 1843: 79), whose ancient members are visible in the masonry of the chapel of Timios Stavros. That chapel was built upon the medieval sanctuary of the thirteenth-fourteenth century, which had also been erected upon the ruins of an Early Byzantine basilica (Lazaridis 1953: 240).
[35] Giannidis 1987: 122; Ross 1843: 69.
[36] Immured in the monastery were spolia from the ancient acropolis of Argos, which is of the same date as the Palaiokastro: Koumentos 1994: 49.
[37] Ross 1843: 69.
[38] Bean and Cook 1957: 119.
[39] Dworakowska 1975: 65, 155.
[40] Runnels 1981.

Figure 4: Unfinished 'Olynthian' handmill, Argos (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

Figure 5: 'Olynthian' handmill, Argos (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

and described as narrow, 'opening into small, possibly artificial rooms'. He did not continue his exploration but he did notice that hopper-rubbers were built in and outside the cave.[41] All the above details enabled us to assume that there was more than one subterranean quarry, the one cited by Ross, Bean and Cook, and Runnels at Avlaki, and the other one mentioned by Dawkins and Wace at Argos. Recently, the Institute of Geology and Mineral Exploration (IGME)[42] undertook a geological survey on the island, and the underground quarry at Argos was examined thoroughly.[43] During that survey, several underground stoas are mentioned in Argos' area,[44] considered to have sheltered the local population and protected it from the pirates' raids.

[41] Runnels 1981: 92-93.

[42] <https://nisyros.gr/toyrismos/peripatitikos-fysiolatrikos/monopati-4-argos-agia-eirini/#&gid=psgal_1466_1&pid=17>, access date: 30 June 2011.

[43] Since 1995, several surveys had been conducted on the island by the author, to localise extraction sites of volcanic rocks suitable for mills. In 2013, a research team consisting of Athanassios Katerinopoulos, Konstantinos Mavrogonatos, and the author, explored the eastern and southern part of the island. Although the underground quarry of Argos had not been found by then, samples of vesicular lava had been collected, to continue with analyses of material. In 2018, the underground quarry at Argos was eventually found and partly investigated with the assistance of Georgios Valvis, archaeologist of the Ephorate of Palaeoanthropology and Spelaiology.

[44] Vougioukalakis and Theodosiou 2012: 28 (map Γ), 29.

Figure 6: Series of wedge-holes, Argos (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

Figure 7: Quarry-front and extracted blocks left *in situ*, Argos (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

Taking into account all the above, we conducted a survey in order to collect rock samples necessary for the archaeometric research and we revisited the underground quarries, to improve our understanding of stone-carving activities on the island during antiquity. First, the area stretching between the volcanic domes of Karaviotis (**Figure 1: 10**) and Trapezina (**Figure 1: 11**) was explored, in order to locate the underground

Figure 8: Pole-hole close to the quarry, Argos (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

of wedge-holes (**Figure 6**), fragments, and chips of the quarried volcanic stone (**Figure 7**), extracted blocks which remain *in situ* and a pole-hole for the retention of carried products with ropes (**Figure 8**). The existence of pressing beds carved in the same local stone proves the variety of agricultural or household implements, which were produced there. Unfortunately, we were not able to spot any of the subterranean tunnels recorded by IGME.

Some years later, another survey[47] in the area to the east yielded the discovery of an underground quarry in the vicinity of Rallis' deserted factory of sulfur on the road to Agia Eirene (**Figure 1: 12**). We cannot be sure if this was one of the quarries mentioned by IGME, but it is probably the tunnel/gallery mentioned by Wace and Dawkins.[48] The entrance to the tunnel is visible at the lowest part of a retaining-wall (**Figure 9**). It measures 1m in width and 2m in height, with the highest point of its ceiling at approximately 1m below the ground-level. The ceiling of the tunnel is semicircular, pointed (**Figure 10**), whereas the walls consist of black andesite rubble blocks and chips, which were also used for retaining-walls in the rural area. The underground tunnel is carved in soft pyroclastic rock (**Figure 11**) but its wide walls, built of rubble volcanic rocks, ensure the safety of the structure and prevent the ceiling from collapsing. The tunnel/gallery runs along a straight line but, after 10m, it bends slightly to the left and, after another 5m, it bends to the right. It leads

Figure 9: Entrance to the underground quarry close to Agia Eirene (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

stoas reported by IGME.[45] We came across an open-air quarry area among the traditional stone-built cottages ('*spiladhia*'), on sloping ground (**Figure 3**). Half-finished and finished 'Olynthian' mills (**Figures 4, 5**) are scattered all over the investigated area. Furthermore, the volcanic boulders of the site preserve clear traces of ancient quarrying, which can be dated between the fourth and the second century BC:[46] for instance, series

[45] See footnote 42.

[46] The dating of the following tool marks is based on comparison with these of the quarries of soft rocks of the Classical and the Hellenistic periods. For example, the series of the rectangular wedge-holes and the square pole-hole are reminiscent of those found at the Hellenistic quarry of Pyli on Cos Island (Poupaki and Chatziconstantinou 2002: fig. 6; Poupaki and Chatziconstantinou 2004: fig. 2), as well as of similar tool-marks detected at Rhodian quarries (e.g. Kallithea, Archangelos, Lindos, etc.), the quarries of Piraeus, Corinth (Kleonai and Examilia), Laconia (Viglafia), Kythera (Avlemonas and Feloti) and Crete (Falasarna, Stavros Akrotiriou and Almyrida Apokorona), all dated in the fourth century BC and the Hellenistic period (Kokkorou-Alevras *et al*. 2014: nos 150, 92, 94, 109, 760-939, 634, 627-629, 689, 238, 240, 420, 417, 402).

[47] For the information cited here, I would like to thank my colleague Georgios Valvis.

[48] Dawkins and Wace 1905: 170.

Figure 10: Tunnel/Gallery of underground quarry close to Agia Eirene (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

Figure 11: Soft pyroclastic rock inside the underground quarry (photo by the author, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

to a square chamber, where rubble material from the extraction seals the tunnel exit. Niches are opened into the walls, probably to enlarge the linear passage, in case two workers moving in opposite directions came across each other. The same niches were traced in the Avlaki underground tunnel/gallery and they are described by Runnels as 'small, possibly artificial rooms';[49] they may have served the same purpose.

The underground quarry at Avlaki had been visited by Ross, Bean and Cook, and Runnels, as mentioned above. Its entrance was incorporated in one of the collapsed buildings at the harbour of Avlaki, which is why it cannot be located any more. However, its existence is well-documented by the older inhabitants of the island, who had visited it.

The presented underground tunnels/ galleries are known to the locals, who claim that they were exceptionally long, branching into several sub-tunnels. The precise time of their abandonment is uncertain. The locals share memories from their childhood concerning their wandering in the tunnels, but none of them remembers having seen workers in them. We assume that these tunnels had been abandoned long ago.

The ancient Nisyrians had expanded their quarrying activities also to the neighbouring islets. On Pergoussa and Pacheia, minor quarries of volcanic rocks had also been recorded, which may have been exploited secondarily for humble artefacts such as mills,[50] despite the lack of evidence. Further investigation is needed for the deduction of secure conclusions.

Remains of millstone workshops

Various toponyms on Nisyros (Μυλοκράτης – **Figure 1: 13**, Μυλοκοποιός – **Figure 1: 14**, Μυλοκοπιό[51] etc.), which derive from the noun 'μύλος' (mill), are rather common. These may imply mill-carving activities during certain periods of the past. However, in some cases the toponym is related to an existing monument, such as the toponym Red Mill (Κόκκινος Μύλος)[52] between Nikia and Avlaki (**Figure 1: 15**), which owes to an old windmill actually built there. That is why we cannot rely on such toponyms to trace the location of ancient millstone workshops. The archaeological evidence for millstone workshops is rather poor:

Close to Palaiokastro, at Kapsalia, remains of the carving activity of millstones had been recorded by Nikos Charitos, an old guardian of antiquities on the island.[53] He had also noticed that various fragmented millstones, even half-finished ones, had been immured

[49] Runnels 1981: 92.

[50] In Pergoussa, there is a quarry of reddish volcanic stone, which probably supplied the material required for the erection of the two towers on the island. Nevertheless, the extraction of millstones has also been recorded (<https://www.geodifhs.com/kappaomegaiotaalpha/pyrgousa>, viewed 20 November 2023). Some minor extraction sites were spotted also at Pacheia, where the same reddish volcanic rock was quarried.

[51] Koutelakis 1993: 177, no. 32.

[52] Arfaras 2002: 85.

[53] Charitos 2005: 332.

Figure 12: Interior of the cave underneath the Drakospilo tower (photo by Giorgos Sakellaridis, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

Figure 13: Foundation of the Drakospilo tower (photo by Giorgos Sakellaridis, courtesy of the Ephorate of Antiquities of the Dodecanese, Hellenic Ministry of Culture).

in the surrounding retaining-walls (πεζούλες) and stone-built cottages (μαντριά) of the area.

Furthermore, Koumouli hill, close to Avlaki, is considered to have been formed by the remains of the quarrying activity for millstones.[54] Nevertheless, no half-finished hand-mills or related artefacts remain. For this reason, it is quite likely that only modern extraction took place here.

The stone quarried from the open-air quarry on the sloping terrain between Karaviotis and Trapezina is estimated to have been used for the hopper-rubbers recorded in the area, which therefore suggests that they were actually fabricated here. The recovered fragments of failed products, the imprints of the extracted 'Olynthian' hoppers and the simple blocks of the same size as the 'Olynthian' mills constitute convincing evidence for the stone-carving activity carried out here. Fragments of quarried rock and millstones either half-carved or finished are scattered all over the area of Argos. The archaeometric methods applied to samples from Halasarna mills confirm this observation because, as mentioned above, some of these mills are carved in volcanic rock from the open-air quarry.

In close proximity to this area rest the remains of Drakospilio (**Figures 12, 13**) at Lefkos Cape (**Figure 1: 16**). This is one of the Nisyrian Hellenistic towers, which formed part of the defensive program of the Hekatomnids in the late fourth century, given that Nisyros fell in the jurisdiction of the state of Mausolus, together with Rhodes and Cos.[55] Drakospilio had

[54] Vougioukalakis and Theodosiou 2012: 33.

[55] Remains of other towers are preserved at the southwestern coast of Nisyros, at Kateros (site Pyrgoi), and in the centre of the island, at Diavatis (Filimonos-Tsopotou 2013a: 154-155; Papachristodoulou 1993: 41, footnote 14). All these towers were part of the defensive network extending not only across Nisyros, but also on the

been erected at the top of a cave, which could offer lodgings to the guardians of the tower (**Figure 12**). It remains obscure if these were also the supervisors of the quarries, given that close surveillance of the quarrying areas was required for the smooth operation of the quarrying activities and the secure shipping of the quarried products, following the example of the Thasian marble quarries. The condemnation of slaves or captives to work as labour-men at the quarries is often quoted by ancient authors,[56] in the context of strict supervision being indispensable for the avoidance of a revolt or escape. The close surveillance of the Nisyrian quarries seems plausible, because of the importance of the quarried material, which was an important Nisyrian product exported massively. However, the lack of archaeological investigation in Argos region hinters any further observations; further investigation is necessary.

The Nisyrian millstone trade: A general overview

The beginning of systematic extraction of Nisyrian lava from the subterranean quarries must be dated approximately to the middle or late fourth century BC, a period of prosperity for the island.[57] The date of the abandonment of the millstone quarrying installations is rather vague, and quite likely to be based on the following factors:

- Firstly, the manner of construction of the subterranean tunnels/galleries resembles Hellenistic constructions on the neighbouring islands, namely the underground tunnel of the Vourina aqueduct on Cos, considered to be Hellenistic,[58] the small tunnel of the building next to the Hellenistic tower at Pacheia (identified as a water-tank or a cheese-dairy), etc.
- Secondly, the date of the open-air quarry at Argos can be regarded as Hellenistic, judging from the extant tool-marks: The wedge-holes which may be attributed to wooden wedges, the absence of the 'a festoni' technique (i.e. the herringbone pattern created by the traces of the quarry-pick on the quarried fronts), which dates approximately from the Late Roman period onwards, the coexistence of 'Olynthian' mills in the quarrying fields, which date from the Late Classical to the Early Roman period,[59] are some of the clues in favour of our proposal that the quarry stopped being active in the Roman period.
- Thirdly, the possible relation of the quarrying activity at Argos with the existing Hellenistic tower at the Cape Lefkos may suggest the main period of operation of the millstone extraction installations.
- Fourthly, the emergence of the quarrying activities and consequently the opening of underground quarries for the exploitation of volcanic lava, one of the most important natural resources of the island, coincides with the period of the Carian supremacy on the island.[60] It is well-known from ancient literature and inscriptions that the Carian territory was very wealthy and that all the Carian cities exploited their mineral resources, such as the green tuff and the silver mines at Myndos, the white marble of Mylasa and Heraclea at Latmus, as well as the dark-coloured marble of Alabanda.[61] The Carians were famous for their remarkable skills in quarrying and carving stones;[62] their collaboration and exchange of technical know-how with the other Dodecanesians, who belonged to the same State of Mausolus, seems plausible. This is also likely for Coan quarrying and carving of various local rocks.[63]
- Finally, Strabo and Antipatros of Thessaloniki, the ancient authors who commented on the Nisyrian millstone quarrying, both lived in the Early Roman period, so they include in their work information of their age or earlier.

Such a historic outline sustains the establishment of the Nisyrian millstone industry, which has been neglected by contemporary literature so far, in the early Hellenistic period. The exploitation of the Nisyrian volcanic lava ensured a steady production of 'Olynthian' and 'Delian' mills, rotary querns, and other artefacts of everyday use (e.g. oil-presses equipment, mortars etc.). The local production was competitive and continued to be significant even in the Early Roman times, as suggested by the rotary querns carved in Nisyrian lava, which were found in the neighbouring Halasarna. It seems plausible that the Nisyrian rotary querns inspired the production on the neighbouring Cos, which was based on the exploitation of the Coan rhyolite quarried in Kefalos peninsula and soon surpassed/overshadowed the Nisyrian products. The recent archaeometric research on findings from Halasarna confirmed the mass production of Coan rotary querns, likely to have been exported (to Delos,[64] Agathonisi[65] etc.). Coan

neighbouring islets, Pergoussa and Pacheia. Until recently, only two towers were documented on Pergoussa islet (Filimonos-Tsopotou 2013a: 155-156). In July 2020, one more tower, of the same date, was explored on Pacheia islet.

[56] Kokkorou-Alevras *et al.* 2010: 66.

[57] Bean and Cook 1957: 118-119; Papachristodoulou 1993: 41.

[58] Poupaki 2011b: (vol. B) 60-61, no. K 79 (with relevant bibliography).

[59] See footnote 7.

[60] Nisyros, same as Cos, Kalymnos and Telos, did not become members of the Second Athenian Alliance, because they were already under the Hecatomnid control (Debord 1999: 283, footnote 51).

[61] Hornblower 1982: 134, footnotes 232-233.

[62] Carpenter and Boyd 1977.

[63] Poupaki 2021b: 149-150.

[64] Poupaki 2011b: (vol. B) no. EA 162, fig. 402 α,β,γ,δ.

[65] Katerinopoulos *et al.* 2016: 190, footnote 42 (citation); Poupaki 2021a: 135.

rhyolite is rarely attested for the carving of 'Olynthian' mills, which were of inferior quality by comparison to the Nisyrian products, yet, a cheap choice for the inhabitants of Halasarna, who could produce imitations of Nisyrian hopper mills in Coan rhyolite.

The epigram of Antipatros of Thessaloniki mentions the use of Nisyrian lava also for the carving of millstones for the watermills, artefacts still unknown among the studied material.[66]

The evidence from Cos demonstrates the strengthened ties with Caria during the first half of the fourth century BC.[67] Although at first sight it seems too daring to suggest the implication of Caria in the establishment of specific stone industries in other subject cities, such as Nisyros, recent studies have demonstrated the transfer of building materials from Carian quarries to Cos and the contribution of Carians to the formation of the Coan stone-carving identity during the Age of Hecatomnids.[68] In such a context, it is fair to argue that the Nisyrians learned the technical skill and the necessary know-how for digging up subterranean quarries from their neighbours, the Carians.[69] Nevertheless, these are only preliminary associations, to be secured in the course of further investigation based on concrete archaeological evidence.

Epilogue

To sum up, the Nisyrian millstone workshop was a unique production unit in the Aegean from the fourth century BC onwards. It remains indisputable that the features of the Nisyrian vesicular lava had been evaluated during the second half of the fourth century BC, so, millstone quarrying operations had been organised and become renowned in the Aegean and beyond. It is almost certain that, from the Roman period onwards, the Nisyrian millstone workshop ceased to operate.[70] The cause may be sought among the particular political circumstances in this part of the Aegean, and it may possibly be related to the systematisation of the exploitation of the Coan rhyolite for querns, which could be easily extracted from the open-air quarries of Kefalos at Cos and would undoubtedly be cheaper.

The manufacture of mills for watermills from Nisyrian lava is only mentioned in literary sources of the Hellenistic period and it requires further investigation.[71] It is quite certain, though, that the appearance of the first grinding machines empowered with water was a long standing tradition, judging from the reference to 'water-wheels' for grinding cereals in the Hammurabi Code, dated in 1800 BC[72] and the existence of a watermill in Perachora since the fourth century BC.[73] The use of the Melian andesite at Rema for the carving of wind- or watermills is often quoted by several scholars, yet, it should be dated from the Byzantine period onwards.[74] This is why the use of Nisyrian lava for earlier watermills, dated to the Classical antiquity, deserves to be further examined.

It definitely remains uncertain whether the mill production of Nisyros continued into the pre-industrial era. The few windmills,[75] as well as the several oil-mills,[76] preserved all over the island are equipped with millstones of uncertain provenance. There are several millstone quarries of Melos, Polyaigos and Kimolos,[77] which were active until the past century, but it remains doubtful if they also supplied material to the Dodecanese islands, which had access to mineral sources closer at hand.

Acknowledgements

I am deeply indebted to the contributors of the provenance studies of the querns from the excavation of ancient Halasarna on Cos island: Athanassios Katerinopoulos, professor emeritus of Petrology at the Geological Department of Athens University, and Konstantinos Mavrogonatos, assistant professor in the Department of Earth Sciences at Pisa University. I also thank Georgios Valvis, archaeologist at the Ephorate of Palaeoanthropology – Spelaiology with whom we explored Nisyros and Pacheia islets, as well as Pergoussa, where we were assisted by Kalliopi Baïrami, Aggeliki Katsioti and Stamatia Marketou, archaeologists at the Ephorate of Antiquities of the Dodecanese. I thank them all for the information provided. For the revision of my English text, I would like to thank Marigo Kantzillieri.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[66] *Anthologia Graeca* 9.418.
[67] La Buff 2016: 53, footnote 151; Poupaki 2021b: 149-150.
[68] Poupaki 2021b.
[69] Carpenter and Boyd 1977.
[70] Querns carved in lava of Mayen in Eifel region (Germany) were of the highest quality and exported in Central Europe during the Roman period. The quarries in Alsace and in Lorraine of France were renowned for their products, too: Poupaki 2021a, 137, footnote 27. Many quarries of millstones had opened in the Italian Peninsula, too (Peacock 1980), which may explain the cessation of mining activities in Nisyros.
[71] Burkert 1997: 41-42.
[72] Code of Hammurabi, nos 53-54 (King 1915).
[73] There is no publication of the mill, except for a wooden reconstruction in the Technological Museum of Thessaloniki (<http://noesis.edu.gr/aet/thematic_areas/p529.html>, viewed 20 November 2023).
[74] Belavilas 2009: 2, footnote 1.
[75] A flourmill is recorded at Mandraki (known as Charitos' mill): Chartofyllis 1990: 245; windmills at Mylokopio of Nikia (Koutelakis 1993: 177, no. 32); the 'Red Mill' at Argos (Arfaras 2002: 85); Silvestros' mill at Lefkantio (Hellenic Government Gazetteer, sheet no. 503/B/7.6.1995).
[76] Billi 2005.
[77] Vaos and Nomikos 1993: 100-104.

Chapter 10
Heracles rock reliefs at quarries and construction sites in Roman Greece: An interpretative approach

Georgios Doulfis

In memory of Yanis A. Pikoulas, του οδοδείκτη μας.

Abstract

Rock-carved Heracles reliefs have been discovered in Corinthia, Laconia and Thasos. They are located at quarries or close to important construction works for which open-air construction sites were necessary and they are generally dated to the Roman times. Only the best known of these reliefs have been briefly discussed in terms of interpretation, and they have been considered either as votive offerings of quarrymen or, in one case, as a representation of Emperor Nero assimilated into Heracles. In this article, an interpretative approach of these reliefs in total is attempted for the first time, in combination with Latin inscriptions from Greece referring to Heracles, relevant philological testimonies, as well as similar monuments, both rock-cut reliefs and inscriptions, from the rest of the Roman world. In addition, a connection between these reliefs and the aroused Roman interest in the places where they stand is proposed. Such interest is mainly found to have been expressed by the Roman authorities, usually the military ones, responsible for the operation of a quarry or the execution of a prominent construction work. This approach sparks further consideration regarding the administration, infrastructure and operation of open-air construction-sites in Roman Greece.

Περίληψη

Ανάγλυφα Ηρακλή σκαλισμένα σε βράχο έχουν εντοπιστεί στην Κορινθία, τη Λακωνία και τη Θάσο. Βρίσκονται σε λατομεία ή κοντά σε σημαντικά κατασκευαστικά έργα για τα οποία χρειάστηκαν υπαίθρια εργοτάξια, και χρονολογούνται γενικά στα Ρωμαϊκά χρόνια. Εξ αυτών, μόνο τα περισσότερο γνωστά έχουν εξεταστεί ως προς την ερμηνεία τους και έχουν θεωρηθεί είτε ως αναθήματα των λατόμων είτε, σε μία περίπτωση, ως απεικόνιση του Νέρωνα αφομοιωμένου με τον Ηρακλή. Με την παρούσα συμβολή επιχειρείται για πρώτη φορά μια συνολική ερμηνευτική προσέγγιση των εν λόγω αναγλύφων, σε συνδυασμό με την εξέταση λατινικών επιγραφών από τον ελλαδικό χώρο που αναφέρονται στον Ηρακλή, σχετικών φιλολογικών μαρτυριών και, επιπρόσθετα, αναγλύφων σε βράχους και επιγραφών από τον υπόλοιπο ρωμαϊκό κόσμο που μπορούν να ρίξουν φως στα εξεταζόμενα. Επιπλέον, προτείνεται μία σύνδεση ανάμεσα στα ανάγλυφα αυτά και στο αυξημένο ρωμαϊκό ενδιαφέρον για τις περιοχές στις οποίες βρίσκονται. Το ενδιαφέρον αυτό φαίνεται να εκφράζεται κυρίως μέσω των ρωμαϊκών αρχών, συνήθως στρατιωτικών, υπεύθυνων για τη λειτουργία ενός λατομείου ή για την εκτέλεση ενός σημαντικού κατασκευαστικού έργου. Η προσέγγιση αυτή προκαλεί περαιτέρω προβληματισμούς σχετικά με τη διοίκηση, τις υποδομές και τη λειτουργία υπαίθριων εργοταξιακών χώρων στη Ρωμαϊκή Ελλάδα.

Keywords: Heracles; rock-cut reliefs; quarries; construction sites; Roman army

The rock-cut reliefs that have been found in Greece are rather few. The inscribed relief of Archedamos, the stonecutter and sculptor from Thera, at the Vari Cave, and a relief of Pan at the god's shrine close to Ilissos river, Athens, are probably the best-known, both dated to the fifth century BC.[1] On Paros, at the quarries close to modern Marathi, a relief with many figures depicting, among others, the Nymphs and Pan has been found.[2] On Thasos, several reliefs on rocks exist: the 'niche of Pan', two reliefs of Heracles standing with his legs crossed and his club brought over them by his right hand, one more relief of Heracles standing (to be discussed below), and one relief of Apollo standing in front of a seated goddess.[3] Four figures, Asclepius,

[1] Archedamos relief: Hallof and Kansteiner 2014; Orlandos 1959-60: 83 footnote 6 fig. 26; Weller 1903. Especially on the chronology of the relief, see Schörner and Goette 2004: 107-110. In the same cave, a seated Cybele is carved on the rock, not in relief but in- the-round. Pan relief at Ilissos: Marchiandi and Mercuri 2011: 485 fig. 267, with the relevant bibliography.

[2] Late Classical. Berranger 1983: 235-259; Bruno *et al.* 2000: 92-94 pl. 7; Kokkorou-Alevras *et al.* 2014: 136-137 no. 489.

[3] Classical to Hellenistic/Early Roman. Holtzmann 1994: 117-126 nos 50-55 pl. 39-41. Especially about the one of Heracles reclining, found at the Saliaris quarry, see Aristodemou 2020-21: 47; Grandjean and Salviat 2012: 194 fig. 117; Holtzmann 1994: 122-123 no. 51 pl. 40a;

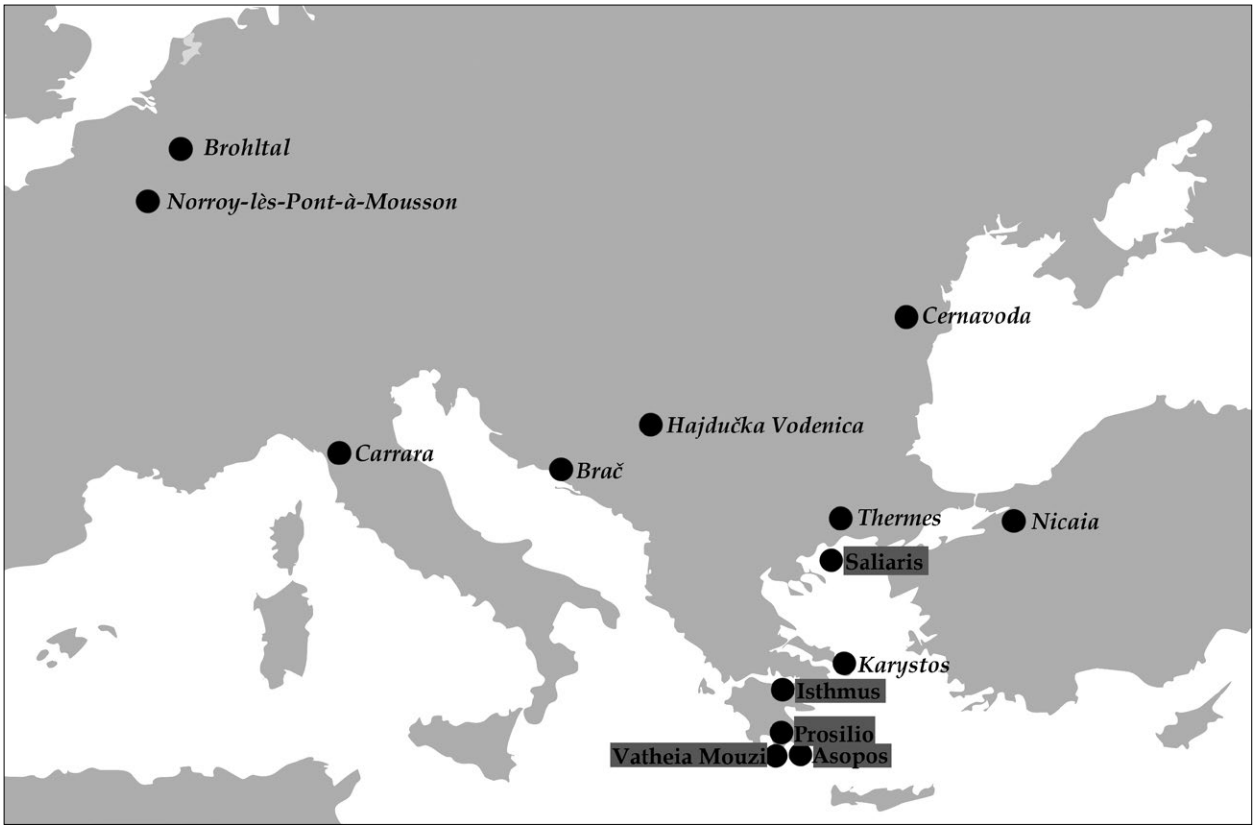


Figure 1: Map of places referred to in relation to Heracles reliefs or inscriptions.

Hygeia, Athena and perhaps Ares, have been carved on a vertical rock surface inside the fortification at Kastri, Archontochori, within the territory of the ancient city of Alyzia in Acarnania.[4] *Mithras Tauroktonos* (the bull-slayer) is hewn out of a rock at Thermes, Xanthi.[5] Many reliefs are carved on the quarry surfaces from which the material for the Roman colony at Philippi was obtained. Several gods and goddesses, both local and newcomers, were worshipped in this extended open-air shrine.[6] The large rock relief of the stern of a ship at Lindos, Rhodes, functioned as a bronze-statue base.[7] Further away, but still in Greek context, Athena's relief is carved at Sömek in Silifke, Turkey,[8] while on a relief at Bīsotūn/Behistun, Iran, dedicated to *Heracles Kallinikos* by a Seleucid satrap in 148 BC, the reclining hero is placed above a lion from a much earlier relief, which is modified to serve as a lion-skin.[9]

Surprisingly, there exist six more rock-cut reliefs, all of which render Heracles in a more or less similar way. They are carved in or close to a quarry or a construction-site, one in Corinthia, one on Thasos and four in Laconia (**Figure 1**). The objective of this contribution is the overall presentation of these reliefs and an interpretative approach to them.

The reliefs

The most prominent of the rock-cut Heracles reliefs is probably the one at the Isthmus of Corinth (**Figures 2, 3**).[10] The relief, 1.5m high, 0.97m wide and 0.27m deep, according to James R. Wiseman, is carved on the Peloponnesian side of the canal cliff wall, close to the west end of the canal. The hero is depicted within a sculpted temple-like frame with two columns and a pediment. He is described as having his right arm folded in and his left one resting on a thick object. Despite its badly eroded state, we think it is clear enough that his right arm is bent and leaning on a diagonally positioned club that rests vertically to the ground, while the lion-skin is draped over his left hand.[11]

Below the village of Prosilion (formerly Stroza), about 16km by car or 10km in a straight line north of the

Kokkorou-Alevras *et al*. 2014: 157 no. 568; Koželj *et al*. 1982: 676 fig. 60; Koželj 1988a: 32 figs. 12-13.

[4] Undated. Heuzey 1860: 412-413 pl. 12; Rhomaios 1930: 143 footnote 2; Stavropoulou-Gatsi 2008: 423 fig. 373.

[5] Roman. Triantafyllos 1990.

[6] Roman. Sève 2014: 246-251 figs. 168-172.

[7] Hellenistic. *Lindos* II: no. 169; Hallof *et al.* 2014: 533-535 no. 12; Filimonos-Tsopotou 2013b: 271 fig. 10, with bibliography.

[8] Roman. Durugönül 1989: 50-51 and 128-137.

[9] Hellenistic. Kleiss 1970: 145-147 fig. 11 pl. 66.

[10] On the Roman attempts to cut the canal at the Isthmus of Corinth, see Arafat 1996: 151-152, with ancient sources; Pettegrew 2016: 166-205; Werner 1997: 114-116; Wiseman 1978: 48-50, with ancient sources.

[11] Gardner 1908: 99; Gerster 1896: 42-43; Pettegrew 2016: 173 and 187-189 figs. 7.3 and 7.5; Salowey 1994: 94 pl. 29a; Werner 1997: 115 fig. 26; Wiseman 1978: 50 fig. 46. The relief is also mentioned by Arafat 1996: 151 footnote 33; Verdelis 1960: 143; Weir 1999: 404.

Figure 2: Corinth, the Isthmus. The Heracles relief in the middle (© Hellenic Ministry of Culture / Ephorate of Antiquities of Corinthia, photo courtesy of UpStoriesGreece).

Figure 3: Corinth, the Isthmus. Heracles relief (© Hellenic Ministry of Culture / Ephorate of Antiquities of Corinthia, photo courtesy of UpStoriesGreece).

town of Gytheion, begins the course of the Roman aqueduct that brought water to the town.[12] The aqueduct is partly carved into the rock and partly built. Two kilometres away from the point where the aqueduct leaves the bank of Smenos river (today known as 'the Bardounia's river'), which the aqueduct follows at a slightly higher altitude, an impressive tunnel has been carved. According to the British explorers of Laconia's historical topography at the beginning of the twentieth century, the tunnel is 1m high, 0.77m wide and 16m long, while more recently the length was estimated at about 30m. Two Heracles reliefs have been carved, one at the entrance (east) (**Figure 4**) and one at the exit (west) of the tunnel (**Figure 5**). At the entrance, the relief is 0.52m high and 0.04-0.03m deep. The hero rests on the club with his right arm bent at the waist while the lion-skin hangs from his left shoulder. He is bearded and he slightly turns his head to the left. At the exit, the relief is of similar dimensions but a bit different in terms of iconography. Although the figure is severely damaged,

[12] The aqueduct has been known since the nineteenth century: Giannakopoulos 1906: 106-107; Forster and Woodward 1906-07: 226-228; Lolos 1997: 306-307; Ormerod 1909-10: 68; Patsourakos 1902: 19-23; Ross 1848: 221-222; Aristodemou and Tassios 2018: 3 no. 18; Themos 1996-97. On the cistern of the aqueduct, see Vitti 2016: 251-256, figs. 3.185-3.188. Although at times it has been considered to be a work of Greek engineering, the aqueduct is definitely Roman, as Themos has now shown: Themos 1996-97: 404-405. About Roman aqueducts in the Peloponnese in general, see Fouquet 2019: 294-295, esp. footnote 1678, with references.

Figure 4: Prosilion, Roman aqueduct of Gytheion. The eastern Heracles relief (© Hellenic Ministry of Culture / Ephorate of Antiquities of Laconia, photo courtesy of Dimitris Rozakis).

Figure 5: Prosilion, Roman aqueduct of Gytheion. The western Heracles relief (© Hellenic Ministry of Culture / Ephorate of Antiquities of Laconia, photo courtesy of Dimitris Rozakis).

it still appears that Heracles is bearded and the lion-skin is hanging from his left shoulder while the lion's head is resting on the left part of the hero's chest. Heracles is probably holding the downturned club in his left hand and maybe another object (a phiale or a drinking cup?) in his right hand.[13]

Close to the cavernous depression called Vatheia Mouzi by the locals, west of the villages Koutrela and Erimos and south of Kouloumi, at the broader area of Oitylon, a similar relief of Heracles is carved on a sharply protruding rock (**Figures 6, 7**). Heracles is leaning with his right hand on his club, while his left hand rests on the thigh. The dimensions of the field carved in relief are *c.* 0.48 x 0.90m.[14] Several traces of limestone quarrying can be seen at the area, indicative of a probably small-scale relevant activity.[15]

Another rock-cut relief of Heracles can be seen at the sandstone quarry of Asopos, modern Plytra (**Figures 8, 9**).[16] Heracles is again leaning with his right hand on his club but this time his left arm is completely covered by the draped lion-skin. The relief is carved in a niche 0.75m high and 0.42m wide, at a prominent location of the site, 1.90m above the present floor of the particular quarry chamber.[17]

[13] Patsourakos 1902: 21-22 offers a thorough description of the relief at the entrance (or east relief), which is also mentioned by Forster and Woodward 1906-07: 227; Giannakopoulos 1966: 106-107; Lolos 1997: 307; Kokkorou-Alevras *et al.* 2009: 173; Salowey 1994: 93; Themos 1996: 403 fig. 10; Themos 2012: 551 fig. 1188. All scholars agree that it depicts Heracles. The relief at the exit, or west relief, is mentioned by Ross and Ormerod, who write, however, that the relief is too damaged, already since Ross' visit in 1834, and the figure is unrecognisable. Themos 1996-97: 403 footnote 8 fig. 8 mentions and depicts the relief, recognising the figure as Pan, after Georgia Kokkorou-Alevras' initial supposition by oral communication. However, Kokkorou-Alevras later identified the figure as Heracles (oral communication), as Giannakopoulos 1966: 107 had already done. The two figures were referred to by the locals as 'the king and the king's son' (Ormerod 1909-10: 68; Ross 1848: 222). Patsourakos 1902: 22 records two interesting folk legends, one about Heracles as builder of the aqueduct and another one about the man who, in Patsourakos' days, destroyed the head of the east relief and – as a result – he went blind and died a bad death. The image of the east relief, of the British School at Athens archive, is published here for the first time and I would like to thank the British School and the archivist Mrs Amalia Kakissis for the permit.

[14] As measured by M. Tsouli.

[15] On the relief, see Christien 2018: 631; Forster and Woodward 1906-07: 241-242 fig. 1; Kokkorou-Alevras *et al.* 2009: 173; Kokkorou-Alevras *et al.* 2014: 183 no. 671; Salowey 1994: 93-94; Tsouli 2010: 568 fig. 102; Tsouli 2015: 823 fig. 3; Tsouli 2018: 358. On the quarry, see Christien 2018: 631-632; Kokkorou-Alevras *et al.* 2014: 183 no. 671; Tsouli 2010; Tsouli 2015; Tsouli 2018: 358.

[16] On the quarry, see Cavanagh *et al.* 1996: 310 no. MM 320; Christien *et al.* 2001-02, 205; Christien 2018, 635; Kokkorou-Alevras *et al.* 2009: 171-177; Kokkorou-Alevras *et al.* 2014: 190 no. 693; Morgan *et al.* 2008-09: 29. On Asopos in general, see Pikoulas 2002.

[17] Kokkorou-Alevras *et al.* 2009: 171 fig. 17.5; Kokkorou-Alevras *et al.* 2014: 190 no. 693 fig. 34.

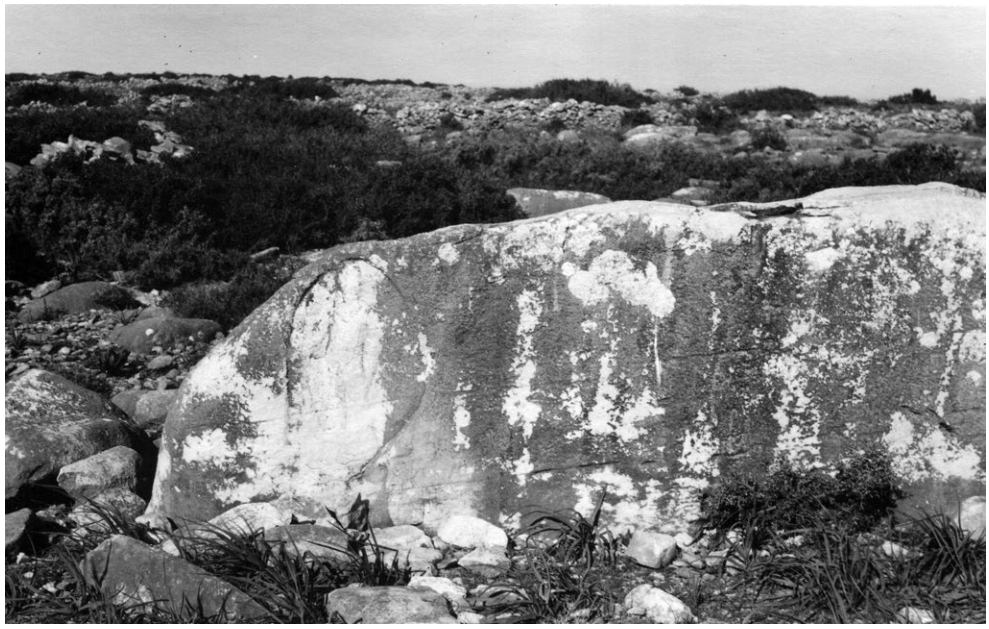


Figure 6: Vatheia Mouzi. The site and Heracles relief (© Hellenic Ministry of Culture / Ephorate of Antiquities of Laconia, photo courtesy of the Archives of The British School at Athens [BSA_HS_LAKII.Temp.032]).

Figure 7: Vatheia Mouzi. Heracles relief (© Hellenic Ministry of Culture / Ephorate of Antiquities of Laconia, photo courtesy of The British School at Athens [published at Forster and Woodward 1906-07]).

Yet another rock-cut relief has been found at the quarry of Saliaris on Thasos, rendering the hero in a similar way to the last ones (**Figure 10**). Heracles is standing and leaning with his right hand on his club while holding the draped lion-skin in his left hand.[18]

The first thing someone notices about the rock reliefs of Heracles is that, as they stand alone, with no other reliefs in their territory as it happens, for example, in Philippi, they have an emblematic character. A second point is that, despite their poor state of preservation, they all look alike, reminiscent of similar statue types depicting Heracles standing and naked, in a dynamic, heroic, contemplative posture. Three of them, the reliefs of Asopos, Vatheia Mouzi and Thasos,[19] follow in general the Boston/Oxford type, after a mid-fifth century BC prototype, in which the hero is depicted beardless, resting his outstretched right hand on the club while the lion-skin is hanging from his left shoulder.[20] In the next two reliefs, the one at the Isthmus[21] and the east one at the tunnel of Prosilion,[22] Heracles resembles the previous type but he is bearded, therefore falling in the type either of Heracles Chiaramonti, after a bronze original of the end of the fourth century BC,[23] or the New York Heracles, after a bronze original of 325-320 BC,[24] more probable models for the reliefs. The last of the six reliefs, the west one at the tunnel of Prosilion, resembles the so-called Heracles *Bibax* or *Dexioumenos*,[25] a common Hellenistic/Roman prototype for the depiction of the hero.

Although Heracles' figure on rock reliefs, as we have just shown, can be connected to specific iconographical types of the hero, the latter cannot be used as indications for the date of the former. These types were reproduced throughout the Hellenistic and

[18] The relief was destructed in 1986. Catling 1980-81: 41; Holtzmann 1994: no. 54, pl. 41a; Kokkorou-Alevras *et al.* 2009: 171; Kokkorou-Alevras *et al.* 2014: 157 no. 568; Koželj 1988a: 69-70 fig. 2; Koželj *et al.* 1981: 963 fig. 72; Palagia 1988: 751 no. 431; Wurch-Koželj and Koželj 1995: 41.

[19] About the attributing of the Thasos relief to the Boston/Oxford type, see also Palagia 1988: 751.

[20] See Palagia 1988: 751-753.

[21] Salowey 1994: 94 has erroneously connected the relief to the Farnese type.

[22] Forster and Woodward 1906-07: 227 have also erroneously connected the relief to the Farnese type.

[23] Cf. Palagia 1988: 752-753, esp. nos 461-462 with figures.

[24] Cf. Palagia 1988: 753-755, esp. nos 527-528 with figures.

[25] Cf. Palagia 1988: 766-769, esp. nos 792-794 with figures.

Figure 8: Asopos. Part of the quarry, Heracles relief in the middle (© Hellenic Ministry of Culture / Ephorate of Antiquities of Laconia, photo by the author).

Figure 9: Asopos. Heracles relief (© Hellenic Ministry of Culture / Ephorate of Antiquities of Laconia, photo by the author).

Figure 10: Thasos. Heracles relief (© Hellenic Ministry of Culture / Ephorate of Antiquities of Kavala – Thasos, photo courtesy of the École française d'Athènes [published in Holtzmann 1994]).

the Roman period. Moreover, there is no excavation context related to the rock-cut reliefs. Thus, their date is obscure. However, they are definitely post-Classical and, at least in some cases, as in that of the Isthmus and the aqueduct of Gytheion, the reliefs are beyond any doubt contemporary to the relevant Roman projects.

Towards a comprehensive interpretation of the reliefs

Very short interpretative comments have been made for some of the aforementioned reliefs from time to time in the past. Béla Gerster, the Hungarian chief engineer of the Corinth Canal who discovered the relief at Isthmus, thought that it could possibly be a funerary one, marking the site of the burial of one of

Nero's engineers, perhaps even of the author of the Roman canal project.[26] A little later, William Gardner wrote that 'near the western end, a quaint little relief of the emperor is cut on the cliff'[27] suggesting that the relief depicts deified Nero himself in a temple. Wiseman interpreted the figure as Heracles holding a club in his left hand and suggested that it was carved to commemorate how far the work had progressed before it was halted.[28] Christina Saloway,[29] Robert Weir,[30] Karim Arafat[31] and Guy Sanders[32] supported that the relief at the Isthmus is a depiction of Nero in the guise of Heracles, as the emperor was already assimilated into the hero, mentioning the ancient narrative about how Nero started digging 'believing he had surpassed all the feats of Heracles' (Pseudo-Lucian, *Nero or Isthmus* 1-5, esp. 3). Edward Champlin[33] and Emma Stafford[34] think that the relief depicts Heracles and that this was Nero's way to show his intentions and to commemorate his personal feat. Walter Werner refers to the relief as a dedicatory one, which 'probably represents Heracles with his club'.[35] More recently, David Pettegrew reconciled the interpretations, supporting that the relief represents Nero as Heracles resting from his feats.[36]

Arthur Woodward connected the Heracles relief at Vatheia Mouzi to the nearby natural cavernous depression, and justified the depiction of the hero by identifying him with a chthonic deity.[37] However, it seems that Woodward had not noticed the quarrying traces in the area, which were recently pointed out by Maria Tsouli. Tsouli connected the relief with this activity, following the view already expressed by Georgia Kokkorou-Alevras and others about other similar Heracles reliefs. She also marked that the worship of Heracles in quarries and the carving of Heracles reliefs on natural rocks either in quarries or near important public technical works 'is documented'.[38]

Salowey looked into the Heracles' myths and specifically the labours of cleaning the Augeas' stable in comparison to the great Mycenaean hydraulic engineering works, such as the drainage of Copais. Thus, she presented Heracles as a deity of hydraulic engineering, citing three rock reliefs of the hero as late examples of this tradition (Isthmus, Gytheion and Vatheia Mouzi).[39]

The Greek quarries research team under the direction of Kokkorou-Alevras first attempted a comprehensive, although very concise, examination of the Heracles rock reliefs. According to the team, 'the dedication of Heracles reliefs of a tutelary and cultic character is a common practice in ancient quarries' (as noticed already by Angelina Dworakowska[40]), 'major technical works' and 'outdoor sanctuaries'. They specifically mentioned the relief at Asopos, which triggered their comment, the one at Gytheion and that at Vatheia Mouzi, respectively.[41] For the latter, as Tsouli had not yet identified the traces of quarrying activity in the area, they followed Woodward.[42]

All the above interpretative approaches present elements that were definitely included in the ancient viewers' horizon of expectations. Surely Heracles' presence on such sites stood as an allegory or a connotation of the extraordinary efforts and the almost supernatural powers required for works like digging tunnels or quarrying. Furthermore, the figure of Heracles at the Isthmus would recall – in the contemporaries' mind – the emperor himself, who worked as a young Heracles in order to build the canal – or at least that was Nero's intention. And it is very likely that everyone who saw the relief and the cavernous depression at Vatheia Mouzi would remember the descent of the hero to the Underworld.

However, if we adopt Tsouli's argument that the relief at Vatheia Mouzi is related to quarrying activity in the area and should not be interpreted as an independent open-air sanctuary, then we notice that all the reliefs in question are located either in quarries or close to large public technical works. Taking this further, we can assume that the public technical works associated with the Heracles reliefs are works that require labour similar to quarrying, such as excavation. This is why we will try here to examine all the Heracles rock reliefs in the light of a structural perspective,[43] hoping that such an approach may have something more to tell us, beyond the individual interpretations already mentioned above. In other words, we will examine the Heracles rock reliefs as pieces of evidence for a custom that habitually places them close to quarries or large public works, and we will try to figure out their

[26] Gerster 1896: 42-43.
[27] Gardner 1908: 99. Pettegrew 2016: 188 has further connected the relief with the emperor's depiction on some contemporary Corinthian coins (AD 67-68), which bear on the reverse the outline of a statue of him standing in a temple with arm bent.
[28] Wiseman 1978: 50.
[29] Saloway1994: 94. Stafford 2012: 153-154 follows Saloway regarding a possible interpretation of the relief.
[30] Weir 1999: 404.
[31] Arafat 1996: 151 is rather skeptical and refers to it in his text as 'a relief Hercules from Nero's attempt [to cut the Isthmus]'. He cites Wiseman and Saloway's interpretation only in the relevant footnote.
[32] Sanders 2005: 14.
[33] Champlin 2003: 138.
[34] Stafford 2012: 154.
[35] Werner 1997: 115.
[36] Pettegrew 2016: 189.
[37] Forster and Woodward 1906-07: 242.
[38] Tsouli 2018: 358.
[39] Salowey 1994: esp. 93-94.
[40] Dworakowska 1983: 53-54. She refers to reliefs, inscriptions, altars and other quarrymen's dedications to Heracles but she mentions none of the five Greek rock reliefs.
[41] Kokkorou-Alevras *et al.* 2009: 171-173.
[42] See above.
[43] Cf. Johnson 2010: 100-101.

meaning in such a context, employing evidence from reliefs and inscriptions in parallel.

First of all, we have to point out that the Heracles reliefs are neither found at all quarries nor close to every major public excavation work. Thus, what the examination of all these reliefs in total offers, and we consider this to be important, is that their original setting, whether a quarry or a public construction project, with the single possible exception of Vatheia Mouzi but only due to lack of information, were points of great interest for the Roman administration. Specifically, the project of opening the Isthmus canal was an imperial initiative and was carried out, to the extent that it was carried out, under the supervision of the representatives of the Roman administration.[44] The Roman aqueduct of Gytheion was part of the wider concern on behalf of the Roman administration for the adequate water supply of the Greek cities.[45] Gytheion, after all, was a city that had repeatedly attracted the Romans' interest. Several emperors had visited it and the city celebrated imperial cult while an active Roman merchant community was established in it.[46] Asopos is supposed to be the result of an emperor's (Augustus?) desire to synoecise the surrounding towns into a dynamic city-port.[47] It seems that the quarry provided the raw material for the building of that new city.[48] At the same place, a probably large community of *negotiatores* was established, as can be inferred from the many *columbarium*-type monuments of the area.[49] Finally, the interest of the Romans in the Thasos quarries was intense, as known from literary testimonies[50] and suggested by the number of Late Roman/Early Byzantine towers that have been located on the island.[51]

Therefore, as it follows from the above, Heracles reliefs carved on rock are found in Greece near large technical works, either quarries or other excavation works, only if they are associated with places of intense interest for the Roman administration, with only one disputed case. This, of course, does not mean that these reliefs could not be objects of worship, as it has been written for the case of Asopos, where cult elements have been found.

At this point, we can expand our field of research in order to draw evidence to substantiate our argument for a connection between Heracles and the Roman administration, usually implemented by military officials.

Apart from the Greek territory, rock reliefs of Heracles, as well as related votive inscriptions, are found in quarries in other parts of the Roman Empire. Specifically, a relief of Heracles/Hercules carved into a rock has been found in the quarry at Rasohe, on the island of Brač, opposite Split, Croatia. The relief dates to the Roman times, probably in the third-fourth century AD. The bearded hero, coarsely rendered, stands in an upright stance with the lion-skin hanging from his left shoulder, so as to partially cover his left side. He holds the Hesperides apples in his left hand and carries the club with his right hand bent behind his neck, resting on his right shoulder.[52] The relief lies close to the Plate quarry. The works at the site and the transportation of marble to nearby Sirmium were of interest and under the administration of the military man Valerius Valerianus in the years of Licinius, between AD 308 and 314, who dedicated to Heracles/Hercules an inscribed altar found in the area (*CIL* III 10107).[53]

At the local quarries in Cernavoda, Dobrudja (modern Romania), a figure of standing Heracles is made in high relief, dated to the second half of the third century AD.[54] A Heracles rock relief was carved by Roman soldiers at Novae (modern Bulgaria), close to a quarry and probably in connection to it.[55] In Nicaea of Bithynia (modern Turkey), and specifically at the quarry at Deliktaş, one more Heracles rock relief can be seen. The hero is again bearded and standing naked. He leans on the club with his right arm and bends his left arm at the waist, holding the lion's skin which hangs from his left shoulder. The hero turns his head slightly to his left, where a rectangular altar stands.[56] The rock relief at Carrara quarry, ancient Luna close to Rome, is slightly different. It shows Jupiter between Hercules and Liber Pater and it may refer to the Severan imperial ideology, representing the emperor Septimius Severus between Caracalla and Geta.[57] The military presence at the quarries is strong and well-testified.[58]

Besides the rock reliefs, the presence of Heracles/Hercules at quarries and public construction sites

[44] See the relevant ancient sources: Philostratos, *Neron* (for comments, see Champlin 2003: 137-138; Korver 1950; Traina 1987).
[45] Themos 1996-97: 404-405.
[46] Doulfis 2019: 102-103; Kanellopoulos and Zavvou 2014: 357-358 footnotes 2-6.
[47] Kahrstedt 1954: 210; Zavvou 2007: 425-426. About Asopos in general, see Doulfis 2019: 122-123.
[48] Kokkorou-Alevras *et al.* 2009: 178.
[49] Doulfis 2020: esp. 132-137 figs. 8-10.
[50] Dubois 1908: 126-129, esp. 126-127, with ancient testimonies. On the other hand, Marc 1995 doubts the possession of one or more Thasian quarries by the emperor, at least during the Early Roman period.
[51] Koželj and Wurch-Koželj 1992.
[52] Bulić 1891; Cambi 2004: 242; Cambi 2005: 126; Cambi 2013 with figs.; Dworakowska 1983: 53; Nikolić 2019: 460; Sanader 1994: 102 cat. no. 25 and fig.; Russell and Glicksman 2015: 235; Vidas 2019: 42-51 fig. 37; Vrsalović 1960: 80-81. Two marble Heracles reliefs have been found in the broader area, of which one is very similar to the rock-cut one.
[53] Mirković 1971: 37; Nikolić 2019: 461; Russell and Glicksman 2015: 235.
[54] Dworakowska 1983: 53; Florescu 1936: 44-45 figs. 7-10; Florescu 1937: 111-112 pls. 23.2 and 24.1.
[55] Tomas 2016: 81.
[56] Yavuz *et al.* 2012: 256 fig. 4.
[57] Lichtenberger 2011: 55 and 82.
[58] Hirt 2010: 174 with bibliography.

during the Roman period is well-documented in inscriptions, as well. The quarry at Karystos on Euboea, Greece, is particularly well-known due to the Roman administration's interest in it. The beauty and quality of Karystos marble led to huge imports to Rome and, most importantly, turned this quarry into imperial property as early as in AD 17.[59] A niche with an inscribed Latin dedication to Heracles/Hercules by the centurion T. Sergius Longus, dated to the first half of the second century AD, is located in the area of the quarry (*CIL* III Suppl. II 12286):[60]

T(itus) Sergius Longus ((centurio)) leg(ionis) XV Apoll(inaris) Herculi sacrum.

Titus Sergius Longus has been considered to be the person in charge for the operation of the quarry and, as such, he makes the relevant dedication to the patron deity, Heracles/Hercules.

In Upper Moesia, at Hajdučka Vodenica (modern Serbia), a tabula dedicated to Heracles/Hercules by the *lapidarii* of two legions, IIII Fl(avia) and VII Cl(audia), has been found[61] in connection to the laborious task of opening a long road by dredging in the reigns of Tiberius, Claudius, Domitian and Trajan (*CIL* III 1699):[62]

Herculi sacrum
lapidari(i) qui exieru-
nt ancones facien-
dos legionis IIII Fl(aviae)
et legionis VII Cl(audiae)
vot(um) so[lverunt]

Moreover, dedications to Heracles, *Hercules Saxanus* (from the Latin *saxum*, rock), are attested at quarries throughout the empire,[63] such as at Norroy-lès-Pont-à-Mousson in Gallia Belgica (modern France)[64] and Brohltal in Germania Inferior (modern Germany),[65] in which Roman legions were engaged very often.[66] *Hercules Maliator*, connected to the craftsmen working in the quarries, the *maliatores*, is attested by its inscribed base (*CIL* XIII, second-third century AD) found at a quarry close to the Roman fortress of Wörth (modern Germany).[67] At this point, we could recall yet another rock relief dated to the Roman times. The relief of Mithras at Thermes, Xanthi, is associated with the existence of a small fortress of the second-third century AD on the neighbouring hill, Stithoma. A Roman military unit settled here safeguarded both a natural passage and the operation of the nearby mines.[68] Besides, it is well known that military men were employed in quarries, mines and construction works as administrative officials, garrisons and even workmen,[69] while the employment of military personnel, architects, engineers and other experts in imperial construction projects related to canals, aqueducts and major public works is well-attested throughout the Empire, including Greece, and recently analysed.[70] Especially for the Isthmus of Corinth,[71] to backtrack to where we started off, we know that both Caligula and Nero, who abortively attempted to build the canal, had employed the army. Caligula sent a military engineer, according to Suetonius (*Gaius Caligula* 21). Nero ordered praetorians to begin the work, again according to Suetonius (*Nero* 19), and employed soldiers to dig the soft earth, together with convicts who dug the rocky ground, according to Pseudo-Lucian (*Nero or Isthmus* 3). Vespasian, who continued the work for a while after Nero's death, sent 6,000 Jewish captives to dig at the canal, according to Josephus (*Bellum Judaicum* 3.540); the presence of Roman soldiers again is self-evident. For all this personnel, Hercules/Heracles was an undisputable patron deity.[72]

In conclusion, Heracles, as we have seen, was a deity that was worshipped in quarries and construction sites in the Greek peninsula, as rock-cut reliefs and inscriptions evince. Furthermore, the comparative examination of other similar reliefs of Heracles from other areas of the Roman world, offers an additional support to our proposed connection of the Greek reliefs to the interest of the Roman administration and presumably to the military officials and forces who implemented it. Therefore, without overlooking

[59] Dubois 1908: 115-125, esp. 115-118; Kokkorou-Alevras *et al.* 2014: 261-264 nos 996-1002, esp. no. 1000; Lazzarini 2007: 183-204. See also Koželj and Koželj-Wurch 1995 on the so-called 'Dragon Houses' as houses for the Roman guard of the quarries.

[60] Chapman 1993: 69; Chidiroglou 2017: 332; Dworakowska 1983: 53; Goette 1994; Hirt 2010: 170–171; Lazzarini 2007: 30 and 189; Nikolić 2019: 460; Russell 2013b: 44.

[61] On the inscription, see Nikolić 2019.

[62] On the road, see Petrović 2019: 258-260 figs. 2-3.

[63] There are many examples like the inscribed altar found at a Roman quarry on the slopes of the hill of Sv. Ilije, locally known as 'Kučićeva kava', Croatia. See Maršić 2007.

[64] Bedon 1984: 45 and 184-188; Boulanger and Moulis 2018: 247–263; Monthel and Pinette 1977: 50-51; Verbanck-Piérard 2021: 128.

[65] *CIL* XIII 7697–7714, 7715–7719; Matijević 2010; Nikolić 2019: 460; Schaaff 2015.

[66] For a list of dedicatory inscriptions and the cult of Heracles and Saxanus by quarrymen and military units, see Haug 1913; Keune 1921. See also Bauchhenß 1986; Bedon 1984: 180-188; Dworakowska 1983: 60; Matijević 2016; Stoll 1998. Silvanus also protects quarrymen, see for example *CIL* III, 12565 (altar devoted to both Heracles/Hercules and Silvanus by a military man employed at the quarry at Bejan, modern Romania); Dworakowska 1983: 60-61; Lazzarini 2007: 30. Cf. Demarolle 2010.

[67] Mattern 2005: no. 186.

[68] Triantafyllos 1990.

[69] Davies 2021: 185-186; Dworakowska 1983: 31, 108-109, 135; Hirt 2010: 168-202; Hirt 2015; Kissel 2021; Kremer *et al.* 2021; Russell 2013b: 41-47.

[70] Lancaster 2010: 464-467.

[71] Wiseman 1978: 48.

[72] About Hercules/Heracles and the Roman army, see Jaczynowska 1981; Solov'yanov 2016.

other connotations regarding the imperial image or the Greek mythological background of the hero, we could consider the rock reliefs of Heracles as a habit, formal or not, of the workmen and their supervisors at construction sites that operated under the control of the Roman administrative machine. Further connection of this habit to Romans, legionnaires, freedmen and others, arises as a very likely case.

After the above approach of the Heracles reliefs, the latter assume different dimensions, besides their usage as objects of worship to the patron god of quarry or other workers. They can be recognised as possible cult remains of Roman military units, and as an expression of the Roman imperial power and its administrative representatives. Moreover, they recall a typical attribute of Heracles as the bearer of civilised life who, despite all adversities, brings the feat to fruition symbolising the supremacy of civilisation – of Rome – against the barbarians[73] or, at least in the case of the civilised Greece, against the forces of nature.

Acknowledgements

Many thanks to Professor Georgia Kokkorou-Alevras, Dr Johannes Fouquet, Dr Dimitris Grigoropoulos, Dr Eleni Kalavria, Dr Rena Poupaki, Dr Maria Tsouli, and Andreas Doulfis for their useful suggestions and comments on this paper, to Maria Politou for editing my English, to the Ephorates of Antiquities of Laconia, of Corinthia and of Kavala-Thasos for the relevant permits, to the UpStoriesGreece YouTube channel for the photos of Figures 2.a and 2.b, and to the Editors of this volume for their invaluable support and crucial remarks. As this paper was finished a little after Yanis A. Pikoulas unexpectedly passed away, I would like to dedicate it to his memory; I was deeply honoured to have Professor Pikoulas as a member of my dissertation committee. He had the gift and the generosity to show us, to his close or distant disciples, new paths to step forward, literally and metaphorically...

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[73] Cf. Fox 1996. I would like to thank Dimitris Grigoropoulos for sharing with me his thoughts on Heracles' image aspects.

Chapter 11
Roman calcite alabasters in Tunisia

Ameur Younès

Abstract

Calcite alabaster was highly valued by the Romans who sourced this material from a great number of the Roman Empire provinces and employed it in various constructions. Even though studies on alabaster have developed over the past decades, ancient alabaster in northern Africa remains little studied in spite of the recent systematic investigations. The surveys of the Tunisian southern and northern mountains of limestone interbedded with alabaster, and of the archaeological sites enabled to identify unknown calcite alabaster quarries, along with architectural elements carved into this material and used in the buildings of the archaeological Roman sites. The results of the macroscopic examination (colours, textures) carried out on the alabaster samples taken from the quarries and from the architectural elements identified in the Roman sites revealed that most of the alabasters employed came from the nearby Roman quarries.

Περίληψη

Το ασβεστιτικό αλάβαστρο (γνωστό και ως αλαβαστρίτης λίθος ή μάρμαρο-όνυχας) ήταν υλικό περιωπής για τους Ρωμαίους, οι οποίοι το προσπορίζονταν από πολλές επαρχίες της ρωμαϊκής αυτοκρατορίας για να το χρησιμοποιήσουν σε ποικίλες κατασκευές. Αν και η μελέτη του συγκεκριμένου υλικού προχώρησε σημαντικά κατά τις τελευταίες δεκαετίες, το αρχαίο αλάβαστρο της βορείου Αφρικής δεν έχει μελετηθεί επαρκώς, μολονότι αρκετά συστηματικά προσφάτως. Οι επιφανειακές έρευνες στα νότια και βόρεια βουνά της Τυνησίας, όπου το αλάβαστρο εμπεριέχεται στις διαστρώσεις ασβεστολίθου, αλλά και σε αρχαιολογικές θέσεις, οδήγησαν στον εντοπισμό αγνώστων μέχρι στιγμής λατομείων αλαβαστρίτη λίθου, καθώς επίσης στην ταυτοποίηση/αναγνώριση αρχιτεκτονικών μελών που είχαν δουλευτεί σε τέτοιο υλικό και χρησιμοποιηθεί σε κτίρια ρωμαϊκής εποχής, σωζόμενα σήμερα στους αρχαιολογικούς χώρους. Τα αποτελέσματα μακροσκοπικής εξέτασης που βασίστηκαν σε χρώματα και υφές και διεξήχθησαν σε δείγματα αλαβάστρου συλλεχθέντα τόσο από τα λατομεία όσο και από αρχιτεκτονικά μέλη σε αρχαιολογικούς χώρους ρωμαϊκής περιόδου, αποκάλυψαν ότι στην πλειονότητά του το υλικό προερχόταν από τα πλησίον κείμενα ρωμαϊκά λατομεία.

Keywords: ancient quarries; calcite alabaster; Roman archaeological sites; Tunisia

Introduction

The term 'alabaster' has been used since the ancient times.[1] Two different types have been distinguished: gypsum alabaster and calcite alabaster. Alabaster was well appreciated by the Romans, who considered this stone as a kind of marble, suitable for carving vases and architectural elements from, to decorate sumptuous public and private buildings.[2] They sourced this material from a large number of mountains in the provinces of the Roman Empire.

Since the end of the nineteenth century, geo-archaeological researchers have begun to study ancient alabaster. At present day, research on alabaster has greatly developed both quantitatively and qualitatively thanks to the growing number of publications on the newly identified alabaster quarries and the architectural elements made of calcite alabaster, together with the macroscopic and microscopic analyses enabling us to determine the provenance (quarry sources) of alabaster employed in the ancient constructions. Nevertheless, apart from a few very interesting writings on the alabaster from Jebel Oust,[3] no study has been carried out on the ancient Tunisian quarries as a whole, nor on the calcite alabaster architectural elements preserved on the archaeological sites.

The present study aims to provide information not only on the already registered quarry of Jebel Oust, but also on other unpublished alabaster quarries in

[1] Cf. Pliny, *Naturalis Historia* 36.12 (Buch XXXVI Die Steine: Naturkunde / Naturalis Historia in 37 (Sammlung Tusculum) Bänden, Berlin: De Gruyter, viewed 27 November 2023, <https://doi.org/10.1524/9783050062099>): 'hunc aliqui lapidem alabastriten vocant, quem cavant et ad vasa unguentaria, quoniam optume servare incorrupta dicatur. idem et ustus emplastris convenit. nascitur circa Thebas Aegyptias et Damascum Syriae. hie ceteris candidior, probatissimus vero in Carmania, mox in India, iam quidem et in Syria Asiaque, vilissimus autem et sine ullo nitore in Cappadocia. probantur quam maxime mellei coloris, in vertices maculosi atque non tralucidi, vitia in iis corneus colos aut Candidus et quidquid simile vitro est.'

[2] Pliny, *Naturalis Historia* 36.1-2 and 12, ed. cf. footnote 1.

[3] Barker *et al.* 2018; Lazzarini *et al.* 2012.

northern and southern Tunisia, and on the alabaster architectural elements identified in the archaeological sites. In order to identify as many alabaster quarries as possible, a targeted survey has been undertaken on the limestone mountains interbedded with alabaster mentioned in the geological maps of the 'Office National des Mines' (ONM) in Tunisia. The results show that the alabaster beds in the southern Tunisian mountains were intensively exploited during the Roman period, as opposed to the northern mountains, where exploitation was not systematic, as – for example – on Jebel Ouahchi (region of Sejnane), where no traces of quarrying have been identified.

Our study is focused on the various data concerning the quarries (size, exploitation and quarrying techniques, alabaster varieties, chronology) and the architectural elements preserved on the sites (types, alabaster varieties, provenance and chronology).[4]

Calcite alabaster quarries

Ancient quarries of calcite alabaster have been identified in northern and southern Tunisia, in the regions of Zaghouan and Elfahs (in the north), and in Medenine (in the south) (**Figure 1**).

Calcite alabaster quarries in the region of Zaghouan

In total, five calcite alabaster quarries have been registered in Jebel Oust, in the region of Zaghouan: one large open-air quarry and four underground ones (**Figure 2**). The large open-air quarry had already been identified by archaeologists and geologists,[5] whereas the underground ones were so far unknown. These quarries are accessible from the local road (C133) connecting Tunis to the thermal station of Jebel Oust, and then from a pathway leading to the mountain. Geologically, calcite alabaster appears in broad beds formed in the fissure-ridges of grey limestone from the Jurassic period.[6] In the large open-air quarry located on the west/northwest of the mountain, the broad calcite alabaster beds are included between Upper Malm and Lower Lias grey limestones in a much tectonised area with abundant faults (**Figure 3**). The stones extracted from this quarry were both grey limestone blocks and alabaster blocks. The quarry is well-preserved and has an almost elliptical shape, oriented east-west (**Figure 4a**). Its long east-west axis is 40.50m, the short north-south axis is 32m, and the average height is about 15.50m. The approximate volume of extracted stones (grey limestone and alabaster blocks) is 15,769cbm. From the quarrying traces left upon the quarry face, the amount of extracted alabaster blocks may be evaluated to 1/10 of the total volume (about 1577cbm). In this quarry, extraction was conducted by channelling, that is, by opening extraction slits on three sides of the block, as the upper horizontal and lower upright side had been previously isolated (with the already extracted blocks giving the quarry face a stepped profile). Then, the quarry workers made a line of fracture and wedge holes on the lower horizontal side, in order to insert metal wedges. Finally, they detached the block from the bedrock by hammering upon the wedges. Such a quarrying technique has been identified in the Roman quarries of Chemtou.[7]

The four small underground quarries, located at the north and west/northwest of the mountain are situated close to each other. One of them has collapsed, whereas the others are preserved in a relatively good condition (**Figure 4b**). Their elongated form, similar to that of a mine's tunnel, follow the alabaster beds. Their length ranges from 10.60m to 27.50m, their width from 1.40m to 1.90m and their height from 1.70m to 2.40m (**Table 1**). The approximate volume of the blocks extracted in the three tunnels is 246cbm, much less than that from the large open-air quarry. In total, the extracted alabaster blocks in all four quarries amounts to about 1823cbm. As concerns the three underground ones, quarrying was accomplished in small tunnels because the layer of the pumice stone covering the alabaster beds is rather thick, ranging from 1.25m to 1.70m (**Table 1**). Such a technique allows the quarrymen to avoid wasting too much time to take off the thick layer of rock, which is useless for construction. Although this quarrying method requires both ventilation and lighting inside the tunnels, yet, so far no trace of ventilation shafts or niches for oil lamps inside the tunnels has been found. Nevertheless, it is possible that, in order to light the far end of each tunnel, oil lamps were placed on movable supports, as noticed in the underground quarries of Tyrrhenian oolitic sandstone[8] and Mio-Pliocene calcareous sandstone,[9] located in the regions of Monastir and Mahdia in the Tunisian Sahel. The cutting marks preserved both on the open-air quarry faces and in the tunnels suggest that the quarrymen implemented the channelling technique by exploiting the natural planes of weakness in the bedrock. The extracted blocks from the underground quarries were small and medium-sized, therefore easier to manoeuvre inside tunnels, such as the underground ones in the Tunisian Sahel,[10] whereas those extracted from the open-air quarry were, in the majority, large-sized.

The small, fragmented alabaster blocks gathered in small piles within the quarry areas attest to the fact

[4] The study of calcite alabaster mosaic tesserae and *opus sectile* has been excluded, as it may be the topic of another paper.
[5] Lazzarini *et al.* 2012: 439-443.
[6] Lazzarini *et al.* 2012: 439-443; Rouvier 1985: 52-54.
[7] Younès 2014a: 179-181.
[8] Younès and Ouaja 2009.
[9] Younès *et al.* 2015.
[10] Younès and Ouaja 2009; Younès *et al.* 2015.

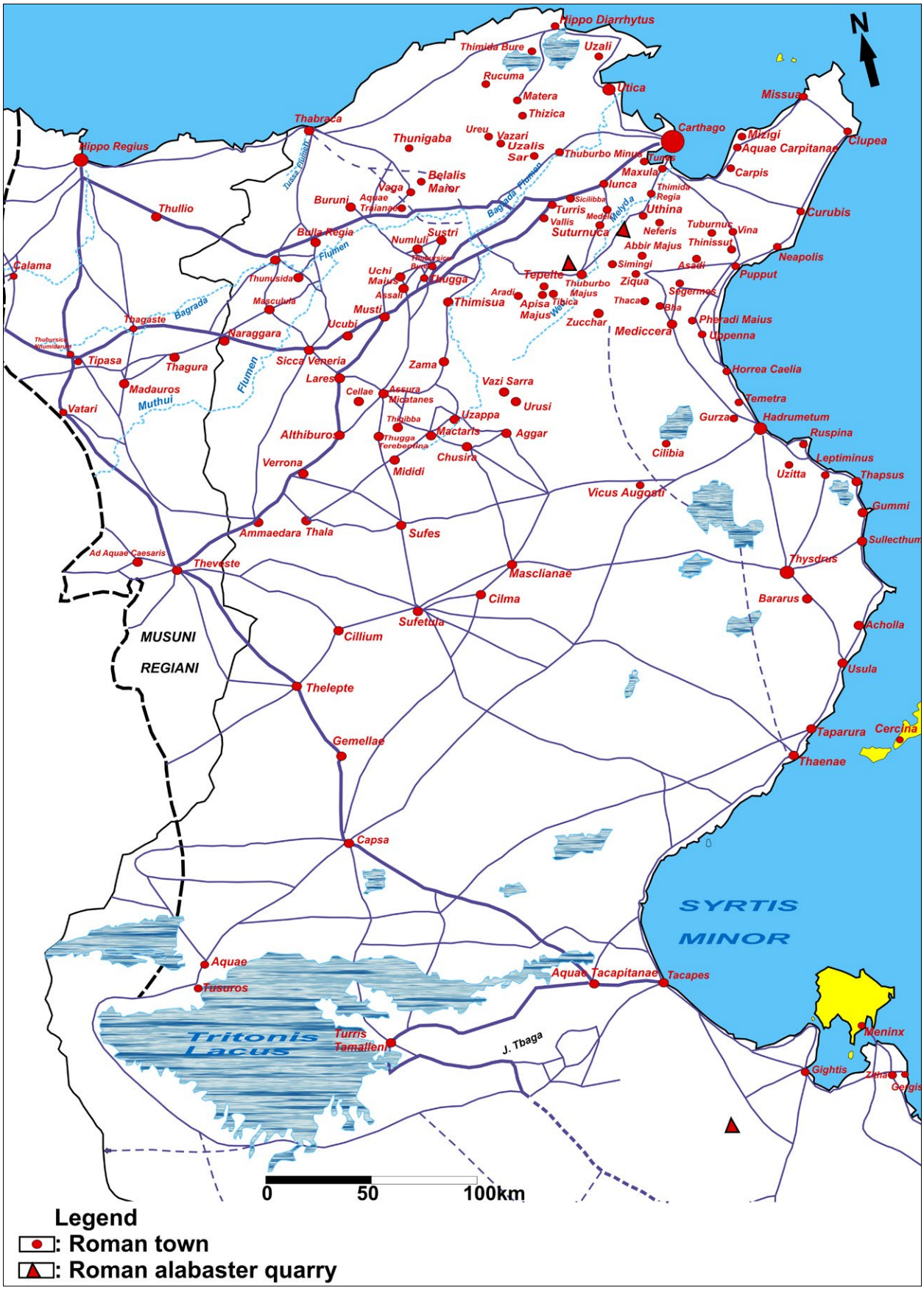


Figure 1: Location map of Roman towns and alabaster quarries in Tunisia (map: Ameur Younès).

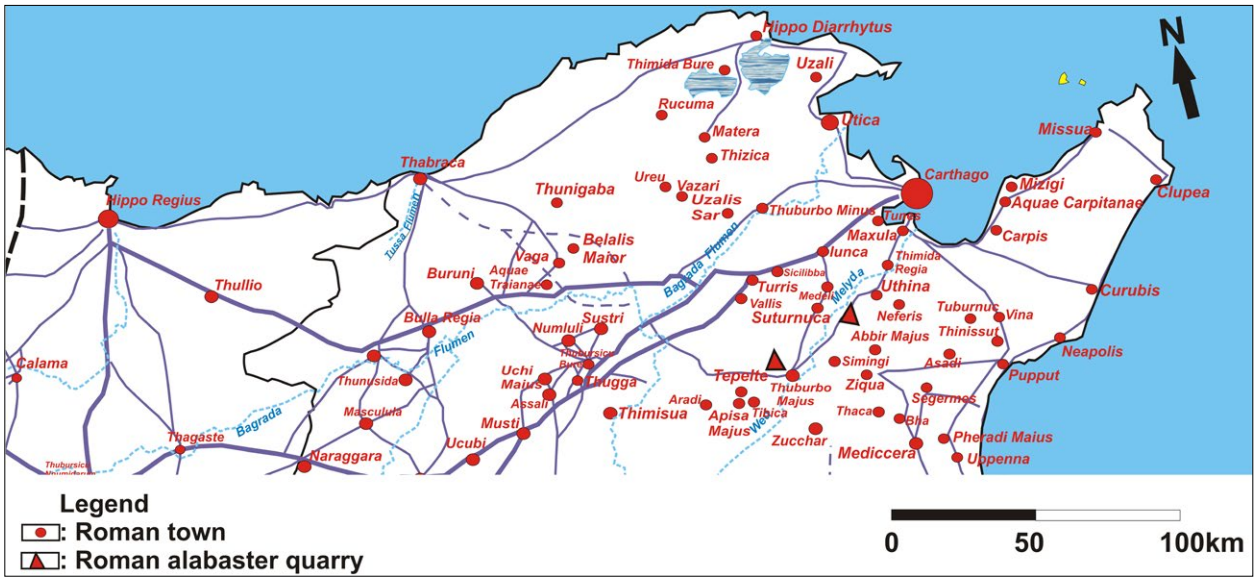


Figure 2: Location map of Roman towns and alabaster quarries in northern Tunisia (map: Ameur Younès).

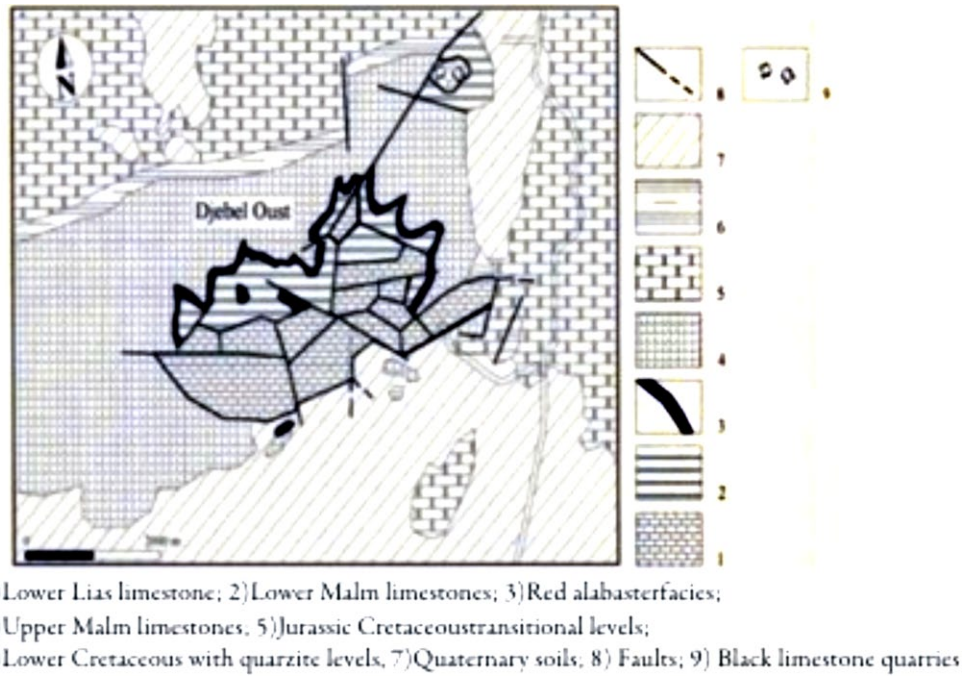


Figure 3: Geological sketch map of Jebel Oust (map: L. Lazzarrini, D. Visonà, M. Giamello and I. Villà).

that the extracted blocks were first cut and shaped *in situ* and then carried into the building sites. On the basis of their different colours and textures, five varieties of alabasters have been distinguished. The first one is characterised by a red background with whitish veins and yellowish bands, along with small greyish and whitish stains (**Figure 5a**). The second one features almost circular and wavy bands of brownish-red and greenish yellow, with whitish and brown veins (**Figure 5b**). The third variety, named 'alabastro a pecorella', is characterised by red, pinkish and whitish stains closely resembling the fleeces of wool on sheep (**Figure 5c**).[11]

The fourth variety has a yellow background over which are distributed white and purplish red veins and bands, in addition to small white stains (**Figure 5d**). The fifth variety is typified by a red background with wavy bands and veins in brown and white, along with white, yellow and greyish stains (**Figure 5e**).

Calcite alabaster quarries in the region of Elfahs

Two previously unknown open-air quarries of calcite alabaster have been identified during the field-walking survey undertaken on the mountains close to the Roman town of *Thuburbo Maius*, in the region of Elfahs (**Figure 2**). One quarry is situated in Jebel

[11] Gnoli 1988: 227.

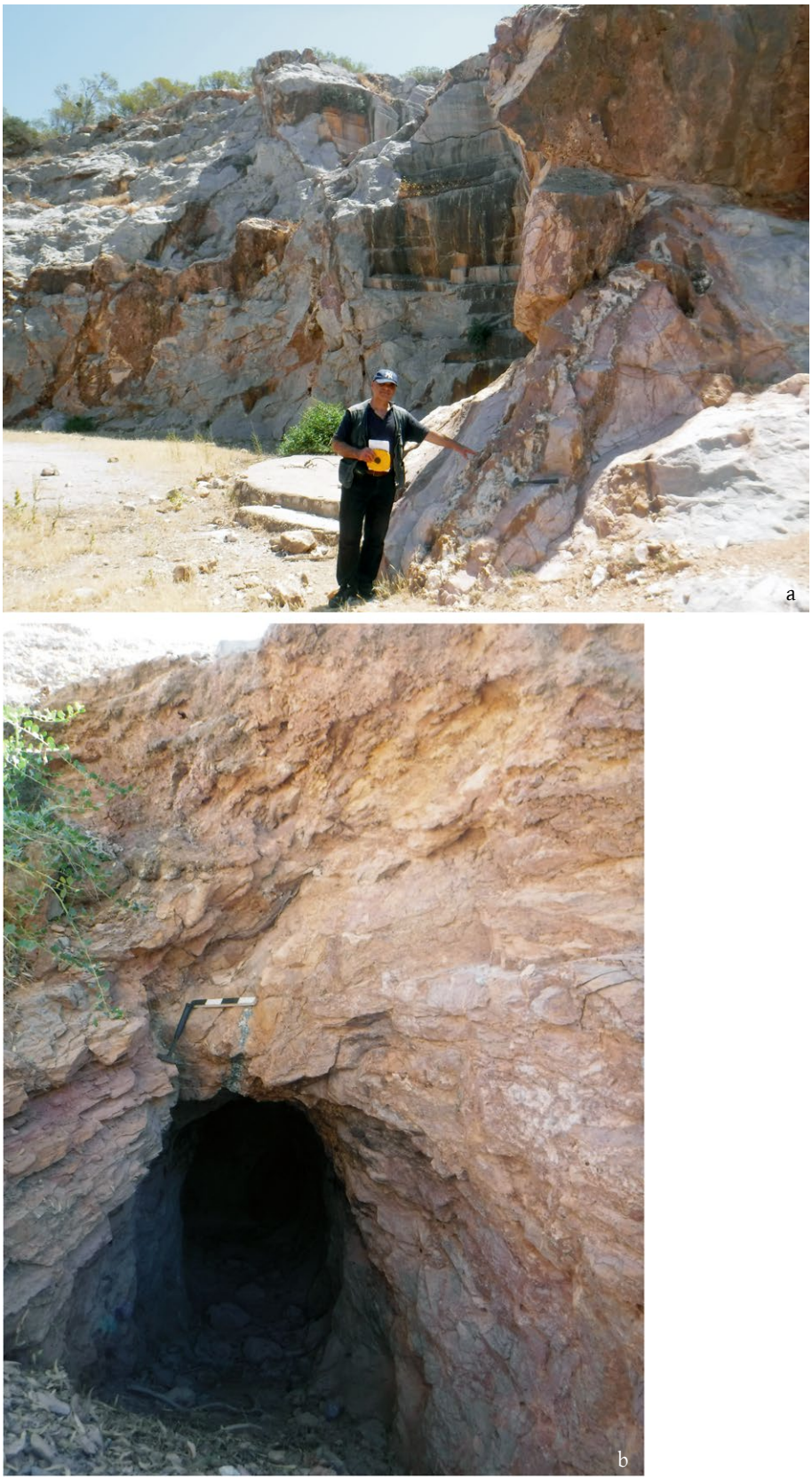


Figure 4: Alabaster and grey limestone quarries in Jebel Oust. a: open-air quarry of alabaster and grey limestone; b: underground alabaster quarry (photos: Ameur Younès).

Rouas and the other one in Jebel Ben Klab. The first one, located on the east/southeast of the mountain-side is accessible via the local road (C 28) connecting Elfahs to Guebellat, and then by following a rural track (**Figure 6a**). Geologically, the alabaster beds occur in the broad north/northwest–south/southeast fissure-ridges with-in the greyish limestone of the Lower Jurassic.[12] This quarry is larger than the open–air one

[12] Boussen *et al.* 2016: 3.

Quarry N°	Length (m)	Width (m)	Preserved height (m)	Thickness of the pumice stone layer above the alabaster beds (m)	Approximate volume of extracted blocks (cbm)
1	10.60	1.40	1.70	1.45	25.3
2	27.50	1.90	2	1.25	104.5
3	25.50	1.90	2.40	1.70	116.3
4	The quarry has collapsed and remains inaccessible.				
			Total amount of extracted blocks from the three tunnels: 246cbm		

Table 1: Sizes of the underground quarries.

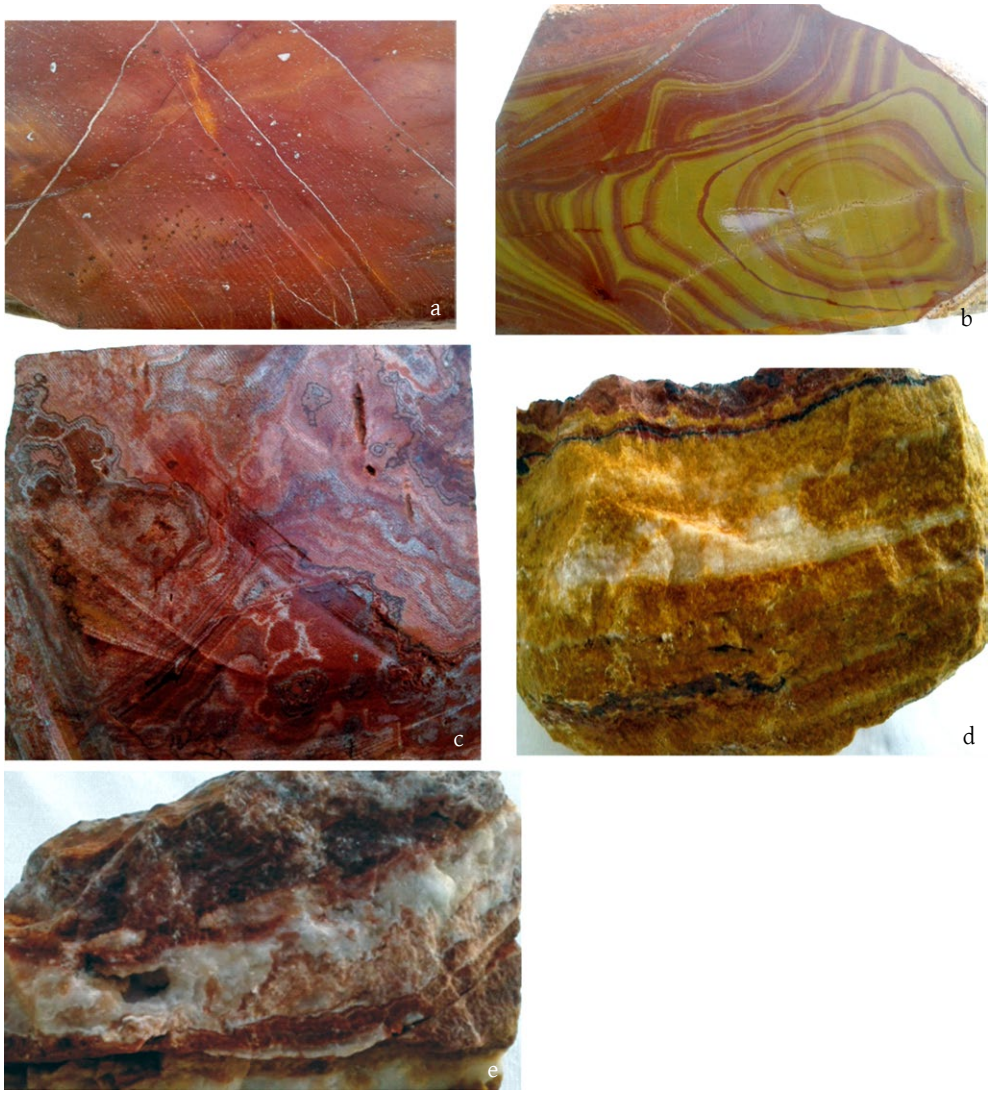


Figure 5: Alabaster varieties from Jebel Oust. a: first alabaster variety; b: second alabaster variety; c: third alabaster variety; d: fourth alabaster variety; e: fifth alabaster variety (photos: Ameur Younès).

identified in Jebel Oust. It has an almost elongated rectangular shape, measuring approximately 105m x 15m x 16m in length, average width and height, respectively. It covers an area of 1575sq.m and the volume of extracted stones (grey limestone and alabaster blocks) amounts to about 25,200cbm. From the cutting marks preserved on the alabaster beds, the amount of extracted alabaster blocks is estimated to have approximated 20% (5040cbm) of the total volume. Quarrying was effectuated by means of channelling, as in the large open-air quarry in Jebel Oust; the quarry faces show stepped and bevelled edge profiles. According to the cutting marks left on the cut rock-faces, the extracted blocks seem to have been of medium and large size (medium size being 50-100cm long and large size exceeding 100cm). The

Figure 6: Alabaster and grey limestone quarries in Jebel Rouas and Jebel Ben Klab. a: alabaster and grey limestone quarry (J. Rouas); b: heap of rock debris in the quarry area (J. Rouas); c: alabaster and grey limestone quarry (J. Ben Klab); d: visible extraction marks (J. Ben Klab quarry) (photos: Ameur Younès).

blocks measuring more than 3m in length would be appropriate for the carving of column-shafts.[13] The heaps of small, fragmented alabaster blocks found in the quarry premises clearly suggest that the blocks were shaped *in situ* (**Figure 6b**). On the grounds of their different colour and texture, four varieties of alabaster can be distinguished. The first one, called 'alabastro listato', is characterised by a whitish background upon which are distributed narrow bands with a wide range of shades, yellowish, brown and blackish, together with lines and veins of grey/black and brown, and small greyish stains (**Figure 7a**).[14] The second one features both thin and wide pinkish veins upon a red ground (**Figure 7b**). The third variety has a red background with thin and wide yellowish veins, in addition to sparse whitish, pinkish and greyish stains (**Figure 7c**). The fourth variety is a banded alabaster with a wide range of brown, yellow and white hues, along with veins and stains of white and purplish-brown colour (**Figure 7d**).

The second quarry, located at the north side of Jebel Ben Klab, about 1km south/southeast of the previous one, is accessible through the local road (C 28) (**Figure 2**). Geologically, the alabaster beds occur in the broad north/northwest-south/southeast fissure-ridges within the greyish limestone of Lower Jurassic. The quarry is much smaller and less well-preserved than the previous one, located at Jebel Rouas. At present day, traces of modern exploitation have been identified (**Figure 6c**). The well-preserved ancient quarry-front is about

[13] Unfortunately, due to shortage of time and equipment, not all the sizes of the extracted blocks whose traces are well-preserved on the quarry fronts could be taken. We shall refer to them in a next research work, dealing with the exploitation of both grey limestone and alabaster in this quarry.
[14] Gnoli 1988: 226, fig. 226.

Figure 7: Alabaster varieties from Jebel Rouas. a: first alabaster variety; b: second alabaster variety; c: third alabaster variety; d: fourth alabaster variety (photos: Ameur Younès).

14m high in places and about 10m wide. Judging from the ancient cutting marks, the quarrying process was conducted by means of channelling, as in the previous two open-air quarries. The extraction trenches and the holes where iron wedges were inserted along the line of rupture are well-preserved in several places. Tool marks (of a pick or *escoude*) are still visible in certain extraction trenches (**Figure 6d**). The quarry fronts sometimes feature a stepped profile. Only one variety of alabaster has been identified; it features a red background upon which are distributed thin and wide yellowish veins, together with few whitish, pinkish and greyish stains, similar to the third variety identified at Jebel Rouas.

Calcite alabaster quarries in the region of Medenine

During the field survey undertaken in March 2015, four ancient calcite alabaster quarries were identified in Jebel Saïkha, area of Toujane in the region of Medenine (**Figure 8**). These quarries are accessible through the local road (C104) connecting the town of Medenine to the villages of Toujane and Matmata, and then by following a rural track (**Figure 8**). Geologically, Jebel Saïkha belongs to a small mountain range on the northern border of the Saharan Platform, at an altitude below 350m.[15] The small mountain range consists mostly of limestone and dolomites of Permian age.[16] The alabaster beds occur in the broad east-west fissure-ridges within the greyish limestone of the Upper Permian bioherms.[17] The four quarries are small-sized, the largest one is 262.5sq.m and the smallest one is 208sq.m (**Table 2**). Quarrying was conducted in the open-air rather than underground, since the layer of sand covering the alabaster beds is too thin, almost inexistent (**Figure 9a**). The cutting marks preserved on the quarry faces suggest that two types of extraction techniques were applied: channelling and splitting. The former technique was the same as that implemented in the open-air quarries in Jebel Oust, Jebel Rouas and Jebel Ben Klab (**Figure 9b**), whereas the latter was identified only in the limestone quarries located in the area of Dougga[18] and in the green-schist quarries in the region of Chemtou.[19] The splitting technique requires less effort by the quarrymen. It consists of widening the natural planes of weaknesses (stratigraphic levels and joints) in the alabaster beds, by using a pick and/or an awl. Then, a series of holes is opened along the forward side of the block to be separated and detached by means of inserted iron wedges. At the end, the quarrymen use a sledgehammer to bang the wedges into the holes until the block gets separated from the bedrock. The extracted blocks are both

[15] Bouaziz *et al.* 1989; Ouaja *et al.* 2002: 6-41.

[16] Razgallah *et al.* 1989.
[17] Zouari *et al.* 1987.
[18] Younès 2018: 103-105.
[19] Younès 2014b.

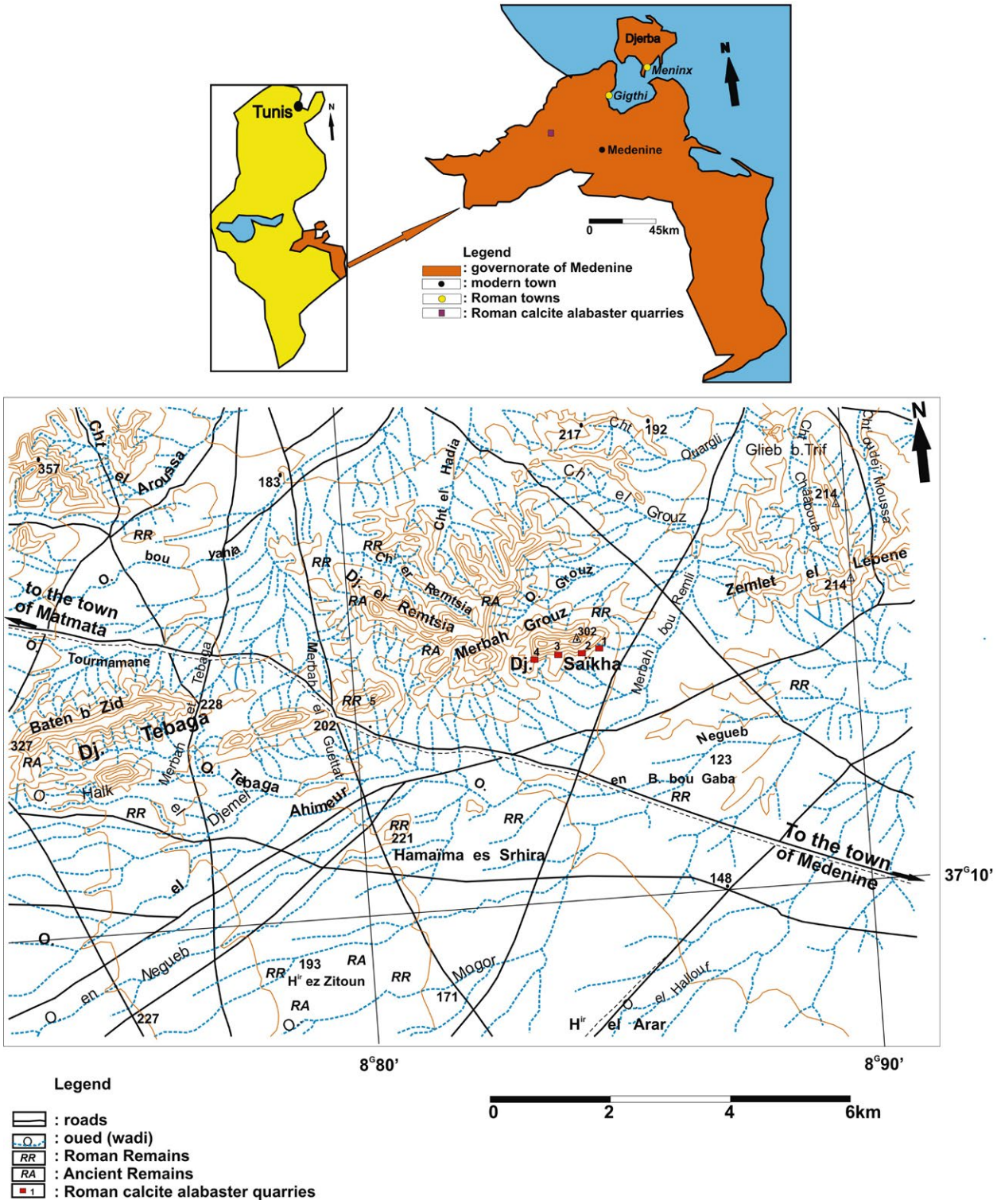


Figure 8: Map of the alabaster quarries in Jebel Saïkha (map: Ameur Younès).

large and medium-sized, namely, between 68cm and 100cm or over 100cm (**Table 3**). The heaps of debris accumulated in the quarry areas clearly suggest that here, too, the blocks were shaped *in situ*, as in the alabaster quarries in the regions of Zaghouan and Elfahs. The quarrymen did not only extract blocks but also column-shafts (**Figure 9c**). The extraction of column-shafts is attested in Roman marble quarries in the *Proconsularis*, i.e. the 'giallo antico' quarry at *Simitthus*[20] and in other Roman provinces such as the Aliki ancient marble quarry, on the island of Thasos.[21] The particular method of quarrying column-shafts allowed one to save time and to reduce the waste

[20] Adam 1984: 27.
[21] Sodini *et al.* 1980: 27, 28, 32.

Quarry N°	Length (m)	Width (m)	Average height (m)	Area (sq.m)	Approximate volume of cut blocks and column-shafts (cbm)
1	25	10.5	4	262.5	1050
2	16	13	4.5	208	936
3	18	13.5	3	243	729
4	16	15	3.2	240	768
					Total: 3483

Table 2: Sizes of the quarries.

Quarry N°	Blocks			Column-shafts	
	Length (m)	Width (m)	Height (m)	Diameter (m)	Preserved height (m)
1	2.35 2.25 1.1 1.05 1 0.95 0.68	1 1 0.5 0.6 0.5 0.75 0.55	0.75 0.75 0.3 0.3 0.3 0.3 0.3	55 55	63 72
2	1.2 1.2 1.2 0.95	0.9 0.7 0.7 0.5	0.65 0.5 0.4 0.3	0.45 0.75	1.25 1.55
3	1.2 1.2 1.2 0.9	0.8 0.8 0.8 0.75	0.7 0.7 0.6 0.45		
4 1.5 1.2 0.9 1 0.7 0.9 0.75 0.5 0.5					

Table 3: Sizes of cut and pre-cut blocks and column-shafts.

while shaping such architectural elements. More specifically, the quarry worker outlines the column-shaft to be cut by opening slits on the upper and lateral sides, which he subsequently widens and deepens, so as to form extraction trenches. Then he makes a line of fracture and holes at the lower horizontal side, in order to insert metalic wedges on which he hammers so as to detach the column-shaft. From the different colours and textures observed in the alabaster blocks, three varieties can be distinguished. The first variety, termed 'alabastro fiorito', consists of two types: the first one is characterised by wavy veins and bands with a wide range of hues (white, beige, brown, yellowish, pinkish and purplish), and rounded inclusions of light brown, yellowish and pinkish colour (**Figure 10a**).[22] The second type features a translucent surface with stains and inclusions of yellow ochre, brown and purplish colour (**Figure 10b**).[23] The second variety is a translucent whitish alabaster with wavy veins and bands of brown and purplish (**Figure 10c**). The third one is characterised by a red background upon which are distributed white and pinkish stains, together with purplish veins.

Uses and provenance of calcite alabasters in Roman archaeological sites

The field survey carried out in the rural and urban archaeological sites revealed that calcite alabaster was used in Roman public and private constructions.

[22] Gnoli 1988: 223-228.

[23] Gnoli 1988: 223-228.

Figure 9: Alabaster quarries in Jebel Saïkha. a: view of the third alabaster quarry; b: marks of alabaster extraction in the second quarry; c: extraction traces of a column-shaft (photos: Ameur Younès).

Uses of calcite alabasters in Roman (archaeological) sites

The survey undertaken in the 18 ancient 'rural sites' plotted on the topographic map of Matmata,[24] located in proximity to the ancient calcite alabaster quarries at Toujane, provided some interesting information. Indeed, constructions made of calcite alabaster rubble stones and blocks have been identified in four ancient 'rural sites' – tentatively interpreted as farmsteads – as we shall see below (**Figure 8**). In the first one, situated at Merbah Grouz, about 0.5km north of the quarries, the vestiges of a building's walls made of small alabaster blocks, greyish limestone[25] and calcareous sandstone have been identified, together with a few sherds of ceramica comune and African sigillata. The second site (plotted B on the map), Bou Gaba, is situated at about 2.7km south/southeast of the quarries. Few fragments of a building's walls made of small alabaster blocks and rubble stones have been identified, along with sherds of ceramica comune and African sigillata (**Figure 11a**). In the third and the fourth sites located at Hmaïma es Sghira, about 2.8km and 3.6km south/southwest of the quarries, vestiges of walls built of small alabaster blocks, and greyish limestone blocks have been identified, together with a few sherds of amphorae, ceramica comune and African sigillata. The remains identified in the aforementioned four rural sites belonged very probably to farmsteads dating back to the Roman period. Judging from the texture and the colours of the small alabaster blocks and rubble stones found on these sites, only a single variety has been employed. It is characterised by a red background upon which stretch whitish and pinkish stains, along with whitish and purplish veins (**Figure 11a**). The small alabaster blocks were extracted from the quarries and the

[24] Topographic map of Matmata, scale 1:100000, OTC, Tunis.

[25] These blocks were extracted from a quarry in Jebel Essouinia, located west of the alabaster quarries.

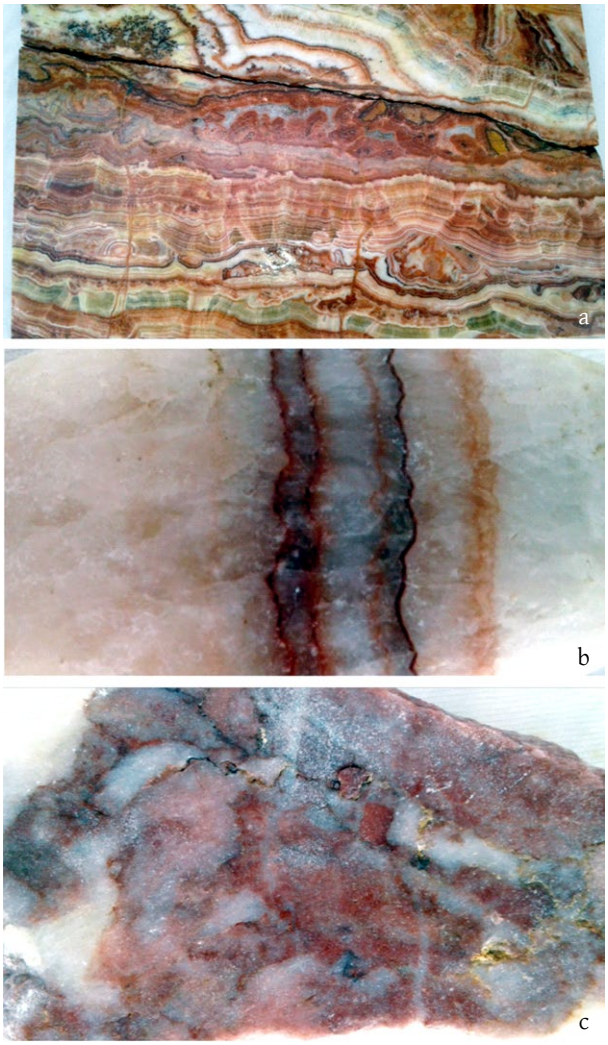


Figure 10: Alabaster varieties from Jebel Saïkha.
a: first alabaster variety; b: second alabaster variety;
c: third alabaster variety (photos: Ameur Younès).

fragments were obtained from the cutting out of big blocks.

In addition to the sector located in proximity to the quarries, the two well-known Roman towns of *Meninx* and *Gigthi* have been surveyed. The information collected suggests that the public monuments in both towns had been decorated with architectural elements made of alabaster. Apart from the limited excavations carried out in the site of Meninx, which yielded the vestiges of a few monuments, the remaining buildings are either mostly or entirely covered in sand.[26] Certain of the unearthed monuments belonged to the public sector (Forum, temples, basilica, etc.). Some of their architectural elements – structural, as well as decorative – were made of calcite alabaster, among which fragments of column-shafts and bases, capitals and sections of entablatures have been identified, although in a bad state of preservation. Four varieties of alabasters have been distinguished on the basis of colour and texture. The first one, termed 'alabastro fiorito' is characterised by wavy bands and veins of different shades (brown, purplish, pinkish and white), with sporadic rounded inclusions of light brown, pinkish and yellowish colour (**Figure 11b**). The second variety features a red background upon which are distributed whitish and pinkish stains, as well as whitish and purplish veins (**Figure 11c**). The third one is a translucent whitish alabaster with brown and purplish veins and bands (**Figure 11d**). The fourth variety, termed 'alabastro listato', has a red background upon which are distributed narrow and wavy bands of whitish and yellowish colour, including wavy purplish lines and whitish stains (**Figure 11e**).

On the archaeological site of the town of *Gigthi*, only one variety of alabaster has been identified: some slabs of 'alabastro fiorito' were used as wall-revetment of the ephebeum in the palaestra, which formed part of the Roman baths (**Figure 11f**). This variety is similar to the one identified at *Meninx*. Furthermore, from calcite alabaster were carved the architectural elements of the constructions located in the urban sectors of several ancient towns in *Africa procosularis septentrionalis*: *Thuburbo Maius*, Oudhna, *Ziqua*, Carthage, Dougga and *Bulla Regia*. At *Thuburbo Maius*, several fragments of column-shafts and a base, part of a cornice, and slabs were employed to decorate public monuments and sumptuous dwellings. On the grounds of their colour and texture, two varieties of alabasters can be distinguished. The first one, the 'alabastro listato', is characterised by a whitish background over which are distributed more or less narrow bands of blackish, brown and yellowish colour, including grey/black, brown lines and small dark grey stains (**Figure 12a**). This variety was used for the carving of column-shafts and a base in the temple of Caelestis, built between the first and the second centuries AD, as well as a cornice of the Capitol, erected in AD 168-169. Moreover, slabs of the same variety were employed as the wall-revetment of a basin in the thermae built during the reign of Antoninus Pius (AD 138-161) and restored in AD 361. The second variety of alabaster, employed for the column-shafts in the temple of Caelestis, features a red background over which are distributed small yellowish veins and few stains of greyish, pinkish and whitish colour (**Figure 12b**).

At Oudhna, some fragments of alabaster column-shafts and slabs for wall-revetment are gathered in a small open area or reused to decorate the pathways within the archaeological site. This sort of alabaster is characterised by irregular bands of white, red and yellow-brown colour, with small grey stains (**Figure**

[26] Drine 2000; Drine 2007; Drine *et al.* 2009: 43-54, 149-166; Ritter *et al.* 2018.

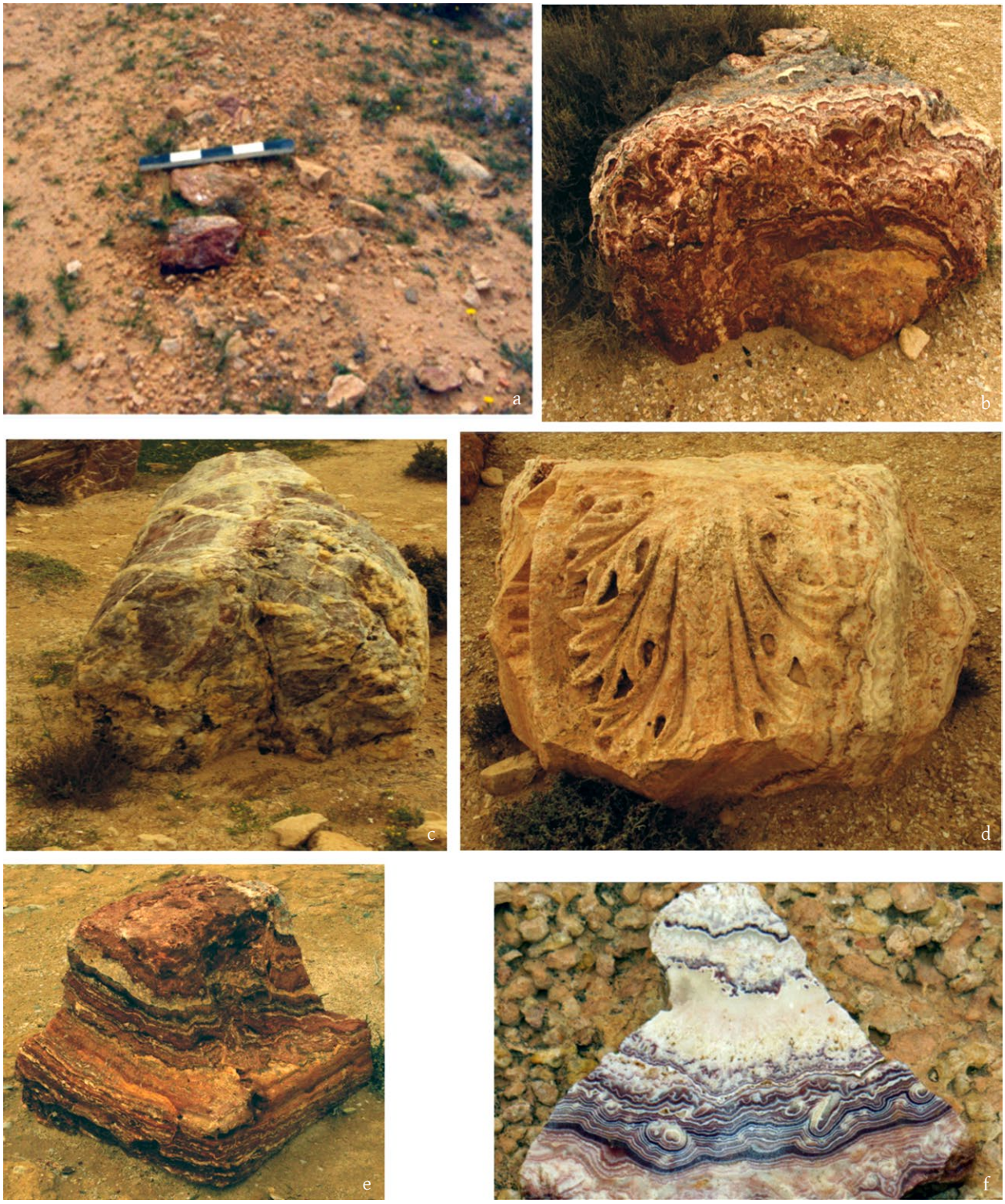


Figure 11: Alabaster varieties from Bou Gaba (rural site), *Meninx* and *Gigthi*. a: small alabaster blocks in the rural site of Bou Gaba; b: first alabaster variety (*Meninx*); c: second alabaster variety (*Meninx*); d: third alabaster variety (*Meninx*); e: fourth alabaster variety (*Meninx*); f: alabaster variety (*Gigthi*) (photos: Ameur Younès).

12c).[27] According to the curator of the site, during a personal communication, these fragments most probably belonged to public monuments of the Roman town. At *Ziqua*, a fragment of an alabaster column-shaft has been identified; it has irregular bands of red, yellow, white and brown colour, with grey stains (**Figure 12d**). At Carthage, fragments of alabaster column-shafts have been recorded in the open-air Museum on the Hill of Byrsa, as well as in a Roman peristyle house, the so-called Aviary House. The fragmented column-shafts displayed in the Byrsa Museum belonged to public monuments; as for the shafts reused in the peristyle

[27] Agus *et al.* 2007: 378-380, 387.

Figure 12: Alabaster varieties from the Roman archaeological sites. a: first alabaster variety (*Thuburbo Maius*); b: second alabaster variety (*Thuburbo Maius*); c: alabaster variety (Oudhna); d: alabaster variety (*Ziqua*); e: first alabaster variety (Carthage); f: second alabaster variety (Carthage); g: alabaster variety (Dougga); h: two alabaster varieties (*Bulla Regia*) (photos: Ameur Younès).

<table>
<tr><th>Alabaster varieties from the quarries of Jebel Saïkha</th><th colspan="2">Alabaster varieties from the archaeological sites in the region of Medenine</th></tr>
<tr><td rowspan="6">1st variety: 2 types of ‘alabastro fiorito’
• Type 1: characterised by wavy veins and bands with a broad range of shades (white, beige, brown, yellowish, pinkish and purplish), and rounded inclusions of light brown, yellowish and pinkish colour.
• Type 2: features a translucent surface with stains and inclusions of yellow ochre, brown and purplish colour.

2nd variety: a translucent whitish alabaster with wavy veins and bands of brown and purplish colour.

3rd variety: characterised by a red background upon which are distributed white and pinkish stains, together with purplish veins.</td><td>Roman rural sites</td><td>Alabaster characterised by a red background upon which are distributed whitish and pinkish stains, along with whitish and purplish veins.</td></tr>
<tr><td rowspan="4">Meninx</td><td>1st variety: ‘alabastro fiorito’ characterised by wavy bands and veins of brown, purplish, pinkish and white colour, with rounded inclusions of light brown, pinkish and yellowish colour.</td></tr>
<tr><td>2nd variety: features a red background upon which are distributed whitish and pinkish stains, and whitish and purplish veins.</td></tr>
<tr><td>3rd variety: a translucent whitish alabaster with brown and purplish veins and bands.</td></tr>
<tr><td>4th variety: ‘alabastro listato’ has a red background upon which are distributed narrow and wavy bands of whitish and yellowish, with the presence of wavy purplish lines and whitish stains.</td></tr>
<tr><td>Gigthi</td><td>‘alabastro fiorito’ characterised by wavy bands and veins of brown, purplish, pinkish and white colour, with round inclusions of light brown, pinkish and yellowish colour.</td></tr>
</table>

Table 4: Data on the alabaster varieties from the quarries of Jebel Saïkha and from the visited ancient archaeological sites in the region of Medenine.

of the Aviary House, they may have originated either from older colonnades of the same building or from some other, neighbouring, peristyle building. On the basis of colour and texture, two varieties of alabasters have been distinguished. The first one is characterised by a red background over which are distributed wavy bands and veins of white and brown, with whitish and greyish stains (**Figure 12e**). The second variety features a yellow background with curved bands and veins in red, violet and whitish colour, along with white stains (**Figure 12f**). At Dougga, a fragment of a column-shaft made of ‘alabastro a pecorella’ has been registered. Its red, yellow and white stains bear close resemblance to the fleece of wool on sheep (**Figure 12g**).[28] At *Bulla Regia*, alabaster column-shafts have been identified in a Roman peristyle house, the so-called House of the Hunt. Two varieties of alabaster have been discriminated on the grounds of colour and texture. The first one features a red background with veins of pinkish and greyish colours, along with sparse whitish stains (**Figure 12h**). The second variety has a yellow background with curved bands and veins of purplish, red and white colour, and a few white stains (**Figure 12h**).

The provenance of calcite alabasters used in the Roman sites

The origins of the alabaster of which the architectural elements unearthed in the archaeological sites were made, has been determined on the basis of two criteria. The first criterion is a comparison of the macroscopic analyses data (textures and colours)[29] of the quarry alabasters with the architectural elements identified in the archaeological sites. The second one is related to the proximity of the quarries to the archaeological sites.

The variety of alabaster employed in the building walls within the four rural Roman sites is similar to that extracted from the quarries of Jebel Saïkha (**Table 4**). The distance between the quarries and the rural sites ranges from 0.5km to 3.6km (**Table 6**). Thus, it is most plausible that the alabaster rubble stones and small blocks used in the building walls inside the Roman rural sites were extracted from the quarries of Jebel Saïkha. In the Roman towns of *Meninx* and *Gigthi*, three of the four varieties of alabasters of which the architectural elements were made, are similar to the first type of ‘alabastro fiorito’ and the other two varieties identified in the quarry of Jebel Saïkha (**Table 4**). The quarry is not very far from the two sites of *Gigthi* and *Meninx* (**Table 6**) and, in the light of the available evidence, this quarry provided alabaster for the carving of the aforementioned architectural elements.

On the site of *Thuburbo Maius*, the two varieties of alabaster used for the carving of the architectural

[28] Hermann *et al.* 2012: 466; Lazzarini 2009: 462.

[29] Due to technical reasons, up to nowadays no microscopic analyses have been carried out on the different calcite-alabasters identified in the quarries and the archaeological sites. We shall undertake these analyses in a collaborative project with colleagues.

Alabaster varieties from the quarries of Jebel Oust, Jebel Rhouas and Jebel Ben Klab		Alabaster varieties from the visited archaeological sites in northern Tunisia	
Jebel Oust	**1st variety:** characterised by a red background with whitish veins and yellowish bands, along with small greyish and whitish stains. **2nd variety:** features almost circular and wavy bands of brownish-red and greenish yellow, with whitish and brown veins. **3rd variety:** 'alabastro a pecorella', characterised by red, pinkish and whitish stains bearing close resemblance to the fleece of sheep. **4th variety:** characterised by a yellow background over which are distributed white and purplish red veins and bands, with small white stains. **5th variety:** characterised by red background with wavy bands and veins of brown and white colour, along with white, yellow and greyish stains.	***Thuburbo Maius***	**1st variety:** 'alabastro listato' characterised by a whitish background over which are distributed more or less narrow bands of blackish, brown and yellowish colours, with grey/black, brown lines and small dark grey stains. **2nd variety:** features a red background with small yellowish veins and few stains of greyish, pinkish and whitish.
		Oudhna	Alabaster characterised by irregular bands of white, red and yellow-brown colour, with small grey stains.
		Ziqua	The alabaster features irregular bands of red, yellow, white and brown colour, with grey stains.
		Carthage	**1st variety:** characterised by a red background over which are distributed wavy bands and veins of white and brown colour, with whitish and greyish stains. **2nd variety:** features a yellow background with curved bands and red/violet or whitish veins, along with white stains.
		Dougga	'alabastro a pecorella' characterised by red, yellow and white stains bearing close resemblance to the fleece of sheep.
		Bulla Regia	**1st variety:** features red background with veins of pinkish and greyish colours, and sparse whitish stains. **2nd variety:** displays a yellow background with curved bands and veins of purplish, red and white colour, with a few white stains.
Jebel Rhouas	**1st variety:** 'alabastro listato', characterised by a whitish background upon which are distributed narrow bands of yellowish, brown and blackish colour, together with lines and veins of grey/black and brown colour, and small greyish stains. **2nd variety:** features both thin and wide pinkish veins upon a red ground. **3rd variety:** has a red background with thin and wide yellowish veins, along with sparse whitish, pinkish and greyish stains. **4th variety:** banded alabaster with a wide range of shades of brown, yellow and white colour, along with white and purplish-brown veins and stains.	***Thuburbo Maius***	(see above)
		Oudhna	(see above)
		Ziqua	(see above)
		Carthage	(see above)
		Dougga	(see above)
		Bulla Regia	(see above)
Jebel Ben Klab	The alabaster features a red background with thin and wide yellowish veins, together with a few whitish, pinkish and greyish stains.		

Table 5: Data on the alabaster varieties from the quarries of Jebel Oust, Jebel Rouas, Jebel Ben Klab and from the visited archaeological sites of the ancient towns.

elements are similar to the respective two varieties identified in the quarries of Jebel Rhouas and Jebel Ben Klab (**Table 5**). Both quarries are located in close proximity to the archaeological site (**Table 6**). Therefore, there is no doubt that both varieties of alabaster were employed for the architectural elements of the Roman monuments at *Thuburbo Maius*. The alabaster employed for the architectural elements found on the site of Oudhna (column-shafts, slabs for wall-revetment) is similar to the fifth variety of alabaster identified in Jebel Oust (**Table 5**). This site is located in closer proximity to the quarries of Jebel Oust than to those of Jebel Rhouas and Jebel Ben Klab (**Table 6**). Thus, it is most plausible that the former quarry was preferred. The alabaster used to carve the column-shaft from the archaeological site of *Ziqua* is similar to the fifth variety of alabaster identified in the quarries of Jebel Oust (**Table 5**). The latter are located closer to this site than the quarries of

Quarries	Ancient archaeological sites	Approximate distances as the crow flies (km)
Jebel Saïkha	Rural site of **Merbah Grouz**	0.5
	Rural site of **Bou Gaba**	2.7
	Rural site of **Hmaïma es Sghira 1**	2.8
	Rural site of **Hmaïma es Sghira 2**	3.6
	Gigthi	45
	Meninx	75
Jebel Oust	***Thuburbo Maius***	23
	Oudhna	14
	Ziqua	15
	Carthage	50
	Dougga	88
	Bulla Regia	138
Jebel Rhouas and Jebel Ben Klab	***Thuburbo Maius***	5
	Oudhna	38
	Ziqua	28
	Carthage	70
	Dougga	65
	Bulla Regia	115

Table 6: Distances between the quarries and the ancient archaeological sites.

Jebel Rhouas and Jebel Ben Klab (**Table 6**). Therefore, the alabaster of this column-shaft reasonably came from the quarries of Jebel Oust. As regards the column-shafts recorded at Carthage, the two varieties of alabaster used for their making are similar to the fourth and fifth alabaster varieties identified in Jebel Oust (**Table 5**). The site of Carthage is closer to the quarries of Jebel Oust than to those of Jebel Rhouas and Jebel Ben Klab (**Table 6**), so, in all likelihood, it was served by the former. The column-shaft of 'alabastro a pecorella' discovered in the site of Dougga is different from the 'alabastro a pecorella' identified in Jebel Oust (**Table 5**). Finally, the two varieties of alabaster used for the column-shafts of the 'House of the Hunt' in *Bulla Regia* are similar to the fourth alabaster variety from Jebel Oust and to the second alabaster variety from Jebel Rhouas (**Table 5**). Both quarries are located far from the archaeological site of *Bulla Regia* (**Table 6**), so, either one could have provided material for the shafts of the 'House of the Hunt'.[30]

Conclusions

The survey carried out on the southern and northern Tunisian mountains consisting of limestone inter-bedded with calcite alabaster beds led to the identification of eleven ancient alabaster quarries, ten of which were so far unknown. In southern Tunisia, four small open-air quarries were cut into the alabaster beds occurring in the limestone deposits in Jebel Saïkha, part of the Medenine small mountain-range. In northern Tunisia, seven ancient quarries of calcite alabaster and grey limestone have been discovered in Jebel Oust, Jebel Rouas and Jebel Ben Klab. In the former, a large open-air quarry and four small-sized underground ones have been recorded, whereas two open-air quarries have been discovered in the latter two mountains. The quarrymen used two techniques in order to cut out the blocks and the column-shafts: the channelling and the splitting technique. The large blocks were shaped already in the quarry premises, so as to facilitate their transport into the Roman rural and urban building sites.

In the absence of literary and/or epigraphic texts, the administration and exploitation of the quarries remain unknown. The calcite alabaster samples taken from the quarries could not be analysed microscopically for technical reasons, and therefore their different varieties have been determined macroscopically (on the grounds of colour and texture). Twelve different alabaster varieties have been identified in total: three from Jebel Saïkha quarries, five from Jebel Oust quarries and four from Jebel Rouas and Jebel Ben Klab quarries. In terms of quality, five of the twelve identified varieties can be classified among the best ones known in the Roman world: 'alabastro a pecorella', 'alabastro fiorito', 'alabastro listato', 'alabastro rosso' and the coloured banded alabaster.[31]

[30] Microscopic and isotopic analyses will provide further details.

[31] Barker 2018: 48-61; Bruno 2002; Hermann *et al.* 2012: 464-465; Lazzarini 2019: 387-388; Lazzarini *et al.* 2012: 436-438; Scardozzi 2012: 578-579.

A survey of the urban Roman sites (*Gigthi*, *Meninx*, *Thuburbo Maius,* Oudhna, *Ziqua*, Carthage, Dougga, and *Bulla Regia*) and the rural ones located in the sector of Toujane has led to the identification of blocks, slabs and architectural elements made of calcite alabaster used for the construction and decoration of buildings. By macroscopic inspection/observation we were able to match each building material (each of the alabaster varieties) of these architectural elements with the respective quarry, and consequently to identify the provenance of each variety: the 'alabastro fiorito' and 'alabastro listato' varieties from the quarries of Jebel Saïkha resemble the material used for architectural elements at *Gigthi* and *Meninx*; the 'alabastro listato' and 'alabastro rosso' of Jebel Rouas are the same as those identified at *Thuburbo Maius*; the 'alabastro rosso' and banded alabaster from Jebel Oust are almost similar to those employed at Carthage. Furthermore, certain quarries are situated close or very close to the archaeological sites (the quarries of Jebel Saïkha are within easy reach from Roman rural sites in the sector of Toujane, *Gigthi* and *Meninx*; the quarries of Jebel Rouas and Jebel Ben Klab are not far from *Thuburbo Maius*; the quarries of Jebel Oust are fairly close to *Ziqua,* Oudhna and Carthage). Therefore, both the macroscopic analyses and the short distance between the quarries and the respective archaeological sites sustain our hypothesis that most of the alabaster varieties used for the carving of architectural elements ('alabastro fiorito', 'alabastro listato', 'alabastro rosso', and banded alabaster) were extracted from the nearby local alabaster quarries. Yet, some varieties, such as the 'alabastro a pecorella' discovered at Dougga, have not been identified among the registered local quarries. Microscopic analysis will not only determine the provenance of this variety (Algeria or any other country),[32] but will also set up a database of all the different alabaster varieties identified in the ancient quarries in Tunisia. Dating the alabaster quarries is not an easy task, in the absence of literary and/or epigraphic texts related to their administration and exploitation. Nevertheless, the alabaster architectural elements of certain monuments enable us to date the exploitation of the quarries generally in the Roman Imperial period. Besides, the 'alabastro listato' column-shafts which decorated the temple of Caelestis, along with a cornice made of the same alabaster variety identified in the Capitol, allow us to assert that the exploitation of the quarry of Jebel Rouas (wherefrom the particular variety was extracted) dates from the first and second centuries AD.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[32] Hermann *et al.* 2012.

Chapter 12

All about marble carving? In search of craftspeople of polychromy in the ancient Roman sculpture workshop

Amalie Skovmøller

Abstract

Sculpture and painting have, since the Renaissance, been regarded as two separate crafts by art historians and archaeologists. The *paragone* debate has since the fifteenth century claimed sculpture and painting to be distinct from one another, and consequently, the sculpture workshop is largely defined as a space where a single craft was practiced, that of marble carving. Yet, in recent years, scholars have discovered an additional, 'colour' dimension of ancient sculpture, including the remains of finished marble sculptures that were fully painted – a revelation that calls for a revisit of the ancient sculpture workshops.

Taking the city of Aphrodisias as a starting point, where a variety of sculpture-centred activities took place from the first to the third centuries AD this paper reviews the evidence which defines the ancient craft identities and the organisation of workshop spaces, providing insight into the realisation of fully coloured/painted marble sculptures. The Sculptor's Workshop in Aphrodisias has been regarded as a sculptor's working space, on the evidence of remains from marble working. However, an epitaph originating also from Aphrodisias refers to a sculptor qualified in working with encaustic painting (*ἀγαλματοποιός ἐγκαύστης*), thus raising questions as to the scope of creativity of the Aphrodisian sculptors, as well as the division between labour and organisational strategies pertinent to workshop spaces that specialised not only in marble carving but also in painting and the realisation of polychrome effects.

Re-evaluating the evidence at hand, this paper discusses the Roman marble sculpture-workshop as a space connecting multiple materials and crafts expertise. Besides obtaining raw material for the marble sculptures, the workshop producing polychrome sculptures would also have needed to stock up on materials needed to colour them. In addition, similarly sculpted figures were painted differently, thus raising the question of whether marble sculptures could be pre-carved and painted later, on demand. Discussing these points in relation to what the archaeological, literary, and epigraphic evidence is able to support, this paper presents new perspectives on the ancient sculpture workshop, uniting a sculptor's and a painter's perspective, which have traditionally been regarded as separate from each other, and adding the creative dimensions of gilding, inlaid eyes and other colourful effects, which originally completed the sculptural form in antiquity.

Περίληψη

Από την εποχή της Αναγέννησης, γλυπτική και ζωγραφική έχουν θεωρηθεί από τους αρχαιολόγους και ιστορικούς τέχνης ως δύο ξεχωριστές τέχνες. Στην συζήτηση για τον συγκριτικό παραλληλισμό των τεχνών (*paragone*) ήδη από τον 15ο αιώνα υπάρχει ο ισχυρισμός ότι γλυπτική και ζωγραφική είναι διακριτές. Κατά συνέπεια, το γλυπτικό εργαστήριο ορίζεται εν γένει ως χώρος άσκησης μίας μόνο δραστηριότητας, ως μαρμαρογλυφείο. Όμως τα τελευταία χρόνια οι επιστήμονες έχουν ανακαλύψει μια πρόσθετη, 'χρωματική' διάσταση της αρχαίας γλυπτικής, συμπεριλαμβανομένων των καταλοίπων ολοκληρωμένων μαρμάρινων γλυπτών που ήταν πλήρως επιχρωματισμένα – μια ανακάλυψη που επιβάλλει την αναψηλάφιση των αρχαίων εργαστηρίων γλυπτικής.

Με αφετηρία την πόλη της Αφροδισιάδας, όπου μια πλειάδα λιθοξοϊκών/λιθουργικών δραστηριοτήτων εκτυλίσσονταν από τον πρώτο έως τον τρίτο αιώνα μ.Χ. η παρούσα εργασία επανεξετάζει τα ευρήματα/ενδείξεις που προσδιορίζουν την ταυτότητα των αρχαίων τεχνών και την οργάνωση των εργαστηριακών χώρων, ρίχνοντας φως στη δημιουργία πλήρως χρωματισμένων μαρμάρινων γλυπτών. Το Εργαστήρι του Γλύπτη στην Αφροδισιάδα έχει ταυτοποιηθεί βάσει καταλοίπων μαρμαρογλυπτικής. Ωστόσο, ένα επιτάφιο επίγραμμα, επίσης προερχόμενο από την Αφροδισιάδα, αναφέρει έναν 'αγαλματοποιό εγκαύστη', ο οποίος δηλαδή επιδιδόταν στην εγκαυστική τεχνική (ζωγραφική με ζεστό κερί), εγείροντας ερωτήματα αφ' ενός για την ευρύτητα του καλλιτεχνικού πεδίου των γλυπτών της Αφροδισιάδας, αφ' ετέρου για το όριο μεταξύ εργασίας και οργανωτικών στρατηγικών σε χώρους του εργαστηρίου που ειδικευόταν όχι μόνο στη μαρμαρογλυπτική αλλά επίσης στην ζωγραφική και την παραγωγή πολύχρωμων αποτελεσμάτων.

Επανεκτιμώντας τα διαθέσιμα στοιχεία, η παρούσα εργασία συζητά το ρωμαϊκό εργαστήριο μαρμαρογλυπτικής ως έναν χώρο συνδυασμού πολλαπλών υλικών και καλλιτεχνικών ειδικοτήτων. Επιπλέον της εξασφάλισης πρώτης ύλης για τα μαρμάρινα γλυπτά, ένα εργαστήριο που παρήγε πολύχρωμα γλυπτά θα χρειαζόταν να εφοδιαστεί με υλικά απαραίτητα για τον επιχρωματισμό. Επιπροσθέτως, κάποιες παρόμοιες γλυπτικές μορφές μπορούσαν να διαφοροποιούνται χρωματικά, οπότε

εγείρεται το ερώτημα τυχόν προκατασκευασμένων μορφών, οι οποίες χρωματίζονταν αργότερα, κατά παραγγελία. Συζητώντας αυτά τα σημεία σε σχέση με όσα μπορούν να στηρίξουν οι αρχαιολογικές, φιλολογικές και επιγραφικές μαρτυρίες, η εργασία ετούτη παρουσιάζει νέες προοπτικές, πρώτον, ενώνοντας την οπτική ενός γλύπτη και ενός ζωγράφου, που κατά παράδοση αντιμετωπίζονταν ως δύο διαφορετικές ιδιότητες, και, δεύτερον, προσθέτοντας την δημιουργική διάσταση της επιχρύσωσης, των ένθετων ματιών και άλλων χρωματικών/αισθητικών αποτελεσμάτων που ολοκλήρωναν τη γλυπτική φόρμα/μορφή στην αρχαιότητα.

Keywords: sculpture; workshop; Roman; marble; polychromy

Introduction

Since the early 2000s knowledge about the original paint on ancient marble sculptures has increased rapidly thanks to worldwide cross-disciplinary collaborations. Insights into how these ancient marble sculptures originally looked fully coloured have challenged the strong-lived presumed whiteness of the ancient world defined by art-connoisseurs and critics of the eighteenth and nineteenth centuries. The notion that marble sculptures should be defined by a non-coloured, flawless whiteness has deeply affected ideas about ancient sculptural aesthetics and in relation hereto also expectations to how ancient marble sculpture workshops were organised, leading to a dominating emphasis on the creative processes of marble carving amongst scholars. However, knowing that ancient marble sculptures were polychrome, by being either fully or partially painted, gilded or adorned with attachments and inlaid eyes, raises the important question of *how*, calling for a revision of the nature of ancient craftsmanship and the presumed activities framed by the spaces of ancient marble workshops.[1] Did the workshops support only sculpting activities thus outsourcing the painting to collaborating specialists; or, did the workshops frame activities of both sculptors and painters within the same space and perhaps by the same person?

Answering these questions requires new ways of thinking about ancient sculptural crafts breaking with definitions of sculpting and painting as fundamentally separate within the European art historical tradition. Since the sixteenth century, artists, scholars and critics have negotiated the definitions of painting and sculpture, known as the *paragone* debate, by emphasising the virtues of the two crafts in attempts to raise one above the other. Leonardo Da Vinci, who praised painting above sculpture in his *Trattato della pittura* (*A Treatise on Painting*, first published in 1632), summoned a picture of two radically different processes of labour related to sculpting and painting: According to Da Vinci, the sculptor was a dusty craftsperson engaged in hard, physical labour in a noisy workshop, while the painter was neatly dressed and executing art in beautiful surroundings while listening to music or book-readings.[2] This distinction between sculptor and painter runs deep, affecting modern evaluations of ancient crafts on behalf of scholars within the fields of art history and archaeology. As a result, traditional analysis of the archaeological material testifying to ancient marble sculpting practices rarely includes reflections on the activities of craftspeople of polychromy, such as painters and gilders, who would have performed the seminal final touches to the white sculptures. Centring on the so-called Sculptor's Workshop, located in Aphrodisias and active from the second to the sixth century AD, this chapter will evaluate and discuss this seeming absence of the non-sculpting craft in the evidence at hand. Revisiting the material remains from excavated ancient sites, including epigraphic testimonies and iconographic representations, this paper will confront and discuss the biased approach of modern scholars towards the ancient marble sculpture workshop, developed through hundreds of years of studying sculpting as a craft separate to that of painting.

Separate crafts and the presumed whiteness of marble sculptures

Traditionally, sculpture has fundamentally been defined as something that is carved, modelled, or cast into a three-dimensional shape, emphasising its physical presence as opposed to the illusionistic creation of space in a painting.[3] During the first half of the sixteenth century, Benedetto da Montevarchi (1502-1565) and Benvenuto Cellini (1500-1571) conducted a large survey amongst their contemporary artist-colleagues questioning them about the fundamental differences between sculpting and painting. The results were published in a treatise in 1549, concluding that sculpting is generally characterised as the inner substance, while painting is the superficial and only seemingly real.[4] This separation between sculpted form and painted image was adopted by eighteenth-century antiquarians and philosophers of aesthetics developing a new sculpture-concept revolving on

[1] Abbe 2015: 176 referring to Loewy 1885: 376 no. 551.

[2] Skytte Jakobsen 2019: 122.

[3] Skytte Jakobsen 2019: 9.

[4] Skytte Jakobsen 2019: 122.

ideas about a monochrome, ideal sculpture idiom that was able to morally elevate the mind of the observer.[5] According to German philosopher Georg Wilhelm Friedrich Hegel, 'sculpture is always concerned solely with the abstraction of form and must therefore on the one hand abandon what is strictly natural in the body, i.e. what hints at merely natural functions, while on the other hand it may not proceed to particularise the most external details.'[6] Taking the fragmented, ancient sculptures, washed clear from all original colours, as demonstrating the most purest and abstract sculpture forms, white marble sculptures manifested pure form 'unpolluted by painter's illusory tricks'.[7]

Such definitions of sculpture, centring on intellectual clarity, uniting idiom, and a transcending whiteness can be traced all the way up to the twentieth century. According to American art critic Clement Greenberg (1909-1994), colour obscures the unity of the sculpture: 'Polished or painted surfaces might in particular instances, if not in others, attract the eye too much, and the attracted eye lingers, while the unattracted eye hastens towards the essential.'[8] This position against polychrome sculpture harks back to the statement made by sculptor Henry Moore at the early twentieth century advocating for a certain 'truth to materials': 'It is only when the sculptor works direct, when there is an active relationship with his material, that the material can take its part in the shaping of an idea. Stone, for example, is hard and concentrated and should not be falsified to look like soft flesh – it should not be forced beyond its constructive build to a point of weakness. It should keep its hard tense stoniness.'[9]

Defining the genre of sculpture as a craft centred on stone and separate from the visual tricks of paintings, is an art-historical construction that sustains a culture-conservative and limited notion of sculpture as a stabile object, although sculpture is a highly mixed and transformative medium.[10] However, this traditional definition of sculpture as materially definite and stable cannot wholly grasp recent studies into the ancient craft and purposes of painted and polychrome marble sculptures, which united the creative processes, materials and tools of the sculptor with those of the painter and other craftspeople of polychromy. What is therefore needed is a shift in focus on ancient marble sculptures from stabile forms carved or cast in singular materials to complex media mixing a variety of materials, offering new frameworks to explore the collaborative practices of joining together different and varying sets of materials and crafts expertise. Following the definition proposed by William John Thomas Mitchell 'medium' is defined as 'the whole set of material practices that bring an image together with an object to produce a picture.'[11] Exploring how the activities taking place in the ancient sculpture workshop may have extended far beyond just sculpting stones, this paper presents a critical evaluation of how the workshop itself, defined as a space supporting not singular but multiple artistic specialisations, adding new perspectives to understanding sculpture as a concept.

Polychrome marble sculptures: From block to final finish

Over the past twenty years, scholars from all parts of the world have joined in cross-disciplinary collaborations uniting university departments and museum institutions in examining, uncovering, identifying, and restoring the preserved paint remains on ancient Greek and Roman marble sculptures.[12] The accumulated results are constantly increasing, proving that ancient white marble sculptures were either entirely or partially covered in paint, and in that sense fully polychrome meaning that they were not monochrome or materially delimited.[13] This new knowledge profoundly alters the view on ancient marble crafts, shifting focus from singular materials, such as the white marble stones, as principal material qualifiers of aesthetics to being three-dimensional canvasses supporting polychrome, animated images. This does not devaluate the role of white marble, which for centuries has been regarded as one of the most important materials for sculpture of the highest quality. However, knowing in what ways white marble mattered to the production and consumption of polychrome sculptures, and how stages of sculpting the stones related to the processes of realising the final polychrome details and surface finish, remains to be properly addressed from the perspective of craft and workshop practices.

In the Roman Imperial period, extraction and trade of white marble stones from quarries in Italy, Greece, Spain, Egypt and Turkey reached its zenith, making white marble the most exploited material for sculptural purposes, and for the past forty years, scholars have been exploring the trading networks circulating large pieces of stones all over the Mediterranean and beyond.[14] Shipwrecks testifying to the trading routes by

[5] Bowyer 2018: 76.
[6] Quoted from Bowyer 2018: 76.
[7] Bowyer 2018: 77.
[8] Greenberg 1995: 191; Skytte Jakobsen 2019: 97.
[9] Moore 1934.
[10] Skytte Jakobsen 2019: 265.
[11] Mitchell 2005: 198; Skytte Jakobsen 2019: 19.
[12] Notable monographs and anthologies on this subject-matter include (but is not limited to) the following publications: Blume 2015; Bourgeoise 2014; Bracci *et al.* 2018; Brinkmann *et al.* 2010; Brinkmann *et al.* 2017; Jeammet 2010; Lenzi 2016; Liverani and Santamaria 2014; Østergaard and Nielsen 2014; Skovmøller 2020; Verri *et al.* 2010.
[13] For a discussion on partially painted white marble sculptures, see Skovmøller 2020: 211-215. For a discussion on the meaning of the term 'polychromy', see Skovmøller 2020: 247-248, 263-264.
[14] The ASMOSIA organisation, established in the late 1980s, has framed a wealth of marble-related research uniting archaeologists

sea reveals the vast and complex infrastructure upheld by the Romans for more than three centuries, and with the aid of analysis strategies developed by the natural sciences, blocks of white stones can now be traced from quarries to workshop and onto display.[15] Increased awareness towards ancient marble workshops have paved the way for a more nuanced understanding of how stones and craftspeople came together in creative spaces in all major cities of the Roman Empire. Recent isotopic analyses of 261 marble portraits, dating from the first to the sixth century AD and originating from Rome, show that the most popular marble stones exploited by the metropolitan craftspeople came from the quarries of Göktepe in western Turkey, the Greek island Paros and (to a lesser extent) Carrara in northern Italy, indicating that the workshops of Rome, the centre of the Empire, were well-connected to foreign sources of the finest specimens of white marble.[16] Epigraphic evidence, such as sculptures signed by sculptors, suggests that craftspeople migrated together with the materials, as well: sculptors from the city of Aphrodisias travelled to central Italy to carve artworks in stones originating from quarries in Asia Minor.[17]

While data on the marble stones and their ancient patterns of distribution and consumption during the Roman Imperial period are increasing, little is known about the practices of the painters who added the final touches of colour to the freshly carved sculptures and other specialised craftspeople such as those adding the leaf gold, metal attachments or inlaid eyes. White marble came in many different, material properties, ranging from coarse- to fine-grained and of different hues and tones, and results from analyses of both stones and pigments suggest, in some cases, that the choice of different stones impacted on the polychrome finishing, thus calling for increased awareness towards how sculpting and execution of various polychrome effects intersected.[18]

Figure 1: Portrait head of an unidentified Roman Youth, from Rome, kept at the Ny Carlsberg Glyptotek, inv. IN 821. Mid-third century AD. Height: 26cm. Göktepe marble with pigment traces (© Ny Carlsberg Glyptotek, photo: Rikke Hoberg Therkildsen).

In 2013, the Tracking Colour project, hosted by the Ny Carlsberg Glyptotek in Copenhagen, initiated a small, experimental project aiming at the recreation/reconstitution of the analysed paint layers preserved on the portrait head of an unidentified male Youth, dated to the second quarter of the third century AD and originating from Rome (**Figure 1**). The portrait represents a young man with a clean-shaven face and short-cropped hair, and the results of isotopic and petrographic analyses of the marble used for the modelling of the head show that it was Göktepe marble; a fine-grained, elastic marble type that takes polish and detailing very well.[19] The marble skin of the youthful face is polished to a high-gloss, while details of the eyes, including eyebrows, are chiselled on the surface of the stone. The short hair is detailed by light incisions on the surface, indicating soft locks, combed from the back of the head to the front. The head was examined by conservator Rikke Hoberg Therkildsen for traces of paint remains, revealing several preserved pigments and paint layers, testifying to an original, fully covered in paint and partially gilded finish: the hair was coloured in ochre yellow, painted on top of underdrawings made by black pigments and Egyptian blue adding depth to the incised strands of hair, and topped-off by thin layers of leaf gold accentuating the individual locks.[20] The high-gloss polished skin was covered in paint made by mixing red and yellow ochre with Egyptian blue, and the placement of the pigments suggests that the

and ancient historians with geologists, physicists, conservators and other scholars from disciplines relevant to the study of ancient stone extraction, circulation and consumption. The organisation has hosted conferences regularly, and results can be viewed in the published proceedings. For more information, see the projects website: <http://asmosia.willamette.edu/>, viewed 15 November 2023. See also in general: Attanasio 2003; Hirt 2015; Lazzarini 2004; Pensabene *et al.* 2015; Russell 2013b.

[15] See in general Attanasio 2003; Lazzarini 2004; Russell 2013b.

[16] Attanasio *et al.* 2019. The analysis targets a rather large group of imperial portraits dating from the first to the sixth century AD. The results indicate that the quarries in western Turkey were by far the most exploited ones for imperial portraiture (44.3 %). Marble from Paros figures as intensely quarried in the early Roman Imperial period, but declines around the second century AD – thus validating the outcome of a series of conferences (Παρία Λίθος 2000, Η Πάρος και οι Αποικίες της 2018). The bulk of Parian marble quarried before the second century AD makes up 28.7 % of the collected material, occurring also in secondary use. Luna and/or Docimium marble play only a minor role in the collected material, which targets imperial portraiture.

[17] On the so-called 'Scuola di Aphrodisias', see in general Squarciapino 1983.

[18] Skovmøller 2020: 141.

[19] Skovmøller 2020: 191; Skovmøller and Therkildsen 2014; Skovmøller and Therkildsen 2015.

[20] Skovmøller 2020: 172; Skovmøller and Therkildsen 2014: 258; Skovmøller and Therkildsen 2015: 896.

paint was applied in a single, thin layer allowing the polished marble substratum to shine through.[21]

There are only a few documented cases, where a high-gloss polished, white marble surface appears to have been entirely covered in paint.[22] Scholars have generally perceived the time-consuming, glossy finish as the final stage in surface treatment applied to a white marble sculpture and presumably seeking to imitate luxurious effects seen on chryselephantine statues.[23] Yet, evidence now suggests that ancient craftspeople also painted glossy, and sometimes translucent surfaces such as glass, raising the crucial question of *how*.[24] The results from analysis of the Roman Youth in the Ny Carlsberg Glyptotek thus called for a re-evaluation of the aesthetic relationship between white marble and paint, shifting focus from the marble itself towards the effects of surfaces, textures and painted finishing. Consequently, this shift called for new understandings of the creative processes and artistic sequences relating to creating this rather complex and fully polychrome, white marble figure, leading to the making of a recreation. The documented paint remains were experimentally recreated by special effects maker, Per Kapper, on a white marble copy, carved from North Macedonian (FYROM) Sivec marble (as Göktepe marble can no longer be obtained) by sculptor Matthew Simmonds.[25]

The results of this experimental process show that sculptor and painter needed to be in close collaboration during several stages of sculpting the marble head.[26] During the different stages of detailing the marble head, Matthew needed to know how Per wanted to highlight specific details in paint, such as the strands of hair, eyes or eyebrows, so that he could angle the chisel-work accordingly. In addition, Matthew had difficulties with obtaining an even, glossy polish of the skin (**Figure 2**). Working in a hard, large-grained Sivec marble, which did not take a high-gloss polish well, Matthew needed to apply different polishing agents at various stages of rubbing down the three-dimensional figure. As a result, the polished finishes of the head were varying and sometimes uneven: caveats around the nose, eyes, mouth and ears were less polished than the broader planes of the forehead, cheeks and chin, which impacted on the paint mixtures applied by Per (**Figure 3**). In order to choose the proper binding agents for his paint mixtures, Per needed detailed insights into the work processes of Matthew. Per worked predominantly with casein as a binder for the skin paint, which did not work well with Matthew's treatment of the broader planes of the figure and, as a result, the head needed to be rubbed down again before the paint layer could be applied (**Figure 4**).[27] In addition, the porcelain-like nature of the glossy finish, required that Per grinded his pigments into a fine paste: while the ochre pigments were easily applied to the high-gloss areas, the Egyptian blue grains (of a structure similar to shattered glass) were difficult to grind and are therefore visible as small, black grains in the thin paint-layers applied on the glossy surfaces (**Figure 5**).

Figure 2: Sculptor Matthew Simmonds carving a detail of the Roman Youth with a point-chisel while comparing to the surface of the original (© Ny Carlsberg Glyptotek, photo: Rikke Hoberg Therkildsen).

Making the recreation in dolomitic white Sivec marble, thus, impacted the process of the colouration of the head. Working in stones, which they knew very well, ancient craftspeople may have anticipated the challenges, which our modern sculptor and painter encountered. Still, the collaboration between Matthew

[21] Skovmøller 2020: 172; Skovmøller and Therkildsen 2014: 258; Skovmøller and Therkildsen 2015: 896.

[22] Examples count the so-called Treu Head from the British Museum (see Verri *et al.* 2010), the ideal female head in the Ny Carlsberg Glyptotek, inv. IN 2815 (Skovmøller 2021: 213; Therkildsen 2012: 45-63), and the five third-century AD portrait heads in the Ny Carlsberg Glyptotek, inv. IN 819, inv. 821, inv. 822, inv. 823, and inv. 826 (see Skovmøller 2020:172-185), and two portrait heads of African Roman Emperor Septimius Severus and his Syrian wife Julia Domna (Abbe 2020: 9-11). Further on the practices of polishing white marble in Antiquity, see in general Abbe 2020 and Skovmøller 2020: 167-169.

[23] Østergaard 2008: 46-50; Reuterswärd 1960: 220-223; Skovmøller and Therkildsen 2011: 35; Skovmøller and Therkildsen 2015: 891.

[24] Abbe 2020: 14.

[25] In general Skovmøller and Therkildsen 2014; Skovmøller 2020: 189-204.

[26] Skovmøller 2020: 197.

[27] In analyses of the Youth's head no traces of binding agents were detected. However, analyses of binders preserved on other ancient marble sculptures show that protein (casein, egg yolk or animal glue) was the prime binder in most cases. Other examples show the use of hot wax and gums. For a detailed account on different binders documented on ancient marble sculpture, see Skovmøller 2020: 131-137.

Figure 3: Special-effects maker Per Kapper, from Kappercreations, applying layers of paint onto the marble copy carved by Matthew Simmonds (© Ny Carlsberg Glyptotek, photo: Rikke Hoberg Therkildsen).

Figure 4: Painted marble copy of the Roman Youth, kept at the Ny Carlsberg Glytotek, inv. IN 821A, with reconstituted layers of paint and gilding (© Ny Carlsberg Glyptotek, photo: Maria Louise Sargent).

Figure 5: Detail of the painted marble copy showing areas where Egyptian blue grains are visible to the bare eye as small, black spots (© Ny Carlsberg Glyptotek, photo: Maria Louise Sargent).

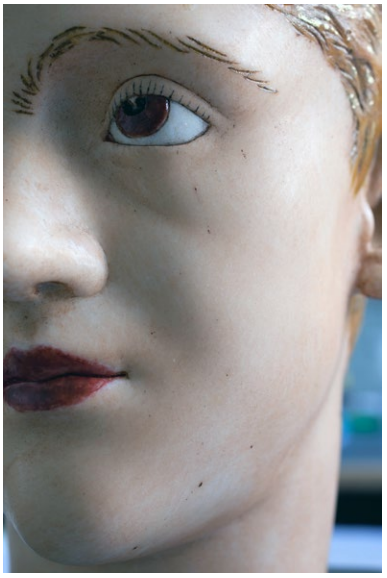


Figure 6: Detail of the painted marble copy showing the glossy shine of the polished marble working its way through the painted layer adding lustre to the finish (© Ny Carlsberg Glyptotek, photo: Maria Louise Sargent).

and Per demonstrates how the creative choices of the sculptor were not about obtaining a final finish, but about modelling a white marble substratum – much like a canvas – thus laying the ground for the painter to finish the sculpture. The choice of marble was not fortuitous: the nature of the stone, its grain size and elasticity, mattered to how textures could be achieved and therefore how the painter could apply the final finishes, from choosing the proper binder to grinding the pigments for the mixtures. The glossy marble added a lustre to the painted finish, imitating the matte, yet shiny effects, of healthy, youthful skin (**Figure 6**).[28]

Very little is known about how these artistic collaborations took place in ancient Greek and Roman workshops, including how the workshop space was organised around the labour of both sculpting and painting; therefore experimental recreations offer valuable insight into the complexities of the processes of production.[29] Research shows that not all white marble sculptures were entirely covered in paint; instead, sometimes certain areas were intentionally reserved in the natural colours of the stones.[30] Evidence is generally

[28] Skovmøller 2020: 197; Skovmøller and Therkildsen 2014: 270.

[29] Skovmøller 2020: 124-143; 189-204.

[30] For a discussion on this, see Skovmøller 2020: 211-215.

sparse and highly fragmentary, and at this stage of research, scholars must keep an open mind towards multiple and various forms of polychromies in relation to ancient white marble sculptures.[31] Were the many steps of sculpting, detailing/refining, texturing and painting the marble sculptures a collaboration between sculptor and painter, as specialised craftspeople representing separate crafts, as in the case of the experimental processes involved in the reconstruction of the painted head of the Youth? Or were sculptor and painter one and the same person? Moreover, did the workshop allow for space for the storage of both the materials and tools necessary for carving marble and the pigments, binders and brushes needed for the application of the final paint layers? To address these questions in more detail, in the following sections we switch geographical location from central Italy to Aphrodisias in western Turkey, where archaeological excavations over the past sixty years have yielded extensive evidence testifying to the practices of Roman marble craftspeople – sculptors, as well as painters.

Evidence for the Ancient Roman marble sculpture workshop: the case of the so-called 'Sculptor's Workshop' in Aphrodisias

For many years, the city of Aphrodisias, located in modern-day western Anatolia (Turkey), has been known as a site of sculptor training and sculpture production excelling in a Hellenistic stylistic eclecticism performed in both white and coloured marble of the highest quality.[32] As part of the Roman province of Asia, the region of ancient Caria included not only Aphrodisias but also Ephesus and Halicarnassus and several marble-extracting sites. The region thus hosted a wealth of marble-activities dating long before it was incorporated into the Roman Empire.

Sculptures signed by Aphrodisian sculptors have been found all over the Roman Empire, including the villa of Hadrian in Tivoli, Central Italy.[33] Aphrodisias has therefore been almost synonymous with sculpture before the city was first excavated in the early 1900s.[34] During the 1960s, the first excavation focused on recovering the sculpture remains, was conducted by Kenan T. Erim, who unearthed an extensive corpus of sculpture from the city, dating from the Late Hellenistic period (first century BC) to the Late Antiquity (sixth century AD).[35] Isotopic analyses of the sculptures show that marble came from a quarry just 2km northeast of the city and 70km southeast of the Göktepe quarries.[36]

Besides the excavated wealth of locally produced sculptures, other important evidence testifying to the sculpting activities within the city includes epigraphic and iconographic sources, as well as architectural structures, notably the so-called Sculptor's Workshop located in the city centre just behind the city's Bouleuterion and the North Agora.[37] The Workshop was first excavated between 1967 and 1969.[38] Around 300 sculpture fragments were found within or near the workshop, which, when put together, amount to around 115 full sculptures associated with the activities of the workshop.[39] Additional finds include marble carving tools, and – based on numismatic finds – the overall structure seems to have been active between AD 200 and 400.[40] At some point during the late fourth or early fifth century AD, the workshop was abandoned, and the site was remodelled to accommodate other activities.[41]

The Sculptor's Workshop was accessible directly from the North Agora, where the Bouleuterion was located, resembling a small, roofed theatre or odeum.[42] The Workshop could be accessed from the east, as well as from the sanctuary of Aphrodite, patron goddess of the city. Its location was therefore central. The Bouleuterion was built in the late second century, and during an extensive remodelling of the North Agora in its fourth construction phase (late second century AD), the rear rooms of the North Stoa eventually housed commercial activities.[43] Eight of these rooms (which may have been eleven in total) have been excavated, and the Sculptor's Workshop took up rooms 3 and 4 including an open yard of about the middle of the second century AD.[44] In the following two centuries, the workshop was modified to meet the specific needs of the carving activities that took place here, by widening and enlarging the space and the doorways to make way for the manoeuvring of large-scale marble sculptures.[45] Besides sculptures and sculpture fragments, the findings from the site include tools and marble pieces used for educating and training sculptors. The space of the Workshop accommodated activities centred on the carving of free-standing figures, portraits and idealistic sculptures, as well as the restoration of older sculptures for new displays.[46]

Traces testifying to the presence of painters have not been recorded in the archaeological publications of the

[31] Abbe 2020: 12-13; Skovmøller 2020: 211-215.
[32] See in general Squarciapino 1943, 1983 and 1991; Van Voorhis 2018: 4-5.
[33] Squarciapino 1983: 81.
[34] Van Voorhis 2018: 1.
[35] Van Voorhis 2018: 1.
[36] Attanasio *et al.* 2008: 219-220.
[37] Van Voorhis 2018: 3.
[38] Van Voorhis 2018: 3.
[39] Van Voorhis 2018: 25.
[40] Van Voorhis 2018: 22-23.
[41] Van Voorhis 2018: 20.
[42] Van Voorhis 2018: 7.
[43] Van Voorhis 2018: 7, 17.
[44] More detailed on the structure and purposes of the other rooms, see Van Voorhis 2018: 10. On the excavation history of the workshop, see Van Voorhis 2018: 10-15.
[45] Van Voorhis 2018: 17.
[46] No marble blocks were found at the site, suggesting that a rough carving would have been performed in the quarries, before the sculptures were transported to the Workshop for finer detailing and texturing. Van Voorhis 2018: 22, 39.

excavation of the site, and there has been no attempt at analysing the sculptures found within the workshop for paint remains.[47] However, analyses performed by Mark Abbe in the 2000s have shown that marble sculptures produced in Aphrodisias were painted and gilded.[48] The analysed marble sculptures include idealistic and portrait sculptures originating from the Hadrianic baths, the West Stoa in the South Agora, the theatre and the Bouleuterion, and they suggest the presence of painters and craftspeople of polychromy within the city. In addition, epigraphic evidence from Aphrodisias suggests a close relationship between painters and craftspeople of polychromy and sculptors. On an epitaph from Aphrodisias, a craftsperson is identified as *ἀγαλματοποιός ἐγκαύστης*, meaning a sculptor specialised in painting in the encaustic technique (that is, using hot wax as a binder).[49] In this case, sculptor and painter was considered to be one and the same person and, by consequence, the ancient sculpture workshop could have accommodated activities of both carving and painting, including the different materials needed to materialise such polychrome sculptures. Applying paint and other polychrome adornments (such as inlaid eyes and metal attachments) to the white marble figures was a process of joining several different and sometimes rare and expensive materials. Keeping the process of recreating the preserved paint on the Roman Youth in mind, this group of craftspeople, including their tools and materials, could be associated with the creative space of the Sculptor's Workshop.

Locating the ancient craftspeople for polychrome sculptures

Having reviewed the published data on the excavated structure of the Sculptor's Workshop, in this section we will discuss the presence of painters and their materials. According to analyses by Julie Van Voorhis, the archaeological remains show how the main carving activities took place in the open yard, supported by the remains of sculpture pieces and tools, while rooms 3 and 4 appear to have sheltered storage and office spaces, placing smaller pieces on shelves along the walls.[50] The yard can thus be imagined as an open space, where sculptors were working, perhaps shaded by awnings, and equipped with benches and stools to sit or stand on.[51] Larger sculptures could have been placed alongside the walls for display, available for inspection by potential commissioners who would enter the facility.

In room 3, an overturned column-base is preserved embedded into the floor, and its purpose remains to be

Figure 7: Carnelian ring-stone, kept at the Metropolitan Museum of Fine Arts, inv. 81.6.48. First to third century AD. Length: 1.2cm (© The Metropolitan Museum of Fine Arts).

defined.[52] While most sculptures were produced in the yard, this block could have been a podium for elevating sculptures that required subtle detailing/refinement, display, or perhaps the application of painting or other decorative elements. Carving activities required space for manoeuvring the stone and avoiding damaging it; notably, the confined, roofed space of room 3 with the embedded working podium would have been the perfect setting for the application of paint, which required concentration. Moreover, it would keep the painter and the materials (such as binders) out of the direct sun. The use of columns to support a sculpture while this was being painted is actually represented on a small carnelian ring stone, dating to the first century AD and showing in the intaglio technique a painter sitting on a stool and painting a sculpted bust, which portrayed a woman (**Figure 7**). The bust is placed on a column-like support, raising it to the level of the seated painter. The column-base in room 3 of the Sculptor's Workshop could have supported life-sized statues and perhaps adjusted to smaller-scale figures, allowing the painter to conveniently approach the sculptures from every angle, while applying and adjusting the layers of paint.

In addition, remains of shelves have been unearthed along the walls in room 3, where the painters' tools and pigments could have been stored. The recovering of pots containing pigments that used to decorate the walls of the houses and temples in Pompeii provides important and unique insights into how the

[47] Van Voorhis 2018: 40.
[48] In general, see Abbe 2008.
[49] Abbe 2015: 176 referring to Loewy 1885: 376 no. 551.
[50] Van Voorhis 2018: 20.
[51] Van Voorhis 2018: 21.
[52] Van Voorhis 2018: 20.

ancient Roman painters handled their pigments. The archaeological evidence from Pompeii shows how the pigments were stored in pots and, when used for application, in shells.[53] Analyses of the residues show that the ancient Pompeian painters used various pigments for red colour, including madder lake (which was originally a dye turned into pigment), cinnabar, realgar, and hematite, as well as ochres for hues ranging from red to orange, yellow and brown.[54] Blue hues were obtained from crushed minerals of azurite, indigo (another dye turned into pigment) and, very rarely, the more expensive lapis lazuli, supplemented by a wide use of the synthetic Egyptian blue pigment.[55] Green hues came from the mineral malachite and green earths or, more commonly, mixtures of Egyptian blue and yellow ochre.[56] Whites came mainly from crushed chalk, limestone, mollusc shells or, in few cases, birds' eggs, while blacks were mainly carbon-based.[57] Finally, purple hues ranged from violet to deep reddish-purple, and were obtained, rarely, from the expensive *purpurissum* (derived from the Tyrian purple dye) and more often from mixing Egyptian blue with hematite or indigo with madder lake.[58]

Pigments were concocted at various sites, all over the Roman Empire, and some were sold in cubical shape making them easier to transport and measure, meaning that the painter would have needed space for the preparation of the ingredients and the appropriate mixtures prior to their application.[59] In addition, binders would also have been essential for making the pigments coherent and capable of adhering to the marble surface. Although little is known about the nature of ancient binders used for the painting of marble, the collected results of analyses show that ancient Roman craftspeople used a broad range of binders including animal glues, eggs, casein, gums, and wax.[60] Preparing and measuring the pigments for mixtures, adding different types of binders for specific paint layers, would therefore have been fundamental to the process of paint application. To this we should also add the materials for gilding, which have been documented by Abbe on several sculptures from Aphrodisias, and perhaps in some cases also inlays and attachments of bone, glass, precious stones, and metal, of which the processing and application also required space.[61] As Helle Hochscheid has shown, rooms 5 and 6 of the North Stoa, one of them containing a hearth, could have been related to the Sculptor's Workshop framing activities related to finishing the marble sculptures.[62] A hearth could have been used to temper binders such as wax, to heat and process different metal attachment or to roast pigments to obtain specific hues.

Although the archaeological remains cannot directly reveal the presence of craftspeople engaged in polychromy in the Sculptor's Workshop, it should not be ruled out that they were here once. As Van Voorhis has pointed out, it is important to consider the nature of the evidence, which archaeological excavations have been able to recover from this structure, and which 'reflects not its full contents, but rather the residue left over from the latest period of its activity and subsequent rebuilding in the area'.[63] Given time to abandon the workshop, the craftspeople would have taken the most important items with them, which would have included the pigments contained in pots and any other precious materials used for polychrome adornments. If such materials were left behind, they would have been reused in later times.[64] In the case of the pigment pots excavated in Pompeii, the pots appear to have been quickly abandoned due to the eruption of Mount Vesuvius, giving the painters little time and chance to bring the materials with them.[65] Preserved *in situ* by volcanic ashes, this is therefore a rare case, and not something to expect from other sites. When reviewing the lack of evidence testifying to the painting of marble sculptures in a flourishing marble-carving city like Aphrodisias, where analyses have shown that sculptures were also painted locally and sometimes by craftspeople that were sculptor and painter in one, it is important to consider how scholars approach and define the spaces where ancient marble sculpture took place.

The Sculptor's Workshop as a space for material assemblages

Keeping the process of the Roman Youth's recreation/reconstitution in mind, the many stages of sculpting and the overall artistic direction of the different craftspeople ultimately lead towards the realisation of fully polychrome figures, calling for a re-evaluation of how scholars reconstitute ancient sculpture workshops based on fragmentary archaeological remains. In the detailed publication of the excavation of the Sculptor's Workshop, Van Voorhis defines a workshop as a 'specific point of production, although not necessarily to one artistic hand or even to one chronological period.'[66] According to sculptor Peter Rockwell, the

[53] La Marciada *et al.* 2018: 459.
[54] Siddall 2006: 24.
[55] Siddall 2006: 25.
[56] Siddall 2006: 27.
[57] Siddall 2006: 28.
[58] Siddall 2006: 25-26.
[59] On the trading of pigment during the Roman Imperial period, see the discussion of the results of pigment analyses used for the wall-paintings in the 'Villa della Piscina' in Rome: Sbroscia *et al.* 2020.
[60] Skovmøller 2020: 131-137.
[61] On gilding, see Abbe 2008: 140-145.
[62] Hochscheid 2020.
[63] Van Voorhis 2018: 4.
[64] Ancient pigments were reused in Late Antiquity and through the Middle Ages. For examples see Howard 2001 and 2003.
[65] La Marciada *et al.* 2018: 459.
[66] Van Voorhis 2018: 5.

organisation of a sculpture workshop may vary greatly, but the division of labour is crucial to the success of the outcome, highlighting how sculptors engaged within the same workshop may have specialised in making/creating/fashioning different elements: some may have roughened out the figure, while others were engaged in the detailed modelling of marble, rendering hair, skin, jewellery, and garments.[67]

Such a division of specialised labour can be glimpsed in the archaeological remains from the Sculptor's Workshop. Unearthed within the workshop was a statue of the so-called 'Unfinished Togatus' (dated by Van Voorhis to the late fourth / early fifth century AD), whose body is finished and polished, while the head remains roughened out and proportionately much larger than the rest of the figure, suggesting that it was not completely finished.[68] The coiffure is roughly modelled by a point chisel, and the face is merely outlined and coarsely finished. The statue suggests that the labour associated with carving full-bodied statues was divided into phases including at least a first one for roughening out the figure, a second phase for detailing and a final one for texturing and polishing, if not also for executing the features of the portrait head on commission, so as to represent an individualised, recognisable patron.[69] The question therefore remains, whether such phases were allocated and assigned to specialised craftspeople. In particular, polishing could have been a task assigned to specialised craftspeople, given that the finished statuettes originating from the Late-Antique production display intricately performed, porcelain-like polishing, which would have been time-consuming.[70] In addition, apprentice pieces, such as unfinished statues and parts of statuary feet, were found in and outside the workshop, revealing the different stages of training in specialised statuary features that also took place within the Sculptor's Workshop.[71]

The amount of evidence suggests that the organisation within the Sculptor's Workshop was pyramidal, with a master sculptor and owner at the top, directing the activities of at least three differently qualified sculptors (most likely reaching a total number between six and twelve): a generally trained sculptor (responsible for the sculpted torsos), a portrait specialist who carved heads, and an apprentice or assistant who roughened out the figures.[72] To them we may add specialists assigned with the detailing/refining and polishing, as well as the handling of the drill.[73] However, the sculptors formed only a part of the workshop's organisation. Although the carving of white marble formed the core of the crafts-expertise housed in the Sculptor's Workshop, it is important to discuss this workshop space as reaching beyond marble carving activities. The craftspeople of the Sculptor's Workshop in Aphrodisias created sculptures, which were mixed and transformative media connecting multiple materials. The ancient workshop thus needs to be redefined within the frame of a new sculpture concept that does not gravitate solely towards white marble. To create a polychrome white marble sculpture in the Sculptor's Workshop in Aphrodisias, white stones needed to be extracted from the nearby quarries and transported to the workshop in the city together with pigments originating from local as well as distant regions, binders, sheets of gold, bones, gems, bronze, silver, lead for dowels, tempered iron for the chisels, stones for polishing, brushes and spatulas, and the list goes on. Traces for such materials and tools may be located and properly identified in an archaeological context, but others, such as stones used for abrasives, pumice, emerald and quartz, may easily be overlooked, whereas others, like wooden shafts for brushes, may have partially or completely perished.[74]

What is needed is a new methodological framework that can re-define the sculpture workshop in terms of space and concept according to these vast material networks, of which so little is preserved, without risking delimiting the space according to fixed and documented material categories. Referencing Howard S. Becker's '*Art World*' from 1982, Hochscheid has defined the networks of people trading and providing materials for artistic outputs, including crafts specialists and assistants working in the workshops, as 'support personnel'. However, I would argue that such networks were much more than supporting the activities of ancient artists; they were the creative community upholding the vital material infrastructure in which the workshops

[67] Rockwell 1993: 148. This division between specialization of labour fits with the organisation-model of the workshops of famous Neoclassical sculptors such as Antonio Canova (1757-1822) and Bertel Thorvaldsen (1770-1844), who both worked in Rome during the late eighteenth and early nineteenth century. For more on this, see in general Skovmøller 2021 and Tesan 1998.

[68] Van Voorhis 2008: 131; Van Voorhis 2018: 27-30 and pl. 10-12.

[69] Van Voorhis 2008: 131. If the portrait-head was executed on commission, this suggests that the sculpture was produced without knowing the patron and thus on stock in the workshop. 'Blank' portraits (meaning that the face was roughly outlined without rendering facial features) is well-known from Roman sarcophagi dating to the first, second and third century AD (Birk 2013: 56 and Appendix B). These 'unfinished' portraits have generally been interpreted as awaiting to be carved in the features of the deceased (which did, for some reason, not happen) (Birk 2013: 56). Other explanations take polychromy into account: The roughened-out faces could either have been finished by covering them in painted plaster, or painted directly onto the marble surface (as has been documented on a Roman garland sarcophagus in the Ny Carlsberg Glyptotek) (Birk 2013: 56; Sargent 2011: 16-19). Finally, Birk argues that these blank portraits held specific social values (relating to ancient Roman conceptions of death) when encountered in burial contexts. For more information, see Birk 2013: 57-58. Perhaps the blank head of the 'Unfinished Togatus' refers to similar conceptions (meaning that it was intended for a burial context), or, perhaps, the explanation is to be found in the practices related to the particular workshop.

[70] Van Voorhis 2018: 40.

[71] Van Voorhis 2008: 122-128.

[72] Van Voorhis 2008: 134.

[73] Van Voorhis 2018: 42, 46.

[74] About tools used to perform high-gloss polishing, see Abbe 2020: 7-8.

were embedded. By shifting attention from artist to community, from white marble to polychrome images, and from sculpture-object to sculpture-image and media, we gain a radically different perspective on the ancient sculpture workshop as a collective space where all of these materials came together. This space did not adhere to the limiting dichotomies established between painting and sculpting by European scholars since the sixteenth century. To investigate the creative space of the ancient white marble workshop is instead to frame a new understanding of the sculptural workshop as a space for material assemblages. It is a way of decentring the 'aesthetic hierarchy of artistic authorship', to borrow the phrasing of Hochscheid, side-stepping not only the traditional focus on the artist as sole and isolated creator of a marble sculpture, but also re-defining the dominant role of white marble within European art and cultural history.[75] The approach centres on the materials and networks of extraction, circulation and consumption of works of art reaching far beyond the confines of the workshop, to engage with complex local and supra-regional material infrastructures.

Conclusive remarks: Sculptures are also (painted) images

Research into the polychromy of ancient white marble sculptures fundamentally displaces the constructed notion that sculptures are not images, media, or assemblages of different materials.[76] The results of analyses of multiple white marble sculptures show that colour was the ancient sculpture norm, either as partially or fully covered in paint, rather than the eighteenth century reception of the *paragone* debate that led to a fetishisation of white marble, which developed into a twentieth century chromophobia.[77] Disregarding the seminal role of the painter in ancient marble workshops leads to this misconception that sculpture is a stabile object separate from the image. Instead, the sculpture-image was fluid and did not begin with the application of a paint mixture; it was in the making already when the proper stone was chosen, when it was carved to emphasise marble imitations of strands of hair and glossy skin, and when the proper pigments and polychrome effects were sourced and processed for application. When an ancient artist in Aphrodisias could be identified as *agalmatopoios enkaustes*, there was much more at play in ancient marble sculpture workshops than just marble carving, and this paper has explored the ancient sculpture workshop as a space for craftspeople, who were the makers, exchangers and fusers of both sculpture objects *and* painted images. Knowing more about the fluidity between ancient crafts and creative processes, therefore, holds the potential to liberate the modern conception of sculpture. Moving from ideas of aesthetics concerning the monochrome simplicity and uniting idioms, to messy sculpture workshops where sculpted object and painted image intertwine, relate, align, and perhaps also sometimes deliberately challenge each other, allows new interpretations of the ancient sculpture workshop as a frictional space, defined by multiple arts and processes, where polychromy was central to address and negotiate, thus blurring the borderline between white marble and painted surface.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[75] Hochscheid 2015: 7.
[76] Skytte Jakobsen 2019: 267.
[77] Bowyer 2018: 77. See also in general Batchelor 2000.

In the ateliers of potters and coroplasts

Chapter 13

The 'Cracking the Code' project: Stamna's pithoi workshops – unveiling pottery heritage

Gioulika Christakopoulou and Helene Simoni

Abstract

Stamna has yielded a wide variety of pithoi. This variety attests to the existence of multiple techniques and specialised knowledge in producing ceramics of this specific typology. Although direct indications of workshop facilities have not been identified, their evolution from storage vessels to funerary containers indicates an adaptation to demand, suggesting a specialised production within a workshop context. Furthermore, the possession of pithos-jars by specific individuals indicates resource management, while their use in funerary practice acquires symbolic significance. Their increased use as tombs signifies the evolution of social applications, indicating a shift in their societal roles. With this data, a process of evolution and innovation emerges in the production of these pithos vessels, indicating that the population groups residing in Stamna during the Protogeometric period had specialised production structures in the broader settlement area.

Περίληψη

Η Σταμνά παρουσιάζει μια ευρεία τυπολογία σχημάτων πίθων. Αυτή η ποικιλία μαρτυρά την ύπαρξη πολλαπλών τεχνικών και εξειδικευμένων γνώσεων στην παραγωγή κεραμικών αγγείων της συγκεκριμένης τυπολογίας. Παρ' όλο που δεν έχουν αποκαλυφθεί άμεσες ενδείξεις εργαστηριακών εγκαταστάσεων, η εξέλιξη της χρήσης τους από αποθηκευτικά σε ταφικά αγγεία υποδεικνύει μια προσαρμογή στη ζήτησή τους, η οποία συνηγορεί σε εξειδικευμένη παραγωγή σε εργαστηριακό πλαίσιο. Επιπλέον, η κατοχή πίθων από συγκεκριμένα άτομα υποδεικνύει τη διαχείριση πόρων, ενώ η χρήση τους στην ταφική πρακτική αποκτά συμβολική σημασία. Τέλος, η αυξημένη χρήση τους ως τάφων σηματοδοτεί την εξέλιξη της κοινωνικής χρήσης των πίθων, δείχνοντας μια μετατόπιση στις κοινωνικές τους εφαρμογές. Με αυτά τα δεδομένα αναδεικνύεται μια διαδικασία εξέλιξης και καινοτομίας στην παραγωγή των πίθων, υποδεικνύοντας ότι οι πληθυσμιακές ομάδες που κατοίκησαν στην Σταμνά κατά την Πρωτογεωμετρική περίοδο είχαν εξειδικευμένες δομές παραγωγής στην ευρύτερη περιοχή εγκατάστασης.

Keywords: Protogeometric Stamna; pithoi variety; ceramic workshops; funerary symbolism; resource management

Potluck chronicles: Exploring the versatile world of pithoi

The presence of clay deposits in the area was evidently one of the primary reasons for settlement in Stamna, Aetolia. Combined with the availability of water and combustible materials, it fulfilled the prerequisites for operating ceramic workshops,[1] particularly for crafting large vessels such as pithoi.[2] Across an extensive time-span from the Neolithic period to the twentieth century, a continuous utilisation of pithoi as a primarily storage medium is observed, catering to both primary and secondary production. They integrated an exceptional manufacturing technology rendering them resilient to mechanical pressures.[3] Their rare displacement, as Elizabeth Boggess notes in her study on Attic pithoi from the Sub-Mycenaean to the Roman era, was due to both the difficulty in their construction[4] and their high value. These factors prompted their owners to repair rather than replace them, allowing for their preservation over extended periods.[5] Consequently, the precise dating of the pithoi remains a challenge,

[1] Arnold 1985: 32.

[2] Scheibler 1992: 89. On the use of the term 'pithos' to describe large storage vessels with references from Homer's epic poetry to the mediaeval period, see Boggess 1989: 219-248; Cullen and Keller 1990: 200-205. On the term's occurrence in the Byzantine period, see Bakirtzis 1989: 110. Bakirtzis further distinguishes between 'pithos' and 'pithari', suggesting that in the former category fall large storage vessels placed in storage pits and remaining immovable, whereas in the latter fall smaller, relatively similar vessels of the same type, which, although serve the same purpose, are possible to remove (Bakirtzis 1989: 110 cited in Giannopoulou 2002: 56).

[3] On the use of 'pithoi' and pithos-shaped vessels throughout history, see Cullen and Keller 1990: 186.

[4] Boggess 1989: 220-237.

[5] For their production, placement and use in later times, see Giannopoulou 2010 with extensive bibliography. In her work she refers, among other things, to the text edition by Beckh, H. (ed.) 1895. *Geoponica sive Cassiani Bassi scholastici De re rustica eclogue*. Leipzig: B.G. Teubner. The assembled ancient authors mention, while commenting on the operational parameters of a ceramic workshop at a site, that not all qualities of clay are suitable for ceramic fabrication – focusing on the qualities of red or white colour, which are suitable either individually or in combination. This conclusion accords with the case of Stamna, where the soil is rich in reddish clay along the hillsides above the lagoon.

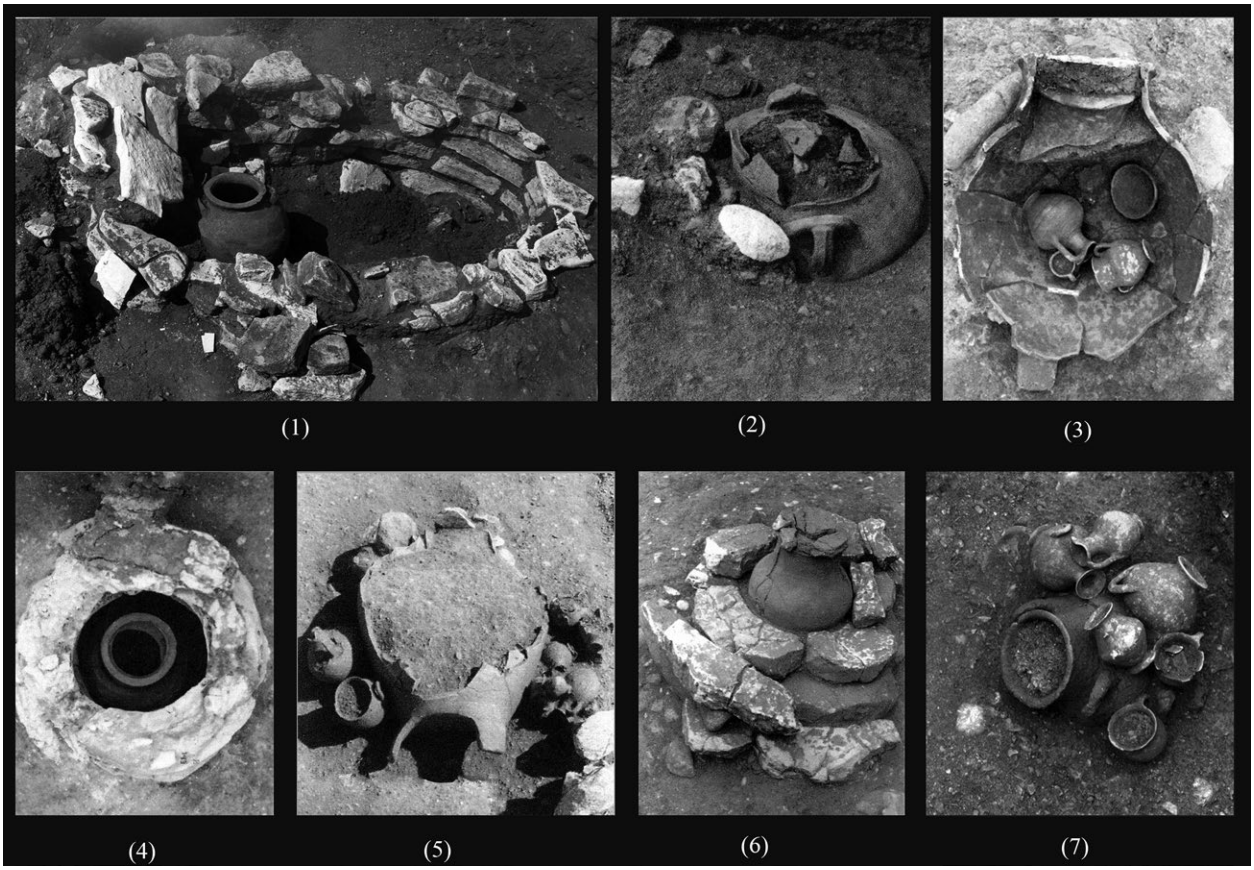


Figure 1: Tripod pithoi or pithos-shaped vessels used for inhumations and cremations (photo editing by G. Somakos).

considering their diverse uses in various social practices, as storage vessels, trade containers, and for funerary purposes as coffins, observed at Stamna.

Currently, the perspective of researchers Vassilis Kilikoglou, George Vekinis, Yannis Maniatis and Peter Day[6] emphasises how the choice of materials and the technical approach in crafting objects not only affect the execution of the work but also reveal the identity of their makers. The handling of materials and the selection of processing methods can serve as a means of recognition or distinction within a society. Furthermore, it illustrates how these choices signify the social role and transmission of knowledge within the community.[7]

The pithoi were widely used in the cemetery of Stamna, marking one of the most prevalent burial practices in this area during the Protogeometric period.[8] They are all handmade and crafted from coarse impure clay, containing a high percentage of small gravels. Depending on their composition and firing conditions, the clay could be either light brown or intensely reddish-brown. Judging from their typology and their abundance, they represent some of the most significant ceramic productions in the region. The overwhelming majority (267)[9] were used for funerary purposes, while 40 of them served as storage containers. All of them contained inhumed individuals, including pithos T250, which was buried alongside another burial within an amphora (inhumation or cremation?) that was sealed with a lid. Among the funerary vessels were also 10 tripod-pithoi or pithos-shaped vessels used for inhumations and cremations.[10] Each of the aforementioned examples has its own typological elements and, for this reason, seven (7) different types are created, each corresponding to one of them (**Figures 1 and 2**).

The practice of inhumation[11] is prevalent in the cemetery of Stamna. The deceased was placed/positioned

[6] Kilikoglou *et al.* 1998: 275. See also Giannopoulou 2010: 69; 2002: 320, where it is stated that variations in the manufacturing technology and morphological characteristics of pithoi are related to changes in the policies of private and public storage (with reference to storage pithoi).

[7] An indicative analysis of the fabrication process of pithoi is provided by Giannopoulou 2010: 1-72. It encompasses techniques such as 'coiling' or 'joining', identified by scholars throughout the centuries, from the prehistoric to the Byzantine period (Giannopoulou 2010: 73 with relevant bibliography).

[8] Christakopoulou-Somakou 2009.

[9] In the catalogue of pithoi (252), as derived from Christakopoulou's ongoing research, cf. Christakopoulou-Somakou (forthcoming), specifically for the purposes of this study tripod-shaped pithoi are included, along with a number of remains associated with tombs (pithos total: 267).

[10] Christakopoulou 2016.

[11] For the potential origin of this burial practice from Anatolia during the Early Helladic period, see indicatively Frödin and Persson 1938: 348-352.

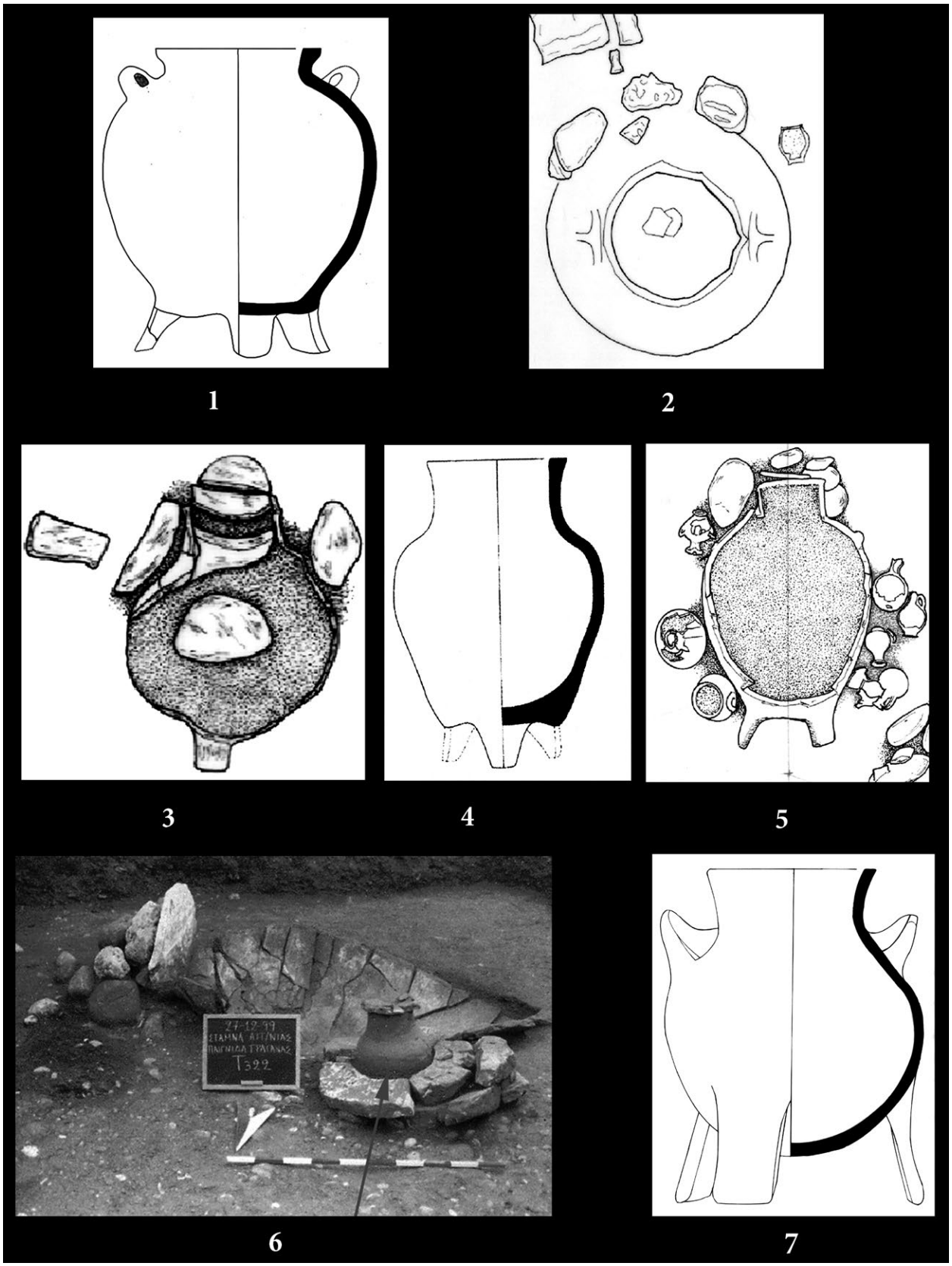


Figure 2: Tripod pithoi or pithos-shaped vessels used for inhumations and cremations (photo editing by G. Somakos).

into the pithos or pithos-shaped vessel through the latter's mouth, legs entering first, with the head near the *stomion* (mouth). When the head of the deceased was placed near the *stomion*, the preferred orientation of the vessel was eastwards.[12] Similarly oriented were the vessels, both funerary and non-funerary, which were placed outside the pithoi, usually at shoulder level, except for the vessel accompanying pithos T50/98, which was found positioned lower, towards the belly of the pithos, with an inverted orientation. Only rarely were the deceased found with their heads near their base/bottom of the vessel. In case the pithos was of small dimensions and the entry of the body of the deceased through the mouth was not feasible, it is probable that a section of the belly was removed using a sharp object, and subsequently sealed/mended either with the same fragment or with one from another pithos.[13] A similar technique might have been employed for the funerary vessels. The arrangement of the buried individuals within the pithoi and vessels[14] adhered to similar guidelines as those observed in traditional burials.

The mouths of the pithoi were sealed by using slabs made of limestone and gray stone. These slabs, varying in shape from irregular quadrilateral to discoid, either covered the mouth of the pithos externally, completely covering it (T56/99) (**Figure 3**), or completely sealed the entrance, having been carved into a similar shape and therefore perfectly fitting it (T44/98). Walls from other pithoi were used to cover the mouths of the funerary pithoi, as they concealed it with their non-visible portion (T175). The base of a wheel-made vessel also served as a cover for the mouth of pithos T268, while a large pot-shaped vessel was used to cover the mouth of T155. In a limited number of cases, clay stoppers/lids (T318/T358) were utilised to securely seal the mouths of pithoi, whereas on one specific occasion (T383), stones were employed to seal the opening of the pithos. In two cases (T205 and T206), clay was found surrounding the mouths and – at the contact points with the covering slab – ensuring its complete sealing.[15] All elements (slabs, pithos walls, stoppers/lids) were reinforced on their outside by two or three stones, sometimes forming small stone piles.

To reinforce the lateral walls of the pithoi, rough/unworked limestone pieces from the surrounding area were utilised, the quantity of which varied depending on the constructor's estimation. In the case of grave T42/98 (**Figure 4**), a single large slab-shaped piece of grey limestone was used. The case of T50/98 is also unique, with its opening closed by a disc-shaped piece of limestone set within its mouth. Four limestone slabs were employed to reinforce it; two of them in sequence, while the remaining two enclosed them, at a 90degree angle. Generally, the stones either individually supported the covering slab or formed stone piles, reaching the shoulders of the pithos (T189/T207), thus reinforcing it at the same time. Apparently in some graves (T175/T157) the excessive number of stones did not correspond to an actual need to reinforce the slabs. It could be suggested that, in cases where an excessive number of stones were arranged in continuous series (pithos T175), they actually delineated the tomb's precise location, hence that of the deceased within the burial area, similar to the tight arrangement of the deceased bodies from vessels inside the tombs. By the same reasoning, in cases where the deceased was accompanied by a multitude of vessels externally arranged along the tomb's sides, irrespective of typology, we might follow the interpretation proposed by Ioannis Moschos, namely that the space of the deceased was demarcated and, therefore, trace the custom back to the Mycenaean times.[16] Noteworthy examples of such an instance are evident in pithos T13/98.

Small vessels, mainly of the oenochoe type, were placed in an upright position, right next to the mouths of the pithoi. In cases of multiple vessels (usually small), they were either stacked in a pile or arranged in rows along one side or both sides. In tomb T13/98 (**Figure 5**), they followed the periphery of the pithos body, including the portion above the covered mouth. Some of these vessels possibly contained offerings for the deceased.

The arrangement in tomb T372 is exceptionally original. A group of diverse vessels accompanying the pithos along its southern side were placed in a row, forming an arc over its belly. Moreover, in the case of pithos T28/98, the limestone slab covering the mouth was raised vertically above the vessel's opening to a height sufficient to be distinctly visible within the burial area. Perhaps it served two purposes simultaneously, both as a cover and a marker of the pithos.

[12] Similar burial orientations are observed in the cemeteries of Eastern Locris, spanning the years from the Protogeometric to the Hellenistic periods (Selekou 2014: 240). According to Selekou, this preference represents 'a consistent burial custom of the Locrians, which for many years, generation after generation, they kept practising to honour their dead'. As at Stamna, similarly in the cemeteries of Eastern Locris, 'the placement of the deceased inside the pithos always had the head positioned near the mouth of the pithos'.

[13] For a similar practice observed in the cemeteries of Eastern Locris, spanning the periods from the Protogeometric to the Hellenistic, see Selekou 2014: 236.

[14] The compact posture of the deceased within the pithoi (as well as in burial vessels) during the Protogeometric period in Eastern Locris might be justified by the limited space inside, as suggested by Selekou 2014: 239.

[15] See footnote 13.

[16] Moschos 2009: 249. The placement of vessels outside tombs constitutes a practice observed throughout the centuries (Selekou 2014: 202, 241). See also Christakopoulou-Somakou (forthcoming) and the relevant discussion on the Data Synthesis.

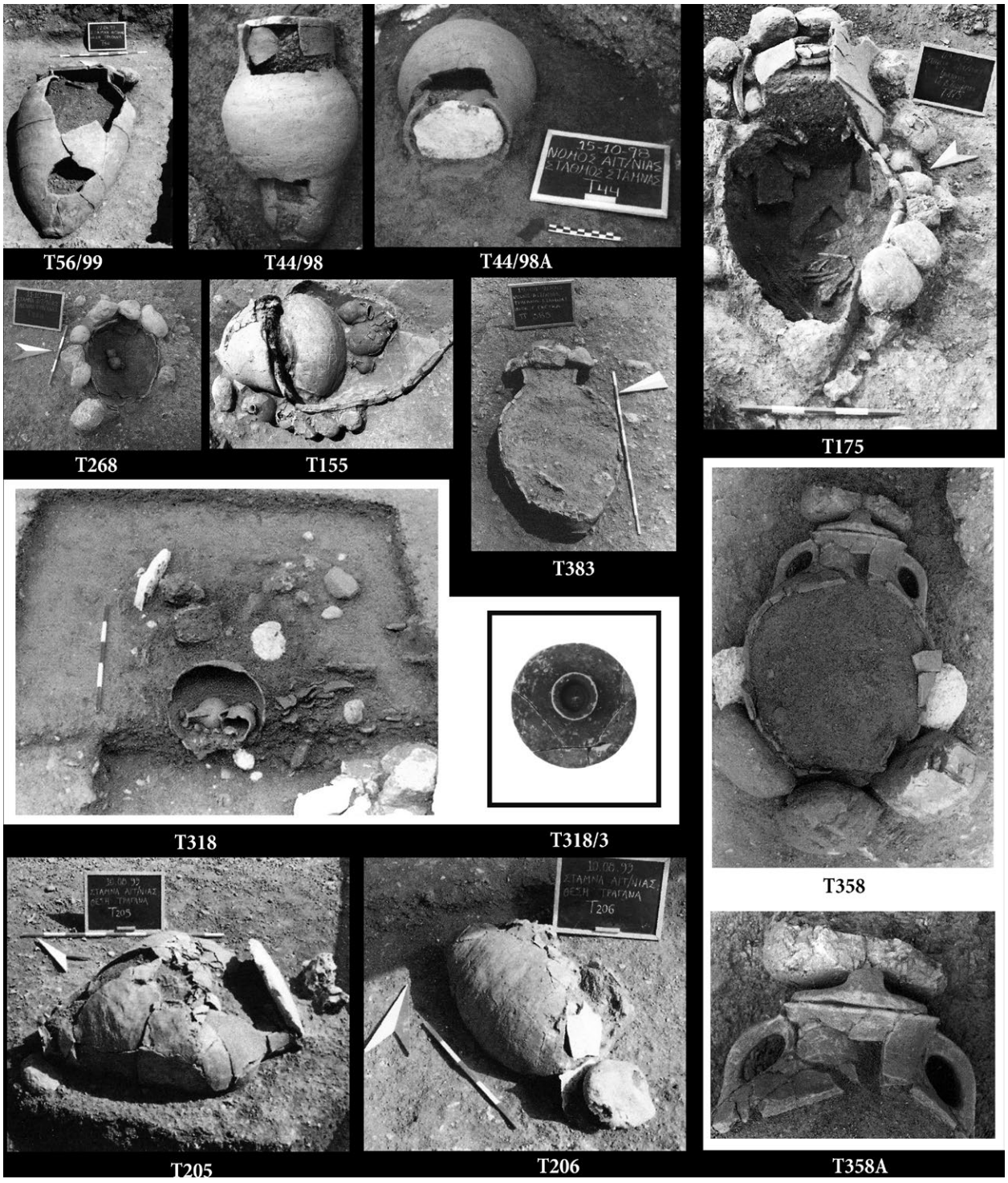


Figure 3: The sealing of the pithos's *stomion*
(photo editing by G. Somakos).

Considering the tomb typology and excavation data, it is inferred that the pithoi received external offerings and were significantly marked or adorned on top, more than the cist graves, in order to indicate their significance.

The comprehensive, nearly complete absence of functional wear and repairs argues either for the assumption that the majority of these were manufactured for funerary use or for their selection from domestic ware based on their excellent condition. In Aetolia-Acarnania, funerary pithoi were already in use as evidenced by their discovery in the tomb of Katouna, Loutraki Aetolia-Acarnania,[17] while the custom of burying adults in pithoi has a long tradition in Peloponnesian regions dating back to the

[17] Kolonas 1997: 60.

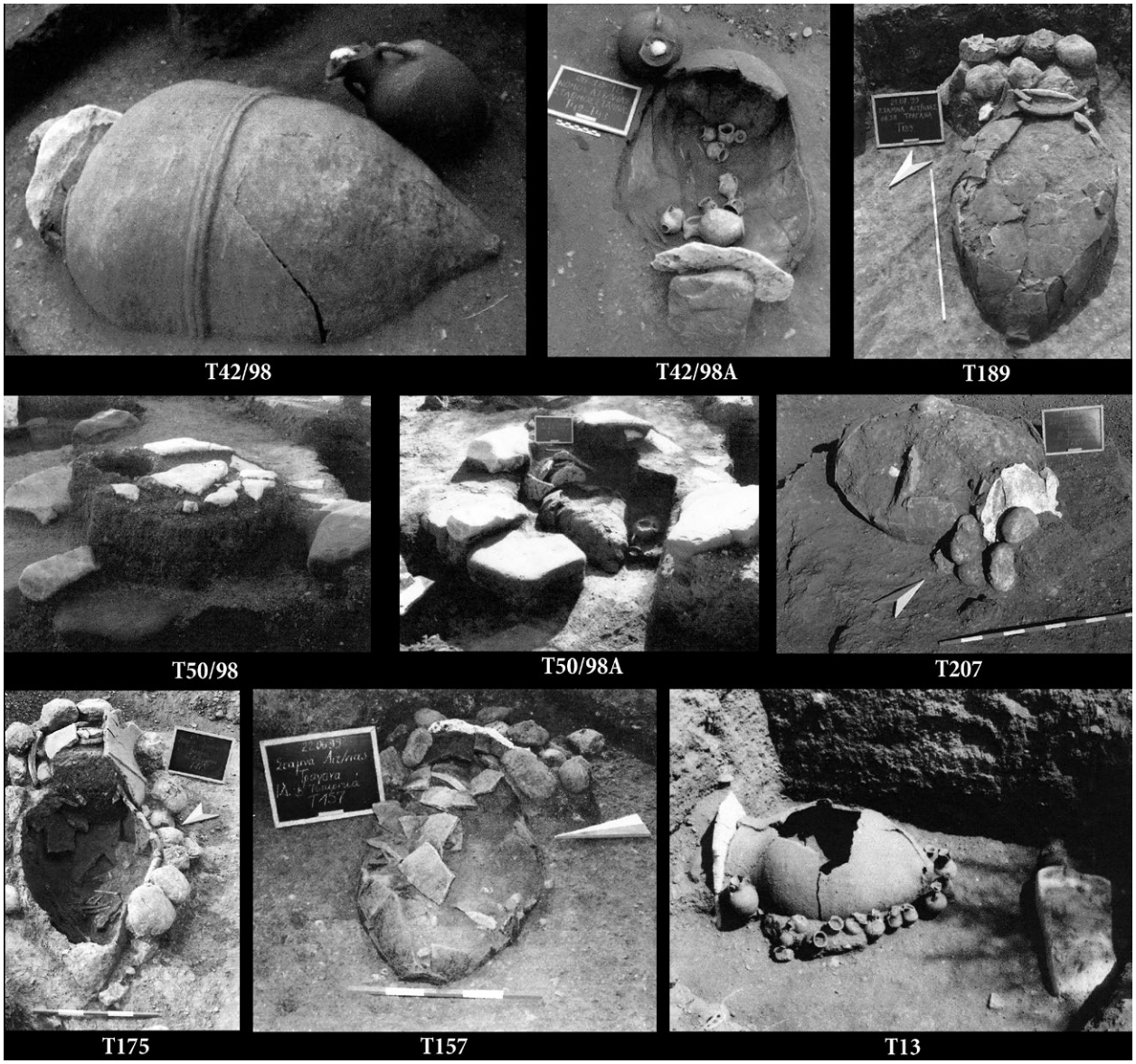


Figure 4: Strengthening the outer walls of the pithoi (photo editing by G. Somakos).

Mycenaean period.[18] However, given the absence of a significant percentage of graves in Aetolia justifying the continuous evolution of this custom and the limited evidence of the pre-Mycenaean presence, the debate remains inconclusive.

The present study will focus on the pithoi originating from funerary contexts. Regarding the storage pithoi mentioned later on, only their bases have been preserved. Considering the existence of large-sized pithoi during the prehistoric, Sub-Mycenaean, and Geometric periods,[19] along with their association with social reorganisations,[20] it is worth noting that a portion of the funerary Protogeometric pithoi in Stamna might have originated from surplus storage. Hence, our investigation aims to identify the socio-political characteristics that shaped their construction within that specific period and within that particular population.

The above viewpoint finds fertile ground in Stamna, as evidenced by the plethora of typological categories (34) (**Figure 6**), encompassing the 267 pithoi under study. Unfortunately, to date, no remnants indicating the function of a workshop have been identified; only funerary structures. Locating them in the broader Stamna area would substantiate, among other things, their local production, given that the high temperature required for their creation demands a spacious and well-equipped area for the fuel material. Their construction method, potentially employing

[18] For a comprehensive bibliography exploring the origins of pithoi and cist tombs, specifically in Achaea and the Peloponnese, see Gadolou 2008 and the respective chapters.
[19] Giannopoulou 2002: 319.
[20] Giannopoulou 2002: 320.

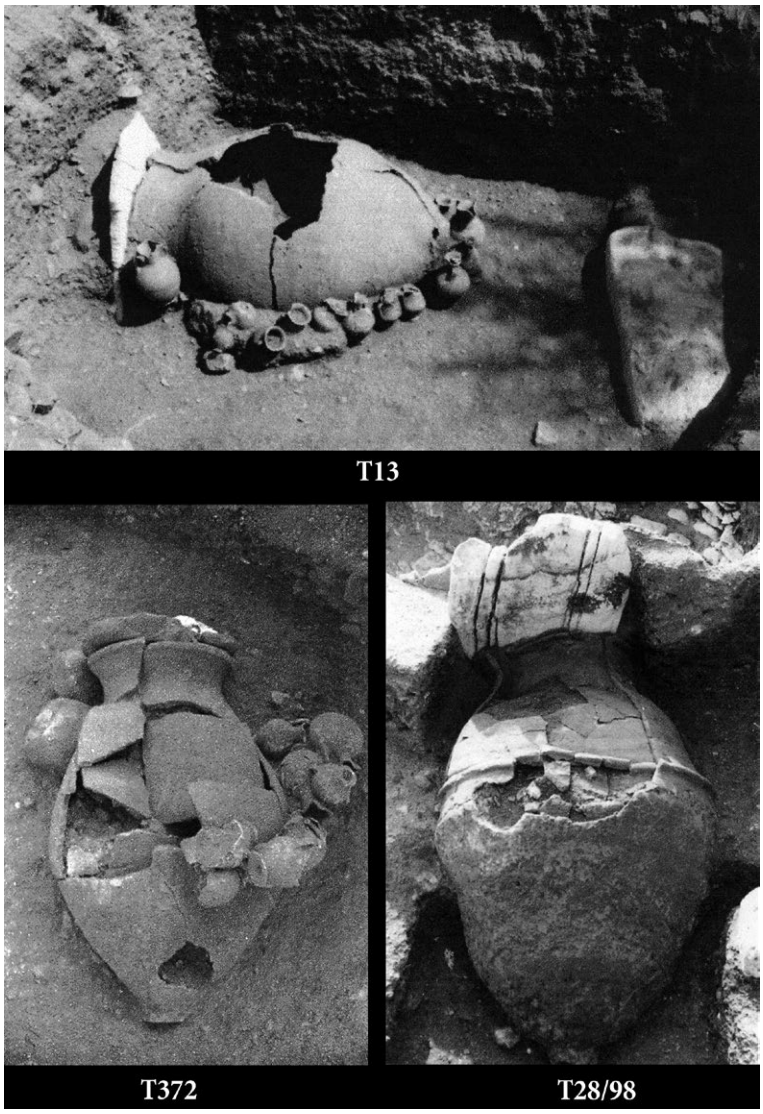


Figure 5: Pithos external offerings (photo editing by G. Somakos).

the technique of joining/mending 'κολλήσεων' hints, as indicated by Demetra Giannopoulou, at the involvement of specialised artisans who *'dedicated themselves entirely to ceramics for a period'*.[21] In conclusion, the discovery of workshops (working spaces) could reveal dimensions akin to those of the funerary pithoi identified, as their manufacturing process required extensive space and a timeframe for the firing process needed for their exposure to high temperatures.[22] Additionally, considering the substantial effort and labour involved in crafting, transporting, and acquiring these vessels due to their high cost, we comprehend the rationale behind the effort to attempt to repair them even when utilised for funerary purposes.

In this study, we begin by assuming that the pithoi can be dated back to the Late Protogeometric period. This is inferred from the consideration of two key aspects: **(a)** their proportionate representation within the broader necropolis area, and **(b)** their association with a population that re-settled in this region. Consequently, the transportation of these large pithoi from distant locations was entirely prohibitive, leading, in other words, to the establishment of workshop facilities to address these needs. The 'joining' technique, presumably applied here, did not require a permanent workshop setup with tools. Therefore, specialised craftsmen, situated in a spacious area rich in raw materials, could efficiently respond at a faster pace and with lower costs to the demands of the population groups.[23] Among the four primary construction techniques proposed by Ioannis Giannakakis[24] for the pithoi, aside from the construction *'των κουλούρων'*[25] evidently used in those featuring peripheral bands modelled in relief, there exists the 'modeling' model, involving the continuous shaping of a quantity of clay until it acquires the desired form.[26] This particular technique probably applies to those pithoi that present a uniform shape without peripheral decorations. Moving on to assumption **(c)**, these large vessels are not merely practical items but often serve as significant symbolic means to express preferences, beliefs, aesthetic criteria, and social priorities of the population group that created them. Considering Prudence Rice's study,[27] where she argues that both the construction method and the shape of the pithoi contain information regarding their usage, we proceed to categorise the pithoi from Stamna into groups, primarily based on their exterior design.

[21] While occupied with ceramics, they would be entirely devoted to this (Giannopoulou 2002: 311). Specifically on the technique of 'joining', see Giannopoulou 2002: 306-312.

[22] According to Giannakakis 2015: 128, the time taken to fabricate a pithos in Late Helladic Messenia was approximately 3 hours. However, this estimation does not take into account all the relevant parameters, such as the multiple stages of the construction process, material variations, and the workers' experience. Cf. Da Vela on knowledgescapes in this volume

[23] Giannopoulou 2002: 312.

[24] Giannakakis 2015: 106.

[25] For the widespread diffusion of this typology in fabrication, also on an international scale, see Giannakakis 2015: 131.

[26] Giannakakis 2015: 106.

[27] Rice 1987: 232.

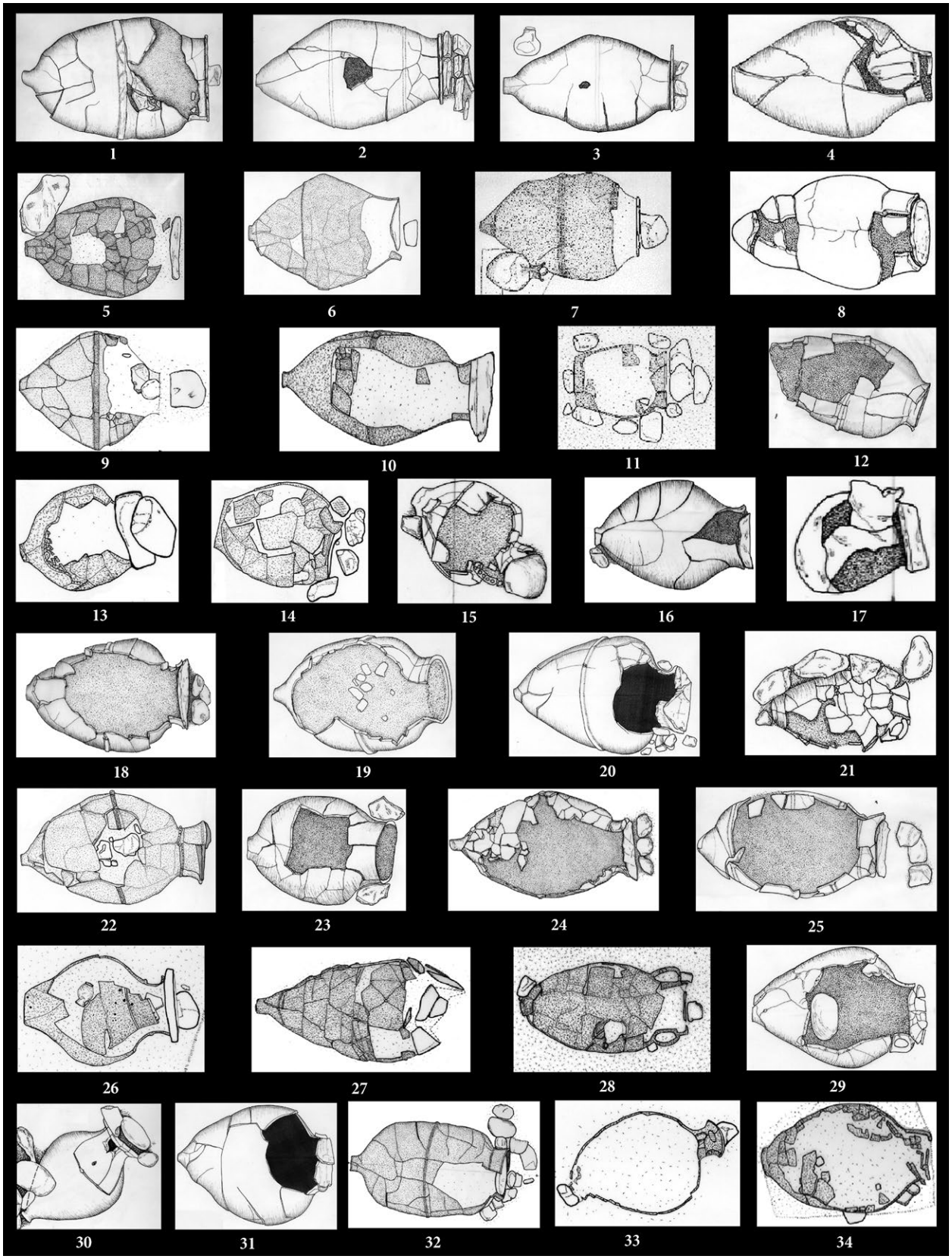


Figure 6: Typological classification of the pithoi from Stamna (after Christakopoulou 2009).

Pithoi the potter's play: A typology tale with a twist

The discrepancy in pithoi usage, alternating between storage and funerary functions, could imply a shift in their intended use or signify potential alterations in societal customs. This, in turn, may raise questions regarding community needs, the production practices of the pithoi, and the relationship between usage and

social identity. Such a contradiction (twist) can also underscore the importance of ongoing research to fully comprehend the practices of ancient society, as it prompts enquiries and clarifications that could lead to intriguing discoveries!

In the formulation of typology, the preference lies in categorising vessels based on one or more fundamental characteristics, as recorded through the standard archaeological process. Classification is governed by the criterion of correspondence and contrast, aiming to organise the observed diversity. Each category encompasses a specific type of vessel characterised by a set of distinct properties, governed by a stable relationship among them. As property we consider a specific feature, such as the shape of the mouth or the maximum circumference (body) in the case of morphology or the elements comprising a decorative motif or pattern, in terms of decoration. The recognition of distinct and selected attributes is a crucial process for extracting common elements among various vessels and the workshops producing them on both a local and broader geographical scale.

The pithos vessels, akin to other containers, encompass several vital attributes fundamental to their daily utility. Aside from the array of fundamental traits, it is pivotal to acknowledge that, regardless of their purpose (funerary or storage), the potters (a) evidently focused on enhancing their resilience, as indicated by the inclusion of gravel in the clay composition, plausibly to make it more solid and durable, and (b) tried to embellish them.

For a more comprehensive overview and to establish a cross-temporal framework concerning the typology of Early Iron Age pithos vessels, a succinct delineation of Boggess' categorisation pertaining to Attic pithos vessels is presented.[28] **A.** In the Sub-Mycenaean period,[29] pithoi exhibit an ovoid shape with a flat base, handles, a tall and narrow neck tapering slightly outwards towards a simple flattened lip. Relatively similar pithoi were discovered in the Geometric period (Boggess Attic pithos 14 and 17) but larger in size, with a differentiated base and mouth, which in the Geometric period may be angular and embellished with grooves (a type similar to that of Stamna could be T24/98, type 4).[30]

B. Additionally, in later periods, there seems to be an addition of relief zones/bands,[31] while in the Sub-Mycenaean period, the jars are typically unadorned. Included in this category are the Sub-Mycenaean 2 Attic pithos, and Pithos 11 of the Protogeometric period. Remarkably, in the Geometric period, this type becomes all the more common for funerary use, featuring a profile terminating in a low foot with a flat base and a broad, outward-curving mouth (Boggess Attic pithos 21, 28, 35, 37).[32]

C. In the Geometric and Archaic periods, the neck becomes taller and wider, with dimensions disproportionate to the overall size of the pithos. This type is not encountered earlier. Similarly, the mouth is wider and the lip is flat (Attic pithos 18, 20 and 22).[33]

D. The Late Geometric period includes pithos vessels numbered 26 and 33. Pithos 26 features a fluted lip and incised decoration at the junction of the neck and shoulder, with a curved neck. According to Boggess,[34] its base terminates in an outward-inclined base, which we could alternatively interpret as a low band. Pithos 33 features a relatively similar profile with a similar lip but different decoration, displaying three incised peripheral bands.

Our objective is to conduct a comprehensive analysis of the typological features and ornamental characteristics exhibited in these large vessels. To begin with, we will undertake an initial classification encompassing the entirety of the pithoi unearthed in the Stamna site. This endeavour aims at establishing a correlation between these vessels and other contemporaneous Protogeometric sites situated in the Aetolia-Acarnania region (**Figure 7**).[35] This preliminary investigation

[28] Boggess 1989: 130.
[29] Boggess 1989: 131 (pithos 1)
[30] Christakopoulou-Somakou 2009: 1034.
[31] Boggess 1989: 132.
[32] Boggess 1989: 132.
[33] Boggess 1989: 132 (pithos 18, 20, 22).
[34] Boggess 1989: 133 (pithos 26).
[35] On the Protogeometric/Geometric presence in Aetolia-Acarnania to-date, see the bibliography concerning the sites in **Figure 7.** Specifically for Stamna, Kalogerikó, see Mastrokostas 1967: 320; for Stamna, Tragana site, see Kolonas and Christakopoulou 1994: 242-243; Kolonas and Christakopoulou 1998: 281; Kolonas and Christakopoulou 1999: 271-272; Christakopoulou-Somakou 2009: 330; Kolonas and Christakopoulou 2001-04: 72. For a broader view of Stamna, see Christakopoulou-Somakou 2009; Gatsi 2010: 1052-1055 Stavropoulou-Gatsi 2018: 240. For a tholos tomb at the Kalandrika location in Stamna, see Kolonas 2018: 85. For recent excavations, see Vikatou 2012a, 2012b; Vikatou 2015a, 2015b, 2015c, 2015d, 2015e, 2015f; Vikatou 2019. For Protogeometric and Geometric tombs in Palaiomanina, see Mastrokostas 1967: 323; Mastrokostas 1961-62: 184-185. For Palaea Pleurona, see Dekoulakou 1982: 219-236; Dekoulakou 1971: 326-327. For Kalydon, see Stavropoulou-Gatsi 2011: 278-299. Additionally, for tombs in the broader region of Kalydon at the Stoupeika and Hondreika locations, see Gatsi 2010: 1058-1059; Vikatou 2015a; Vikatou 2016: 26-27 fig. 8; Vikatou 2019: 396. For finds from the Geometric period resulting from the systematic research of the city and the acropolis, see Bollen 2011: chapter 3.5, catalogue nos 3, 14-15; Stavropoulou-Gatsi and Dietz 2011: 275. For the Lagkada Karapanou location in Kalydon, see Stavropoulou-Gatsi 2011: 279, where the discovery of 20 graves, cist-shaped and pithos, is documented. The same source speculates about the existence of a broader Protogeometric cemetery extending on the lower northeast slopes and outside the Classical/Hellenistic fortification (Stavropoulou-Gatsi 2011: 296 fig. 231). Additionally, in Stavropoulou-Gatsi 2018: 241, reference is made to the discovery of three Geometric clay vessels from the wider area of Kalydon, though no further clarifying details are provided. Concerning the Kryoneri site, where a Late Geometric/ Early Archaic cemetery was found, see Stavropoulou-Gatsi 2005: 473-

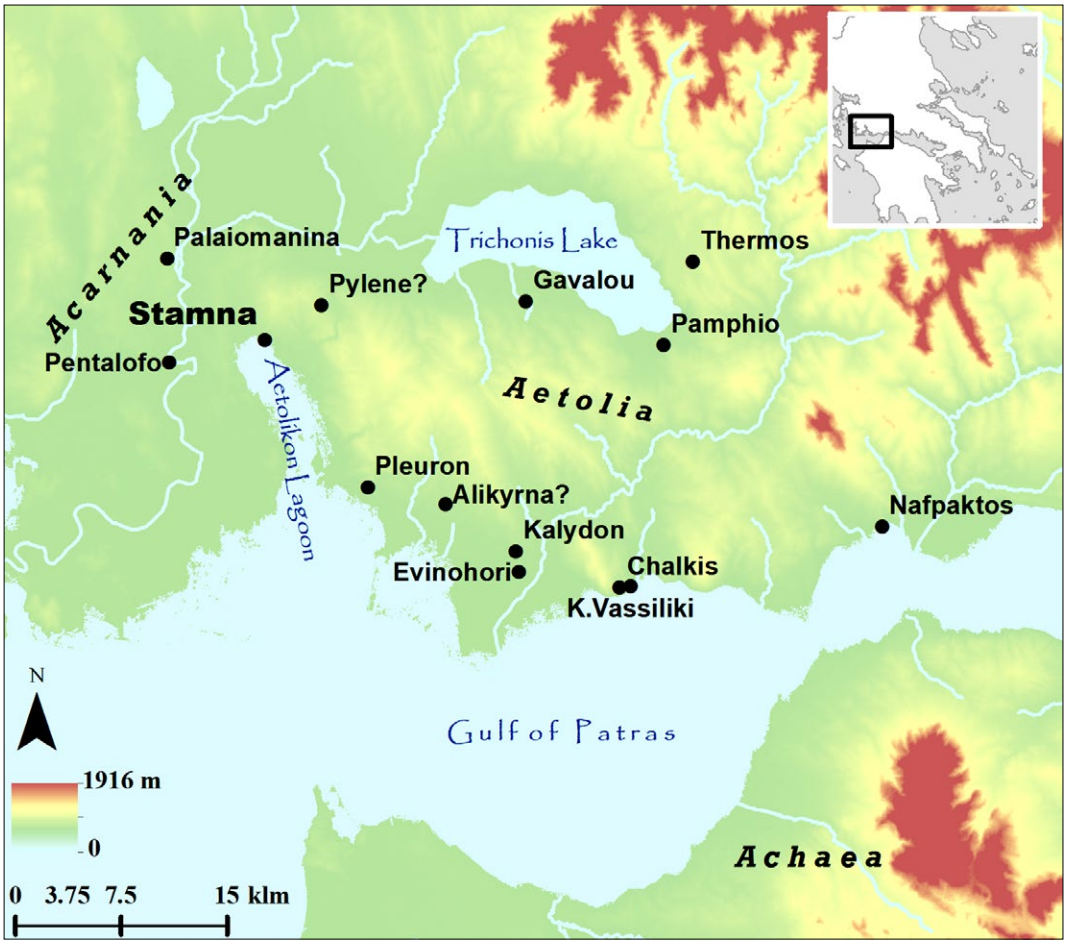


Figure 7: Protogeometric/ Geometric presence in Aetolia-Acarnania to date (map by H. Simoni, based on ASTER GDEM v2 data, a product of METI and NASA).

forms the fundamental basis for our sustained investigation, aligning with the research objectives outlined in *'Cracking the Code; Symbols, meanings and networks in Early Iron Age Greece. Evidence from the Stamna pottery'*.[36] Through this approach, a workshop's activity is evidenced by the varied techniques and tools used in creating such vessels, even if the workshops themselves have not yet been identified. On the other hand, this study serves as a preliminary stage of a broader investigation into Stamna ceramics by its authors, aiming to thoroughly document the workshops, their possible origins, and expansions. These pithoi are categorised into eleven distinct groups based on their shape, base, handles, and the ornamental bands that embellish them (**Figure 8**). This classification highlights the variety of forms and characteristics that jars may feature, emphasising the significance of details in how we identify and distinguish them.

More specifically, each category of pithos vessels exhibits unique characteristics, which render it distinct. From the contour of the body, to their decorative elements, pithos vessels can bear impressive differences. In this manner, each category represents a wealth of knowledge and comprehension of their diversity,

474, fig. 7. For the Evinohori Railway Station, see Mastrokostas 1967: 320; Stavropoulou-Gatsi 2011: 279-299. For Gavalou, see Stavropoulou-Gatsi 1980: 102-130. About the Protogeometric settlement at Thermon, laid out in the area of earlier structures, such as the Megaron B, see Papapostolou 2008 and Papapostolou 2014. In the Pamfio Marathia settlement (Stavropoulou-Gatsi 2018: 238), local dark-coloured pottery was discovered, also found at Thermon and Stamna, as well as Early Iron Age sherds related to Megaron B in Thermon (for a relevant discussion, see Papapostolou 2008: 58 fig. 28; Papapostolou 2014: 92, 102). In the above catalogue, Vokotopoulou's study from 1969 should be included, concerning the vessels from Oikonomou collection, which belong to the same technological tradition as the objects under study. For the region of Alykirna, where Protogeometric funerary and settlement remains were found, see Vikatou 2012b; Vikatou 2015d; Vikatou 2016. Geometric finds, primarily from tombs, are also mentioned in the region of Naupaktia, namely at Kryoneri and Naupaktos (Saranti 2022: 120-164). Additionally, the village of Pentalofos yielded a Protogeometric amphora from the ancient cemetery of the area (Kolonas 2018: 82). For an overview of locations in Aetolia throughout the centuries, see Dietz 2019.

[36] Christakopoulou, G. and H. Simoni 2023-2024. *Cracking the Code: Symbols, meanings and networks in Early Iron Age Greece – Evidence from the Stamna pottery*. Washington DC: Center of Hellenic Studies, Harvard. This project aims to explore the cultural significance and symbolic motifs found on 709 ceramic vessels discovered in the Stamna region of Aetolia. These vessels were recovered from the excavation of 500 tombs. By analysing the geometric patterns, spatial arrangement, and aesthetic qualities of these motifs, the study seeks to uncover their potential as symbols of identity, potentially transcending national boundaries across the Eastern Mediterranean, Aegean, and Asia Minor. The project employs GIS techniques for quantitative analysis to support interpretations and understanding of these motifs' meanings and their broader implications for intergroup interactions during the Iron Age.

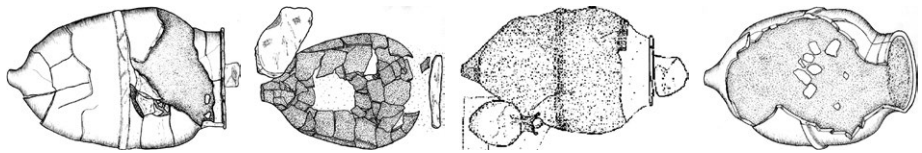
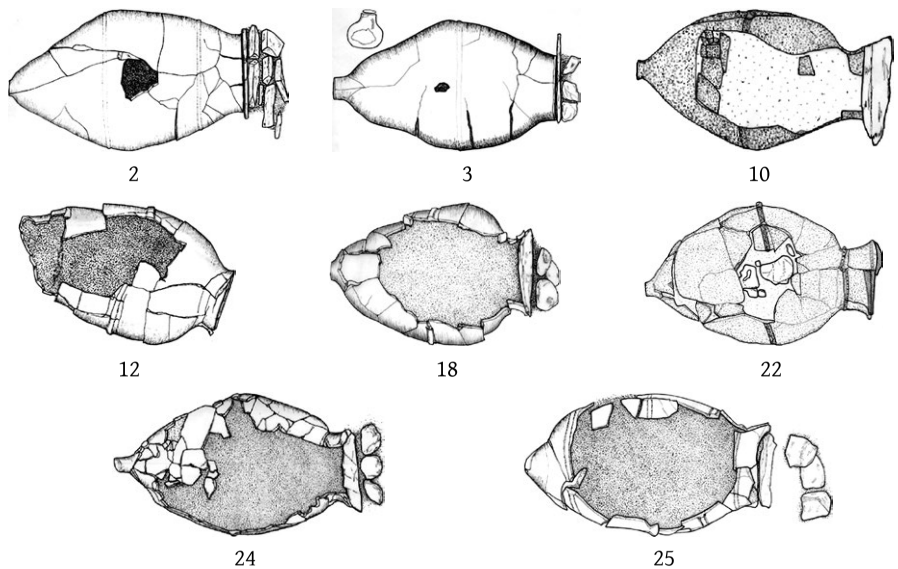
Category 1: Cylindrical/ovoid body terminating in a compact cylindrical neck. Adorned with a plastic decorative band or without.  1 5 7 19	*Type 1:* Cylindrical-ovoid body terminating in a compact cylindrical end. Rounded and slightly projecting rim. Relatively tall and perpendicular neck at the shoulder level. The maximum diameter of the jar is at the height of its shoulders. A plastic band adorns its upper body (T1/98). *Type 5:* Broad ovoid body ending in a tall and wide cylindrical base (T27/98). *Type 7:* Cylindrical body tapering into a conical lower part and terminating in an acute base. Flat rim, low neck, nearly non-existent. Exhibits a banded decoration around its mid-height (T42/98). *Type 19:* Broad ovoid body with an acute base culminating in a compact cylindrical end. Neck with a concave profile. Flat, projecting rim. Embellished with a plastic band just below the shoulder level (T92/99).
Category 2: Biconical/ovoid body, base either conical or terminating in a compact cylindrical shaft. Decoration with one to three plastic rings.  2 3 10 12 18 22 24 25	*Type 2:* Biconical body, conical base. Flat and slightly projecting rim. Low neck with a concave profile. The maximum diameter of the jar is positioned low compared to its overall height. Two plastic bands encircle the body just below the shoulders and the maximum diameter (T7/98). Type 3: Biconical body with a base terminating in a compact cylindrical shaft. Flat rim, perpendicular neck to the body. The maximum diameter is at the midpoint of its height and encircled by a banded decoration (T8/98). *Type 10:* Ovoid body ending in a low banded shaft. Tall, perpendicular neck at the shoulder level. Adorned with a plastic band at the height of the maximum diameter (T59/98). *Type 12:* Ovoid-cylindrical body. Tall neck with a slightly concave profile (T14/99). Plastic band below the height of the maximum diameter. *Type 18:* Ovoid body with a base forming a low protrusion. Neck with a concave profile, flat rim, slightly projecting outward (T75/99). *Type 22:* Acute-based biconical body. Tall, angular neck protruding outward. Funnel-shaped mouth with a flat and slightly projecting rim. Plastic bands at the neck base and maximum diameter (T185). *Type 24:* Biconical body terminating in a tall and narrow compact cylindrical shaft. Neck with a concave profile, flat and projecting rim (Type 212). *Type 25:* Ovoid body with a relatively acute base. Relatively elevated neck, flat and projecting rim. Exhibits plastic bands at the neck base, maximum diameter, and lower body (243).

Figure 8: Typological classification of the pithoi from Stamna
(after Christakopoulou and Simoni 2023-2024).

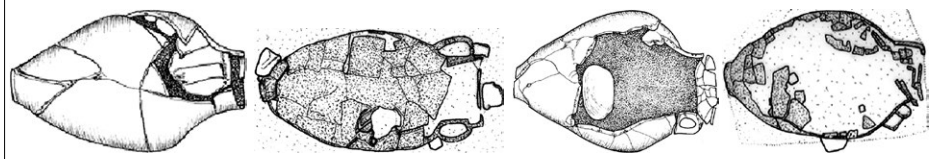
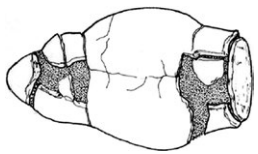
Category 3: Ovoid bodies with a flat base. Strip handles from the mouth to the shoulder.  **4** 28 29 34	*Type 4:* Ovoid body terminating in a flat base. Short neck, flat and projecting rim. Features a handled band with a central groove, vertically positioned from the neck base to the shoulder (T24/98). *Type 28:* Cylindrical body ending in a flat base. Neck slantingly expanded outwards. Flat, outward-projecting rim. Strip handles, vertical and angular, starting immediately below the mouth and ending high on the shoulder (T306). *Type 29:* Conical/carinated body terminating in a flat base. Neck with a concave profile, flat and projecting rim. Strip handle, vertical from the mouth up to the shoulder (T326). *Type 34:* Ovoid body ending in a low flat base. Strip handles, vertical and angular, from the mouth up to the shoulder (T424).
Category 4: Intensely biconical-shaped bodies, bases terminating in a low cylindrical stem. Adorned with plastic ring. 6 9	*Type 6:* Intensely biconical-shaped body, base terminating in a low cylindrical stem. The widest diameter of the body lies low, forming a distinct curve. Flat rim, neck with a concave profile. Features a plastic ring just below the body's widest diameter (T38/98). *Type 9:* Intensely biconical-shaped body with a pointed base. Flat rim, neck with a concave profile. Bears plastic ring just above the widest diameter (T57/98).
Category 5: Bodies in the form of a conical coil terminating in a curved base.  8	*Type 8:* Conical coil-shaped body ending in a curved base. Tall, perpendicular neck (T44/98).
Category 6: Broad cylindrical/ovoid bodies, flat base. 11 14	*Type 11:* Broad cylindrical body terminating in a wide flat base. Flat rim, sloping neck on the shoulder (T13/99). *Type 14:* Broad ovoid body with a wide, flat base. Flat rim, neck with a concave profile. Cylinder-sectioned handles growing high on the shoulder (T27/99).

Figure 8: Continued.

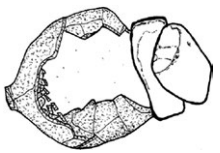
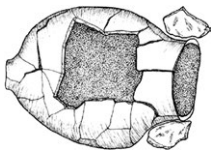
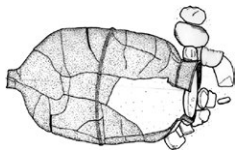
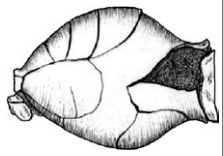
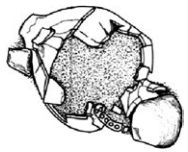
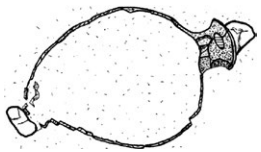
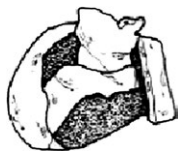
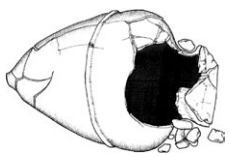
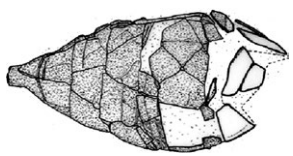
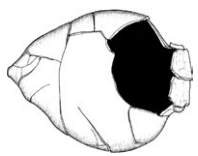
Category 7: Broad amphoriskos/conical/cylindrical bodies, low pedestal base.  13  23  32  16	*Type 13: Broad* conical body terminating in a low pedestal base. Angular, outward-projecting rim (T26/99). *Type 23:* Broad cylindrical body narrowing abruptly at the lower section, ending in a low pedestal base. Neck with a concave profile, flat and projecting rim (T196). *Type 32:* Cylindrical body widening from the height of the maximum diameter downward, terminating in a compact, narrow, and low cylindrical stem. Neck slantingly expanded outwards, flat rim. Plastic ring at the neck joint and mid-height. The widest diameter lies in the lower body of the vessel (T368). *Type 16:* Biconical body terminating in a narrow and low pedestal base. Neck with a concave profile, flat and projecting rim (T65/99).
Category 8: Conical/ovoid bodies, flat base. With or without handles.  15 21  33	*Type 15:* Conical body, expanded narrow base. Vertical neck on the body. Strip handles, vertical from the mouth to the shoulder (T51/99). *Type 21:* Ovoid body terminating in a flat base. Neck with a concave profile, flat and projecting rim. Strip handle with a concave back, vertical from the mouth to the shoulder (T174). *Type 33:* Ovoid body ending in a curved base. Particularly tall neck with a concave profile, flattened rim, projecting outward. Deficient in handles that started just below the mouth (T374).
Category 9: Ovoid body, continuous with the curved base.  17	*Type 17:* Ovoid body forming a continuous curved base. Neck with a concave profile, flat rim (T69/99).
Category 10: Intensely conical/pyriform bodies with a continuous outline towards the acute base.  20  27  31	*Type 20:* Intensely conical body, nearly continuous towards the acute base. Features plastic ring just below the maximum diameter. Neck with a concave profile, flat and projecting rim (T93). *Type 27:* Intensely conical body, continuous towards the compact cylindrical base (T284). *Type 31:* Pyriform body, almost continuous with the acute termination. Short neck with a concave profile, flat rim (T336).

Figure 8: Continued.

Category 11: Pyriform body, flat base. With or without rings.	30 26	*Type 26:* Intensely pyriform body ending in a broad flat base. Tall neck, slightly angular outward. Bears plastic ring at the junction with the shoulder (T253). *Type 30:* Pyriform body terminating in a narrow pedestal base. Low neck with a concave profile, flat rim (T335).

Figure 8: Continued.

encompassing subcategories with characteristics related to the main one. From cylindrical to conical and from ovoid to biconical shapes, each form carries its own unique presence and utility.

In conclusion, this categorisation enhances our understanding of the manifold ways, in which pithoi evolved and were used by the Stamna population. Through these typologies, we discern the richness of tradition, the diversity of design, and the significance of the details contributed by the ceramic workshops of the population under study.

Pithos potpourri: Observations

In this chapter the pithoi from Stamna are studied from a quantitative perspective (**Figure 9**). Of the 267 pithoi, 218 are classified in one of the aforementioned categories, with the rest being preserved in a non-satisfactory condition and therefore being not possible to allocate. More than 50 per cent belong to category 1, while the rest fall into the remaining categories and especially 2, 7 and 8. Possibly the simple structural and design elements of category 1 are less complex, compared to other categories, and perhaps better meeting the demands of the burial practice.

The bases of the pithoi affect their stability and may affect their performance and durability in different conditions. Interestingly, the high frequency of occurrence of the cylindrical base (50 per cent) compared to other shapes, such as the flat and the band-like ones may imply that the independent standing of the pithoi in an upright position was not needed. Therefore, they were purchased to be embedded in soft ground or placed sideways as mortuary vessels.

This is also supported by the limited number of handled pithos (4 in total, scattered in four different burial clusters (clusters Tsikrika, Gkeka, Ch. Kontomitsos, and Kalandrika). Apparently, pithoi were not meant to be moved, because they were originally intended for burial rather than transport and storage of goods. In addition, only four pithoi bear signs of repairs, consisting mainly of multiple perforations (holes) on their surface, from which the original joints (reasonably made of lead) are missing. They mostly belong to the numerous category 1 (clusters Tsikrika, Ch. Kontomitsou, Public Road km 8050, and Papadopoulos). This preference for intact and flawless pithoi demonstrates respect for the dead and the value of the integrity of the material that acted as a protective shell on their *post mortem* journey. Coupled with a preference for soft, curved contours of the body and base of the pithoi, we can recognise a sign of affection towards the dead who symbolically return to their mother's womb.[37]

[37] The use of pithoi as burial containers dates back to the Neolithic period, observed in Kephala, Keos (Coleman 1977), where findings

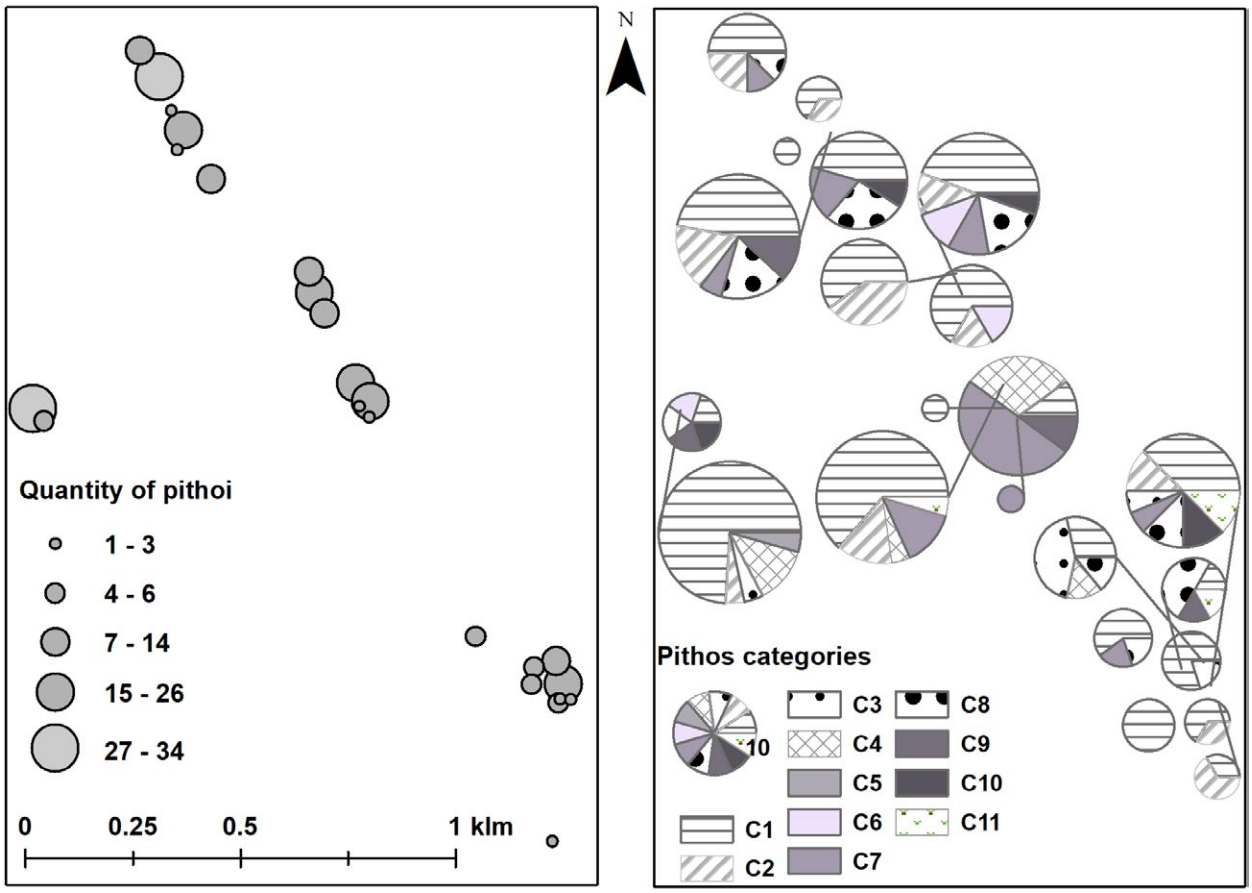


Figure 9: Distribution of burial clusters in Stamna. Shape and size vary based on a) the quantity of pithoi, on the left, b) the quantity of pithoi and their relative proportion in each category, on the right (map by H. Simoni).

Regarding the sealing of their mouths, out of the 189 pithoi for which information is available, 172 were blocked with stone slabs, mostly worked limestone, while 17 were covered with sherds from other pithos, as well as from vases. Half of the former and one third of the latter fall under category 1.

The decorative elements of the pithoi are developed in gradations with the prevailing theme being the relief ring that surrounds the body of the vase. 94 pithoi with one, two, three or four rings are recorded. The largest concentration can be found on the clusters of G. Kontomitsou and I. Kousarida (10 each) and Papadopoulos (19). Almost half belong to category 1, followed by category 2. More elaborate decoration is observed on some pithoi, such as rings of cord-shaped or banded cross-section, with impressed or incised circles or grooves. Such decoration occurs on 22 pithoi, with half showing simple elements and the other half with multiple combinations. These decorative elements appear in only 12 clusters and fall under 6 different categories, with a predominant presence in category 1.

Next, we look for the ratio of the number of grave good inclusions to the number of pithoi per category, with emphasis on feasting vases and weapons. While in most categories there seems to be an almost uniform distribution both of vessels and weapons, categories 6 and 4 stand out, as the former features consistently the smallest number of grave goods per pithos, whereas the latter features the largest. These two categories are interesting because the quantity of the offerings is consonant with the decoration of their outer surface. Category 6 is poorly furnished and lacks decorative elements. On the other hand, abundant offerings and the proportionally more decorated pithoi (about 2/3) are found in category 4.

To sum up, it seems that the local population paid their respect by decorating the pithoi or by depositing goods or in combination. Rejecting communal burials, their aesthetic criteria were applied in order to express an individual sense of farewell and mourning, for each one of their dead separately, thus probably resonating their social or symbolic status.[38]

(perforations for repairs) indicate their reuse – a practice similarly identified at Stamna.

[38] Cannon 1995; Philippa-Touchais 2011: 35.

Elegance in tripod pithos: Ceremonial artistry in funerary practices

At the Stamna cemetery, ten (10) tripod-shaped pithoi/vessel containers T348, T350, T351, T362, KT2/94, T66, T322, T11/98, T104, T121 are present. Three types (KT2/94, T66, T322) were found literally embedded within built pits and were exclusively used as ash urns. The pithos T11/98, also used as an ash container, was found independently in the area, vertically positioned on the ground, as was the T104, found independently but tightly enclosed by a group of vessels. The tripod pithoi T121 and T348, positioned independently in the area and placed obliquely in the ground, contained skeletal remains of cremated individuals.

Each of the aforementioned examples bears its typological features, thereby giving rise to the following distinct types, each corresponding to one of these (**Figure 10**).

Storage pithoi: reservoirs of antiquity

For the storage pithoi (**Figure 11**) (П1, П62, П64, Т(;)180, П117, П118, П279, П314, П315, П316, П325, П327, П328, П329, П330, П331, П332, П333, П389, П402, П129, П36, П111, П112, П113, П114, П116, П416, П407, П409, П337, П338, П380, П381, П382, П384, П86, П87, П285, П294), we lack sufficient data due to two main reasons: firstly, the overwhelming majority of the examined pithoi in this study originate from burials, and secondly, because only their bases have been preserved from the excavated and relatively identified ones. The pithoi used for burials were mostly found in horizontal or semi-inclined positions within carved soil cavities, a placement distinguishing them from the storage ones, which predominantly stood vertically in the ground. Moreover, their discovery locations were not correlated with any residential or workshop areas. By exception, the pithoi T181, T182, T183 (**Figure 12**), where only the vertically positioned bases were preserved, were considered as burial containers due to their content consisting of bone remains and vessel fragments.[39] As regards the tripod-shaped pithoi, occasionally containing cremated remains, they were placed vertically in the ground, while in cases of inhumation (T121 and T348), they were found in a horizontal position.

Pithos profiles: Unveiling shapes and surfaces

During the Protogeometric period, pithoi used as burial containers are also encountered in the rest of Aetolia-Acarnania, as previously highlighted. In Gavalou, specifically for interring the deceased, intact pithoi were not employed but, instead, their structural walls were utilised.[40] During the Geometric period, the inhumation of the dead in pithoi is observed in Naupaktos[41] and Kryoneri Messolonghi.[42] More specifically, the funerary pithoi of the Geometric period unearthed in Naupaktos were positioned both vertically and horizontally. They featured a cylindrical termination and were adorned with decorative relief bands.[43] As indicated by the excavator, these represent the earliest funerary remnants of this period in the region. Given the relatively limited sample size, secure conclusions regarding habitation cannot be drawn.[44] The exclusive production of pithoi for burial purposes occurs also in other regions, such as neighboring Achaea[45] during the Geometric era, in Tragana[46] and Triantafyllia of Eastern Locris.[47] Generally, the practice of burial in pithoi, although prevalent in Aetolia-Acarnania and Achaea, is not common in other well-known regions of the Geometric period, such as Attica.[48]

Turning to the morphological diversity of the pithoi, a remarkable variety is demonstrated by their broad range of shapes, which includes ovoid, conical, biconical, and spherical types, with the biconical profile being the prevalent shape, recurrent in the micro-ceramics of Stamna and actually distinguishing/differentiating the production of Stamna from contemporary vases in other regions. Certain pithoi feature narrow or pointed bases, while others have broader bases, likely to meet varying needs or purposes. This diversity in shapes reflects the complexity of needs and the variety of conditions that the pithoi may encounter in different environments or uses.

The width of their *stomion* is significant: given that the pithoi were crafted to serve burial needs, their mouth width had to be sufficient to comfortably accommodate the entry of a deceased body. Examining the mouth width of the burial pithoi discovered at Stamna, alongside their contextual placement and the dimensions of the entombed individuals, prompts enquiries as to whether these pithoi were specifically crafted for burial purposes or repurposed from the owners' storage facilities. This notion is supported by

[39] Kurtz and Boardman (1994) note child burials during the same period in vertically placed vessels. A similar practice is observed in Thebes for infant burials (Aravantinos 1994: 269) and Corfu, where both adult and child burials were conducted in vertically positioned pithoi (Lazari *et al*. 2018: 710).

[40] Stavropoulou-Gatsi 1980: 106-107.
[41] Saranti 2022: 137.
[42] Stavropoulou-Gatsi 2005.
[43] Saranti 2022: 132.
[44] Saranti 2022: 137.
[45] Gadolou 2008: 197. As mentioned by Alexopoulou (2021: 570), at Kalavryta the burial in pithoi is considered to be the exclusive burial practice.
[46] Onasoglou 1981: 6.
[47] Selekou 2014: 81. For the origins and enduring adoption of this specific burial practice in Northern and Central Greece, the Peloponnese, the islands, and in Asia Minor, see Selekou 2014: 247 with bibliography.
[48] Alexandridou 2016: 343; Selekou 2014: 278-279.

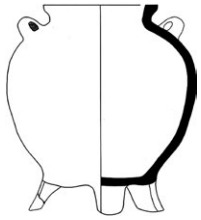
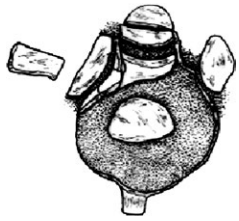
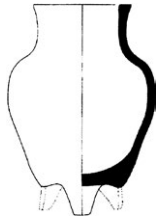
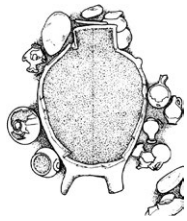
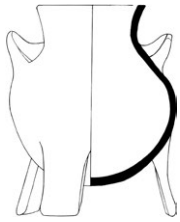
Type 1		A spherical body featuring two handles of rectangular cross-section positioned horizontally on the shoulder. It rests upon a flat base from which three legs of rectangular cross-section protrude (KT2/94).
Type 2		A spherical body, with a flat base where only the three points of emergence of the three legs are preserved. Two T-shaped handles positioned at shoulder height, each vertical shaft of which is adorned with a central ridge. (Found incomplete at the neck and mouth) (T11/98).
Type 3		Spherical body, neck with a concave outline, flat and protruding lip. One leg, rectangular in cross-section, has been preserved (T121).
Type 4		Conical body, triangular legs. Tall neck with slightly curved profile, flat lip (T66).
Type 5		Ovoid body, rectangular legs. Vertical neck attached to the body, flat lip (T348).
Type 6		Compressed spherical body, broad and tall neck, vertically placed on the body. Triangular legs, flattened. No handles (T322).
Type 7		Spherical body, slightly outwardly flaring lip, neck with concave profile. Rectangular handles emanating horizontally from the vessel's shoulder, slightly elevated. Rectangular legs, flattened (T104).

Figure 10: Tripod pithos (photo editing by G. Somakos).

the discovery of burial pithoi, of which the belly surface was incised with a tool (**Figure 13**), in order to facilitate the entry of the deceased body through an aperture there.

The *handles* of the pithoi are typically positioned according to the occasional needs, either to assist in the pithos' easier handling or to provide decorative elements. The presence or absence of handles may

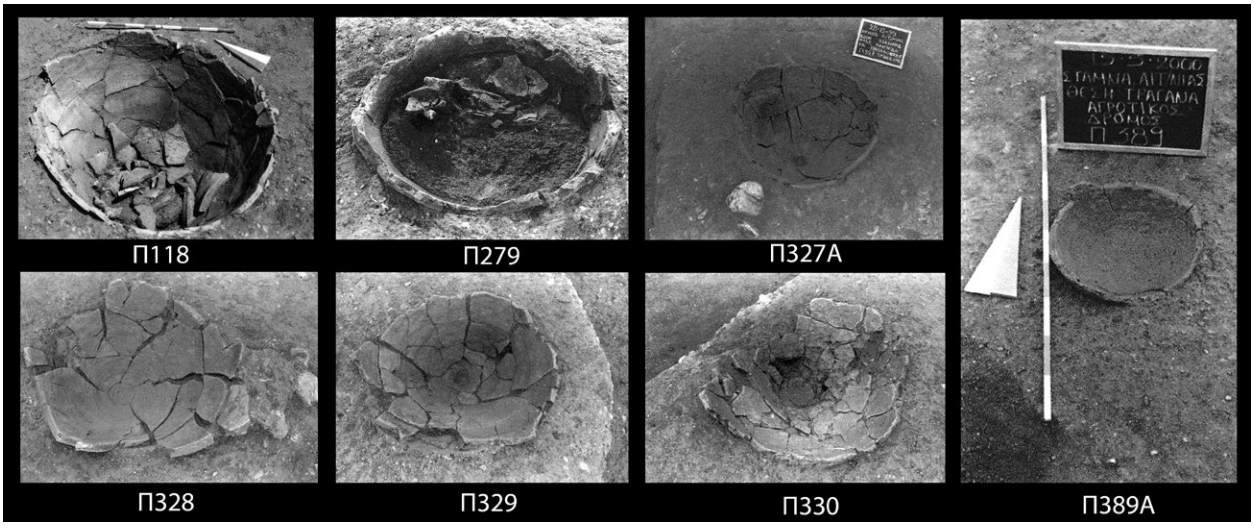


Figure 11: Storage pithoi (photo editing by G. Somakos).

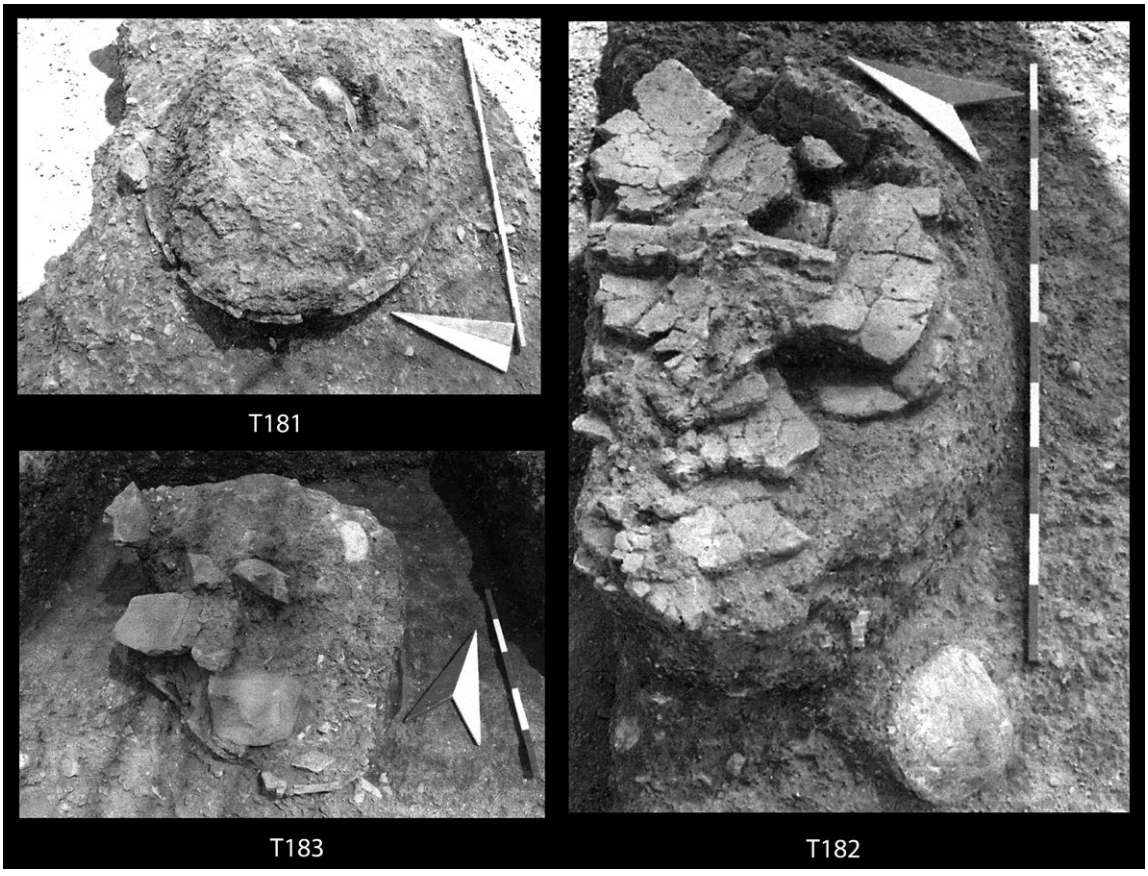


Figure 12: Pithoi with vertically positioned bases (photo editing by G. Somakos).

stem from functional or aesthetic factors. They are chosen based on the desired use and the appearance intended for the vessel. Boggess[49] chronologically differentiates between Attic pithoi of the Bronze Age and those of the Iron Age, based on the presence or absence of handles. For this argument, she cites, among other examples, the discovery in the Agora of two identical pithoi, one dated to the Mycenaean period (Late Helladic IIIB-C) and the other to the Iron Age, differentiating them on the grounds of the presence or absence of handles, respectively. The pithoi from Stamna[50] displaying characteristics of the earlier period are likely to have had a prolonged use and to have been potentially reused as burial vessels.

[49] Boggess 1989: 2.

[50] On categories 11 and 14, see Christakopoulou-Somakou 2009: 1036-1037.

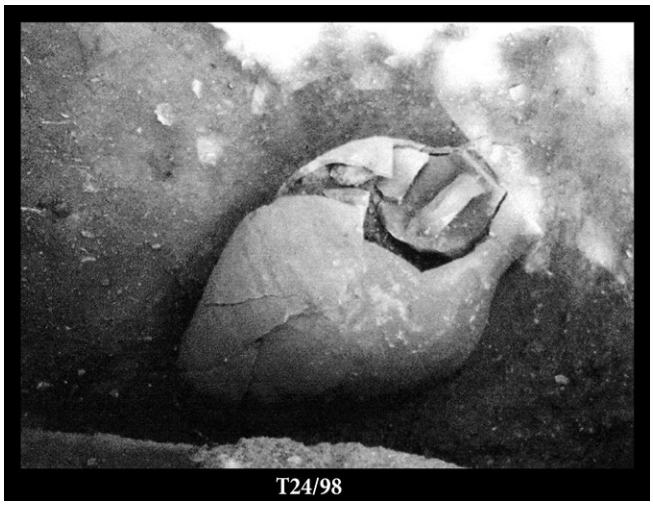


Figure 13: Entry of the deceased into the pithos after the removal of its wall (photo editing by G. Somakos).

In categorising ceramic production, the identification of the profile and shape of the rim is often a criterion, although this alone is not always sufficient for the comprehensive classification of pithoi. A complete analysis of the entirety of the pithoi is necessary, rather than solely relying on fragmented information. By presenting the integrated profile of the pithoi, it becomes possible to significantly comprehend the ceramic production of that specific period in the particular geographical location.

At Nihoria, pithoi display variability in terms of bases; scholars propose that flat and rounded bases typify storage pithoi, whereas knob-shaped terminations characterise those intended for burials.[51] Conversely, in Stamna, this distinction is absent, due to the prevalence of funerary pithoi. As per the proposed classification, these encompass all types of bases. It is possible that some initially served storage or culinary functions, like the tripod-shaped, handmade pithoi. However, owing to the limited cases and the absence of comparative residential data, a definitive categorisation cannot be reached. Being unable – at the moment – to draw conclusions, we are obliged to maintain the aforementioned theories.

According to Giannakakis' study[52] on Late Helladic pithoi, it is plausible that ceramists experimentally realised that a broad base combined with tall vertical walls in large vessels might weaken the vessel's integrity. This is due to the lateral forces/stresses generated by the weight of the vessel's contents, which could potentially lead to wall ruptures. However, narrow or pointed bases (frequently observed in pithoi) convert or redirect these forces, allowing the vessel to better withstand pressure. Additionally, spherical pithoi have a more robust structure and tend to be more resistant to the weight of their contents. Their generally rounded shape results in a more uniform weight distribution, reducing the risk of wall collapse and offering additional vessel strength.

The understanding of these factors was probably reached through experimentation. It is also plausible that subsequent pithoi makers retained these features without direct experience concerning their stability. With regard to cases of pointed and narrow bases, some sort of a stabilising medium might have been necessary during their fabrication, such as partially embedding them in the ground or securing them with stones.

Taking the aforementioned cases into account, a discrepancy arises with regard to the use of funerary pithoi at Stamna. If the fabrication of pithoi intended for storage required a knob-shaped termination/ending, it seems that in this area the quantity of pithoi used for burial might have originated from a residential context, since the knob-shaped terminations vertically in the soil indicate their positioning with or without a support.[53] On the other hand, it could be argued that the Stamna population selected this typology because storage pithoi implied domestic surplus, symbolically representing a social/economic status for the deceased and their family, further emphasised by their embellishment.

Pithoi patterns: The quirky charm of design

The decoration of pithoi during the Protogeometric period plays a significant role in their recognition and classification. Decorative elements may serve as keys for their identification concerning pithoi from other geographical areas, as they tend to exhibit common characteristics and can be categorised. However, certain exceptions include some mass-produced large storage vessels and pithoi, which might have had more 'standard' shapes and decorations due to their production conditions. Given that these vessels were entirely handcrafted, variations in their overall categorisation are expected.

With a considerable number of pithoi available in Stamna and their continuous presence throughout the Late Geometric period, the analysis of decorative patterns becomes imperative. This study could guide us regarding the evolution of specific pithos types

[51] Giannopoulou 2012: 84.
[52] Giannakakis 2015: 137.
[53] Already during the Early Helladic period jars with knob-shaped terminations appear to have been crafted for domestic purposes, intended to be partially submerged, placed vertically in the ground (see Cullen and Keller 1990).

and enable attempts to establish a chronological sequence, a task that the typology alone cannot provide under current circumstances. Fortuitously, the absence of evidence indicating mass production's possibility elsewhere renders the majority of these vessels products of indigenous creation, including their individual elements, such as decoration.

It is crucial to consider potential diverse influences that might affect the decoration of these vessels, leading us to focus on their broader geographical presence during the Iron Age to pinpoint them. Our objective is, therefore, to identify distinct parameters that, when discerned, would allow for a more precise classification of the pattern both chronologically and in terms of its dispersion across various regions. Hägg[54] had previously undertaken a typological evolution of Argolid and Central Greece pithoi, categorising them based on their outline from an ovoid without neck type (ninth century BC) to carinated and, towards the end of the eighth century BC, to distinctly cylindrical forms. Conversely, in the Messenia region, the ovoid without neck type of pithos remained constant throughout the aforementioned period. In Attica, Boggess' study[55] concluded the use of solely handmade examples[56] with ovoid outlines and simplified decoration throughout the Sub-Mycenaean, Protogeometric, and Geometric periods, with the pithoi transitioning to more complex outlines and decorations towards the end of the latter. By the transition to the Archaic period, the wheel was already utilised in their construction.

At this point, it is pertinent to revisit Giannakakis's study[57] regarding the storage pithoi dating from the Middle Helladic to the Late Helladic periods, as it concludes the potential formation of three geographic regions, denoted through the typology of their storage vessels, signifying potential cultural influences and exchanges. The first encompasses the region of Eastern Central Greece, the Peloponnese, and the Argo-Saronic Gulf, the second relates to Western Peloponnese and Aetolia-Acarnania, while the third potential region comprises Phocis and Locris. It is evident that the second and third geographic regions are of particular interest to us as potential precursors to our classification. Subsequently, Boggess's study follows, concerning the typology of Attic pithoi in the Iron Age, along with that of other researchers[58] who, by examining the Geometric era within the wider Achaea region, provide material for discussion regarding subsequent eras from our standpoint.

John Bintliff,[59] when discussing the decoration and typology of ceramic vessels used as ash containers from the Early Iron Age to the Geometric periods, acknowledges the former's enigmatic nature, contrasting with the latter's apparent correlation with human characteristics. This aligns with James Whitley's[60] theory asserting that *'Seemingly the deceased are tied to their final resting place in 'embodied' and gendered pots'.* Both scholars draw from anthropological studies indicating a trend where men were typically placed in neck-handled amphorae, while women were interred in belly-handled vessels. Maniaki and Moutafi's anthropological study in neighboring Achaea, focusing on inhumated deceased within pithoi, invites parallels with Stamna regarding the pithos shape, its ornamentation, and the accompanying artefacts for women and men. However, the limited sample size in Achaea and the absence of an anthropological study in Stamna pose limitations. Similarly, the relationship between vessel shape and gender suggests a profound link between the deceased and their eternal resting place, underscoring the significance of identity even beyond death. By this reasoning, the specific shapes of these vessels appear to signify a cultural inclination to uphold identity and tradition beyond mortal life. The significance attributed to these pithos vessels provides valuable insights into ancient beliefs surrounding life, death, and the enduring nature of identity beyond earthly existence.

The funerary pithos jars discovered at Stamna showcase a diverse array of intricate decorations. These include relief bands intricately designed with impressed circles and wavy lines, some adorned with parallel rows of small impressed circles or featuring central grooves. Notably, there are bands with various groove configurations – some framed by processed bands, others adorned with small circles or employing impressed techniques. Additionally, bands exhibit combinations of impressed circles, while certain sections display isolated circles or continuous patterns. Further embellishments involve rope-like decorations on bands of varying thickness. Interestingly, some vessels remain undecorated, showcasing an ovoid body leading to a corresponding base, contrasting with the intricacies of the adorned ones.

Rope decoration: The utilisation of this motif has been observed since the Neolithic era in diverse geographical

[54] Hägg 1974.
[55] Boggess 1989. For the evolution of the Attic amphora, cf. Brann 1962.
[56] Boggess 1989: 106.
[57] Giannakakis 2015: 41.
[58] See, among others, Alexopoulou 2021; Gadolou 2008; Maniaki 2009; 2013; 2014; 2019a; 2019b; Maniaki and Moutafi 2019. Cf. A. Maniaki, A diadem to bid farewell to a beloved woman. A symbolic grave gift with a social context connecting ancient to modern Greece (poster presented at the 14th International Conference on the Social Context of Death, Dying and Disposal, 04-06/9/2019. Bath, UK. <https://www.academia.edu/42322113/A_diadem_to_bid_farewell_to_a_beloved_woman_A_symbolic_grave_gift_with_a_social_context_connecting_ancient_to_modern_Greece_The_14th_International_Conference_on_the_Social_Context_of_Death_Dying_and_Disposal_04_06_9_2019_Bath_UK>.)
[59] Bintliff 2012.
[60] Whitley 2001.

Figure 14: Small, handcrafted vessel Π170/1, with rope ornament and impressed decoration (photo editing by G. Somakos).

areas both within and beyond the Hellenic territory. The design's characteristics suggest an emulation of the visual aspect of rope attachments, historically employed for purposes of handling and protection.[61] Additionally, it is employed in ornamenting/decorating a small, handcrafted vessel Π170/1 (**Figure 14**), complementing an impressed decorative pattern in Stamna, as well as the diagonal lines on the pithoi in Agora.[62] Rope-like embellishments adorned a pithos in Nihoria Messinia, where the pithos type served as both burial and storage during the Protogeometric period. This design bears similarities to the decoration in Stamna, encompassing applied bands with incisions and impressed decoration, continuing the tradition from the Early Bronze Age.[63] Moreover, in Nihoria,[64] during the Late Geometric period, a pithos resembling category 30[65] in Stamna is found, typologically identical (ovoid outline terminating in an acute-based form) but undecorated.

Plastic decoration: Embellishment via relief bands has been identified on the bodies of funerary and storage pithoi (e.g. T185, Π409, Π381, T29) (**Figure 15**). Notably, the case of storage pithos Π337 stands out, adorned with relief bands (0.045m thick) and featuring a midrib wherefrom double semicircles are formed on either side.

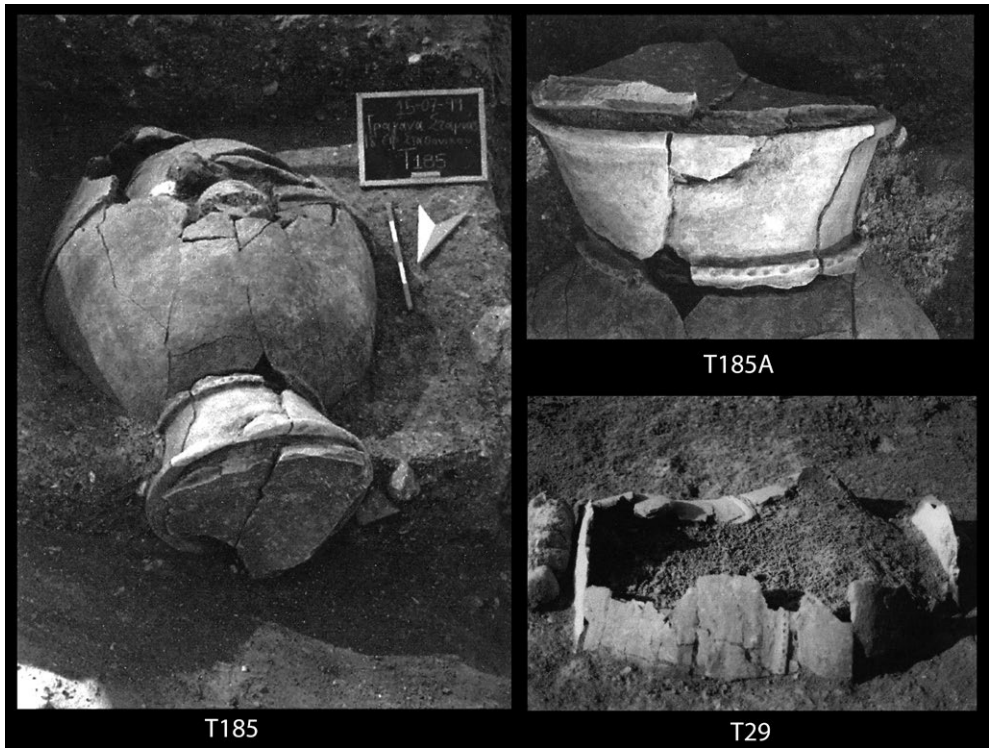


Figure 15: Pithos with plastic decoration (photo editing by G. Somakos).

The use of plastic bands serves a significant function beyond decoration: firstly, it acts as an additional means to enhance durability, and secondly, it cleanses any visible marks that arise during the construction of various parts of the vessel (employing the method of 'κουλούρες'[66]). This very technique is employed internationally, for example,

[61] Giannakakis 2015: 100.
[62] Papadopoulos and Smithson 2017: 804.
[63] Giannopoulou 2002, 84; McDonald *et al.* 1983: 89, 108.
[64] Cullen and Keller 1990: 189 fig. 2f (after McDonald *et al.* 1983: pl. 3.162).
[65] Christakopoulou-Somakou 2009: 1041, T335.
[66] Giannakakis 2015: 90.

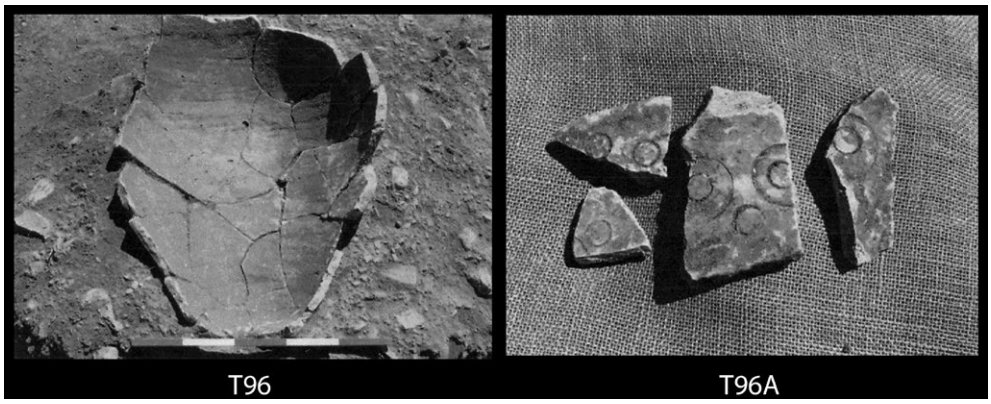


Figure 16: Pithos with impressed decoration (photo editing by G. Somakos).

in Spain, where traditional pithos craftsmen often constructed massive vessels (Tinajas) using this specific technique.[67]

Impressed ceramics: In Stamna, the craft of impressed ceramics on artisanal vessels is exemplified by fragments found from the neck of the pithos T96 (**Figure 16**). Cases of impressed ceramics from the Geometric and Late Geometric eras have been uncovered in Achaea, highlighting the presence of a distinctive ceramic workshop.[68]

Pithoi: 'Decorating' society (stories etched in clay)

The funerary pithoi represent a significant aspect in comprehending the social structure of a settlement. Their quantity in comparison to other tombs, architectural features, typology, and decoration offer valuable insights into our understanding of social hierarchy or differentiation in Stamna.

The pithoi in Stamna provide a fascinating perspective on social development and spatial utilisation. Their broad typology, comprising approximately 34 distinct types, and their linear decoration suggest their original use as storage vessels, a corollary of the settlement's expansion and the need for the storage of food or goods; nevertheless, the possibility that at least some of them evolved into serving funerary purposes cannot be precluded. Thus, the gradual transition of their use from storage to funerary purposes may be correlated with the settlement's development. As communities grew, the pithoi probably began to be used as tombs, indicating the evolution of social hierarchy or social dimension, transitioning from the living to the deceased.

This does not constitute a completely vague and specific designation but provides an alternative interpretation for the use of these pithoi, signaling the need for further analysis and research on this subject.

More specifically, the possession of pithoi exclusively by certain individuals suggests their familiarity with the accumulation, the managing and storing of commodities; in other words, it suggests their status and financial brackets. In a funerary context, this resources-related dimension[69] of acquisition and ownership assumes a symbolic significance, linking the owner of the pithoi to the deceased, and conferring upon him social and economic prestige.

Funerary pithoi represent a significant aspect of social structure, based on archaeological findings. Their use as tombs demonstrates the social standing of individuals or groups within the community. The quantity, quality, and presence of specific types of pithoi can serve as indicators of social status. Moreover, their use as tombs may be associated with the display of wealth and the demonstration of social importance within a community. Therefore, as their increased frequency of use in the funerary practices of Stamna is observed, it signals the expansion of the potential applications of pithoi in specific aspects of human life, in contrast to previous eras where their use as funerary items was limited.[70]

An indicative demonstration of the significance of pithoi in an era preceding the Protogeometric is evident in the presence of pithoi made of stone in the tholos tomb of Clytemnestra,[71] in Mycenae, which served as a symbol of high social status and economic prominence. Specifically, the selection of a pithos for use in a tomb, even in a symbolic manner, represents a substantial investment in resources, indicating its value and importance. In other words, the pithos reflects affluence and stands as a metaphorical allusion to full warehouses. Initially, their apparent imposing nature also exhibits their association with the principle of storage, as mentioned earlier. These pithoi are perceived as objects that showcase social position and societal prestige due to their characteristics and implied rich

[67] Lister and Lister 1976: 85-86 (cited in Giannakakis 2015: 131).
[68] Gadolou 2008: 305-307.
[69] For a discussion about the various meanings of resource – πόρος in Greek – in ancient texts, see Simoni *et al.* 2021.
[70] Cullen and Keller 1990: 194-195.
[71] Pierce-Blegen 1941; Wace *et al.* 1921-1923: fig. 80.

storage use. These attributes can be regarded as symbols of power and social superiority within the community. Therefore, in Stamna, the substitution of cist graves with pithoi directly symbolises the significance of the deceased individuals, regardless of the pithoi's specific type or the quantity of associated offerings.

Based on the aforementioned, the economic activity of the residents of Stamna, potentially involved in advancing new commercial and craft opportunities, enabled citizens to prosper following the collapse of the Mycenaean civilization and population migration. Stamna appears to have been the pivotal centre of a culture that notably flourished during the late Protogeometric period evidenced by its gradual expansion into the geographically demarcated region of Aetolia, indicating stability and prosperity. The population growth, in turn, led to land distribution and utilisation needs. Additionally, archaeological evidence, as presented, indicates the existence of markets, ports, pottery-processing industries, and potential trade routes facilitated by a well-organised land network or possibly through the adjacent Aetolian lagoon, if navigable.

The available data concerning the economic structures of Stamna do not lead to sufficiently substantiated conclusions due to the lack of information pertaining to ancient settlements. However, the burial evidence aligns with a distinct hierarchical authority, which was likely more favourably disposed towards the rest of the population, contrasting with that of the Mycenaean period. Upon their re-settlement in Stamna, the population groups delineated their distinctiveness concerning power gradients, evident in the differentiation of their necropoleis. These necropoleis indicated corresponding functions to their in-life settlements relative to the central settlement unit at Kefalovryso. Within these domains, concurrent burial layers, distinct burial types including peculiar constructed tombs with cauldrons and tripod-shaped pithoi, along with circular enclosures on the upper surface serving for worship, projected an order not grounded in subjugation or the imposition of violence, but rather in the establishment of a legitimate succession of power based on the reverence for past generations.

More than 50 per cent of the graves, within the entire necropolis, pertain to funerary pithoi (funerary use), while a small percentage, approximately 7 per cent, represents storage containers (domestic use).[72] Their construction techniques, the addition of external rings, the production and use of clay stoppers/lids, and the carving of discoid stones for sealing, initially indicate the specification of their productivity towards a defined productive 'model'. From this, not only the labour cost of this particular production has been estimated but also the enterprise's profit. In other words, it highlights a commercial society featuring well-established ceramic workshops among others that generated functional artefacts, resulting in profit and serving as a robust economic asset for their creators.[73] Furthermore, the observed practice of repairing these pithoi, in cases where it was detected, attests to the value of these vessels and the level of difficulty in terms of depositing their economic counterpart to such an extent that repair was favoured over their reacquisition (T45/99, **Figure 17**). The initial 34 different types of pithoi composing the typology of the published necropolis, considering their decoration and the fact that the vast majority remained intact without signs of repair, are deemed significant indicators of the residents' prosperity.

For the purposes of *'Cracking the Code: Symbols, Meanings, and Networks in Early Iron Age Greece. Evidence from the Stamna Pottery'*[74] we have restricted the categories to eleven (11) (**Figure 8**). This refined categorisation offers a more focused and analytical framework for the study, facilitating the identification of specific trends or correlations that statistical analysis of the data can unveil. Specifically, statistical methods allow for a comprehensive examination of the data, revealing potential correlations between the type of pithos and their overall usage. It can also discern if there are groups of pithoi more closely associated with specific construction techniques or even with distinct social groups within the ancient Stamna society. This further data analysis can provide deeper insights into the lifestyle, practices, and organisation of the ancient community, considering the analysis of the graves, the objects used for burial, and their decoration.

The appearance of pithoi seems to conform to shared artistic principles governing the ornamentation of other ceramic artefacts within a cohesive cultural context. Put differently, akin to the variations and resemblances in decorative patterns observed in 'micro-ceramics',[75] significant, deliberate choices in adorning larger vessels can also be identified. The decorative decisions appear to respond to both external influences, such as environmental observations, and internal factors, including the psychological disposition and expressive capacity of the artisan. This co-existence underscores the significance of both the surroundings and the artist's mindset, revealing their sensitivity toward the cultural milieu of their time.

[72] Christakopoulou 2016; Christakopoulou-Somakou (forthcoming).

[73] Christakopoulou 2023.

[74] The project has been awarded a research fellowship at the Center of Hellenic Studies, Harvard, Washington DC. Project outline soon to be published online, see footnote 36.

[75] The term is arbitrary and, in this specific case, it refers to the ceramic artefacts from Stamna.

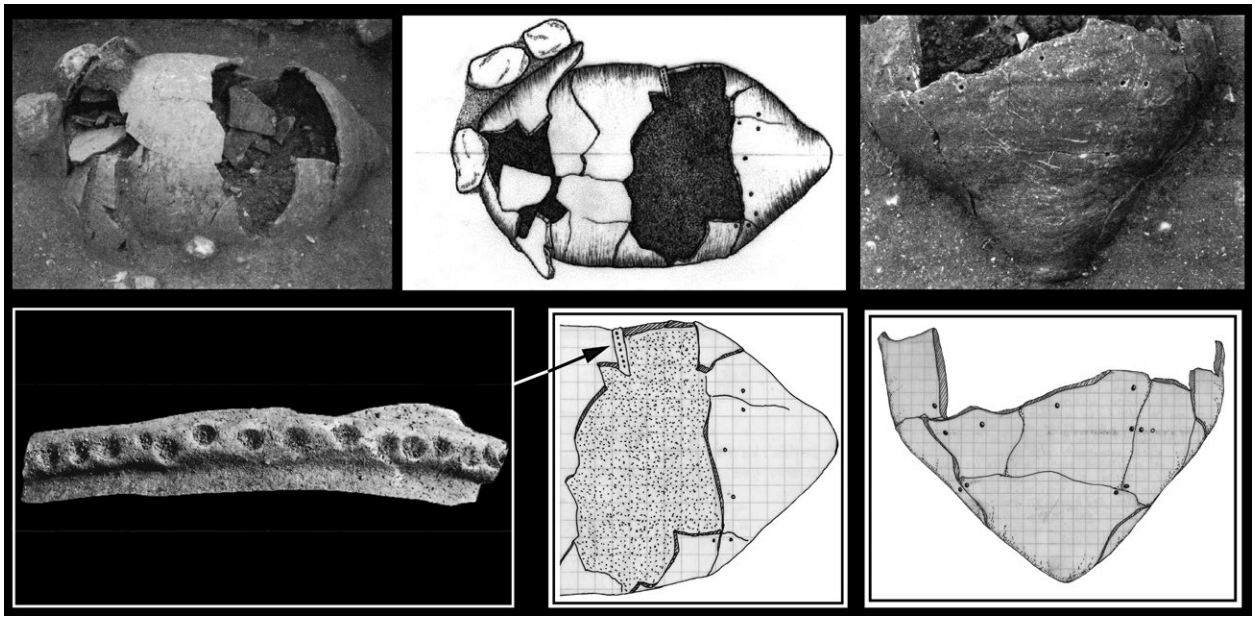


Figure 17: Pithos 45/99 that bear signs of repairs
(photo editing by G. Somakos).

Eternal embrace: The dual identity of Stamna's pithoi as coffins

The broader interpretation of the Stamna pithoi as vessels found exclusively in a funerary context and construed as coffins brings about a substantial shift in our understanding of the use of these vessels. Although primarily known for their storage utility, they exhibit a more diverse array of applications that connect them to the society of the era, associating them with the Underworld.[76] More specifically, the use of pithoi as coffins implies a unique method of storage and utilisation, where the body of the deceased was necessarily interred and thus integrated within a large 'container'. This practice not only indicates the storage function of the pithoi but also highlights a connection between storage and interment as an expression of human care, storage, and *post mortem* body preservation. This practice might be interpreted as an indication of a probable belief in preserving social identity within a confined storage space like the pithos, thereby offering new dimensions to comprehending ancient burial practices and, furthermore, the beliefs of the era.

However, what is the nature of the construction of the very object used as a coffin? Due to the inherent nature of clay as a material used for both creation and shaping of an object anew, it is intertwined in many societies with the earth itself and with the concept of regeneration.[77] The use of these 'coffins' made from clay could symbolise the return of the individual to the earth, the cycle of life, and the renewal of nature. Rebirth constitutes a common theme in many religions and cultures, and the use of clay in burial might represent this continuous cycle of life and death.

It seems that both the typology and the decoration of these vessels are associated with the era in which they were created and represented. It is not coincidental that before the end of the Late Helladic IIIC period, the pithoi had moderate dimensions and their decoration was simple, consisting of few perimeter bands. These characteristics were also adopted in the transition to the Early Iron Age. Already by the end of the Mycenaean period, the economic model of accumulating reserves in an administrative center for distribution among the population it represented, had been sidelined, making room for a new economic model that operated – at least at this level – with the surplus accumulated individually by each family. Therefore, it is understandable that there was no longer a need for the construction and maintenance of large pithoi for storing surplus, nor the necessity to display them prominently even through their rich decoration, deviating from their tradition as symbols of economic and social power.

In conclusion, the typology and decoration of the pithoi are linked to the evolution of the era, evident as, prior to the end of the Late Helladic period, the decoration simplified, reflecting the shift to a new economic model with individual wealth accumulation. This evolution suggests a transition from collective storage practices to individual ones, while the use of pithoi as coffins indicates that these vessels hold broader significance beyond mere storage containers. Archaeological findings demonstrate that the use of pithoi in burial contexts represents an aspect of social and religious

[76] Cullen and Keller 1990: 202 with bibliography.
[77] Cullen and Keller 1990: 201-204 with bibliography.

belief, emphasising their importance in preserving the past and the beliefs of that era.

Several timeless references associate the pithos with concepts related to the fertility of the earth or nature, and the idea of renewal, rebirth, or revival. The combined reference to 'fertility and rebirth' in both storage and burial pithoi is interpreted as a way to express the significance of regeneration and the continuity of life after death. Storage pithoi are linked to storing food or goods for the long-term ease of their owners in sustaining themselves, whereas burial pithoi served their interment purpose.

The emphasis on caring for the soil, fertility, and rebirth might indicate ancient civilisations' perception of the continuous cycle of life and death, where the fertility of the land and the renewal of nature were correspondingly connected to the idea of immortality or its enduring renewal. Thus, the pithoi can be considered as symbols of this continuous cycle of life and renewal, reflecting the worldview and beliefs of the Stamna community during the Protogeometric period.

How do the available archaeological findings and known information shape our understanding of the ceramic workshops at Stamna, and what conclusions can be drawn from these insights?

These workshops are proposed to have comprised a production space with various functional areas, potentially featuring a central manufacturing zone equipped with wheels for micro-ceramics and diverse tools for shaping vessels. Additionally, specific areas may have been designated for the application of decorative elements, such as plastic and impressed features. The idea of ceramists working outdoors for flexibility and ventilation during the ceramic-making process is also considered. The outcome, as categorised above, demonstrates that these workshop-spaces embodied a sense of creative collaboration and traditional craftsmanship. This collaboration significantly contributed to the development of ceramic art in Stamna during the Protogeometric period, showcasing both intellectual and emotional dimensions of art.

Moreover, the abundant production of pithoi, their impeccable appearance, and the attention to detail in their decoration underscore the meticulous consideration of construction and structure by the potters. The craftsmanship displayed is not only skillful but also meticulously designed, revealing discipline and thoughtfulness. The revelation of these artefacts today, after centuries, with all its implications (crumbled clay, shattered jars, equally decayed skeletons, displaced artefacts), further emphasises their significance. The 'deconstruction' of these findings might ultimately reveal a hidden grandeur, accentuating the radiance of craftsmanship of the past.

In conclusion, the discovery and identification of the pottery workshops are of paramount significance on our understanding of the environment in which these vessels were created. The location and identification of Stamna's workshops allow insights into construction techniques, materials used, and how communities of that era organised their ceramic production. The analysis of these workshop facilities sheds light on the social and economic aspects of pot production, offering a comprehensive view of the lifestyle and beliefs of that era. By emphasising the importance of these workshops, this paper delves into comprehending not only the technology and social organisation but also the potential religious practices during their operation. The influence of these workshops on the development and evolution of the local community opens new perspectives for reshaping research approaches and unveiling aspects that may not have been adequately explored until now.

Acknowledgements

This paper was written under a Research Fellowship funded by the Harvard University, Center for Hellenic Studies. We extend our sincere appreciation to everybody at the Center, for their generous support that facilitated the research and development of this article. The provided resources and intellectual environment have significantly enriched the content, and we are sincerely thankful for their invaluable assistance. Additionally, we express our heartfelt thanks to the editors of the volume, Dr Elena Partida and Dr Constanze Graml, for their invitation to include our study in their compilation. We are honoured to be part of this distinguished volume and appreciate the opportunity to contribute to the scholarly discourse under their guidance.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

Chapter 14

The coroplast's workshop and its production: Reflecting on the craft practices of the Archaic πλάστης in Magna Graecia

Eukene Bilbao Zubiri

Abstract

Recent research on ancient crafts and the development of an anthropological approach to manufacturing systems have placed artisans and their workshops at the very centre of current studies on material culture. This contribution focuses on the manufacturing processes of craftsmen specialising in the production of ritual clay figurines in Magna Graecia during the Archaic period. Despite a relative knowledge of the areas of craft production in Italiote *poleis*, the evidence associated with the coroplastic crafts of this period is extremely meagre. In order to fill this gap, it has become essential to carry out an autoptic examination of the objects and compare them on a broad geographical scale, in order to understand the specific features of workshops and the creative and cultural dynamics in which they were embedded within the *polis* and on a regional scale. This approach sheds light not only on the technical skills shared by these craftsmen specialising in figurative art, but also on the choices made in terms of modelling that reflect conscious mechanisms of emulation that link workshops and communities at different levels. This makes it possible to highlight the importance of Greek settlements in the Gulf of Tarentum in the process of adopting and consolidating a moulded craft that developed progressively until the middle of the sixth century BC, and then the major turning point marked by the appearance, at that time, of highly efficient workshops that attempted to assert their creative specificities through new chaînes opératoires and differentiated choices in modelling. The aim of this paper is to encourage the application of a large-scale comparative technological approach in order to reveal the richness of Magna-Graecian coroplastic workshops and their contribution to the artisanal and artistic evolution of the central Mediterranean.

Περίληψη

Η πρόσφατη έρευνα στις αρχαίες χειροτεχνικές δραστηριότητες και η ανάπτυξη μίας ανθρωπολογικής προσέγγισης των κατασκευαστικών συστημάτων έχουν θέσει τους τεχνίτες και τα εργαστήριά τους στο επίκεντρο των σύγχρονων μελετών πάνω στον υλικό πολιτισμό. Η παρούσα συμβολή επικεντρώνεται στις κατασκευαστικές διαδικασίες τεχνιτών ειδικευμένων στην παραγωγή τελετουργικών πήλινων ειδωλίων στη Μεγάλη Ελλάδα, κατά την Αρχαϊκή περίοδο. Παρά τις σχετικές μας γνώσεις όσον αφορά τις περιοχές χειροτεχνικής παραγωγής στις Ιταλιώτικες πόλεις, τα τεκμήρια που συνδέονται με την κοροπλαστική δημιουργία εκείνης της περιόδου είναι πενιχρά. Προκειμένου να καλυφθεί αυτό το κενό, είναι απολύτως απαραίτητη η αυτοψία και η σύγκριση των αντικειμένων σε ευρεία γεωγραφική κλίμακα, ώστε να γίνουν κατανοητά τα ιδιαίτερα χαρακτηριστικά των εργαστηρίων, καθώς και η δημιουργική και πολιτιστική δυναμική, όπου αυτά εντάσσονται μέσα στην πόλη και σε τοπικό επίπεδο. Μια τέτοια προσέγγιση φωτίζει όχι μόνο τις τεχνικές δεξιότητες που μοιράζονταν οι τεχνίτες των εικονιστικών/μορφογραφικών τεχνών, αλλά επίσης τις επιλογές τους σε θέματα μορφοπλασίας, οι οποίες αντικατοπτρίζουν συνειδητούς μηχανισμούς άμιλλας που συνδέουν εργαστήρια και κοινότητες σε διαφορετικά επίπεδα. Έτσι αναδεικνύεται κατ' αρχάς η σημασία των Ελληνικών οικισμών στον Κόλπο του Τάραντα, σε μία διαδικασία υιοθεσίας και αποκρυστάλλωσης μιας πλαστικής/μορφοποιητικής τέχνης που εξελίχθηκε προοδευτικά μέχρι τα μέσα του έκτου αιώνα π.Χ., και, κατόπιν, το μείζον σημείο καμπής χάριν στην τότε εμφάνιση εξαιρετικά αποδοτικών εργαστηρίων που δοκίμασαν να προβάλουν τις δημιουργικές ιδιαιτερότητές τους μέσα από νέες 'λειτουργικές αλυσίδες' (παραγωγικές διαδικασίες) και διαφοροποιημένες επιλογές στην μορφοπλασία. Σκοπός του παρόντος άρθρου είναι να ενθαρρύνει την εφαρμογή μίας συγκριτικής σε ευρεία κλίματα τεχνολογικής προσέγγισης, ώστε να αποκαλύψει τον πλούτο των εργαστηρίων κοροπλαστικής της Μεγάλης Ελλάδας και την συμβολή τους στην εξέλιξη των τεχνιτών και καλλιτεχνών της κεντρικής Μεσογείου.

Keywords: Magna Graecia; coroplastics; chaîne opératoire; creative processes

Plastic creation in Magna Graecia was mainly the work of craftsmen specialised in working with clay. In the south of the Italic peninsula, this raw material was used by the Greeks in the manufacture of ceramics, statuary in-the-round, architectural decorations, as well as small objects including ritual figurines. These figurines, discovered by the thousands in cultic contexts, offer us a vital key to understand the ritual practices and beliefs of the Magna-Graecian communities, as has been discussed at length in the scientific literature,[1] but they

[1] Most recently: Di Tuccio 2021.

also allow us to grasp the richness of the practices of the coroplasts in Magna Graecia.

Despite the scanty evidence we have of the workspaces used by the coroplasts – the craftsmen specialised in the manufacture of terracotta figurines – careful observation of the material itself allows us to extract valuable information about creative dynamics. The growing interest in archaeological research regarding the working methods of the craftsmen, from the technical gestures and stages of the chaîne opératoire that enabled them to implement all their savoir-faire, to the functional purpose of the object that dictates certain choices of form, now favours a broader approach to the understanding of the technical and creative issues of this category of object. The following pages provide some observations on the conditions and processes of the craftsmen of the Archaic period with the aim of highlighting the rich perspectives that this material still has to offer us. For this purpose, I focus on three aspects that may have repercussions on craft practices: firstly, the spatial question, which is still unanswered both in terms of the topographical insertion of the workplace within the *polis* and in terms of the morphology of the workshop; secondly, the technical processes that allowed this craft to develop and diversify from the mid-seventh century BC onwards; and finally, the technical and stylistic emulation between workshops as a driving force behind the renewal of craft practices through the example of the productions of the second half of the sixth century BC.

What sort of a workshop for the πλάστης of Magna Graecia?

The term 'coroplast' is commonly used to designate the specialised craftsman who shapes small-scale terracotta figurines, mainly using a mould during the Greek period, but the data from the excavation of craft spaces and the study of materials lead us to revisit the perception of the coroplast as a craftsman restricted to moulding and demoulding. In fact, his technical prerogatives, his savoir-faire (know-how) and even his place of practice intersect with those of other craft specialities working with clay, particularly potters. For these reasons, but also to avoid reinforcing the boundaries established in the history of archaeological research between classes of material, the term 'πλάστης' can, in some cases, be more accurate than 'coroplast'.

However, the data available on the spaces and working methods of these craftsmen in the Archaic period are meagre.[2] Only rare examples of moulds dated from the seventh century have been found, such as those from the Potters' Quarter in Corinth,[3] and no coroplast workshops are known in the Greek world before the last third of the sixth century BC, whereas they are attested from the fifth century and until the Hellenistic period. Joint activity of coroplasts and potters is documented in the sixth century in Argos, where excavations have uncovered figurine dumps,[4] and in the workshop of Figaretto, north-west of the sanctuary of Mon Repos in Corfu, which produced ceramics and figurines between the end of the sixth century and the third century BC.[5] As in Greece, archaeological excavations in Magna Graecia (**Figure 1**) have revealed many indicators of potters' activity, providing a topographic anchor to research on clay craft, but the activity of the coroplasts is mainly known through the moulds.[6]

Tarentum is an exceptional case due to the discovery of more than 1,300 whole or fragmentary moulds for the production of figurines, of which more than 200 are inscribed. They date mainly from the second half of the fourth century, but a few examples date back to the end of the Archaic period.[7] The inscriptions were etched at the back of the mould, generally before firing, and could take the form of whole names ascribed to the craftsman himself, isolated letters or marks. A mould of an enthroned female figure, among the oldest, bears a particularly long inscription, 'I am of Philoxenus',[8] but the Tarantine corpus includes other examples dating before 425 BC and bearing the names of Apollonius, Hippias, Pantaleon and Dionysius.[9] Two potter's kilns of the Archaic period have been found in Tarentum, one in Via Pupino located in the urban area and considered to be the oldest known in the city, the other at Punta Penna-Pizzone in the area of the central narrowing of the *Mare piccolo* and close to the site of the discovery of the large votive deposit of Pizzone.[10] Neither of them, however, seems to be associated with the firing of clay figurines.

At Locri, the excavations uncovered several artisanal nuclei, particularly in the urban sector of Centocamere adjacent to the eastern side of the enclosure, where numerous kilns and shops were found, including two kilns of the Archaic period in blocks 12 and 13, as well as a fragment of a clay temple-model.[11] Moulds dating only from the fifth and fourth centuries BC testify to the manufacture of terracotta figurines on-the-site,[12] but those of the previous periods have not yet been discovered.

[2] An initial assessment of the potters' activities was made by Esposito 2013.

[3] Stillwell 1948: 87-90, pls 29-30, nos 1-6.
[4] Sanidas 2013a: 156; Sanidas 2016: 18-20.
[5] Preka-Alexandri 2016: 227-230.
[6] An updated compilation of discoveries related to production activities in Magna Graecia has been published in: Rizzo 2019.
[7] Ferrandini Troisi *et al.* 2012; Rosamilia 2017: figs. 3, 4.
[8] Ferrandini Troisi and Chelotti 1992: 207, fig. 454.
[9] Rosamilia 2017: 469.
[10] Dell'Aglio 1996: 53; Dell'Aglio 2001: 176-178.
[11] Meirano 2012: 260-262.
[12] Barra Bagnasco 1986: 147.

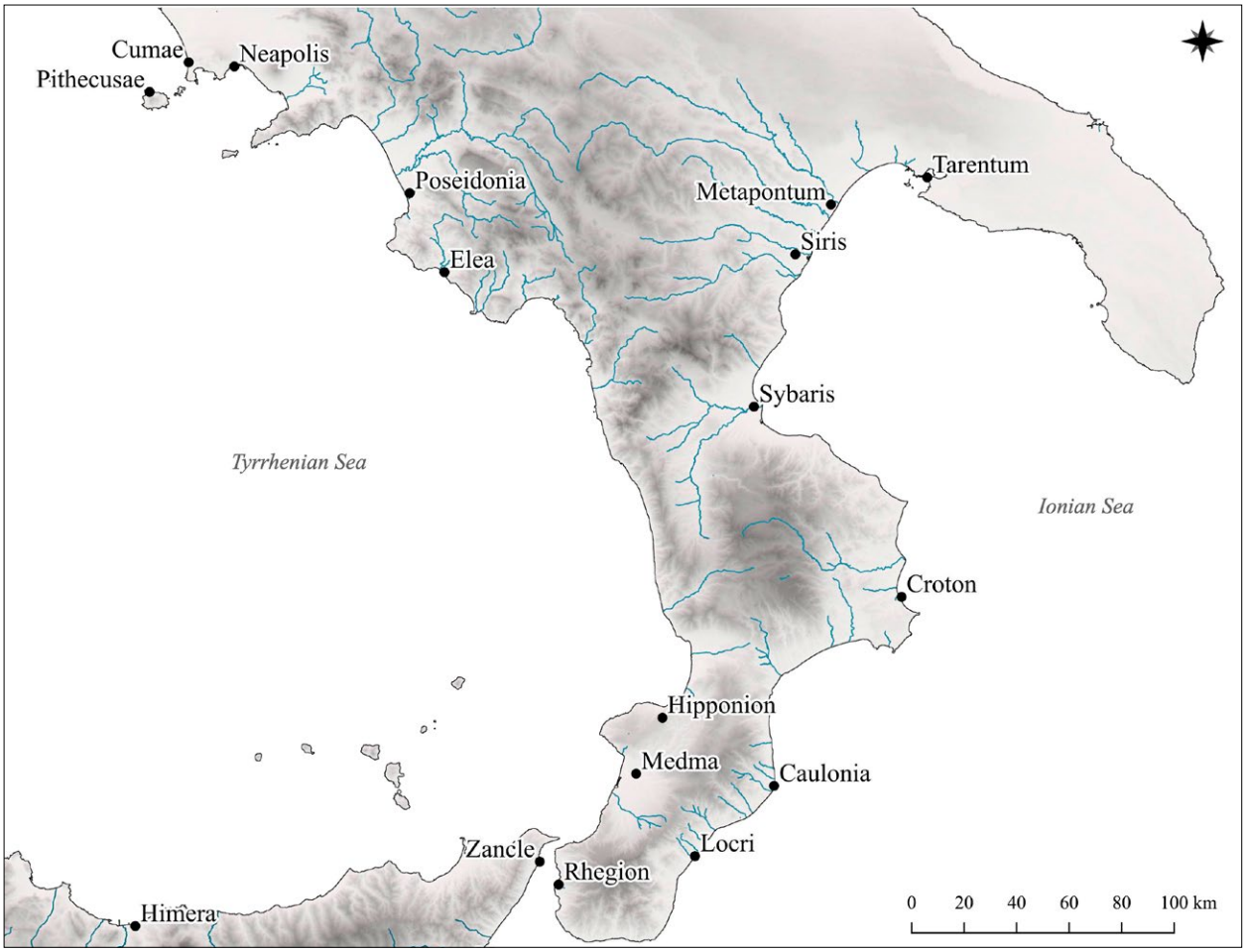


Figure 1: Greek *poleis* of Magna Graecia during the Archaic period (map by the author).

Excavations carried out in the small sanctuary of Destra Basento in Metapontum, at the foot of the northern slope of the hill of San Teodoro in the Basento Valley, have provided a mould, yet unpublished, corresponding to a female type of the sixth century BC clutching a bird and a wreath against her body.[13] Those in the so-called contrada Sansone defined by Felice Gino Lo Porto, corresponding to the western sector of the intramural area, near the west gate of *contrada* Crucinia, yielded a fifth-century mould.[14] In addition, the excavations of the *kerameikos* adjacent to the inner northern line of the city walls led to the discovery of two circular kilns dating from the middle of the sixth century BC, which testify to the use of this space for the firing of ceramics.[15] Kiln D is associated with pit 12 containing fragmentary vases, and production dump 13 with enthroned female figures and miniature ceramics is considered to be a votive deposit rather than a dumping ground. Kiln G remains unpublished. Three more kilns were discovered in the Metapontine *chora*: a kiln associated with a farmhouse and a necropolis dated to the second quarter of the sixth century BC at Cugno del Pero;[16] a kiln associated with a farmhouse and a necropolis of the same period at Saldone; and a kiln associated with a ceramic dump at San Basilio, south of Basento.[17]

Kilns discovered in other cities of Magna Graecia and dating to the Archaic period are worth mentioning, although the production of figurines cannot be confirmed. At Sybaris, the excavations in the nucleus of Stombi, in the plain to the north of the Crati, have revealed two circular kilns associated with buildings *a* and *i*, which date to the beginning of the sixth century BC, and small and medium-sized statuettes of the second half of the sixth century BC.[18] A small mould representing a Gorgon's head, with a handle on the reverse for stamping, was discovered there in 1971,[19] but there is no evidence to confirm that the statuettes were made on the site. The discovery of terracottas similar to

[13] Bilbao Zubiri 2017: 999, fig. 4. Eight additional fragments from the Bradano sanctuary: Caruso 1997: 125-140, 221-223, pls VI, XIV.1; Letta 1971: 28; Sestieri 1940: 54.
[14] Lo Porto 1966: 160-161. This is site 7: fig. 6 and pl. II. Lo Porto considered the existence of a production area, but a single mould is not sufficient to confirm this hypothesis.
[15] D'Andria 1975; Silvestrelli 2005.
[16] Adamesteanu 1973a: 54.
[17] Prieto and Carter 2011: 610, no.134.
[18] Guzzo *et al.* 1970: 228-230; Guzzo 1972: 30-33; Guzzo *et al.* 1972: nos 85-87, 172-174, 202, 220, 224-226, 240-243.
[19] Guzzo *et al.* 1972: 116-117, no. 215, fig. 125 (inv. 44176).

those found in the sanctuary of Timpone della Motta, as well as metal ornaments and vessel, numerous looms and large quantities of ceramics are consistent with ritual activities. Unfortunately, systematic excavations have not revealed clear evidence of a religious function of the uncovered structures. A recent re-examination of this context has favoured the hypothesis that Stombi was not itself a place of worship but developed in relation to a nearby sanctuary, unidentified as yet.[20]

In addition, we should mention the productive units (*Officine* I, II, IV, V) and a building that housed craft activities (*Casa* I),[21] as well as a mould for a female figure of the beginning of the sixth century BC,[22] discovered in Croton. Two kilns have been found in the *Ufficio postale* and in Cospito-Caserta to the southeast of the Siris settlement,[23] as well as misfired ceramics dated to the second half of the sixth century BC from the sanctuary of Linora in the southern plain of Poseidonia.[24] However, none of these contexts seem to have produced figurines.

In Magna Graecia, workshops of diversified productions were able to emerge thanks to craftsmen sharing their mastery of the same material. As they provide us with a geographical anchor, we must also consider the existence, at the same time, of production structures dedicated exclusively to coroplastics. The *lacunae* that make it difficult to reconstruct the workspaces may have various explanations: it may have been an activity punctuated by the religious calendar; development in the craft sphere or in society may have led to a longer-lasting development of the workspaces; the topographical continuity and the possibility of restructuring archaic workspaces in later periods may have erased some archaeological strata. To this we can add the fact that the coroplast's activity did not require much space or solid structures besides the kiln.

Apart from the kiln, a structure built in a space adapted to the presence of fire, a coroplast's activity did not require complex facilities because neither the preparation of the clay in settling pits[25] nor the shaping of the statuettes took up too much space; besides, drying could take place in the open-air. Access to water had to be secured, but the archaeological data available from the excavated production contexts do not suggest this specific need, with the exception of the wells found at Stombi in Sybaris. Moreover, we should remember the advantage of this particular raw material: clay could be reshaped or remoulded before firing, limiting waste, and any terracotta object could be crushed in order to obtain grog, a degreasing agent found in some large mixed-technique figures from Metapontum,[26] as it increases the consistency and the strength of the object before and during firing. Obtaining grog, which could have multiple uses in clay crafts, may have eliminated firing failures or the moulds themselves.

As we shall see below, observation of the objects provides us with information on the chaînes opératoires involved in shaping the objects, while the stages prior to shaping, i.e. the supply networks of raw materials and their transformation into materials suitable for shaping,[27] are not given much consideration when it comes to coroplastics. Can we envisage, as in the case of potters, that it is the craftsman himself who extracts and transforms the raw material, or did he share supply channels with the potter or with other craftsmen who used this clay? Is this difference between specialised craftsmen relevant when thinking about shared savoir-faire? The hypothesis of a common supply network can be envisaged within polyvalent workshops, but perhaps also between specialised workshops, echoing the shared use of kilns for firing classes of material with similar physical properties. Other questions remain open, such as the material conditions of the workshops, the pace of production and the number of people involved.[28]

Technical processes in relation to the adoption of the mould

During the Bronze and the Iron Age, the manufacture of terracotta statuettes is attested in southern Italy through standing figures, couples, horsemen or in the form of appliques to vases discovered in the Italic sites.[29] This technique did not lead to an important production in terms of quantity, and the progressive settlement of the Greeks on the southern coasts of the peninsula in the eighth century BC, namely in Cumae, Rhegium, Sybaris, Croton or Tarentum, did not fundamentally modify the rank of figurines in material culture. They remained rather scarce during the first decades of these young communities, with the possible exception of Pithecusae.[30] It was the adoption of the mould in the

[20] Luberto 2021: 118-126.
[21] Verbicaro 2010.
[22] Iaculli 1986: 412, pl. VI, 2.
[23] Adamesteanu 1973b: 451-453; Cuomo Di Caprio 1992: 79; Tagliente 1986: 129-130.
[24] Avagliano 1992.
[25] These pits have only recently received attention as regards their importance for craft dynamics, and they are poorly documented. We can mention a few examples linked to the production of ceramics from Thasos in north Aegean (Blondé *et al.* 1992: 16-18), Megara Hyblaea in eastern Sicily (Gras *et al.* 2004: 174) or Incoronata in southern Italy (Denti and Villette 2013: 15-17).
[26] Bilbao Zubiri 2019: 872-873, fig. 6.
[27] On the preparation of clay: Cuomo Di Caprio 2007: 141-159.
[28] An ethnographic approach could shed light on some of these questions: Hasaki 2011.
[29] Babbi 2008. Etruscan plastics, particularly from Pontecagnano, appear to be the most diversified, whereas sites that were later included in Magna Graecia or neighbouring the *poleis*, such as Timpone della Motta, Macchiabate, Termitito or Scoglio del Tonno, have yielded only a few examples.
[30] The 'stipe dei cavalli' of Pithecusae constitutes a major but isolated assemblage in the panorama of archaic Campania: D'Agostino 1995.

second half of the seventh century BC that profoundly and lastingly transformed the dynamics of production and consumption. This innovation was introduced in the Italic peninsula from the Aegean basin, where certain cities in Asia Minor, Crete and the Peloponnese, who combined a longer history of figurative arts with a greater enthusiasm for moulded products, led to the emergence of an Italiote craft industry specialising in the mass production of figurines. Workshops mastering the processes of shaping and firing emerged in the second half of the seventh century BC in Tarentum, Sybaris and Metapontum, as well as at Incoronata, while, according to the extant bibliography, excavations in contemporary Magna-Graecian settlements do not seem to have yielded moulded material comparable to that of those of the Gulf of Tarentum.

From the seventh century BC onwards, moulding became the preferred technique for the manufacture of these small objects, but the processes involved were not restricted to moulding. Even when an object is fully moulded, the craftsman implements different techniques: preparation of clay crusts of consistent thickness, casting of an impression in the mould with one or more crusts, filling of the reverse, extraction, cutting of the lateral edges, smoothing of the reverse (with a tool or by hand), reshaping of certain details, such as the bases on which certain types rest or anatomical elements, if necessary. Though moulding may seem to be a repetitive procedure, each object went through a unique process. In addition, moulded figures are sometimes the result of mixed processes: the moulded core can be enriched with hand-made elements, with considerable technical and iconographic repercussions.

The importance of what I call mixed chaînes opératoires, i.e. combining different shaping techniques, is considerable in the history of manufacturing. From a technical viewpoint, the combination of moulding and modelling facilitates the shaping of certain iconographies while limiting the risk of deforming the object before firing. The figurines of *kourotrophoi* discovered in Tarentum and Poseidonia, dated to the end of the seventh century and the beginning of the sixth century BC are a good example of the complex technical choices made by some of the first craftsmen using the mould (**Figure 2**).[31] In these cases, the mould is reserved for the head, the upper body is made by hand and the lower part can by cylindrical or a flat piece with a support in the back to hold the figure upright. The increasing use of moulding relegates modelling to a secondary position: this is the case in the dressed and naked dedicators of Metapontum[32] or the naked

Figure 2: *Kourotrophoi* from Poseidonia (left: Orlandini 1983: fig. 316) and Tarentum (right: Orlandini 1983: fig. 304).

dedicators of Poseidonia (**Figure 3**),[33] both carrying their arms forward in the offering gesture. Four female figures in this position, considered as a group of dancers, was also found in the sanctuary of Hera at Foce del Sele (Poseidonia).[34] The forward position of the arms could have been a problem when taking the impression in the mould because of the difficulty of extracting the arms. To counter this, craftsmen chose to hand-shape the arms separately, and then to attach these limbs to the moulded figure. Although moulding became the norm during the Archaic period, the use of modelling became essential in these iconographies, which developed in the first half of the sixth century BC, in order to limit the risks of deformation, thus making the chaîne opératoire more efficient.

The re-examination of archaic Metapontine productions has made it possible to highlight certain manufacturing processes in the shaping of female dedicants. This iconography appeared in Metapontum in the first half of the sixth century BC within a group of types whose heads are stylistically close to Corinthian figurative tradition. Thanks to the analysis of several series coming from different sanctuaries of this *polis*, it was possible to understand how the craftsmen conceived these dedicants beforehand, anticipating the stages of production and implementing their realisation.[35] Several types are characterised by the existence of two iconographic variants deriving from the same prototype

[31] Orlandini 1983: figs. 304, 316.
[32] For example, for the urban sanctuary: Barberis 2004: figs. 81-100, 111-114, 116, 120-125, 205-206.
[33] Miller Ammerman 1991: figs. 1, 8, 10.
[34] Greco 1998: 56-57.
[35] Bilbao Zubiri 2022.

Figure 3: Clothed and naked dedicants from Metapontum (a-b: courtesy of the MIC - Musei nazionali di Matera - Direzione Regionale Musei Nazionali Basilicata – Museo Archeologico Nazionale di Metaponto e Museo Archeologico Nazionale di Potenza *D. Adamesteanu* / photo by the author) and Poseidonia (c: © Parco Archeologico di Paestum e Velia, Ministero della Cultura / photo by the author).

for which we can mention one where the first variant represents a figure moulded in one piece and clasping its arms to its body (**Figure 4 a-b**), while the second variant has modelled arms stretched forwards in the gesture of offering (**Figure 4 c-d**). Close observation reveals a horizontal mark in the biceps of the first variant, a shallow cut made before firing that does not correspond to any anatomical or clothing element. In the figures with the arms stretched forwards, this mark corresponds to the upper limit of the surface of the modelled limbs, which led me to conclude that the notch was a mark planned by the craftsman in order to facilitate and standardise the creation of the second variant representing the dedicant. This observation sheds light on the way in which the craftsmen planned the creation of two iconographic variants, as early as the shaping of the prototype, or at least before firing, and anticipated beforehand the practical aspects of their manufacture.

A set of figurines discovered in the Centocamere area of Locri, stylistically close to Corinthian figurative tradition and dated, like the previous dedicants, to the first half of the sixth century BC, shows a similar approach.[36] In this Locrian lot, the figurines representing a standing female figure share three common elements: the individualisation of the legs under the garment and their framing by two vertical side folds; the plastic representation of the lower limit of the *apoptygma,* which falls to the level of the abdomen; and a mixed chaîne opératoire. The moulded core of the figure appears to partially incorporate the right arm, while the left forearm was not incorporated into the mould. In most examples, both arms are reshaped by hand and the upper part is set back from the garment in order to accentuate its volume. The forearms are hand-made and assembled to the moulded core either extended in the gesture of offering, or folded back on themselves with the hand on the shoulder (**Figure 5**). In the best-preserved examples of this iconographic variant, the right hand holds a bird, which makes these figurines, to my knowledge peculiar to Locri, a particularly original representation of the bird-carrier.

The addition of modelled arms could also be accomplished by means of a mortise-and-tenon system, as shown by a figurine discovered at Croton, where the elbow is replaced by a mortise that runs through the entire thickness of the figure in order to firmly fasten the added arms (**Figure 6 a**).[37] Several Metapontine types have a finish that reminds of this joining system: we can mention two of them, stylistically original, where the elbow is replaced by a bas-relief ring with a slightly hollowed centre, a direct reference to the mortise (**Figure 6 b-c**). Such a non-functional finish to receive a limb is surprising, to say the least. Perhaps the simple evocation of the mortise could have referred, in the imagination of the clients, to the arms that it was

[36] Sabbione 1970: figs. 1-18.

[37] Spadea 1994: 9-10, fig. 8.

Figure 4: Female types adapted into two variants from Metapontum (courtesy of the MIC - Musei nazionali di Matera - Direzione Regionale Musei Nazionali Basilicata – Museo Archeologico Nazionale di Metaponto e Museo Archeologico Nazionale di Potenza *D. Adamesteanu* / photo by the author).

supposed to accommodate. Among the Metapontine material we should also refer to a type stylistically close to the one adapted into two variants, discussed above, close to the Corinthian plastics, but whose elbows finish also recalls the mortise (**Figure 6 d**). This formal originality, neither functional nor anatomically faithful, raises questions about the repercussions of these shaping choices, particularly appreciated in Metapontum, upon the use of the object in a cult context.

Figure 5: Female types from Locri (Sabbione 1970: figs. 6 and 12).

Other productions suggest that the choice of a mixed chaîne opératoire is not linked only to a practical issue simplifying the working steps. A series of Metapontine reliefs representing a female figure seated on a throne with lion-feet illustrates how a technical challenge can be associated with a search for formal diversity (**Figure 7**). This figure, which can be up to 20cm in height, is crowned with a headdress of which the shape varies. In the long series found in the sanctuaries of Metapontum, the headdress can be high and straight, flared, pointed, or even replaced by a hand-made veil covering the head and shoulders. All of these forms are represented in the sanctuary of San Biagio alla Venella and do not seem to have, in the current state of documentation, any connection with specific features of the cult. The same could be said of the headdresses of the large mixed-technique figures, which will be discussed at greater length later, whose shape can be more or less flared, but also straight or pointed. Although we should bear in mind that certain particularities of the cult, which currently elude us, could perhaps explain these variations, on the other hand the latter serve to diversify the forms within the same series. The enthroned type and the later large mixed-technique figures correspond to series made in greater quantities in the Metapontum area, which could indicate that this diversification of the headdress took place to counter the repetition of the same figure in large quantities.

In the second half of the seventh century BC, the use of mould became the main technique of making figurines throughout the region, and the development of this craft was intrinsically linked to the practice of donating terracotta figurines intended mainly for

Figure 6: Female figurines with mortise-and-tenon system or related, from Croton (a: Spadea 1994: fig. 8; b-c) and Metapontum (b, c, d: courtesy of the MIC - Musei nazionali di Matera - Direzione Regionale Musei Nazionali Basilicata – Museo Archeologico Nazionale di Metaponto e Museo Archeologico Nazionale di Potenza *D. Adamesteanu* / photo by the author).

rituals in a religious context. The moulding technique made it possible to produce everyday ex-votos, for which the demand continued to increase with the appearance of new sanctuaries and the intensification of their frequentation, leading to an increase in production volumes and probably to the adaptation of the workspaces themselves. Although moulding and demoulding a figurine are relatively simple technical tasks to carry out, the challenge for the coroplasts in these early workshops lay in the exponential development of their activity during the first half of the sixth century BC, which is reflected in increasingly longer series, rather than in the shaping procedure itself. Indeed, the analysis of production over the long

Publication permission is restricted to the print edition.

Figure 7: Enthroned female type with hand-made headdress from Metapontum (courtesy of the MIC - Musei nazionali di Matera - Direzione Regionale Musei Nazionali Basilicata – Museo Archeologico Nazionale di Metaponto e Museo Archeologico Nazionale di Potenza *D. Adamesteanu*, and Museo archeologico provinciale "M. Lacava" di Potenza / photo by the author).

term shows, for the better documented production centres such as Metapontum, the passage from series of moulded types known in the seventh century in a few specimens to longer series that reproduce the same type in several hundred individuals in the middle of the sixth century.[38] This evolution must have had an impact on the organisation of the workshops and lengthened the time dedicated to each stage of production (shaping, drying), but the question of the temporality of these activities is not yet sufficiently developed in coroplastic studies.

Creative emulation in the workshops of the second half of the sixth century BC

Throughout the period following the adoption of the mould, the diversification of production is circumscribed by the use of this instrument, relegating modelling to a secondary rank, as an auxiliary technique. However, in the second half of the sixth century BC, some highly efficient workshops brought modelling back to the centre of their creative practices. A regional comparative analysis makes it possible to highlight new technological and stylistic trends that emerged at the time, among others, to better understand the

[38] For example, the Metapontian enthroned figure chosen here to illustrate the variation of the headdress is known, in this *polis*, at least in 350 items.

Figure 8: Female figurines in a warlike gesture and representing a *potnia theron* from Sybaris (a-b-c: Croissant 1992: pl. XL.1-2,5) and Metapontum (d-e: courtesy of the MIC - Musei nazionali di Matera - Direzione Regionale Musei Nazionali Basilicata – Museo Archeologico Nazionale di Metaponto e Museo Archeologico Nazionale di Potenza *D. Adamesteanu* / photo by the author).

mechanisms of formal emulation and the role that technical choices played within them. This question is vast and the observations made in a few pages can only be partial, but they offer interesting topics for reflection in order to grasp the tight relationship between the choice of technical procedures in coroplastics and cultural processes in the Magna-Graecian environment.

The first set of testimonies to be considered comes from Sybaris and Metapontum, where excavations brought to light two types of medium-sized statuettes, one up to 60cm high, representing equivalent iconographic subjects. We find a figure represented raising his arm in a warlike gesture in the Metapontine sanctuary of San Biagio alla Venella (*palladion*) and in the Sybarite sanctuary of Timpone della Motta (*promachos*) (**Figure 8 c, e**), as well as the figure of the *potnia theron* (mistress of animals) accompanied by animals (**Figure 8 a, d**). Small mammals such as dogs and goats are attested in the Timpone and Stombi in Sybaris, as well as at San Biagio alla Venella, in the sanctuary of Bradano, at Crucinia and at Lago del Lupo-propr. Arezzo in the Metapontino. The variant with birds seemed to be peculiar to San Biagio[39] but one bird head was recently discovered in Francavilla Marittima.[40] The correspondence of iconographic compositions through the combination of composite headdresses, ornaments and, above all, animals indicate proximity in the codification mechanisms of certain images of a cultic nature, due to the sharing of common figurative elements in the belief system of these two *poleis* in particular. The diffusion of *potniai* in various sanctuaries confirms that this subject was not exclusive to a single religious context, although its use may have been peculiar to some religious communities active in Metapontum and Sybaris.

In addition, these specific types share two fundamental characteristics. Their manufacture is based on the same savoir-faire and the same choices regarding the shaping process: the head and the bust are made with two or three crusts of clay in a mould, whereas the abdomen, arms, animals, as well as the wings in the case of the *potnia,* are modelled by hand following

[39] An iconography that dates back to the first half of the sixth century BC in Metapontum: Bilbao Zubiri 2017: 998, fig. 3 a-b.
[40] Mittica and Perrone 2019: fig. 5.

Figure 9: *Acroteria* from Tarentum (Rescigno 2019: fig. 9).

the same assembling patterns. The upper part of the figures is attached to the lower one by a sort of mortise-and-tenon system, due to which the abdomen ends in a triangular outgrowth, and the backside preserves similar smoothing traces. The craftsmen who conceived and shaped these complex figures demonstrate a refined mastery of anatomical modelling, as the elegant faces attest, and great expertise in dealing with the technical challenges of large pieces via balancing the weights so that the figure may stand upright. As I proposed previously, these two types in particular share the same technological and stylistic characteristics, leading us to ascribe their creation to a single workshop.[41] Comparative archaeometric analyses would be welcome to provide supplementary data on this matter.

In the Gulf of Tarentum, other plastic creations of the second half of the century allow us to follow the links woven between the artisanal spheres of neighbouring cities. A comparison between the corpora of Tarentum and Metapontum reveals various degrees of correspondence, including technical solutions such as the cylindrical or *imbrex* supports used in a considerable number of mixed-technique figures.[42] Ágnes Bencze has traced the stylistic affiliations of Tarentine coroplastics to show the 'achaeanism' of the A series and the BA type through the stylistic choices that fairly faithfully reproduce those of Metapontum and Sybaris. However, this figurative trend coexists with other traditions, including Bencze's C and D series, which are close to the Laconian stylistic traditions,[43] even if she also underlines the links with the figures of mixed-technique referred to as 'de San Biagio'. These productions testify to the diversity of stylistic trends coexisting in a society, an observation opposed to the rigid distinction between the 'laconism' of Tarentum and the 'achaeanism' of Metapontum, which now gives way to a more stimulating view of material culture as a reflection of the plurality of society.

In this context, it is important to mention two female *acroteria* (apex figures) discovered in Tarentum (**Figure 9**) whose structural and stylistic resemblance to the statuettes of mixed-technique disseminated in the 'Achaean' *poleis* was recently underlined by Carlo Rescigno, who rightly affirms that 'in età arcaica, sull'arco ionico della Basilicata, appare inutile cercare di definire confini stilistici, aree chiuse'.[44] Although the chaînes opératoires are diverse in order to adapt to the architectural function, these pieces illustrate the sharing of the same models with craftsmen active on the construction sites at Tarentum.

However, these two *poleis* did not follow an equally creative path: in the second half of the sixth century BC, the Metapontine workshops produced mainly these large standing figures in a mixed-technique, such as those shared with Sybaris, and other stylistic variants and smaller figures conceptually linked with them. The Tarentum workshops, on the other hand, seem to be more diversified, with standing figures comparable to the Metapontine ones, moulded enthroned figures and reliefs of *symposiasts* (participants in feasting) that appear in the city around 540-530 BC. Within this

[41] Bilbao Zubiri 2019: 871.
[42] Tarentum: Bencze 2013: pl. VI, e-f, pl. VII, a-b, f, g; Metapontum: Orlandini 1983: no. 408; Barberis 2004: figs. 155-159.
[43] Bencze 2013: 54-62, 76-78 (A and BA), 78-113 (C and D).
[44] Rescigno 2019: 884, 887 (about the *acroteria*).

Figure 10: Female figurine in a warlike gesture and enthroned female figurines from Poseidonia (© Parco Archeologico di Paestum e Velia, Ministero della Cultura / photo by the author).

iconographic type, Bencze identifies four trends, the techniques of which are worth commenting on: in the G and H series, the use of modelling is reserved for the *kline* (couch) or certain elements such as *rosettes*, while in the J and K series, the more confident use of modelling for the rich headgear and beards is strongly reminiscent of the techniques attested in the Metapontine material.[45] While these technical choices show that the workshops responsible for the J and K series were familiar with the technical solutions adopted in neighbouring *poleis*, the dominant use of mould suggests an iconographic choice that strongly characterises the local production.

The identification of the processes chosen by the workshops of the Gulf of Tarentum in the second half of the century is essential for shedding light on the artisanal traditions of the various centres of creation and, on a wider scale, on the similarities and differences that contribute to the technical and cultural characterisation of votive coroplastics. This approach can be enriched by being extended to other geographical areas.

The *polis* of Poseidonia is an interesting case because it is close to Sybaris and Metapontum. Its workshops developed discreetly in the first half of the century, but certain types already shared similarities with the Metapontine production of the time, such as the nude dedicants discussed above, which were conceptually close to dressed Metapontine types. The Poseidonian workshops gained considerable momentum in the second half of the sixth century BC, among other things, through the production of mixed-technique figures. The female type in a warlike gesture known at Sybaris and Metapontum is also attested in the northern urban sanctuary (**Figure 10 a**), but in Poseidonia the moulded type, corresponding to the head, mainly represents enthroned figures (**Figure 10 b**), a major iconography in the *polis* until the fourth century BC.[46] Some of these seated figures illustrate the tight relationship between Campania and the Gulf of Tarentum during the period in which this iconography emerged among the Poseidonians. This is a quantitatively important

[45] Bencze 2013: 139-164, pls XXIII-XXX (G and H), 164-185, pls XXX-XXXVI (J and K).

[46] As the quantifications carried out in some sanctuaries confirm: Ammerman 2002: 29, table 1 (Santa Venera); Cipriani 2008: 136 (northern urban sanctuary); Greco 2010: 589 (Heraion of the Sele). The materials from the southern urban sanctuary reflect as well the importance of this subject: Sestieri Bertarelli 1990: 26-28, 33, 35-47.

group of statuettes, formed by a moulded head and a modelled body and seat. These statues bear witness to a double phenomenon: the adoption of a type of face that was widespread in the Greek *poleis* settled in the Ionian coastline of southern Italy, reproduced here on a reduced scale, and the adaptation of the iconographic subject to local needs by means of a hand-made seat. The shaping is based on the same skills as in the case of the *potniai* or warrior figures known in the Gulf of Tarentum, but it results in an original creation that can be qualified as peculiar to Poseidonia. It is interesting to note that this type, which spread in the 'Achaean cities' and was even copied in Tarentum, is also found in the indigenous Campanian environment, in the form of an enthroned figure in Pontecagnano, and in a new iconographic variant in Eboli where the figure wears a *kylix* on her head.[47] These pieces suggest that Poseidonia became an important relay of Greek material culture in the second half of the sixth century BC, at a time when the religious sphere was emerging autonomously in certain settlements at the edge of the Magna-Graecian world.

However, the production linked to this stylistic tradition does not seem to be as prominent in the plastic creations of Poseidonia as they were in Metapontum. Other typologies of mixed-technique and moulded figures, dated to this period, have been found in the city (**Figure 9 c-d**). Although it is difficult to propose an exact chronological sequence for these series, this material demonstrates that local workshops did not adhere monolithically to this trend and chose to create new stylistic languages. This could indicate a certain degree of resistance to exogenous influences and a desire for autonomous development among workshops or among customers involved in the religious rites of Poseidonia, in order to maintain their cultural specificity. The obvious enthusiasm for this trend in Metapontum contrasts with the greater formal diversity of Poseidonia, which could reveal weaker bonds of the latter, at that time, to the artisanal and cultural dynamics of the 'Achaean cities' of the Gulf of Tarentum.

Although successive stylistic studies have sought to classify the products of this period, our concrete knowledge of how these highly efficient workshops emerged in the Magna-Graecian environment is extremely limited. These objects make it possible to follow certain broad outlines of the artisanal practices of the coroplastic workshops, but the picture that emerges is complex and never linear, as it is made of adoption, rejection and innovation. Amongst these reactions, it seems appropriate to briefly refer to the

Figure 11: Female mixed-technique figurines from Locri (Arias 1976: pl. LIX 1-2).

relationship of these workshops with the Locrian sphere. The production of terracotta figurines in Locri was not particularly intensive before the middle of the sixth century BC but, in the second half of the century, it gained new momentum through both iconographic and technical choices.[48] The many moulded Locrian *protomai*[49] (busts) could be considered as an indicator of the proximity of Locri to the Sicilian cultural milieu, while other contemporary creations seem more original. This is the case of the mixed-technique figurines called *a leggio* (**Figure 11**),[50] which appear rather isolated in the Magna-Graecian panorama. On the contrary, it seems to me that the cultural issues surrounding these creations only take on their full meaning when integrated into a regional-scale study.

In these large mixed-technique figures, only the face is moulded, to be attached to a body that was often formed by a flat hand-made crust folded into curve on which the hand-made arms, shoulders and hair are attached; the body is also modelled, and the lower part of the body is mainly hand-made. These Locrian objects illustrate good knowledge of the technical features of

[47] Both exhibited in the respective museums of each site. Pontecagnano: grave no. 7053 (inv. 67532); Eboli: grave no. 31 from the necropolis of Via San Bernardino (inventory number unknown).

[48] Bilbao Zubiri 2020: 21-22.

[49] Barra Bagnasco 1986.

[50] Arias 1976: 482-487, pl. LIX 1-2. Paolo Enrico Arias dated them to the first half of the sixth century BC, while Claudio Sabbione dates them to the second half of the century, in consonance with the large figures of mixed technique, considered above, which appear in the middle of the century: Sabbione 1996: 35-36.

contemporary production and a savoir-faire similar to that of the Gulf of Tarentum, but also choices of form, such as the flat hand-made crust curved to form the bust, which testify to independent choices. In my opinion, we are faced with a creative emulation based on resistance on the part of the Locrian workshops, which seek to clearly distinguish themselves from the 'Achaeo-Tarentine' sphere, in order to propose creations that are original in terms of technique and style. The dynamism and the formal diversity of the Locrian workshops during the second half of the century leads to the affirmation of local plastic creations which results, in the fifth century BC, in very high-quality productions, such as those of the famous *pinakes* (plaques).

Concluding remarks

The variety of solutions implemented by coroplasts and the fast evolution of technological trends during the Archaic period makes it difficult to provide a synthesis in a few pages. Many points still need to be clarified, such as the temporality of production and the distribution dynamics of types which spread on a wide scale[51] as we have briefly alluded with the large figures of mixed technique from the second half of the sixth century. Given the difficulty in identifying production areas and facilities dedicated to the serial production of figurines before the Classical period, extensive material studies must be carried out in order to elucidate the way in which these craftsmen operated. Despite the gaps, we can affirm that these craftsmen demonstrated an excellent mastery of materials and techniques, and a solid capacity for adaptation and formal innovation to consolidate this speciality over time. An autoptic examination of the archaeological material and its consideration on a multi-scalar perspective makes it possible to trace concrete connections between contemporary centres.

The material considered in these pages suggests that the technical repertoires from which the craftsmen draw were equivalent from one production centre to another, and it did not change fundamentally during the period under consideration, as shown, for example, by the use of cylindrical supports in the end of the seventh century and again in the second half of the following century. Beyond these particularly exuberant creations, the procedures of moulding and finishing before firing are common within the coroplasts sphere. Although some choices of forming may differ to stand out as a workshop, shaping techniques (moulding, modelling, assembling limbs, folding plaques, incision) are pulled from a common technological ground. It seems that it is not through technical innovation that this craft evolved, but rather through a gradual increase of production that allowed to improve the processes of shaping and standardising the chaîne opératoire. This was essential to encourage the diversification of iconographic subjects to better respond to evolving specificities of the cult.

In comparison with other areas of the peninsula, the quantity of moulded productions dated to the seventh century in the Gulf of Tarentum shows that this area played an early and fundamental role in the adoption of the moulding technique. At this time, productions from Sybaris and Metapontum shared identical shaping processes and similar stylistic characteristics suggesting a tight connection in the emergence of this craft, but in general, early coroplastics in Magna-Graecian *poleis* was clearly differentiated. The activity of these workshops does not seem to evolve in a linear manner throughout the region during the first half of the sixth century, and it is rather difficult to establish concrete relations between settlements. From a quantitative point of view, most of these Greek *poleis* did not engage in a significant production right away, but workshops implemented their production by adapting shaping processes, such as the anticipation of iconographic variants identified in Metapontum.

This situation contrasts with the emergence of high skilled workshops of the second half of the sixth century. At this time, coroplastic activity appears particularly innovative and positioned in a stronger 'international' perspective. The large-scale circulation of a number of mixed-technique types makes it possible to define various geographical areas materially connected. This reflection requires a long work of typological classification and cross-referencing between centres, but it is possible to reconstruct some of the circuits that contributed to the forging of a Magna-Graecian material and visual culture. At this time, the closest technical and stylistic bonds concern again Sybaris and Metapontum, for which the existence of itinerant craftsmen should be considered. The same figures have been found discretely in Siris, Croton and as far as Poseidonia. In this last case, these creations from the Gulf of Tarentum cohabited alongside Poseidonia's own creations, similar in their mixed technological character but stylistically diverse.[52] This trend also affected the workshops of Tarentum, which produced large figures of similar technique as well as large reliefs, mainly moulded, that used the same physiognomic canons but incorporated into local

[51] The analysis of the spatial distribution of coroplastic types, both on the scale of a *polis* and on the scale of Magna Graecia, is not currently very extensive and concerns isolated types rather than systematic studies of large ensembles of material. An inspiring study has been carried out on the Strait of Messina: Pautasso 2014. This type of spatial approach has been adopted regarding the analysis of the archaic coroplathy of Metapontum in a study carried out by myself; the publication is in preparation.

[52] Sestieri Bertarelli 1990: 26-28, figs. 14-16. The review of this adaptation process in Poseidonia is ongoing.

stylistic and iconographic designs. Finally, the case of Locri appears to be partly related since its workshops took up these mixed processes without actually imitating exogenous models. However, this trend was not predominant and moulded productions, especially *protomai* characterised by an important typological diversity, seem to enjoy a greater degree of popularity among Locrians.

In the late sixth century, fully moulded productions became the norm again in order to create draped, enthroned figures or offering bearers.[53] These productive patterns illustrate an important renewal in manufacturing processes, as well as in the visual repertoire dedicated to ritual practices. This evolution within the craft sphere has not been thoroughly investigated but an overview of the issue by means of comparative analysis on a large scale and over a sufficiently long period highlights the potential to carry on a reflection on the evolution of savoir-faire and the way in which artisanal practices have accompanied social ones, thus providing useful input to our knowledge on the history of the clay crafts of the Western Greeks.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[53] For example, in Poseidonia (Ammerman 2002: 68-84, nos 119-170, pls XIII-XIX), Metapontum (Liseno 2004: 41-50, pls VIII-XIX) or Tarentum (Lo Porto 1964: 251, figs. 67-68).

Chapter 15

Localisation, distribution and nature of pottery production of the fourth-century BC ceramic workshops in Ano Petralona, Athens: A synthesis of the available archaeological evidence

Marilena Kontopanagou

Abstract

The area of Ano Petralona is a modern, densely populated quarter situated close to the three western hills of Athens and marked by intense building activity over the last decades. Luckily, the latter resulted in the discovery of at least 37 individual find-spots related to pottery production in antiquity.

The choice of location for the installation of ceramic workshops was determined by the abundance of water, supplied by a complex hydraulic system of channels, pipes, cisterns, a fountain-house at Antaiou street and wells. The presence of architectural remains provides the main piece of evidence for the existence of a workshop complex, confirmed also by the nature of portable finds in context. The huge quantity of the pottery recovered so far in the course of rescue excavations at Ano Petralona suggest the mass production of black-glazed tableware in common shapes, such as plates, cups, bowls, lekythoi, kantharoi, skyphoi, hydriae, lamps, plain ware, as well as terracotta figurines, but also shapes of a particular use, such as the kernoi unearthed in the same kiln on 159 Trion Hierarchon street, besides the numerous ring-shaped clay supports. It appears that this production would meet the needs not only of the citizens of Athens but also of a wider commercial network, a market beyond the city, since these shapes were widespread across many Greek cities. Researchers of Athenian topography and craft activities have identified the area as a 'potters' quarter' active in the second half of the fourth and the beginning of the third century BC, with clusters of craft establishments.

Περίληψη

Η περιοχή των Άνω Πετραλώνων αποτελεί μία σύγχρονη πυκνοκατοικημένη αθηναϊκή συνοικία σε εγγύτητα με τους τρεις δυτικούς λόφους της Αθήνας, που χαρακτηρίστηκε από έντονη οικοδομική δραστηριότητα στη διάρκεια των τελευταίων δεκαετιών, με αποτέλεσμα να έχουμε την τύχη να αποκαλυφθούν τουλάχιστον 37 νέες διάσπαρτες θέσεις σχετιζόμενες με κεραμική παραγωγή. Η επιλογή της τοποθεσίας για την εγκατάσταση των εργαστηρίων βασίστηκε στην παρουσία επαρκούς ποσότητας νερού, η παροχή του οποίου γινόταν από ένα περίπλοκο σύστημα από κανάλια, αγωγούς, δεξαμενές, το κρηναίο οικοδόμημα στην οδό Ανταίου και πηγάδια. Η παρουσία των αρχιτεκτονικών καταλοίπων αποτελεί την κύρια ένδειξη παρουσίας εργαστηριακών συγκροτημάτων, η οποία ενισχύεται από τον χαρακτήρα των κινητών ευρημάτων που βρέθηκαν στους χώρους τους. Η τεράστια ποσότητα κεραμικής που έχει έως σήμερα περισυλλεγεί κατά τις σωστικές ανασκαφές στην περιοχή των Άνω Πετραλώνων υποδεικνύει τη μαζική παραγωγή μελαμβαφούς επιτραπέζιας κεραμικής σε κοινά σχήματα, όπως πινάκια, κύπελλα, φιάλες, ληκύθους, κανθάρους, σκύφους, υδρίες, λύχνους, αλλά επίσης πήλινων ειδωλίων, πολυάριθμων πήλινων δακτυλίων-στηριγμάτων, καθώς και σχημάτων με ειδική χρήση όπως οι κέρνοι, που αποκαλύφθηκαν εντός του ίδιου κλιβάνου στην οδό Τριών Ιεραρχών 159 μαζί με αγγεία άλλων σχημάτων. Φαίνεται ότι αυτή η παραγωγή ικανοποιούσε τις ανάγκες όχι μόνο των κατοίκων της Αθήνας, αλλά και ενός μεγαλύτερου εμπορικού δικτύου εκτός της πόλεως, αφού αυτά τα σχήματα αγγείων ήταν ευρέως διαδεδομένα σε πολλές ελληνικές πόλεις. Από τους μελετητές της αθηναϊκής τοπογραφίας και της τεχνικής παραγωγής, η περιοχή των Άνω Πετραλώνων αναγνωρίζεται ως μια 'συνοικία κεραμέων' δραστήρια κατά το δεύτερο ήμισυ του τέταρτου και τις αρχές του τρίτου αιώνα π.Χ. με συστάδες εγκαταστάσεων τεχνικής παραγωγής.

Keywords: Ano Petralona; black-glazed tableware; potters' quarter; deme of Koile; kernoi

The area of Ano Petralona[1] is a modern densely populated Athenian quarter located close to the three western hills of Athens, namely, the Pnyx, the Hill of the Nymphs and the Hill of the Muses, which outline an extended archaeological park to the southwest of the Athenian Acropolis (**Figure 1**). The intense exploitation of the quarries, which were opened at the periphery of the rocky hills during the past two centuries,[2] as well as

[1] Biris 2006: 17; Kairofilas 1995: 171.

[2] Voutira 2017: 36.

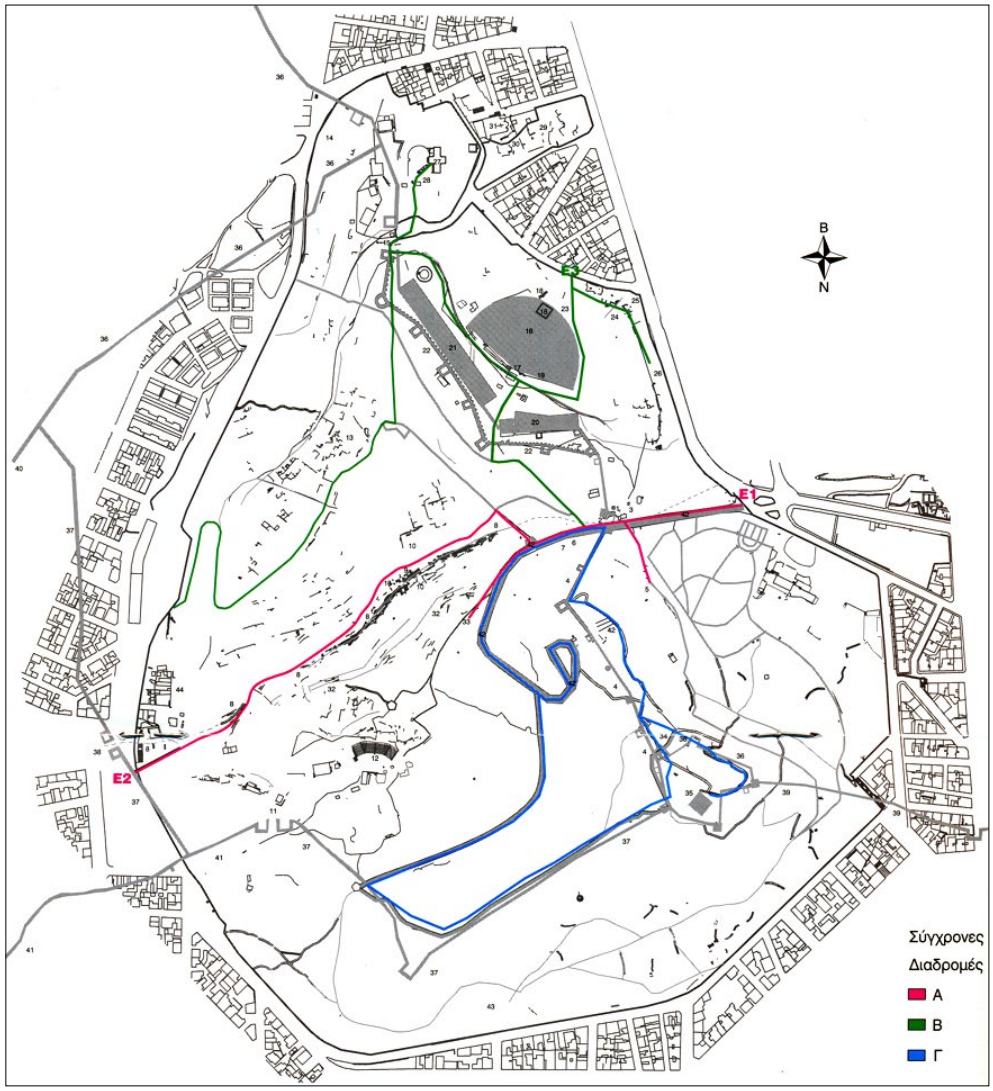


Figure 1: The area of Ano Petralona in Athens, west of the Hills to be linked by routes for visitors (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

the building activity in the last decades of the twentieth century, had an impact upon the natural setting.

Systematic research during the 'Unification of Archaeological Sites of Athens' project, which was completed before the Athens 2004 Olympic Games,[3] brought to light a sizeable, full-width, stretch of the ancient road crossing through the deme of Koile, as well as public and private buildings flanking this road. As a result, the archaeological park of the Athenian western hills has been essentially connected with the area of Ano Petralona.

The numerous rescue excavations in private plots and within the frame of public works at Ano Petralona, conducted by the Ephorate of Antiquities of the city of Athens over the recent decades,[4] unearthed at least 37 individual find-spots related to pottery production, which operated during a specific period of time and provide – via the abundance of archaeological finds – concrete evidence for the spatial arrangement of workshop installations and craft specialisation (**Figure 2**). Taking into account the available evidence, an attempt is made to collect and evaluate the rich archaeological data.[5]

A brief history of the environs

The earliest archaeological evidence from Ano Petralona dates back to the Mycenaean period, comprising two furnished Mycenaean funerary constructions (a chamber tomb and a cist grave) found at the south end

[3] For general information on the project and the areas included, see <https://www.culture.gov.gr/el/service/SitePages/view.aspx?iID=2579>, viewed 4 November 2023.

[4] A general remark which applies to most of the archaeological sites in Athens is the stratigraphic and chronological complexity of material evidence, related to the uninterrupted habitation of the city from antiquity to modern times, a phenomenon also observed in the area of Ano Petralona, although on a smaller scale.

[5] Kontopanagou and Stamoudi 2013: 305-322 (a comprehensive article about the archaeological finds of the Classical times). For a more general synthesis of excavations in Athens, see Banou 2013: 291-293; Karagiorga-Stathakopoulou 1988; Parlama 1990-91; Parlama 1992-98; Parlama and Stampolidis 2000: 18-22.

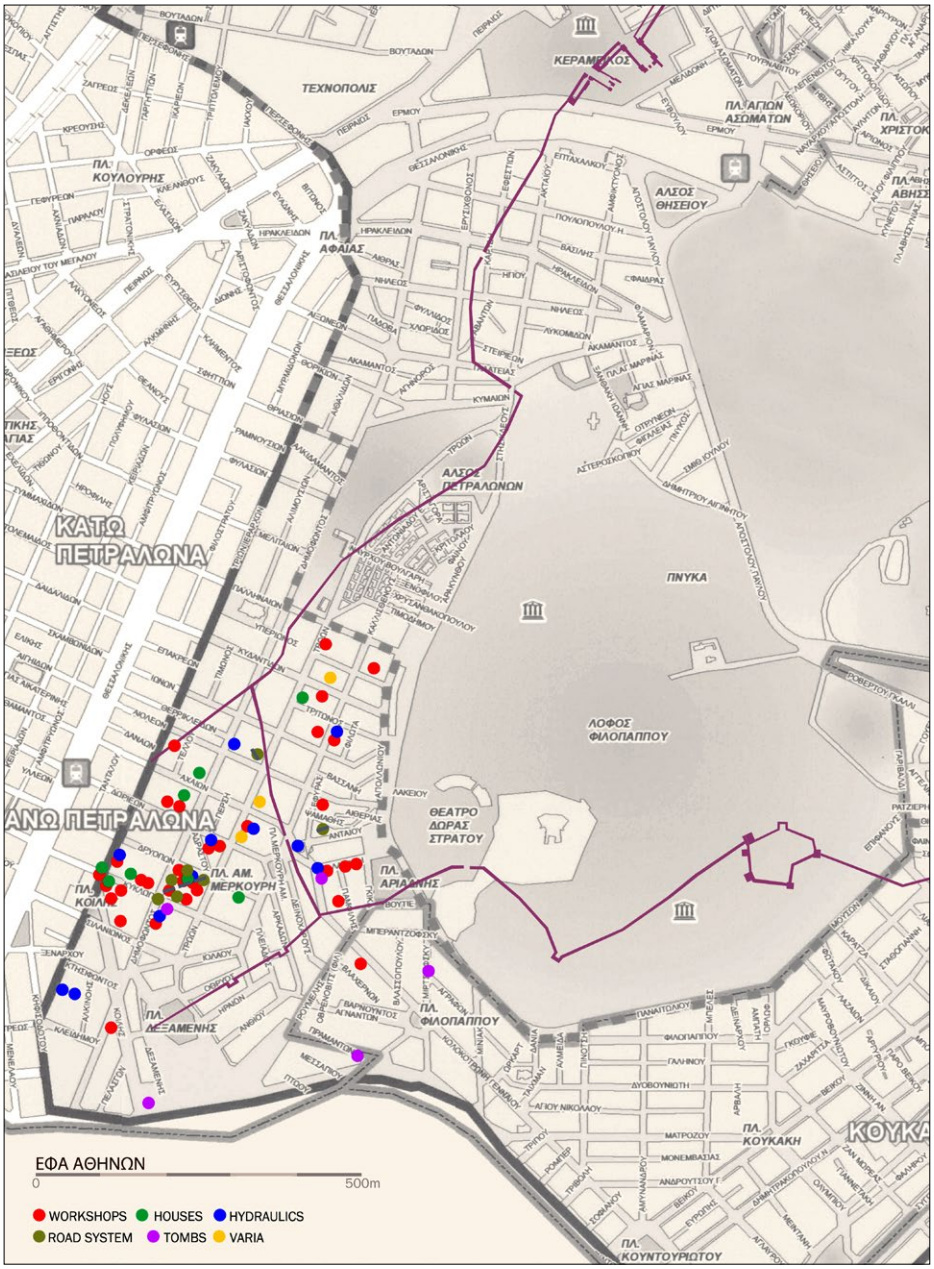


Figure 2: Athens. The spread of different archaeological sites excavated in the area of Ano Petralona (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

of Trion Hierarchon street.[6] Notably, material evidence of habitation is also available from the Classical period and until the Late Roman times. The area is located on the west fringe of the deme of Koile[7] and developed as a subsequent expansion of the inhabited area within the ancient circuit-wall of Athens after the Persian Wars (490-480 BC).[8] The deme of Koile was situated in the deep concave area between the Hill of the Mouses and the Hill of Pnyx, and it was densely populated in comparison to Melite, which was an aristocratic deme down the slopes of the Areopagus Hill, the Hill of the Nymphs and the Pnyx. The *'odos dia Koiles'* was the most important landmark of the deme of Koile (**Figure 3**), while the political significance of the Pnyx for public life contributed decisively to the growth of the deme of Melite.[9] The northern border of the area was a deep

[6] For the damaged/looted chamber tomb, see Pantelidou 1975: 46; Threpsiadis 1971: 32. For the cist grave, see Orfanou 1993.

[7] Koile, which literally means the concave area between two hills, was one of the demes following the reforms of Kleisthenes. Lalonde 2006: 113-114; Traill 1975: 55, 110.

[8] The *peribolos*/precinct of the Themistoclean period was constructed in 479/8 BC rather carelessly (as the Athenians were in a hurry) using uneven stone blocks of various kinds, as well as older material (architectural and sculptural fragments of the Archaic period). Themistocles also persuaded the Athenians to complete the construction of the walls of Piraeus, which he had started in 493/2 BC as an eponymous archon, because he thought it would help the city of Athens flourish (Thucydides, *Historiae* 1.93.5, ed. Κέντρο Ελληνικής Γλώσσας 2012, viewed 7 November 2023, <https://www.greek-language.gr/digitalResources/ancient_greek/library/browse.html?text_id=73&page=29>). Theocharaki 2020: 25-27; Travlos 1993: 48.

[9] Christopoulou 2004: 30; Dakoura-Vogiatzoglou 2004: 3-4; Traill 1975: 10, 50, 67. Costaki (2006: 159) mentions that only five demes lay within the city walls, namely, Melite, Koile and Kollytos to the west and southwest, and Kydathenaion and Skambonidai to the north of the Acropolis.

Figure 3: Athens, the '*odos dia Koiles*'. View from the East (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

rock cleft (*barathron*) where, according to ancient writers and some modern scholars, people sentenced to death for murder, by the Athenian law court, were executed.[10]

The deme of Koile flourished mainly after the construction of the Long Walls of Athens (the Phalerikon and the North Wall), a project planned by Themistocles and finished by Cimon, in order to secure transportation to and from the ports of Phalerum and Piraeus. The fortified area between the city of Athens and Piraeus was spacious enough to offer protection and accommodation to the citizens and the necessary supplies in case of war.[11] In 445 BC, a median wall between the two already existing Long Walls was built, called the South Wall, serving as a protected passageway, i.e. safeguarding the road which connected Athens with Piraeus. The partial destruction of the Long Walls and the fortification of Athens by Lysander, was followed by a phase of systematic and massive reconstruction of the circuit-wall, under the auspices of Conon (395-391 BC).[12] In the aftermath of the Athenians' defeat at the battle of Chaeronea in 338 BC, the circuit-wall was repaired and Lycurgus added a front palisade wall (the Proteichisma) to the city walls opening trenches in front of it.[13] Towards the beginning of the third century BC a second line of fortification[14] was constructed along the crest of the Hills of the Muses, the Pnyx and the Nymphs' Hill; it was called the Diateichisma and it separated the western part of the Koile residential area from its centre. The formerly inhabited area was gradually deserted and occupied by clusters of graves, accessible through the complex road system of the district. After the sack of Athens by Sulla in 86 BC and the destruction of the Long Walls, the three Hills were completely abandoned and the area was occupied by extensive cemeteries.[15]

The road system

Two main routes connected Athens with Piraeus, and they can be traced in the area of modern Ano

[10] Judeich 1931: 140, 425; Papachatzis 1974: 150; Rangavis 1991: 132. The *barathron* was probably situated between the elementary school and the quarry on Dimofontos street. On the contrary, Chryssoulaki (2022: 26-33) considers that public executions took place close to the cemetery of Phalerum, based on the lack of settlements in Phalerum, the presence of the burials of the deviants and previous finds alluding to the execution practice of *apotympanismos*.

[11] Plutarch, *Themistocles* 19.3 (ed. Κέντρο Ελληνικής Γλώσσας 2012, viewed 7 November 2023, <https://www.greek-language.gr/digitalResources/ancient_greek/library/browse.html?text_id=100&page=14>): 'ὃ καὶ συνέβη· γνόντες γὰρ οἱ Λακεδαιμόνιοι τὸ ἀληθὲς οὐκ ἠδίκησαν αὐτόν, ἀλλ' ἀδήλως χαλεπαίνοντες ἀπέπεμψαν. ἐκ δὲ τούτου τὸν Πειραιᾶ κατεσκεύαζε, τὴν τῶν λιμένων εὐφυΐαν κατανοήσας καὶ τὴν πόλιν ὅλην ἁρμοττόμενος πρὸς τὴν θάλατταν, καὶ τρόπον τινὰ τοῖς παλαιοῖς βασιλεῦσι τῶν Ἀθηναίων ἀντιπολιτευόμενος'; Pausanias 1.2.2 (ed. Papachatzis 1974): 'ἀνιόντων δὲ ἐκ Πειραιῶς ἐρείπια τῶν τειχῶν ἐστιν, ἃ Κόνων ὕστερον τῆς πρὸς Κνίδῳ ναυμαχίας ἀνέστησε: τὰ γὰρ Θεμιστοκλέους μετὰ τὴν ἀναχώρησιν οἰκοδομηθέντα τὴν Μήδων ἐπὶ τῆς ἀρχῆς καθῃρέθη τῶν τριάκοντα ὀνομαζομένων.'; Conwell 2008: 1, 8-10, 55-57; Travlos 1993: 48-49.

[12] Petritaki 2009: 460; Theocharaki 2020: 27-30.

[13] Theocharaki 2011: 119-121.

[14] Dakoura-Vogiatzoglou 2004: 36-37; Theocharaki 2011: 84, 125-126.

[15] On the gradual abandonment of the area, see Thompson and Scranton 1943: 357, 360-361, 379-381. Cf. Dakoura-Vogiatzoglou 2009: 231-232; Lazaridou 2004: 5; Travlos 1993: 78.

Petralona and Thissio: firstly, the main route for carriages (*αμαξιτή οδός*) running parallel to the exterior of the North Long Wall[16] and passing through the Piraeus Gate, unearthed on 50 Herakleidon street,[17] and secondly, the aforementioned '*odos dia Koiles*', stretching through the passage between the Long Walls, which was 184 meters wide, in use from the Archaic period onwards and having considerably impacted the spatial organisation within this zone. It started in the area of Koile and was considered to be the shortest and safest way for the transportation of people, food supplies, trade products and soldiers, especially during the Peloponnesian War.[18]

The natural rock functioned as the road surface, the occasional cavities on it being filled with layers of trodden earth, where necessary. Two-storey houses with external staircases, storerooms, the Agora of the deme of Koile, shops, wells, cisterns, courtyards and pavements for the pedestrians, which had been carved in the rock, were uncovered during the excavation research carried out on both sides of the road. Alleys and side streets connected the inhabited area. The road's total length was probably 40 stadia, equal to the length of the Long Walls. Its width ranged from 2.40/3.5 to 8.5m. The total length of the road through Koile, uncovered in the area between Pnyx and the modern ring-road of Philopappou, is 600m. Wheel-ruts, for the wagons used for the transportation of goods, were carved in pairs into the rock surface and it has been estimated that the interaxial spacing for the carriages was 1.44m wide. The road passed through a gate of the city walls in the area of Ano Petralona. Unfortunately, the gate has not been located, as yet. Two possible locations have been proposed for it: either at the junction of the Aitherias, Psamathis and Gika streets, or at the junction of Antaiou and Apolloniou streets, respectively.[19] Sections of the *dia Koiles* street surface have been unearthed in several plots[20] of Ano Petralona.

The ancient fountain house,[21] called '*the Koile Fountain*' by Olga Dakoura-Vogiatzoglou, is located at the intersection of Antaiou and Yennaiou Kolokotroni streets in the area of the modern Merkouri Square (**Figure 4**). It was possibly located near the western gate of the Themistoclean Wall, definitely close to the road through Koile, supplying inhabitants and passengers with fresh clean water. It was carved into a natural cave, where an oval basin was established.[22] Dakoura-Vogiatzoglou[23] dates the construction of the fountain in the last quarter of the fourth century BC, based on the study of the pottery and the small finds collected from the interior of the structure. It remained in use until the mid-second century BC, while the damage of its façade and marble parapet took place in the sixth century AD, during the Slavic invasion of Athens.

Sources on ancient ceramic workshops

The extant texts of ancient authors, the iconography on Attic and Corinthian pottery and primarily the available archaeological evidence from major and minor excavated sites constitute sources of rich information on the nature, organisation and production of ceramic workshops.

The poem 'Kiln' ('*Κάμινος*') in *The Life of Homer* by Pseudo-Herodotus was a hymn of apotropaic character referring to evil spirits or demons named Σύντριψ, Σαβάκτης, Ωμόδαμος, Σμάραγδος and Άσβεστος, who could destroy the production of the potters in the kilns.[24]

The most detailed representations of kilns and their components, including men working by the kilns, and several stages of pottery manufacture are depicted on the archaic votive clay plaques from Penteskoufia, a site to the southwest of the Acrocorinth, where a shrine of Poseidon was situated. The potters and painters probably offered the plaques, of which the estimated number is about 1000 pieces, to the shrine, as dedications. The most popular decorative theme, except for Poseidon and Amphitrite, is potters at work. On many of the plaques, kilns and scenes relevant to pottery making are depicted, such as digging in clay

[16] Petritaki 2009: 454-468. Parts of the route to Piraeus through the Long Walls, as well as parts of the Long Walls themselves and cemeteries beside them, have been found further south in the suburbs of Tauros, Moschato and Faliro.

[17] Spathari 1982: 23-24; Steinhauer 2009: 39-40.

[18] Herodotus (*Historiae* 6.103.3, ed. Κέντρο Ελληνικής Γλώσσας 2012, viewed 7 November 2023, <https://www.greek-language.gr/digitalResources/ancient_greek/library/browse.html?text_id=30&page=154>) mentions that Cimon, the father of Miltiades, was killed and buried (in 524 BC) beside the *odos dia Koiles* 'καὶ τὴν νίκην παρὲις τούτῳ κατῆλθε ἐπὶ τὰ ἑωυτοῦ ὑπόσπονδος. καί μιν ἀνελόμενον τῇσι αὐτῇσι ἵπποισι ἄλλην Ὀλυμπιάδα κατέλαβε ἀποθανεῖν ὑπὸ τῶν Πεισιστράτου παίδων, οὐκέτι περιεόντος αὐτοῦ Πεισιστράτου· κτείνουσι δὲ οὗτοί μιν κατὰ τὸ πρυτανήιον νυκτὸς ὑπείσαντες ἄνδρας. τέθαπται δὲ Κίμων πρὸ τοῦ ἄστεος, πέρην τῆς διὰ Κοίλης καλεομένης ὁδοῦ· καταντίον δ' αὐτοῦ αἱ ἵπποι τετάφαται αὗται αἱ τρεῖς Ὀλυμπιάδας ἀνελόμεναι.' Cf. Costaki 2006: 581-584, 520 (koile, Melite). Ficuciello 2008: 46 describes that it was a two-way road for coaches, also used for the transportation of stone blocks for the construction of the Long Walls. On the walls of Piraeus (Thucydides, *Historiae* 1.93.1-5, ed. Κέντρο Ελληνικής Γλώσσας 2012, viewed 7 November 2023, <https://www.greek-language.gr/digitalResources/ancient_greek/library/browse.html?text_id=73&page=29>) see Dakoura-Vogiatzoglou 2009: 225-230.

[19] Ficuciello 2008: 100; Dakoura-Vogiatzoglou-2009: 227-230.

[20] Kontopanagou and Stamoudi 2013: 309-312 (19 Antaiou, 111-113 Dimophontos, 33 Cyclopon, 36 Dryopon).

[21] Costaki 2006: 38, 81; Kontopanagou and Stamoudi 2013: 316-317. In the archive of the Ephorate of the city of Athens, see file 'Krene Antaiou'.

[22] The dimensions of the fountain are: 2.14m to 4.48m (width), 7.50m (maximum length) and 1.00 to 2.07m (height). Water was directed into the basin from the east side of the structure, through four small holes cut in the middle of a horizontal channel.

[23] Dakoura-Vogiatzoglou 2017: 100-107.

[24] Hasaki 2002: 57-60; Papadopoulos 2003: 191; Scheibler 1992: 122.

Figure 4: The Koile Fountain, Ano Petralona (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Figure 5: The Munich hydria depicting a workshop scene, attributed to the Leagros Group (after Bentz *et al.* 2010: fig. 88).

beds, making pots on the potter's wheel, whole kilns in profile, people arranging the fire for the kiln, and pots inside the kiln.[25] A representative and detailed scene of the premises of a ceramic workshop, with at least eight men carrying out tasks at different stages of work, features on the shoulder of a black-figured hydria attributed to the Leagros Group (**Figure 5**).[26]

[25] Boardman 1998: 185; Chatzidimitriou 2005: 31-42; Hasaki 2002: 434-452, 471; Scheibler 1992: 123. Noble (1960: 317-318) described the steps in the making of an Attic vase starting with the digging for clay, the washing of the clay and the settling-basins where impurities were removed, the time they stored the clay to ripen and its mixture with small quantities of older clay. What followed was the drying of the clay to a workable condition, and its treatment until air bubbles were eliminated and the clay was smooth. The next step after the above-mentioned preparation was the forming of the pot either on the wheel or in a mould, the decoration of the vase and, finally, the process of firing.

[26] Chatzidimitriou 2005: pl. 10, K39 (Munich, Staatliche Antikensammlungen, inv. 1717); Hasaki 2002: 48, pl. 1.11b; Scheibler 1992: 136, figs. 97, 101, 102.

Criteria for choosing the location of Athenian workshops

As concerns their location, and given that ceramic workshops would produce a lot of fumes, dust, dirt and possibly noise, they should be situated at the edge of the city.

The choice of the specific location for a workshop installation depended on certain prerequisites/factors, such as the abundance of water, usually supplied by a complex hydraulic system of channels, pipes, cisterns, fountain buildings and wells. Abundant water is necessary for the procedure of clearing the clay and also for every stage of pottery production.[27]

John Papadopoulos mentions also that kilns are often found on the site of an earlier or even contemporary

[27] Misailidou-Despotidou 2020: 14-16; Scheibler 1992, 133.

cemetery, such as the Athenian Kerameikos.[28]Availability of clay beds within a short distance from the workshop area,[29] fire woods and raw fuel would be an advantage, as was the convenient geomorphology, such as stable bedrock, air circulation, and ground inclination. Accessibility to an organised road system for the needs of transportation of raw materials and finished products was also crucial to the successful operation of a workshop. A long tradition in pottery making was established at Athens, at least since the Geometric period, with the production of a wide range of high-quality funerary pottery found in Athens, Attica and elsewhere. On the grounds of certain traits observed in the decoration of vases, certain 'painters' and their 'workshops' have been identified by scholars.[30] Despite the obviously rich production of the pottery workshops, it is noteworthy that no material traces of the actual work-places, where the highly elaborated geometric and archaic pottery was manufactured, have been identified so far.

In the Athenian Kerameikos, which literally was the Potters' Quarter,[31] handicraft activity was carried out close to the city walls. So far, the earliest archaeologically documented ceramic workshop from this area, dates from the fifth century BC and it was located at the southwest part of the Kerameikos road, outside the Dipylon gate. It consisted of an elongated courtyard with a circular cistern in the middle and a tile-paved corridor, which led to several auxiliary rooms. Pear-shaped kilns of the fourth century BC were found beneath the sepulchral monuments on the left side of the Dipylon road and the area of the Kerameikos Museum.

In the area of the later Athenian Agora, John Papadopoulos identified significant evidence of potters' debris which indicates that installations, including kilns, were scattered over part or much of the area from the Protogeometric period onwards, and published a detailed catalogue of the material found in several wells and pits. The material consisted of pottery, trial pieces, lamps, terracotta loom-weights, spindle whorls, beads or buttons, kiln firing supports and lumps of clay, as well as a large quantity of small terracotta figurines of several types. Finally, Papadopoulos suggested that the original Kerameikos of Athens was located in the area of the Classical Agora.[32] Indeed, a pottery kiln in a house of the Late Geometric/Early Archaic period near the later Tholos in the Agora predates the earliest known kilns from the Kerameikos area.[33] A ceramic workshop area of the Classical period (the first phase of it dates to the second and third quarters of the fifth century BC, and the second one to the beginning of the fourth century BC) has been excavated at the junction of Lenormant and Constantinoupoleos streets.[34]

Identifying ceramic workshops at Ano Petralona. The pieces of evidence

A field archaeologist participating in either a systematic or a rescue excavation needs particular material evidence in order to distinguish a workshop area,[35] such as the presence of architectural units (a building complex, separate rooms or at least walls and their floors, storerooms and special structures, open-air or semi open-air light structures).[36] In our case, the presence of architectural remains provides the bulk of evidence in favour of the existence of a workshop complex, confirmed also by the nature of the portable finds in context. More specifically:

- At the junction of Dimofontos and Dorieon streets a group of six walls was revealed, founded in the natural bedrock and built of stone masonry and mud (**Figure 6**). Their function was identified by the author as a workshop of the late fourth century BC mainly on the grounds of their content: a large quantity of black-glazed tableware, small lekythoi, bowls, kantharoi, lamps, loom weights and a large number of clay rings or supports, which were commonly used for the separation of pots in pottery kilns.[37]

[28] Papadopoulos 1992: 220.

[29] Boardman (1998: 11) wrote about clay that 'local sources were naturally exploited and the usual place for the kilns would be near them unless they were too far from the relative safety of a town'. Chatzidimitriou (2005: 31) mentions that the appropriate clay should be distinguished for its plasticity and toughness while being fired.

[30] The Dipylon Master, the Hirschfeld Painter, the Lambros Workshop, the Workshop of Athens 706, the Sub-Dipylon Group, the Workshop of Athens 894, the Analatos Master, the Kynosarges Painter, etc. Cf. Brann 1962: 12-26; Brouskari 1979: 9-10, 60-73; Coldstream 2008: 8-90. The Dipylon Master is the most outstanding and influential personality in Late Geometric vase painting, according to Brouskari.

[31] Banou and Bournias 2014: 266; Baziotopoulou-Valavani 1994: 47; Sanidas 2019: 77-79; Stroszeck 2017: 138-146.

[32] Papadopoulos 2003: 21, 23-189 (the publication of the finds collected from Well N 12:3, L 11:1, A 20:5, Well K 12:1, Well H 16-17:1, Well P 8:3, Well L 6:2, Well M 13:1, Well N 11:5, Deposit G 15:5, Kiln Deposit H 12:17, Deposit S 17:2, Area S 17:2, Well R 17:2, Well or Pit M 11:1, Well I 13:4).

[33] Brann 1962: 110-111; Papadopoulos 2003: 126-143; Thompson 1940: 6-7.

[34] Baziotopoulou-Valavani 1994: 47-51; Sanidas 2013a: 75-76; Zachariadou *et al*. 1985: 39-50. Workshop activity was testified by the occurrence of four kilns and eleven pits alongside the cemeteries and the three roads uncovered there. The main workshop area was situated in the south part of the excavated plot, while the pits were scattered in the field and the excavators suggested that the whole district was in fact a potters' quarter.

[35] Baziotopoulou-Valavani (1994: 45) states that ceramic workshop installations were humble structures, easy to be eliminated in a modern city like Athens. Therefore, special architectural features, such as the presence of kilns, cisterns for the purification of clay, pure raw clay deposits, broken, misfired or half-finished pots, trial pieces, clay rings, moulds and tools are finds that facilitate the identification of a workshop area by the excavator. Cf. Hasaki 2002: 252-264.

[36] On representations of ceramic workshops on Athenian vases, see Chatzidimitriou 2005: 43. The interior of the workshop is marked by the presence of columns and roof, whereas the exterior by a kiln in-the-open, possibly a courtyard.

[37] Kontopanagou 2010a: 52; Kontopanagou and Stamoudi 2013: 315.

Figure 6: Junction of Dimofontos and Dorieon streets, Ano Petralona. General view of the excavated walls (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Figure 7: 15 Dorieon street, Ano Petralona. A bronze-casting workshop (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Furthermore, in the adjacent plot on 15 Dorieon street, the remains of a bronze casting workshop (**Figure 7**) of the fourth century BC had been found in 1994.[38] The function of this area seems to have been industrial, at least during that specific period.

- At the junction of Dorieon and Troon streets seven quite small cisterns (**Figure 8**) were found. Antonia Kokkoliou suggested that the cisterns were used for the purification of raw clay masses before their use in the pottery-making process. The provision of water in the area is evidenced by the presence of a pipe. All cisterns date to the mid-fourth century BC and, after their abandonment, they were filled with sherd debris.[39]
- Another extended building complex on 23, 25 and 27 Cyclopon street[40] has been excavated over several exca-vation seasons. The ancient tenants of the domestic building in the first plot are likely to have carried out intense handicraft activity in the neighbouring plots, as indicated by a system of cisterns, clay pipes, and rock-cut water pipes connected with the cisterns.[41] Numerous loom-weights, small lekythoi and a fragment of a female terracotta figurine were collected. On 16-18 Cyclopon street, three rectangular cisterns and a well were in use at the end of the fourth century BC.[42]
- In the city block encompassing the plots 38, 36[43] and 34[44] Dryopon street, 111-113-115[45] Dimophontos street, and 31-33 Cyclopon street, handicraft activity is suggested by the presence of specific types of finds, such as intact or broken ring-shaped clay supports, misfired and

[38] Kontopanagou and Stamoudi 2013: 313; Orfanou and Kaletzi 1994: 40-41.

[39] Kokkoliou 2001-04; Kontopanagou and Stamoudi 2013: 313.

[40] Alexandri 1975 and 1976; Banou 2013: 290-291; Kontopanagou and Stamoudi 2013: 313-314.

[41] Kontopanagou and Stamoudi 2013: 317-319. Provision of water and its use is attested in the field by the presence of built or rock-cut reservoirs, cisterns, channels, pipes and wells.

[42] Liangouras 1973-74: 41-43, Plan 51.

[43] Kontopanagou and Stamoudi 2013: 311-312.

[44] Kokkoliou (2000b) describes the repertoire of the waste, i.e. black-glazed salt cellars, small lekythoi, *guttus askoi*, kantharoi and moulds.

[45] Orfanou 1994.

Figure 8: Junction of Dorieon and Troon streets. View of the cisterns (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

stuck vases, hundreds of potsherds of repeated black-glazed small shapes. These finds strongly suggest mass pottery production close to the road (**Figure 9**), parts of which have been unearthed in these particular plots. The case of the plot on 36 Dryopon street is a characteristic, typical example of the complex character of finds encountered by the archaeologist during rescue excavations (**Figure 10**). Part of the ancient road of the late fifth century BC (20m long and 2.50 to 4.50m wide) was unearthed (**Figure 11**) and identified as possibly the *odos dia Koiles*. A large quantity of smashed bricks and tiles used in the construction of the compact road layers had derived from a nearby workshop. A rectangular cistern was found in the vicinity of the road, filled with abundant workshop debris of the fourth century BC. This was apparently an integral element for the function of a workshop complex, which extended onto the adjoining plot on 38 Dryopon street.[46] A long wall was built later, which served both as a retaining-wall of the road, affected by the cemetery of the second century BC, and as the south *peribolos* (precinct) of the same cemetery.

- On 6 Tellou street[47] the residues of a workshop area were unearthed. The plan of a room built of rough rock-cut blocks has been restored, possibly a collapsed kiln. A long and thick wall to the east of the room was then uncovered (**Figure 12**). Between the two structures a thick layer of stones mixed with broken pottery, clay rings, stuck plates, vitrified clay and misfired pots, has been identified as the debris of a kiln (**Figure 13**). The vase repertoire of the fourth century BC contained mainly black-glazed kantharoi, bowls, plates and fishplates, amphorae, *guttus askoi*.[48] From the deepest layers, overlying the bedrock, two heads of terracotta figurines and a group of miniature pots (kantharoi, skyphoi and situlae) were also collected (**Figure 14**).
- On 159 Trion Hierarchon street, in the course of a rescue excavation, the remains of a workshop installation dating to the late fourth century BC came to light.[49] It consisted of two walls, a group of three ceramic kilns[50] and a well (**Figure 15**).

[46] Tsouklidou-Penna 1981.

[47] Kontopanagou 2009; Kontopanagou and Stamoudi 2013: 315.

[48] For parallels, see Sparkes and Talcott 1970: Part 2, pl. 39, nos 1192-1196.

[49] Kontopanagou 2010b; Kontopanagou and Stamoudi 2013: 313.

[50] The presence of a kiln is definitely a major criterion for the identification of a ceramic workshop installation. According to Hasaki (2002: 5, 77-90; Hasaki 2020: 284-286), pottery kilns were usually built up against the slopes of hills, in order to avoid digging in a flat ground from scratch. Stable bedrock is also more secure against thermal shocks. The structural elements of the Greek kiln, an updraft double-chambered construction, had been established already in the Middle Helladic period and did not change significantly over the millennia. A typical ceramic kiln consists of the bottom chamber and the combustion chamber, where the fuel is placed and fired, and the gases are concentrated. The temperature inside the combustion chamber is typically hundred degrees higher than in the main pot-firing chamber. The outline of the combustion chamber can be either circular/oval or rectangular. The *eschara*, the perforated floor between the bottom and the upper chamber, constitutes – according to Hasaki – the most reliable criterion for the identification of a ceramic kiln. The *escharas* have several vent-holes of equal dimensions arranged in concentric circles, probably pierced with a wooden stick. Parts of columnar supports also imply the functioning of kilns. The stocking-channel is the channel usually projecting from the outline of a kiln; therein the fuel was placed. In the firing chamber, pots and other ceramic objects were placed and fired. Its lower part was usually made of bricks and sherds plastered with clay, while its dome normally had to be rebuilt before each new firing. It had a chimney and possibly large holes. The presence of oven and furnaces is also relevant to the ceramic production, the making of vases, mud-bricks or roof-tiles. For example, see Kolonas 1981 on 37 Pallinaion street, where two large ovens of a ceramic workshop were unearthed.

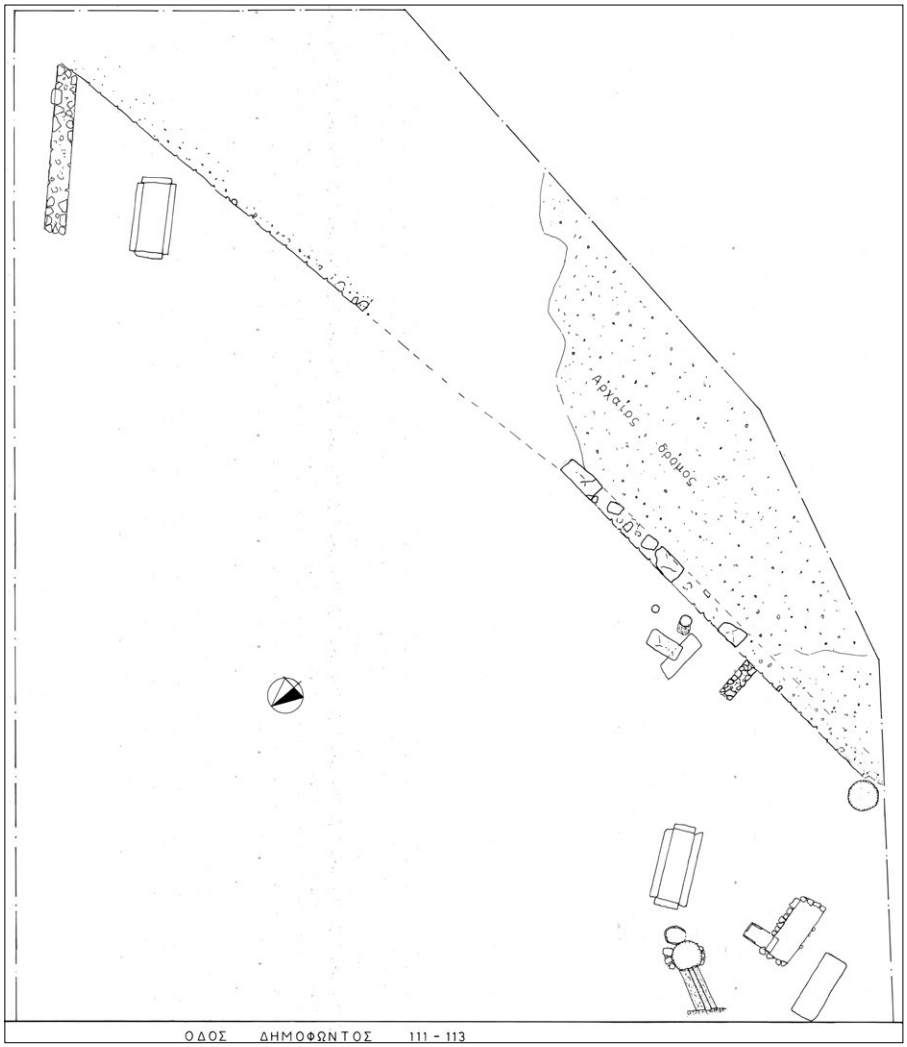


Figure 9: 111-113-115 Dimophontos street, Ano Petralona. Drawing of the excavated cemetery fringing an ancient road (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

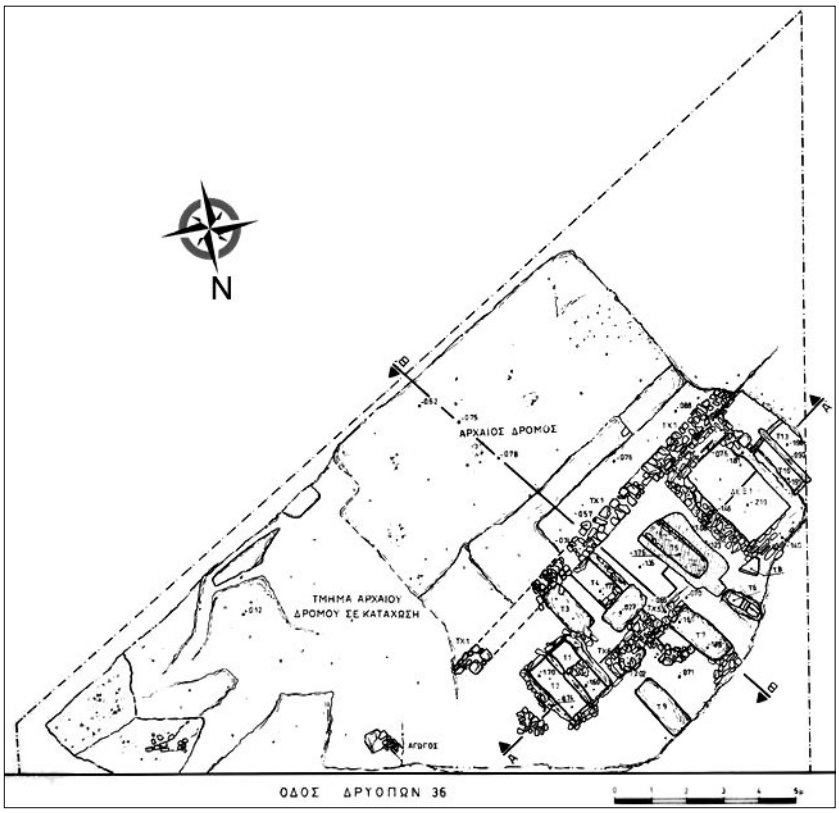


Figure 10: 36 Dryopon street, Ano Petralona. Plan of the excavation with an ancient road running to the South (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Figure 11: 36 Dryopon street, Ano Petralona. Ancient road surface and retaining-wall (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

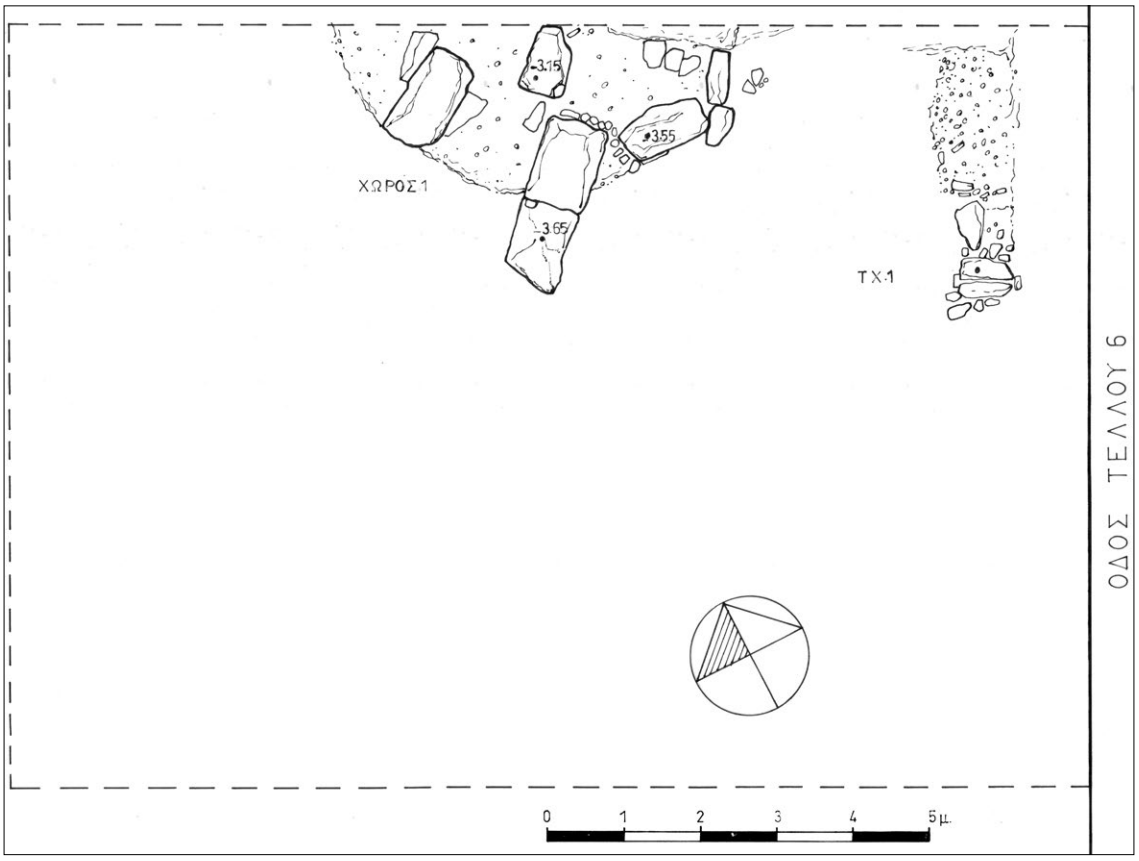


Figure 12: 6 Tellou street, Ano Petralona. Ground-plan of part of the excavation (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Wall 1, oriented SW-NE, is preserved at a length of 7.60m, height 0.70m and width 0.45m. It was founded on the hard bedrock and well-built with both sides as facades. Wall 2 ran vertical to Wall 1 and was poorly preserved. The two of them probably formed a semi-outdoors space, separating and protecting the workshop from the weather conditions.[51] Kiln 1, lying close to the south face of Wall 1, was rectangular, measuring 1.90 x 1.50m. In fact, only the ground of the kiln's combustion chamber was preserved,

[51] Hasaki 2002: 74. Very often the kilns were surrounded by walls, either for structural reasons or for protecting the firing process.

Figure 13: 6 Tellou street, Ano Petralona. Vitrified clay pieces (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Figure 14: 6 Tellou street, Ano Petralona. Miniature *situla* (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

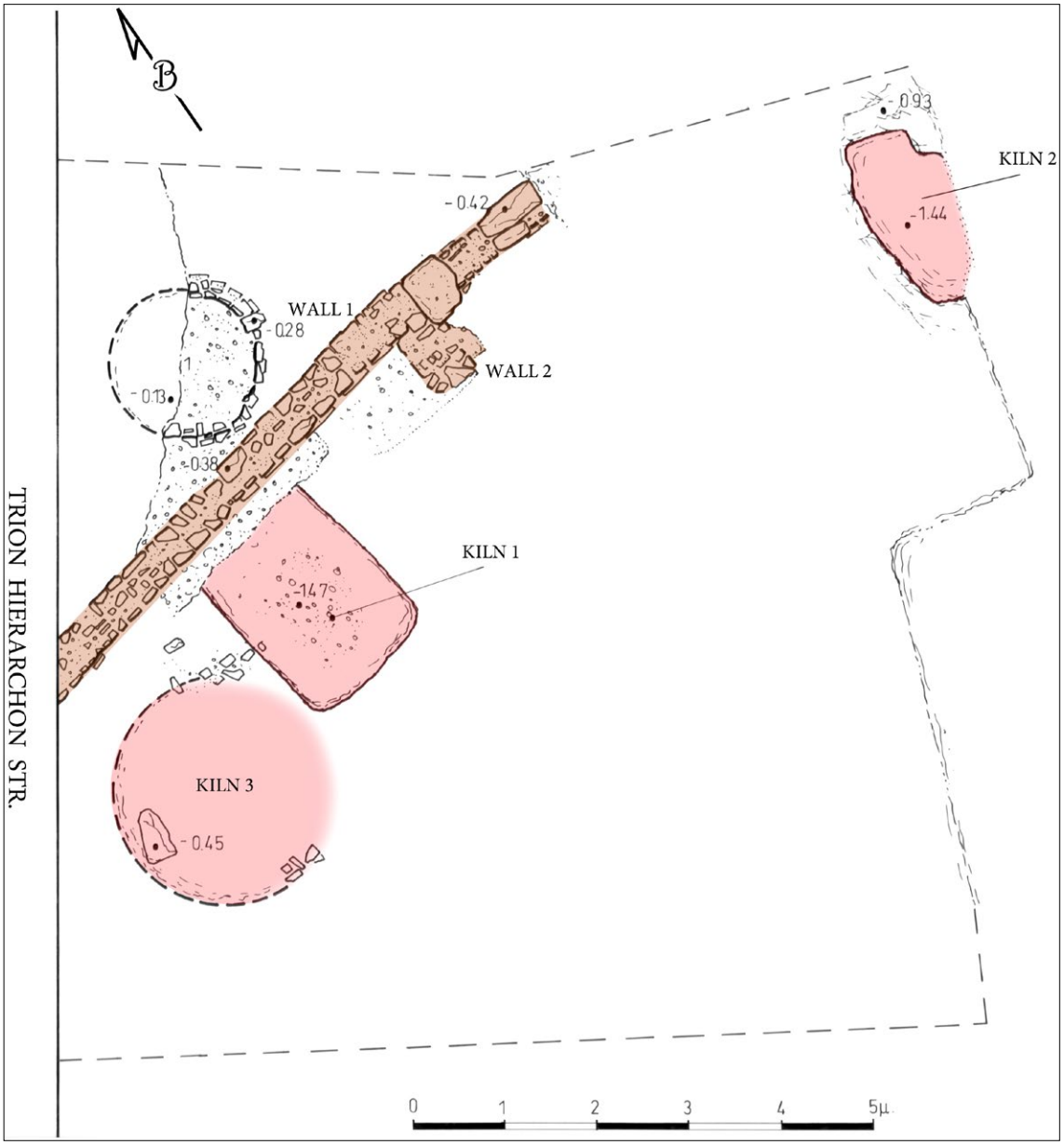


Figure 15: 159 Trion Hierarchon street, Ano Petralona. Plan of the excavation (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Figure 16: 159 Trion Hierarchon street, Ano Petralona. Kiln 2, with shattered vases *in situ* (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

where burnt bricks, pieces of glazed clay, ashes and charcoals, one part of a kiln *eschara* and a few potsherds were found. Kiln 3 was located to the west of Kiln 1 and had collapsed sometime during the period of its use. Surprisingly, the pottery it contained during its collapse was found *in situ* during the excavation. The content included 43 intact pots, mostly black-glazed tableware, such as bowls, plates, kantharoi, lekythoi and lamps, many fragments of broken pots and numerous ring-shaped clay supports. In the northeast corner of the plot, part of a circular Kiln 2 (measuring 2.00 x 1.10m) was excavated (**Figure 16**). The area had been sealed off by a thick undisturbed layer of soil. In total, 58 vases were collected from the interior of the kiln, as well as numerous potsherds and clay rings. One of the clay rings is inscribed with the letter E (epsilon) (**Figure 17**).[52] The shape repertoire of these vases is the same as of those found in Kiln 3, except for the unexpected occurrence of a group of twelve almost intact kernoi, as well as body fragments of some more similar vases.[53] Eleven kernoi are of a simple,

Figure 17: 159 Trion Hierarchon street, Ano Petralona. Clay ring with the letter E (epsilon) (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

plain type, whereas one is a composite kernos bowl. Four out of the eleven kernoi (A 21871, 21872, 21874, 21879) are undecorated (**Figure 18**), their height ranging from 0.064 to 0.107m. The remaining seven (A 21873, 21875, 21876, 21877, 21878) of the eleven plain kernoi preserve white paint on their surface. Their height ranges from 0.046 to 0.085m. The surface of miniature

[52] Similar clay rings with inscribed letters have been found at the junction of Lenormant and Constantinoupoleos streets, see footnote 34.

[53] Pollitt (1979: 206, 208-209) has given an exact description of kernoi 'the basic shape consists of a conical base surmounted by a bowl with two distinct sections, a lower body which flares out to a thick flange and an upper body which curves inwards toward a wide mouth. The mouth is usually marked by a raised rim. The flange normally has two loop handles and is usually pierced by several holes, most commonly a pair of holes placed adjacent to each handle.' According to Mitsopoulou (2010: 47-56; Mitsopoulou 2011: 189-205; Mitsopoulou 2014), a kernos in the classical world was used in rites for the chthonic mother-goddesses Rhea, Cybele and Demeter. The plain-type vessels were the majority and used as votive. In Attica, kernoi were ritual vessels used for the worship of Demeter and Kore (Persephone) during the Eleusinian mysteries. They were made of clay, marble, bronze and sometimes they were gilded. Participants in the Eleusinian mysteries, who were walking from Athens to Eleusis, carried the *kykeon* (a kind of ritual drink) inside the vases. Kernoi have been found in massive amounts at Eleusis, below the Stoa of Philo and the Bouleuterion, at Kerameikos, in pits thrown after their use at the City Eleusinion (Agora), in a pit by Hiera Odos and a small number in Attica. At most sites, the kernoi do not come from a sealed stratified context.

Figure 18: 159 Trion Hierarchon street, Ano Petralona. Kernos A 21872 (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

kernos A 21877 (**Figure 19**) is covered with white paint, the flange bears decoration of red motifs in radial arrangement and the upper body bears four rectangular red motifs, filled with rectangular patterns. On the second miniature kernos A 21878 the upper body is decorated with four rectangular patterns filled with triangles. The surface of the rim is decorated also with ovoid patterns in red and blue-green colour, the periphery of the flange is painted with faded red color and the horizontal surface, with ovoid patterns, displays a motif in red and blue-green on the surface of the lip. The kernos bowl A 21882 (**Figure 20**) is a wide deep bowl, 0.29 m in diameter, featuring seven attached onto the rim small bowls-kotyliskes. The inner surface is reddish-glazed and the exterior black-glazed, possibly misfired.[54]

[54] Thompson 1936: 340, 447-450, fig. 20. For parallel, see Sparkes and Talcott 1970: 183, pl. 44, no. 1364.

Figure 19: 159 Trion Hierarchon street, Ano Petralona. Kernos A 21877 (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Figure 20: 159 Trion Hierarchon street, Ano Petralona. Kernos bowl A 21882 (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

The twelve kernoi constitute a distinct group of similar typology, which co-existed with the black-glazed vases of the late fourth century BC. They were not differentiated in any way from the other vases in this particular context. Since these vases were never put into use, the content of the kiln having probably been destroyed or collapsed, they offer us information on the stage and scale of production. The small percentage of kernoi among a huge quantity of household pottery raises the issue of their distribution pattern, occurring

Figure 21: 10 Valavani street, Ano Petralona. Vases from the workshop area (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

Figure 22: Junction of Aioleon and Psamathis streets, Ano Petralona. General view of the unearthed walls (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

also in the other workshop areas of Ano Petralona, and possibly confirming their functional sophistication and specialisation. Perhaps the kernoi served the needs of a nearby sanctuary, such as the City Eleusinion in the Agora, or some other yet unknown.[55]

- The building complex in the plots on 4, 6 and 10 Valavani street, comprising three adjacent rectangular rooms and five walls at a height of 0.70m with plastered floor surface, extended across a wide area.[56] Apart from the presence of pure raw clay masses, the existence of a few kernoi of the simple type among a large quantity of intact black-glazed vases (**Figure 21**) and pottery sherds, dumped fragments of misfired pots, all dating to the second half of the fourth century BC, is certainly intriguing.
- At the junction of Aioleon and Psamathis streets the remains of four walls dated to the fourth century BC were found.[57] Wall A was 1.10m wide, which led the excavators to assume that it could be either an exterior wall or the retaining-wall of a narrow road or alley (**Figure 22**). It seems that limited craft production was practiced in this building, since a group of pyramidal loom-

[55] The round pit found on 73-75 Troon street could possibly be attributed to the cult of Artemis. Kontopanagou and Stamoudi 2013: 317, fig. 12.

[56] Chatzipouliou 1988a and 1988b; Karagiorga-Stathakopoulou 1979; Kontopanagou and Stamoudi 2013: 314; Sanidas 2013a: 91.

[57] Lyngouri-Tolia 1985a.

Figure 23: Junction of Aioleon and Psamathis streets, Ano Petralona. Loom-weight with the letters 'ΓΛΥΚ' stamped on it (© Ephorate of Antiquities of the city of Athens, Hellenic Ministry of Culture).

weights bears the stamped letters ΓΛΥΚ, possibly after the name of a potter or the owner of the workshop (**Figure 23**). Loom-weights with the same stamp have been found in deposit pits in the Athenian Agora, within a quite short distance from this specific installation.[58] Among the pottery collected, at least one kernos of the simple type has been identified.

The quantity of pottery collected from the excavations at Ano Petralona suggests that workshops in this area were mostly engaged in mass production of household pottery, the main shapes being black-glazed bowls, plates, jugs, oinochoae, kantharoi, kylikes, lekythoi, amphorae, as well as loom-weights, lamps, clay figurines, miniature and more specialised shapes, decorated (mainly red-figured), as well as coarse ware. The area has been identified as a 'Potters' Quarter',[59] active during the second half of the fourth and the beginning of the third century BC, with clusters of workshop installations within short distance from the centre of public and commercial activity.

The location of the workshops, close to the major and minor streets at Ano Petralona, was a vital factor for the circulation of their goods inside the city as well as beyond, since many Greek cities and their colonies were provided with Attic pottery for the needs of everyday life, cult and funerary use.

Acknowledgements

I express my gratitude to Dr E. Kountouri, Director of the Ephorate of the city of Athens and the former Director Dr E. Banou for the support on this project, as well as to my colleague and friend Dr K. Stamoudi. Many thanks are due to a number of colleagues: F. Pasadaki and E. Servetopoulou, A. Kontonis, E. Klimanoglou, G. Asvestas, C. Fouseki, G. Perrou, M. Flouskakou and C. Vomvogianni. I would like also to mention Dr K. Manteli for her overall help, Dr A. Syrogianni and Dr Chr. Mitsopoulou for introducing me to the world of the Eleusinian cult and kernoi.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[58] Thompson 1936: 344, fig. 25 no. B 45 (SS 327).

[59] Baziotopoulou-Valavani 1994.

Chapter 16

Local *knowledgescapes* in pottery production: A new heuristic approach to the Iron Age pottery workshops between the Arno Valley and the Po Plain

Raffaella Da Vela

Abstract

Which level of knowledge is necessary for pottery production and how is it embedded into the ecology of the production sites and into the social structures of local communities? Through the concept of local *knowledgescapes*, the present paper approaches the role of knowledge as social resource in pottery workshops of an Italian mountainous region, the northern Apennines, between the ninth and the fifth century BC. This region was a connecting zone between societies with various cultural backgrounds, where human mobility allowed a spread of knowledge in pottery production and consumption. The consequence of these personal and cultural contacts was the formation of a broader community of practices, in which the *ergasteria* played an active role in introducing new technological skills and trends of taste within local communities. A comparative analysis of different layers of knowledge has been conducted in 37 pottery workshops, starting from the most basic level, this of the traditional ecological knowledge needed for establishing the production site, to the most complex level, this of the social and institutional practices, such as literacy and rituality within workshops. Knowledge and knowledge transfer have been regarded as immaterial resources, embedded in socio-natural networks, in which ecological, economic and social features are involved in complex interactions. These *knowledgescapes* were undergoing continuous changes in time, in a context of transformations, such as change in power structures and in dwelling strategies of local societies. Local *knowledgescapes* in pottery production and the *ergasteria*, as their place of establishment, maintenance and innovation, show that cultural belonging and tradition, encounters and innovation were constitutive elements of the daily routine in producing pots. Pottery production was thus not only a matter of practical utility, but also the way to construct social meaning and values.

Περίληψη

Ποιο επίπεδο γνώσης απαιτείται για την κεραμική παραγωγή και πώς αυτό εντάσσεται στην οικολογία των θέσεων παραγωγής και τις κοινωνικές δομές των τοπικών κοινοτήτων; Μέσα από την έννοια των τοπικών 'γνωστικών τοπίων' η παρούσα εργασία προσεγγίζει τον ρόλο της γνώσης ως κοινωνικού πόρου στα κεραμικά εργαστήρια μιας Ιταλικής ορεινής περιοχής, στα βόρεια Απέννινα, μεταξύ του ένατου και του πέμπτου αιώνα π.Χ. Η περιοχή αυτή ήταν μία συνδετήρια ζώνη μεταξύ κοινωνιών με ποικίλα πολιτιστικά υπόβαθρα, όπου η ανθρώπινη κινητικότητα διευκόλυνε τη διάδοση της γνώσης στην κεραμική παραγωγή και κατανάλωση. Συνέπεια αυτών των διαπροσωπικών και πολιτισμικών επαφών ήταν ο σχηματισμός μια ευρύτερης κοινότητας πρακτικών, όπου τα εργαστήρια έπαιξαν ενεργό ρόλο εισάγοντας νέες τεχνολογικές δεξιότητες και συρμούς προτιμήσεων εντός των τοπικών κοινοτήτων. Μία συγκριτική ανάλυση διαφορετικών διαστρώσεων γνώσης έχει εφαρμοστεί σε 37 κεραμικά εργαστήρια ξεκινώντας από το πιο βασικό επίπεδο, εκείνο της παραδοσιακής οικολογικής γνώσης που είναι απαραίτητη για την ίδρυση μιας παραγωγικής θέσης, έως το πιο περίπλοκο επίπεδο, των κοινωνικών και θεσμικών πρακτικών, όπως η εγγραμματοσύνη/μόρφωση και τελετουργικότητα μέσα σε εργαστήρια. Η γνώση και η μετάδοσή της έχουν θεωρηθεί ως άυλοι πόροι ενταγμένοι σε κοινωνικο-φυσικά δίκτυα, όπου οικολογικά, οικονομικά και κοινωνικά στοιχεία εμπλέκονται σε περίπλοκες αλληλεπιδράσεις. Τα εν λόγω 'γνωστικά τοπία' διέπονταν από συνεχείς αλλαγές μέσα σε ένα πλαίσιο μετασχηματισμών, όπως είναι οι μεταβολές στις ισορροπίες ισχύος και τις στεγαστικές στρατηγικές των τοπικών κοινωνιών. Τα τοπικά 'γνωστικά τοπία' στην κεραμική παραγωγή και τα εργαστήρια ως χώρος δημιουργίας, διατήρησης και ανανέωσής τους, φανερώνουν ότι η πολιτιστική καταγωγή και παράδοση, οι συναντήσεις και καινοτομίες αποτελούσαν συστατικά μίας καθημερινότητας στην παραγωγή αγγείων. Αυτή, επομένως, δεν ήταν μόνο θέμα πρακτικής χρηστικότητας, αλλά επίσης ένας τρόπος δόμησης κοινωνικού νοήματος και αξιών.

Keywords: resources; mobility; community of practices; urbanisation; Etruscans

The title of this paper, *local knowledgescapes*, combines two conceptual frames commonly used in anthropology and archaeology in the last few years, but never in the correlation proposed here: that of *local knowledge* and of *knowledgescapes*. Before explaining the intention of this play on words in which both terms have been combined, it is necessary to briefly present each one of them individually. The term *local knowledge* is defined by Christoph Antweiler as a social product, situated and consisting of 'factual knowledge, skills

and capability'.[1] This concept was intensively discussed in social anthropology after the publication of several works on the topic in the early 1980s, especially the homonymous book by Clifford Geertz (1993).[2] The main criticisms of the term *local knowledge* stem from its interpretation as 'indigenous' knowledge, a term which, although used in development studies to refer to the ecological and organisational involvement of local communities, has been frequently considered to be the result of a colonialist or new colonialist approach.[3] The concept of *local knowledge* has progressively evolved to become that of *Traditional Ecological Knowledge* (T.E.K.), in which attention is primarily focused on human-environmental interaction and application of local competencies, in particular in the use of natural resources.[4] The reception of the concept of T.E.K. in archaeology is limited to studies on mobile pastoralism.[5] The second concept, the '*KnowledgeScape*',[6] was introduced by Ulf Matthiesen (2005) to indicate a 'knowledge turn in a social-science-based spatial research', and has been adopted in archaeology by Friederike Jürke, Julia Montes-Landa, and Alessandro Ceccarelli (2020) in a collection of essays. The editors explain the advantages of using the term '*knowledge-scapes*' in archaeology, and define it as a 'context and environment in which knowledge evolves, changes, is transmitted and exchanged and dissolved'.[7] They claim that *knowledge-scapes* fit into the theoretical frame of contextual archaeology and, because of the properties of knowledge that are transmitted, exchanged, or based on cooperative forms,[8] also into that of the archaeology of interaction.[9]

The present paper suggests the combination of local knowledge and *knowledgescape*, by applying the new form of *local knowledgescapes* to reconsider workshops not only as production spaces, but also as places in which cultural and technical knowledge were transmitted and re-elaborated.

The cultural and geographic frame: The Etruscans and the Apennines

The region of the northern Apennines (**Figure 1**), comprising the territory between the Po and Arno valleys, encompasses about 500sq.km and includes varied geographic features: mountains from 800m to 1265m in height, with rocky ridges, high pastures areas, forests, and several lakes;[10] high hills and hill belts on both sides of these mountains, including several karstic areas, rich in thermal springs and underground waters, and also heavily eroded, uncultivable areas; complex riverine systems springing from the mountains and flowing on both sides of their ridges, northwards into the Po river or into the Adriatic Sea, and southwards into the Arno river or the Tyrrhenian Sea; finally, there are huge alluvial plains, which were largely wetlands during the Iron Age. These diverse landscapes were inhabited in different ways during the period studied here, between the ninth and fifth centuries BC. Several settlements and some isolated farmers were concentrated in the areas between the hill-belts and the wetlands, and also in the flat-bottomed riverine valleys, while a few hill-top settlements and some central religious hubs were located in the mountainous areas. The geological conditions of the more densely settled areas, with the alluvial plains and good availability of clay deposits and several minerals, were suitable to support pottery working[11] and ideal for the installation of pottery workshops, as the discovery of abundant locally produced pottery in the whole region confirms. Although few production sites are well-preserved, recent archaeological activities (especially preventive/rescue archaeology) have permitted the mapping of some ancient urban and suburban workshops, which constitute the base of the present study. It is not only the geographical and geological peculiarities, with the consequent availability of data on the pottery workshops and their environments that make this region worthy to be elected as an area of interest. The concept of *local knowledgescapes* also incites us to consider the cultural and social evaluation of *ergasteria* in local communities, and their function in the definition of local identities or supra-regional communities of practices.[12] The region of the Apennines is well-known as a liminal zone, or better put, as a huge area connecting clusters of different

[1] Antweiler 1998.
[2] In Geertz's perspective, the boundaries between local and non-local are established according to an emic approach (Geertz 1993: 58-61).
[3] For a debate on the terms 'indigenous' and 'colonial knowledge', see Dirksmeier and Flechner 2021: 16-17; Sillitoe 2006: 1-2.
[4] Berkes 2018: 26.
[5] Oteros-Rozas *et al.* 2013.
[6] The different spellings have been adopted as per the corresponding referenced works.
[7] Jürke *et al.* 2021: 4.
[8] Matthiesen 2005: 8-10.
[9] Knappett 2011. For a network approach to pottery production, see esp. pages 66-89.
[10] It is important to notice how the wetlands, and particularly the lakes, have undergone substantial change in the last 2000 years, and how most of the lakes from the Iron Age have now dried up, while others have been artificially made in the last century (for example, about Lago degli Idoli see Borchi 2007; about Lago di Albagino see Perkins *et al.* 2020; about Lago Montese di Bracciano see Badiali 2013). A huge part of the wetlands in the foothill region had already dried up by the Roman Imperial Age, at least for agricultural purposes (Ortalli 2009: 80). Nevertheless, recent geo-archaeological studies have demonstrated how the region was already particularly rich in drinkable water and waterways in the prehistory, and also show how many seasonal streams springing from the Apennines flowed down into the plains (Ferrari *et al.* 2006; Pallecchi 2011; Pizziolo 2015: 113).
[11] Clop *et al.* 2014: 26.
[12] The present paper adopts the definition of a 'community of practices' proposed by Lave and Wenger (1991), in the form elaborated by Knappett 2011: 102: communities of practices are relationally built communities, resulting from shared technological and cultural practices rather than determined by space. For the application of this concept to the archaeology of production, see also: Hasaki 2012; Hasaki and Pont 2019.

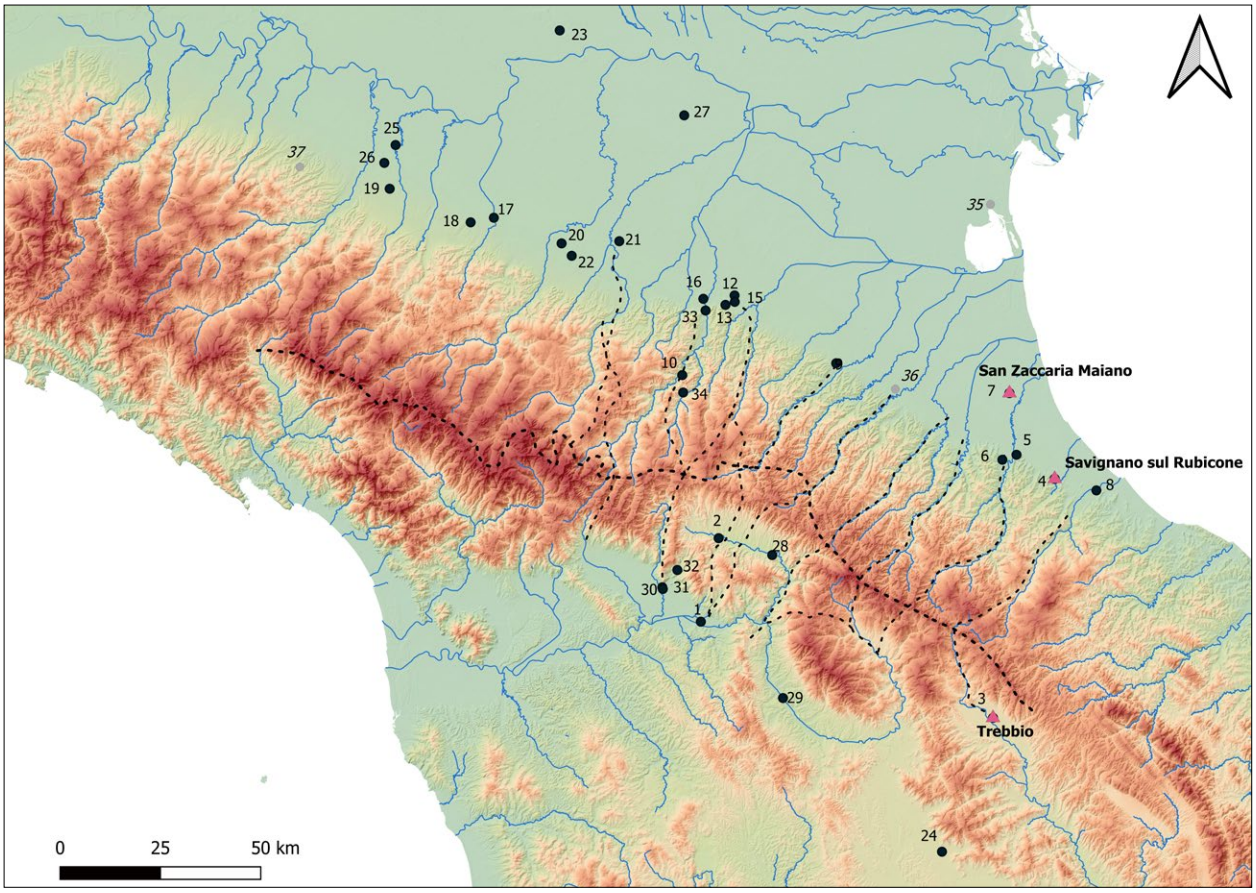


Figure 1: Pottery workshops in the Apennines and the surrounding plains between the ninth and the fifth century BC. The workshops exclusively attested by working tools, without any extant structures, are indicated by grey dots and numbers in italics. The sites using miniature pottery in cleansing rituals are indicated by red triangles (author using QGIS 3.8 DEM ESRI 3035 Copernicus 1.1; Vector data sources: see Table 1).

cultural identities, which in the Iron Age were defined by different languages, burial customs and rituals, as well as specific forms of housing. Historically, researchers have labelled these identities by using ethnic definitions, such as 'Etruscan', 'Umbrian', 'Venetic', 'Ligurian', 'Italic' and so on, based on literary sources from the early Roman Imperial Age such as Livy, Plutarch, and Pliny the Elder.[13] This interpretation was strongly influenced by the Roman vision of the region, focused on the central role of cities as administrative and commercial hubs.[14] The idea of the Apennines as boundaries has the same background, as known from a passage of Livy.[15] This view is also reflected in the late antique *itinerarium pictum*, reproduced in the Middle Age in the *tabula Peutingeriana,*[16] where the Apennines were depicted as a strong/solid geographic entity cutting the Italian peninsula in two halves. In recent decades, a more accurate contextualisation of the literary sources[17] and the progress of archaeological research invite us to discuss this division of the region into ethnic areas, and to switch to a more open conception of local societies and communities.[18] Archaeological findings indicate that local Iron Age communities perceived the Apennines as a contact zone rather than a barrier. The distribution of settlements and necropoleis shows that many routes crossed the Apennines. Communal cult places were placed at the nodal points of these routes. There, the variety of votive offerings suggests that these places were meeting points for people coming from both sides of the Apennines: they converged seasonally, probably for religious festivals.[19] The consequence of this perception of the mountains as a contact zone was the circulation of material culture and ideas, as is also reflected by some aspects of the funerary cultures and grave goods.[20] The static division of the region into territories belonging to different '*ethne*' has been

[13] For a discussion of the possible interpretative approaches to the Etruscan colonisation, see in particular: Harari 2010; Malnati 2015; Sassatelli 2008: 73-74; Zamboni 2018: 31-34.
[14] Harari 2010: 51-52.
[15] Livy 26.15.6: 'Appennini dorso Italia dividitur.', English translation by the author 'Italy is divided by the ridge of the Apennines.'
[16] Bosio and Rosada 2020: 119-121.
[17] Sassatelli 2008: 71-73.
[18] Perkins 2021: 250.
[19] Da Vela 2022b: 293-294; Da Vela 2022c: 188.
[20] Santocchini Gerg 2012; Santocchini Gerg 2021. For an analysis focused on the distribution of 'bucchero pottery', see recently Santocchini Gerg 2022.

critically regarded; moreover, ideas of human mobility across the Iron Age Apennines have changed, shifting from the idea of an Etruscan (mass) colonisation of the region to a more nuanced concept of the mobility of individuals and small groups.[21] The consequence of these new interpretations of the archaeological data has been the replacement of the colonial perspective of the nineteenth and early twentieth centuries with more flexible theoretical frameworks, such as those of liminal landscapes, frontier zones, contact zones, and socio-economic networks.[22] Although this new perspective is currently widely represented, the colonial interpretation of material culture, social change, and the economic and urbanistic turn, as well as of the territorial organisation in the countryside, does continue to be accepted.[23] Studies on pottery production have played an important role in this debate, as the choice of this topic for several recent conferences and research projects demonstrates.[24] If the equation 'pots = peoples' is clearly rejected nowadays,[25] other more subtle versions of this approach, such as 'workshops (or techniques) = peoples', or the idea that the introduction of innovation in pottery production is a consequence of 'colonisation' or acculturation, should be also avoided and critically viewed.[26] An analysis of the pottery workshops in the region that applies the concept of *local knowledgescapes* permits a more nuanced view of the introduction of innovation in local workshops and the rise of shared communities of practice in pottery production.

The dataset

The archaeological dataset of the present analysis consists of 37 pottery-production sites on the foothills of the Po plain, north of the Apennines, as well as in the northern Arno valley to the south of the Apennines and, more rarely, in the internal valleys of the Apennines themselves,[27] dating from the ninth to the fifth centuries BC (**Figure 1; Table 1**).[28] The distribution of the known evidence is affected by two main factors: the systematic excavation of some sites, in particular the city of Marzabotto, and the occasional presence of production sites in modern infrastructural building lots, which have been preventively investigated (the so-called 'rescue' investigation). Each detailed publication of a workshop, even of those partially preserved or excavated, yields precious information on the technological and spatial choices made in pottery production processes. A rich and particular set of evidence is provided by the urban workshops of Marzabotto (10-11),[29] Felsina (Bologna) (12-15), and Forcello di Bagnolo San Vito (23), which were embedded in the contemporary urban planning and by the workshop of the proto-urban settlements of Figline La Rotta (29),[30] Gonfienti layers under the Building E3 (30) and La Quercia in Val di Setta (34). For many other workshops, the relationship with the larger settlement is vague: a suburban location can be supposed for the workshops of Florence Cinema Apollo (1), San Piero a Sieve I Monti (2), Trebbio Spinellina (3), Savignano sul Rubicone (4), Cesena Tipano (6), San Zaccaria-Maiano (7), and Imola Montericco (9). The relationship between the dates and typologies of the workshops indicates a progressive development towards more efficient firing processes, with a shift from open firing structures to two-chamber kilns, and the reorganisation of the working places. These changes, which seem to have been concluded within the second half of the sixth century BC, correspond to the introduction of new forms and styles in the coarse-ware production and seem intended to increase the quantity and the quality of the products, probably meeting an analogous urban demand.

Knowledge and knowledge transfer as immaterial resources in pottery workshops

Knowledge in a pottery workshop is not limited to the competence and skills required for the making of pots. Certain types of knowledge were necessary, even long before the pottery making started, in order to choose the site and plan the installation of the working space. In this phase, the T.E.K. of local geomorphological and climatic conditions, the availability of raw materials and the systems of infrastructure was required.[31] After choosing the workshop location, the planning process of the working spaces probably began. This second phase was integrated into the first one and must have included water management, as well the storage and preparation of the clay. After this, the kilns were constructed in a specific form, responding to the requirements of the production and the competencies of the potters. If the kiln-makers and the potters were not the same persons, then they must have already cooperated at this first stage of planification of the site. After the construction of the workshop (the

[21] Zamboni 2018: 238-239.
[22] Sassatelli 2008: 418; Zamboni 2012; Zamboni 2018.
[23] Labate 2006: 4; Malnati 2015: 1438-1439.
[24] See Cappuccini and Gaucci 2022.
[25] For a synthesis on this discussion, see Clop *et al.* 2014: 26.
[26] Loney 2000, with a review of the models of technological change in ceramic studies.
[27] Although the kilns in Poggio Colla and Podere Funghi date to the Hellenistic period, their design, as well as the working tools, present strong analogies with the earlier ones. On the arx of Poggio Colla (28), earlier kilns are also known: Vander Poppen 2013: 172, footnote 27.
[28] The principal features of the workshops, their sites, and their general bibliographic references are stated in **Table 1**. The identification numbers in the first column of the table correspond to those on the map (**Figure 1**) and within brackets – by the workshops names – in the text.
[29] The present paper refers to the general bibliography on pottery production in the city (Morpurgo 2017; Morpurgo *et al.* 2017). For an analysis of the workshops' features, House 1 of Regio IV, Insula 2 has been selected as a case-study (**Table 1**), since the context was particularly well-preserved, thoroughly excavated and published: Govi 2010: 189-191; Pozzi 2010.
[30] Giroldini 2022: 19-21.
[31] Clop *et al.* 2014: 26.

No.	Site	References	k	ph	O	R	Y	C	H	•	D	U	W	p	T	X	Date centuries BC
1	Florence Cinema Apollo	Cianferoni and Da Vela 2015; Da Vela 2019; Da Vela 2022a	10	3	■		■	■	■		■	■	■	■	■		6th - first half 5th
2	S. Piero a Sieve I Monti	Salvini 1994; Salvini and Salvadori 2022	2	2	■			■						■			7th - first half 5th
3	Trebbio Spinellina	Gliozzo *et al.* 2013; Iaia and Moroni Lanfredini 2009	3	3	■			■			■	■			■	■	7th - 6th
4	Savignano sul Rubicone	Miari 2003	12		■		■		■	■		■	■	■	■	■	7th - 6th
5	Cesena Foro Annonario	Gasparini 2016: 43-44	1	1	■				?	■	■	■		■	■		7th - 6th
6	Cesena Tipano	Gelichi and Negrelli 2008: 61, OSV018; Miari 2016: 149-150	1		■												6th - 5th
7	S. Zaccaria-Maiano	Miari *et al.* 2008	2	2	■			■				■		■	■	■	6th - early 5th
8	Verucchio Pian del Monte	Miari 2003: 510; Taglioni 1997: 215	3		■												9th
9	Montericco	Masi von Eles 1982: 142	1		■											?	6th - 5th
10	Marzabotto Regio IV,2 Casa I	Govi 2010: 189-191; Morpurgo *et al.* 2017; Pozzi 2010	9	3	■	■				■		■		■	■		5th
11	Marzabotto Regio II,1	Pozzi 2010: 277-279; Sassatelli 2011	1			■				■				■	■		5th
12	Bologna S. Donato	Vanzini 2019: 24	2		■												second half 8th
13	Bologna S. Domenico	Miari 2003: 511	1		■										■		8th - 6th
14	Bologna Villa Cassarini	Romagnoli 2014: 77-82	1		■										■		end 6th - early 5th
15	Bologna S. Vitale	Taglioni 1997	17		■	■			■	■	■		■				first half 8th
16	Casteldebole	Miari 2003: 511	4		■												
17	Reggio Emilia S. Claudio	Miari 2003: 511; Taglioni 1997: 216-217	1		■				■	■							6th
18	S. Bartolomeo Case Bigi	Miari 2003: 511	2		■				■								first half 6th
19	Gaione	Locatelli 2013a: 12; Miari 2003: 511	1		■							■					
20	Formigine	Cardarelli and Malnati 2006: 268-270, FO 245, fig. 451	1	1	■		■		■			■		■			7th - 6th
21	Magreta	Cardarelli and Malnati 2006: 270-272, FO 900, FO 908			■		■		■			■		■	■		6th - 5th
22	Baggiovara	Miari 2003: 512; Stoppani and Zamboni 2009	3		■	■			■					■			6th - 5th
23	Forcello di Bagnolo S. Vito	De Marinis and Rapi 2007: 73-75			■	■							■				second half 6th
24	Cortona Fossa del Lupo	Fedeli *et al.* 2007	3	1	■		■			■	?						second half 6th
25	Baganzola	Catarsi 2013	3		■												second half 6th
26	S. Pancrazio	Guidorzi 2013	9	2	■				■			■	■		■		6th - early 5th

Table 1: Workshops in the region of the Northern Apennines (seventh to fifth centuries BC), with bibliography and particular features: (k) number of kilns, (ph) phases, (O) round kilns, (R) rectangular kilns, (Y) wall-trace deviating the kiln mouth, (C) stone closing the front of the kiln mouth, (H) cylindrical stand, (•) perforated floor, (D) dolium fragments as structural parts, (U) working pit in front of the kiln mouth, (W) simultaneous work at different, adjacent kilns, (p) system of water-pipes or channel, (T) roofed area, (X) cleansing rituals. *In italics: workshops suggested indirectly through working tools.*

No.	Site	References	k	ph	O	R	Y	C	H	•	D	U	W	p	T	X	Date centuries BC
27	Barchessone Cappello	Cardarelli and Malnati 2003: 65-68; MI 121, MI 126, MI 130	2,1;1	1	■							■	■				7th - 5th
28	Vicchio Poggio Colla	Fedeli and Warden 2005; Olcese 2012: T072; Pelacci 2022: 437; Warden *et al.* 2005: 258-262	4		■					■							4th - 2nd
29	Figline La Rotta	Fedeli *et al.* 2013; Giroldini 2022; Giroldini and Baldini 2020	4	3	■				■	■	?				■		5th
30	Gonfienti	Pagnini 2022a: 180-182 (*Rastrelli 2002*)	1	1	■						■						6th?
31	Campi B. via del Pantano	Tuci 2022	1	1	■												End 6th - early 5th
32	Calenzano Carraia	Tuci 2007	2	2	■						?						6th
33	Casalecchio di Reno	Ortalli 2002	1	1	■												
34	La Quercia in Val di Setta	Desantis *et al.* 2022	5		■		■		■	■				■			6th - 5th
35	*Argenta*	Taglioni 1997: 216; Stoppani and Zamboni 2009: 378							■								
36	*Faenza Piazza d'Armi*	Masi von Eles 1982: 197							?	■							second half 6th
37	*Salsomaggiore*	Taglioni 1997: 215							■								

Table 1: Continued.

site of production), other levels of knowledge were activated, namely those related to the *production* itself: the preparation of raw material, the making of the pots, their decoration, and their firing. Just as in the construction of the workshops, these different areas of technical knowledge may have been embodied in one person or a group of persons (for example, in the case of small family workshops), or may have been delineated as different professions. As unexpected as it seems, even the disposal of the workshop could be considered a phase in which special knowledge was required, as testified by frequent evidence of meticulous methods for separating materials, and complex processes for closing kilns and pits, as well as the ritualised cleansing of the firing structures and clay sources.[32] Once we have clarified that knowledge and knowledge transfer relate to all these different phases, from the installation to the abandonment of the workshops, it becomes possible to analyse different knowledge layers in detail, in order to understand how this knowledge constituted a resource for local communities.[33]

The first layer of knowledge comprises the ability to choose the right site. In the collected archaeological record, it is possible to identify two trends. The first one is present as early as the end of the Villanovan period (up to the ninth century BC), and consists in the choice of a site with particularly favourable geological and geographical conditions. Many workshops were installed in loamy and sandy areas rich in clay deposits and water, frequently near a stream (or a secondary brook). This preference endured over the following centuries and could be partially verified as characterising the sites at Florence Cinema Apollo (1), Savignano sul Rubicone (4), or Cesena Tipano (6). From the second half of the seventh century BC and in particular during the following sixth century BC, another trend emerges, though it did not completely replace the first one. Workshop locations from this period are often chosen for their proximity to a sanctuary, as in Marzabotto near Tina temple, or they appear embedded in an urban system, as in Marzabotto itself (10-11) or Forcello di Bagnolo San Vito (23), where more workshops and craft activities were clustered in specialised areas.[34] The knowledge relating to the workshop location is thus primarily configured as *Traditional Ecological Knowledge* (T.E.K.), evolving into a more complex combination of environmental and social factors with the rise of urbanisation.[35] In both

[32] These disposal rituals have been considered by Mario Denti as a way of preserving the social memory of pottery-making within local communities: Denti 2014.

[33] Here, the word 'resource' refers to any tangible or intangible means of acquiring something particularly valuable for society, which requires a conversion of economic and cultural capital: Bartelheim *et al.* 2021: 9; Hardenberg *et al.* 2017: 14.

[34] On the question of crafts/artisans' quarters in ancient Greek cities, see Sanidas 2019.

[35] On the urban turn in the Po plain and the Arno valley, see Malnati

Figure 2: Infrastructural embedding of pottery workshops in their socio-natural networks. View of the Reno Valley from the plateau at Marzabotto (photo by the author).

Figure 3: Several workshops north of the Apennines were located in the Secchia Valley, which was rich in raw materials and constituted a natural route toward the Apennines (photo by the author).

cases, another fundamental criterion arising from this knowledge is the good integration of workshops into infrastructures of supra-local connectivity and communication, such as the regional routes leading to mountainous passes, or the riverine network (**Figures 2** and **3**).[36]

A second layer of knowledge can be observed in the internal organisation of the workshop, ruled by precise ergonomic parameters.[37] Within our sample of workshops, some strategies for the regulation of water supply were adopted both north and south of the Apennines, for example, the use of a channel simply excavated in the ground and crossing the area diagonally with respect to the production facilities, such as in Florence Cinema Apollo (1), San Piero a Sieve I Monti (2) and Cesena Foro Annonario (5). There are other remarkable similarities in the measurements and spatial relationships between the kilns and the roofed areas intended for shaping/modelling, drying, and storing pots, which are found in immediate proximity to the main kiln: Florence Cinema Apollo (1), Savignano sul Rubicone (4), Cesena Foro Annonario (5), San Zaccaria-Maiano (7), and Barchessone Cappello (27). There are also common specific spatial arrangements, which aim to facilitate the firing and moving of both raw materials and final products, such as an excavated depression in front of the kiln entrance, sometime serving several kilns in alternating use, and profiting from proximity to the kiln during warming and cooling processes: Florence Cinema Apollo (1), Trebbio Spinellina (3), Savignano sul Rubicone (4), San Zaccaria-Maiano (7), and Forcello di Bagnolo San Vito (23). Furthermore, a slightly deviated line for the wall of the kiln mouth to allow better control for stoking and ventilating of the fire is present at multiple sites: Florence Cinema Apollo (1); Savignano sul Rubicone (4), Cortona Fossa del Lupo (24), and Vicchio Podere Funghi (Hellenistic). Finally, the use of a massive stone in front of the entrance to maintain the temperature is also attested on both sides of the Apennines: Florence Cinema Apollo (1) and San Zaccaria-Maiano (7).

2015: 1439-1441; Poggesi 2011: 40-41; Sassatelli 2010.

[36] This is the case, for example, with the workshop at San Piero a Sieve I Monti (2), in terms of transport route connection to the mountain passes (Della Futa, Dell'Osteria Bruciata and del Giogo): Salvini and Salvadori 2022: 471; Sarti 2020: 226.

[37] The term 'ergonomics' refers to the study of the relationship between workers and working space in the workflow: Da Vela 2022a: 31-32; Wilson 2000: 560.

A further level of knowledge is displayed in the choices of form for the kilns. Kilns across the entire area covered by this study present a progressive standardisation in their general form, consisting of a two-chamber kiln with a vertical structure, separate firing and combustion chambers,[38] a circular outline, provisory clay vault, and short *praefurnium* (stoking chamber).[39] It is also possible to note some particular differences in kilns of the same typology. For example, the form of the perforated floor can vary. In many cases, these floors are similar to those of Greek kilns,[40] supported by one or more cylindrical stands, but sometimes the floor itself is replaced with bars supported on the stands. Further variation can be found in the kinds of support used.[41] The stratigraphic dating and comparison of finished products, where available, indicate the simultaneous use of a few different morphologies/forms of perforated floor, even for the same kind of products. Nevertheless, the use of different forms of kilns within the same workshop is very seldom and recurs only in urban contexts, where we could suppose that this was due to the presence of a higher number of craftsmen, probably including some foreign craftsmen.[42]

Moving on to the phase of the actual pottery fabrication, two special case-studies have been selected, the first relating to technical choices and the second to form-related choices. This limited selection is necessary, as it is impossible to provide a complete review of the features of every pottery class in the region here. The first case examined is vacuolated pottery (ceramica vacuolata or vacuolare), attested from at least the end of the sixth century BC and enduring until the Medieval period (fifteenth century AD). Vacuolated pottery is a coarse ware featuring the use of particular inclusions, probably calcite fragments, or alternatively the use of clay naturally rich in calcite. Once exposed to the firing process in the kiln, the calcite undergoes a chemical reaction, in which a part of the compound is transformed into carbon dioxide and evaporates, leaving small structured polyhedral holes (vacuole) in the body of the pot.[43] The pots resulting from this technical knowledge are not suitable as cooking pots, since they are not heat-resistant, but they have a special capacity to maintain the temperature of food or liquid stored in them, and are particularly light and resistant to mechanical stress, breakage and wear, so they are well suited as transport and storage containers.[44] This type of manufacture needs a specific technical knowledge, in response to functional purposes, applied to different pot shapes and in combination with different kinds of clay. More extensive archaeometric analysis could facilitate attribution of these vases to local workshops rather than to commercial exchange. However, their attribution to local manufacturers (wherever such analysis has been performed),[45] as well as their utility and place as coarse-ware in households, and their consistency with known local pottery shapes, allows us to propose a wider diffusion of this specific technical knowledge on both side of the Apennines, as early as the Late Archaic period (**Figure 4, Table 2 v**).

The second case study can be considered skeuomorphic or functionally skeuomorphic:[46] referring to the decoration in form multiple grooves on the vase wall, known as 'a solcature' or 'strigilata'.[47] This plastic decoration was effectuated with lines of horizontal single grooves and the application of cords encircling the collar between the rim and shoulder of containers and other cooking pots, and can be identified from very early on, even in rare contexts dating from the Late Bronze Age, on the Po plain.[48] A turn in the frequency of use can be detected during the second half of the seventh century BC, when the decoration became standardised in the form of deep grooves, especially on containers (*ollae*) with a straight and inverted rim. It clearly became very popular in workshops on both sides of the Apennines, for example at Florence Cinema Apollo (1), San Piero a Sieve I Monti (2) and Forcello di Bagnolo San Vito (23). At that time, this decoration was also widely distributed in terms of consumption patterns (**Figure 4, Table 2 s**). In the fifth century BC, a similar decoration can be also found on fine pottery,[49] where the possible functional aspects of the grooved surface (allowing for better grip and suspension

[38] Cuomo di Caprio 2007: Type 1; Roux 2019: 118 (vertical updraft kiln); Sotgia 2019: Type 3.2.

[39] The public kiln of Tina temple in Marzabotto is an exception (Sassatelli 2011: 152-153), as it is rectangular and larger than the curved ones.

[40] Fragments of the perforated floor have been found at Cesena Foro Annonario (5), in an archaeological context dating from the first half of the sixth century BC, and at Faenza Piazza d'Armi (36), in a context from the second half of the sixth century BC.

[41] The identification of such stands in the early bibliography can be difficult, because of their similarity to kiln spacers. On this topic, see Taglioni 1997: 214-217. Recently, more attention has been paid to the identification of these objects *in situ*, within their excavation context. For example, Monica Miari was able to identify three pots (*ollae*) employed as stands for the perforated floor in a kiln of Cesena Tipano (6): Miari 2016: 149-150, fig. 2.3.B.

[42] Rectangular and round kilns, as at Marzabotto, are present in similar urban workshops in some Greek colonies, e.g. at Selinus (Bentz *et al.* 2013) and Naxos (Lentini 2012). For possibly shared knowledge on pottery-workshops at Marzabotto with Greece and Magna Graecia, see Morpurgo *et al.* 2017: 116-117.

[43] For the general characteristics of the paste, see Giannichedda and Quirós Castillo 1997. For a detailed description based on archaeometric analyses (Fourier Transformed Infra-Red Spectroscopy), see Poggiali and Serafini 2022; Serafini 2019: 146-149.

[44] Serafini 2019: 149-150.

[45] Poggiali 2017: 120-122; Poggiali and Serafini 2022.

[46] A possible function of this moulded decoration as to provide a better grip on the vases, especially after their exposure to heat as cooking-pots, has been proposed by Casini 2007: 249.

[47] Buoite and Zamboni 2008: 73, Type 1; Salvini and Salvadori 2022: 476.

[48] The grooves and cords were in the Bronze Age pots only slightly embossed: Cardarelli and Malnati 2003: 146, CA 365, fig. 86.

[49] Masi von Eles 1982: 307-308 (Covignano, Seminario); Perkins 2022: 373 on 'bucchero' vases (Poggio Colla).

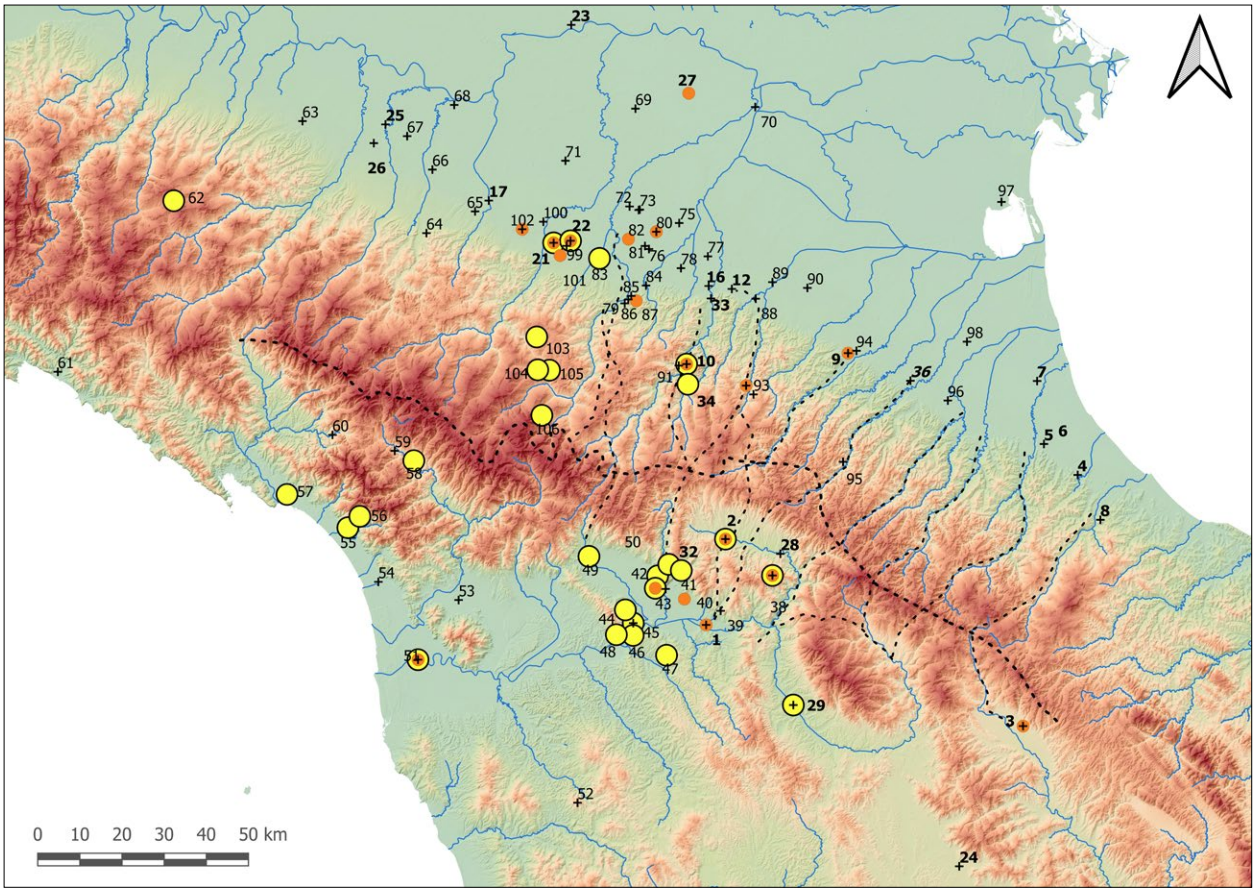


Figure 4: Distribution map of the vacuolated pottery (marked by yellow dots), strigilated (orange dots) and impressed pottery (marked by crosses) (author using QGIS 3.8 DEM ESRI 3035 Copernicus 1.1; Vector data sources: see Table 2. 2).

using ropes) were discarded in favour of its purely skeuomorphic value.

Potters on both side of the Apennines not only seem to share such technical and morpho-functional or decorative choices, but also other forms of knowledge, especially regarding the personalisation of pottery and clay objects, using specific impressed motives (*decorazione a punzone* or *stampigliata*), in the form of circles and 's'-shapes (**Figure 4, Table 2 X**).[50] These motives appear to respond to a desire to personalise the final products, rather than to indicate their production places. In any case, the frequent use of the same type of impressed motives both north and south of the Apennines, especially on textile tools (loom weights, spools and spindles), but also on storage pots, and eating and drinking pots, suggests shared habits in both the production and consumption of pottery. Impressed pottery, although very widespread in household and funerary contexts, has only been found in a few of the known workshops, for example at San Piero a Sieve I Monti (2) in the Mugello Valley.[51] The pots produced here show impressed decoration like those found in the Idice and Reno valleys north of the Apennines, which are usually attributed to the production of workshops at Felsina. These motifs, which must be imprinted before the objects are fired, display knowledge of the social values and symbolic codes of the local societies being utilised in the workshops where they were made.

Finally, there is one particular field of knowledge that indicates how the shared practices in pottery production across different geographical areas and regions cannot be exclusively attributed to the objects' agency, namely the ritualised disposal of kilns and workshops before their abandonment. The shared behaviours and protocols used when abandoning these production facilities suggests not only the common perception of pottery production as a ritual act, but also contact across regions within the craftsmen's milieu, facilitated by personal mobility. These ritual acts especially involved the use of miniature pots and other objects, intentionally disposed of in the abandonment layers,

[50] Cappuccini 2022: 332-335; Neri 2007; Salvini and Salvadori 2022: 476; Santocchini Gerg 2012; Sassatelli 2008: 90. A potter's working set, including a double-faced clay stamp to impress circles, has been found among the grave offerings of a rich woman in Casalecchio sul Reno: Kruta Poppi 2015: 109-110 nos 7-9.

[51] Salvini and Salvadori 2022: 476-478.

No.	Site	X	v	s	References
1	Florence Cinema Apollo	●		●	Da Vela 2019: 37; Santocchini Gerg 2012: 237-238
2	S. Piero a Sieve I Monti	●	●	●	Salvini 1994; Salvini and Salvadori 2022
3	Trebbio Spinellina	●		●	Iaia and Moroni Lanfredini 2009
4	Savignano sul Rubicone	●			Miari 2022: 209, fig. 2.
5-6	Cesena Foro Annonario, Tipano	●			Miari 2016: 149; Miari 2022: 209-210; Negrini 2022: 223-224, fig. 4; Santocchini Gerg 2012: 242-243
7	San Zaccaria-Maiano	●			Miari *et al.* 2008: 31-32
8	Verucchio Pian del Monte	●			Santocchini Gerg 2012: 225-241
9	Montericco	●		●	Masi von Eles 1982; Negrini 2022: 220
10-11	Marzabotto Regio IV,2, Casa I, Regio II,1	●	●	●	Santocchini Gerg 2012; Serafini 2019: 151, fig. 4.
12-15	Bologna S. Donato, S. Domenico, Villa Cassarini, S. Vitale	●			Santocchini Gerg 2012: 226-242
16	Casteldebole	●			Santocchini Gerg 2012: 233-238
17	Reggio Emilia S. Claudio	●			Santocchini Gerg 2012: 235-236
18	S. Bartolomeo Case Bigi				Miari 2003: 511
19	Gaione				Locatelli 2013a: 12; Miari 2003: 511
20	Formigine				Cardarelli and Malnati 2006: 268-270, FO 245, fig. 451
21	Magreta	●	●	●	Cardarelli and Malnati 2006: 270-271, FO 900; Neri 2007: 97
22	Baggiovara	●	●	●	Santocchini Gerg 2012: 232-235; Stoppani and Zamboni 2009
23	Forcello di Bagnolo S. Vito	●			De Marinis and Rapi 2007; Santocchini Gerg 2012: 232-245
24	Cortona Fossa del Lupo	●			Cappuccini 2022: 335; Da Vela and Krämer 2022
25	Baganzola	●			Buoite 2013b: 55
26	S. Pancrazio	●			Buoite 2013a: 25; Stoppani 2013: 7
27	Barchessone Cappello			●	Cardarelli and Malnati 2003: 68, MI 130
28	Vicchio Poggio Colla	●			Santocchini Gerg 2012: 230-235
29	Figline La Rotta	●	●		Agresti *et al.* 2022; Giroldini 2022: 51-52
30	Gonfienti	●			Pagnini 2022b: 191-192
31	Campi B. via del Pantano				Tuci 2022
32	Calenzano Carraia		●		Poggiali and Serafini 2022: 463-464 no. 83; Tuci 2007: 150
33	Casalecchio di Reno	●			Kruta Poppi 2015: 105-109
34	La Quercia in Val di Setta		●		Desantis *et al.* 2022: 187
35	Argenta				Taglioni 1997: 216; Stoppani and Zamboni 2009: 378
36	Faenza Piazza d'Armi	●			Negrini 2022: 222-224, fig. 4; Santocchini Gerg 2012: 224, fig. 1
37	Salsomaggiore				Taglioni 1997: 215
38	Monte Giovi	●	●	●	Cappuccini 2017; Poggiali 2017; Poggiali and Serafini 2022
39	Fiesole	●			Santocchini Gerg 2012: 231-234
40	Querciola Sesto f.no			●	Agresti and Zannoni 2014: 208-216, fig. 126.7-9, fig. 130.5-7
41	Prato La Retaia		●		Perazzi and Poggesi 2011: PO 63
42	Prato La Pietà		●		Perazzi and Poggesi 2011: PO 69
43	Prato Fonti Alte		●	●	Perazzi and Poggesi 2011: PO 53
44	Carmignano Castello		●		Serafini 2019: 152
45	Artimino	●	●		Serafini 2019: 151, fig. 4
46	Pietramarina		●		Poggiali and Serafini 2022; Serafini 2019
47	Poggio la Sughera		●		Serafini 2019: 152
48	Montereggi		●		Serafini 2019: 151, fig. 4
49	Pistoia		●		Poggiali 2017: 119
50	Montale Alto		●		Poggiali and Serafini 2022: 463-464 no. 81
51	Pisa	●	●	●	Neri 2007: 14-15; Serafini 2019: 151, fig. 4
52	Volterra	●			Santocchini Gerg 2012: 230
53	Lucca	●			Santocchini Gerg 2012: 228-229, 240
54	S. Rocchino	●			Santocchini Gerg 2012: 228-244

Table 2: Distribution of impressed (X), vacuolated (v) and strigilated (s) pottery (see **Figure 2**), with bibliography. Numbers 1 to 34 refer to the production sites discussed in the paper (cf. **Table 1**).

No.	Site	X	v	s	References
55	Borra dei Frati		●		Serafini 2019: 151, fig. 4
56	Azzano		●		Poggiali 2017: 219
57	Luni		●		Poggiali 2017: 126-127, fig. 112.2-3.
58	La Murella		●		Poggiali 2017: 123
59	Camporgiano	●			Santocchini Gerg 2012: 247, fig. 2
60	Codiponte	●			Santocchini Gerg 2012: 247, fig. 2
61	Chiavari	●			Santocchini Gerg 2012: 228-235
62	Monte Menegosa		●		Poggiali 2017: 126
63	Fidenza (Siccomonte)	●			Santocchini Gerg 2012: 227
64	S. Polo di Servirola	●			Neri 2007: 95-96; Santocchini Gerg 2012: 227-235
65	S. Rigo Biasola	●			Santocchini Gerg 2012: 235
66	S. Ilario d'Enza	●			Santocchini Gerg 2012: 224, fig. 1
67	Pedrignano	●			Stoppani 2013: 7-8
68	Brescello	●			Neri 2007: 73; Santocchini Gerg 2012: 225
69	Mirandola	●			Neri 2007: 81 f., Santocchini Gerg 2012: 224, fig. 1
70	Bondeno	●			Neri 2007: 73-74; Santocchini Gerg 2012: 233-236
71	Carpi	●			Cardarelli and Malnati 2003: 149-150, CA 107; Neri 2007: 77-78
72	Nonantola	●			Neri 2007: 83-84
73	Pod Puglia	●			Cardarelli and Malnati 2003: 120-121, NO 173
74	Pod Golfiera	●			Cardarelli and Malnati 2003: 119-120, NO 82
75	San Giovanni in P.	●			Neri 2007: 90-94
76	Castelfranco Emilia	●			Neri 2007: 79-80
77	Calderara di Reno	●			Neri 2007: 76.
78	Anzola dell'Emilia	●			Neri 2007: 73-74
79	Savignano sul Panaro	●			Neri 2007: 88-89
80	Rastellino	●		●	Cardarelli and Malnati 2009: 56-57, CE 146
81	Galoppatoio	●			Cardarelli and Malnati 2009: 51, CE 108; Neri 2012: 17–118
82	Campazza			●	Cardarelli and Malnati 2009: 62, CE 392
83	Canneti		●		Cardarelli and Malnati 2009: 270-271, CR 9
84	Bazzano	●			Neri 2007: 65-72; Santocchini Gerg 2012: 229-240
85	S. Anastasia	●			Cardarelli and Malnati 2006: 179, SV 34
86	Formica	●			Cardarelli and Malnati 2006: 174, SV 15
87	Pasano			●	Cardarelli and Malnati 2009: 173, SV 7
88	Caselle S.Lazzaro	●			Santocchini Gerg 2012: 228-238
89	Castenaso	●			Santocchini Gerg 2012: 236
90	Fossatone	●			Negrini 2022: 222-223
91	Pian di Venola	●			Santocchini Gerg 2012: 237-238
92	Ca´ di Bugané	●		●	Ammirati 1990: 78-80
93	Pianella di Montesavino			●	Unpublished. Museo di Monte Bibele, Monterenzio
94	Imola	●			Santocchini Gerg 2012: 224, fig. 1
95	S. Martino in Gattara	●			Negrini 2022: 218-228, figs. 2-5; Santocchini Gerg 2012: 224, fig. 1
96	Villanova	●			Santocchini Gerg 2012: 228-238
97	Spina	●			Santocchini Gerg 2012: 227-239
98	Russi	●			Negrini 2022: 220; Santocchini Gerg 2012: 233, 236
99	Casinalbo	●			Cardarelli and Malnati 2006: 271, FO 246
100	Rubiera	●			Neri 2007: 85-87; Santocchini Gerg 2012: 235-242
101	Corlo			●	Cardarelli and Malnati 2006: 261, FO 3
102	Cacciola di Scandiano	●		●	Santocchini Gerg 2012: 230-231, 239
103	Pompeano		●		Cardarelli and Malnati 2006: 72
104	Ponte d'Ercole		●		Cardarelli and Malnati 2006: 165, PO 9
105	Monzone-La Casaccia		●		Cardarelli and Malnati 2006: 115, PA11; Serafini 2019: 155-156
106	Sestola		●		Cardarelli and Malnati 2006: 188, SE19

Table 2: Continued.

in particular within the kilns and clay pits,[52] before the cleansing of the working area, which consisted of levelling and filling kilns and pits (**Figure 1**, red triangles). This ritual practice is known in workshops abandoned during the second half of the sixth century BC, on the eastern side of the region studied here. The exploitation of the same immaterial resources in workshops on both sides of the Apennines shows how local potters took a similar approach to resolving specific problems or goals of the production process: the installation of the workshop in a topographically convenient site, the water management, the supply of clay and other necessary raw materials, and the control of fire and wind. Here, we can detect a shared local ecological knowledge in the region. Moreover, local *knowledgescapes* present a similar response to social needs and social changes, such as the organisation of the working spaces, the use of impressed decoration and later of inscriptions to make the objects unique, and the use of special techniques or formal features to respond to specific functional needs (as in vacuolated pottery and strigilated *ollae*). Finally, similar ritual behaviours can be observed during the disposal of the place of production.

Nevertheless, these shared practices relating to technical, form-related/stylistic, socio-economic or religious knowledge appear in different combinations in each individual local workshop. There is, for example, no evident link between technical choices related to the presence of a perforated floor or some other form of division between firing chamber and vessel chamber, and the type of objects produced. Similarly, no uniformity can be found between the workshop design and different layers of cultural knowledge, such as that necessary for the cleansing rituals. For example, the workshops at Trebbio Spinellina (3), Savignano sul Rubicone (4), and San Zaccaria-Maiano (7), where miniature pots and miniature objects were deposited at the bottom of the kiln or clay pits before filling them in, only share isolated aspects, such as the form of the kilns and the organisation of the space, with multiple kilns accessible from a common working area. Other aspects, such as the water management, are different, all variously adapted to local conditions. The final products are also different, probably adapted to local demand. For the moment, it is not possible to establish the ways in which knowledge was transferred and combined in these different contexts. Even if the similarities in the general planning and management of the working areas could eventually be considered as an adaptation to the natural preconditions of each site, it remains difficult to explain how and why similar rituals were performed at the end of the kiln's productive life. The different constellations of each workshop indicate that complex models should be suggested to guide future enquiry, combining the mobility of single craftsmen or professional groups, the exchange of knowledge within social networks, the transmission of knowledge in the form of temporary contacts and encounters, and the imitation of objects and forms.

A complex of knowledge, resources and knowledge on resources in pottery workshops

In order to take the analysis to another level, we must take into account the fact that these places of production were embedded into their resource landscapes and regional transport route systems, and therefore consider the workshops as elements of complex socio-natural networks.[53] Pottery workshops show a recurring pattern in their geographic positioning. They were located close to streams and are more frequently found in the plains regions, between hill-belts and the wetlands. Furthermore, they were usually placed close to settlements, as at San Piero a Sieve I Monti (2), Savignano sul Rubicone (4), and San Zaccaria-Maiano (7); in proximity to the main routes leading to the mountain paths, or directly embedded in the urban context, as at Marzabotto (10-11), Felsina (Bologna) (12-15), and Forcello di Bagnolo San Vito (23), where they were integrated into the transport route networks. This fact indicates that the purposes of pottery production, although oriented to local demand, were not exclusively limited to the local market. The integration of the workshops in their resource landscapes must have required a combination of material and immaterial resources, as well as a certain level of infrastructure. Most of the workshops are thus found in areas rich in raw materials, such as clay from the alluvial plains and fuel from the nearby bushy foothills. They were strategically positioned within the communication network for the transportation of the materials themselves, but especially for the more fragile final products, and they were also linked to a local source of demand, constituted by their own local urban populations or that of neighbouring communities.

The workshops were not only integrated into similar socio-natural networks, but also played an active role within them, since they were productive hubs, which trigger the mobility of people, objects and resources. This is for example suggested by the presence of similar ritual practices before the abandonment of the workshops on both sides of the Apennines mentioned above: at Trebbio Spinellina (3), Savignano sul Rubicone

[52] Within the kiln at San Piero a Sieve I Monti (2): Bechi 2022: 426; Salvini 2009: 27. Also at Trebbio Spinellina (3): Da Vela 2022b: 286. In the pits: Savignano sul Rubicone (4): Miari 2003: 510; San Zaccaria-Maiano (7): Miari *et al.* 2008: 32.

[53] The term socio-natural is here used to denote a frame in which ecological and technological aspects are so tightly intertwined, that they are impossible to consider separately from each other. See Arias Maldonado 2015: esp. 55-71.

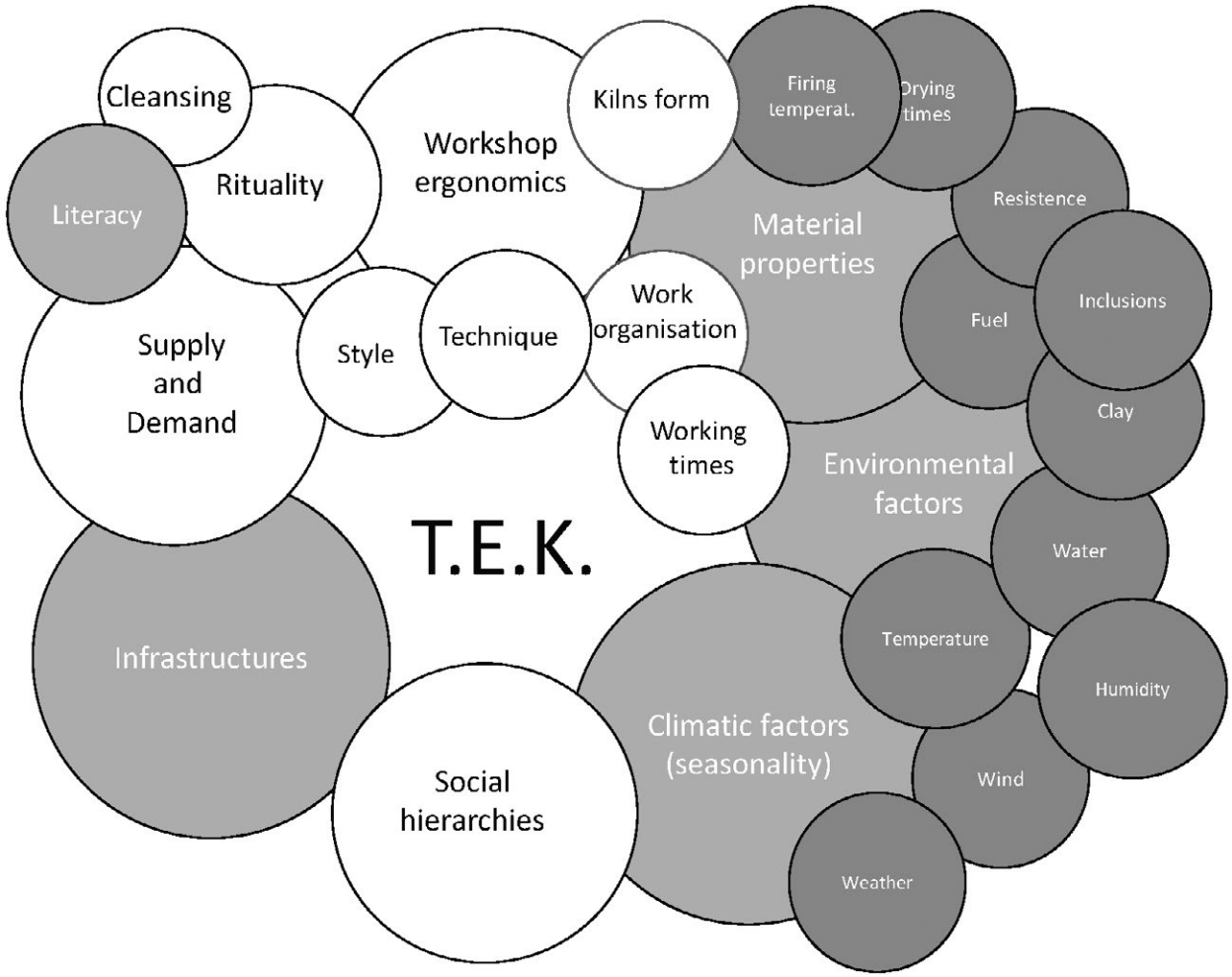


Figure 5: *Knowledgescapes* as 'ResourceComplexes'.

(4), and San Zaccaria-Maiano (7). These three workshops were geographically connected by the main route across the mountain, running through the Casentine Valley and to the Pratomagno upper trail. One of these resources is, as discussed above, knowledge. Rik Vaessen has already suggested that transmission, change and innovation in pottery production were the result of agency distributed across a hybrid network of humans and things.[54] Mohamed-Ali Berhouma, in his analysis of the workshops as places of creative interaction between matter, images, and artists or craftsmen, also presents the entanglement of knowledge and change as a part of the workshop routine.[55] These remarkable approaches, which permit us to consider knowledge and innovation in pottery production as the dynamic results of interaction between humans and things, may be especially fruitful when integrated into the conceptual frame of the 'ResourceComplex', a meshwork of material and immaterial resources, and related socio-cultural dynamics.[56]

The first level of our enquiry analysed knowledge and knowledge transfer as immaterial resources in the pottery workshops. Considering these specific resources as part of the 'ResourceComplex' *knowledgescape* (**Figure 5**), we can observe how different levels of knowledge were intertwined with many other tangible and intangible resources. These include environmental and climatic factors, the properties of the worked raw materials, local and regional infrastructures, as well as the related socio-cultural dynamics, such as economic supply and demand, social hierarchies and structures, spatial and social organisation of the work, and rituality. This network perspective presents clear advantages over a teleological view of the workshop as a production space. Though these aspects are still present, a network perspective focuses far more on the interconnection between acts, meanings and values. The workshop is seen as a place in which both the knowledge necessary for pottery production and the social value of that knowledge were transmitted and negotiated. Consequently, the chaîne opératoire is conceived of here as a flow of skills, consisting of variously ritualised or embodied acts and information, which

[54] Vaessen 2014: 130.
[55] Berhouma 2017.
[56] Bartelheim *et al.* 2021: 13-15; Klocke-Daffa 2017: 254-256.

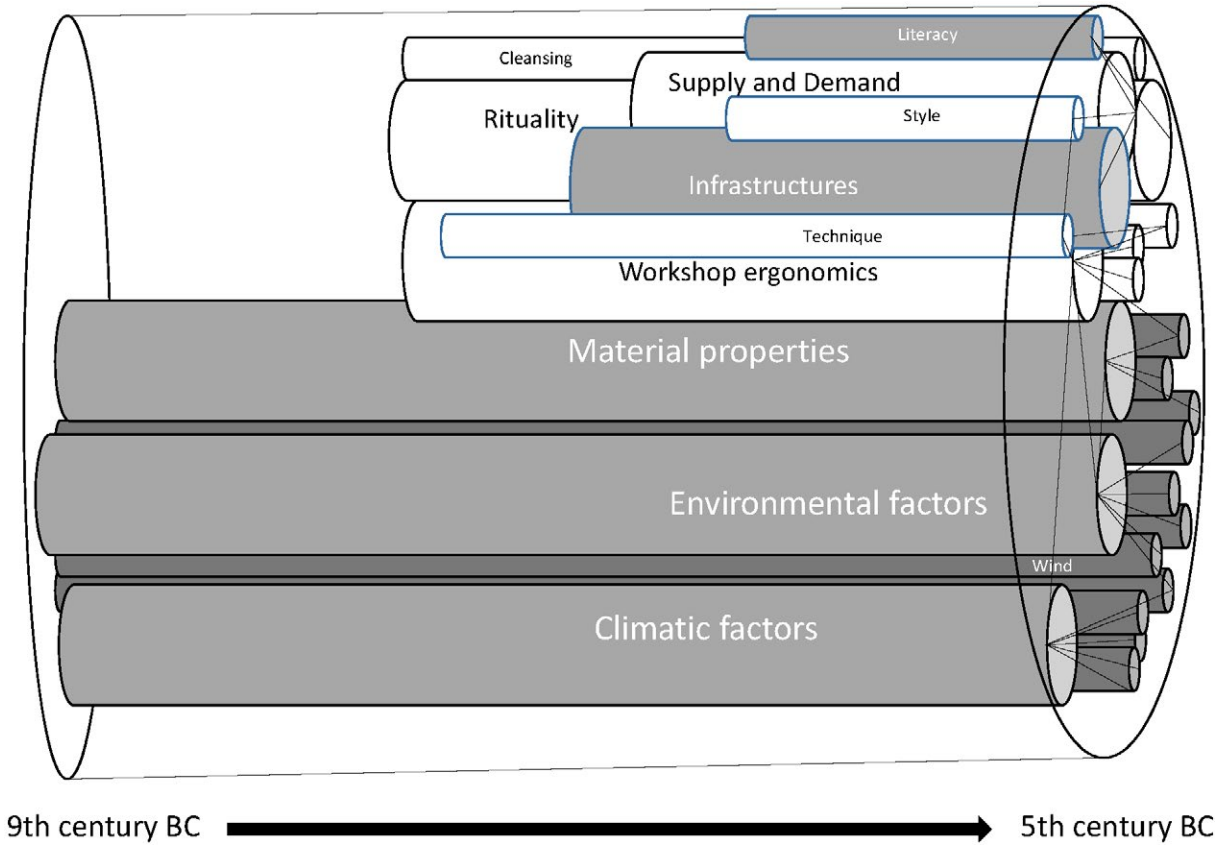


Figure 6: Diachronic evolution of *knowledgescapes* in pottery workshops.

frame the workshop within the surrounding cultural and natural landscape.[57] This level of interpretation allows us to detect contacts, exchanges and similar choices between geographically distant workshops, but in the form of semantic interconnectedness rather than geographical connectivity.

A network perspective also allows us to visualise the different layers of knowledge required in the workshop: for example, knowledge concerning the location, the infrastructure, the ergonomics, and the actual pottery-making could not have been separate. All these layers must have been interconnected and linked to the same material and immaterial resources, although different factors and agencies may have been involved. The situational aspects of knowledge and resources, linked to the environmental and infrastructural nodes of the 'ResourceComplex', prompt us to define local *knowledgescapes* as geographically and chronologically embedded when we observe them in a particular moment. This, in turn, explains the apparent lack of consistency and continuity in the transfer of knowledge, ideas and practices across the Apennines. Moreover, each workshop network had the potential for virtually unlimited growth, since it shared resources and knowledge with all other neighbouring and distant workshops accessing the same infrastructures and agents. The consequence of this entanglement is that *knowledgescapes* are not self-contained, but rather linked on a supra-regional scale to many other local *knowledgescapes*.

Knowledgescapes in the diachronic analysis

As we can easily see in this diachronic analysis of our contexts, local *knowledgescapes* are fluid and dynamic networks of embodied technical skills, concepts and ideas, which change over time. The introduction of new elements in local workshops, in the form of innovation or change, raises many questions regarding the knowledge and knowledge transmission related to making pots, and the relationship between embodied skills, learning processes and improvements or inventions. The flow of information and choices which triggered such changes was not accidental, but rather part of the creative process intended as an interaction between matter, ideas and intentions.[58] The rhythm of change does appear to have been continuous and did not involve all aspects and processes of the *knowledgescapes*. For example, the kilns in urban workshops (as at Marzabotto and Felsina) can present a strong element of continuity in terms of firing

[57] For a non-linear approach of the chaîne opératoire, see Schlanger 2005: 20-21. For an analytical understanding of the socio-cultural value linked to the *chaîne opératoire*, see Roux 2019: 308-316; Roux 2020.

[58] Loney 2000: 661-662; Vaessen 2014.

structures with those set in suburban contexts, and even those of pre-urban periods. Concerning the spaces and structures at the places of production in particular, Helen Loney's analysis of prehistoric Italian pottery-production supposes a certain conservatism or long-lasting continuity.[59] This is also addressed by Giulia Morpurgo in her consideration of the continuity of the location of workshops in different phases of the urban life of Marzabotto (10-11).[60]

The dynamic evolution of local *knowledgescapes*, viewed here as a diachronic network of material and immaterial resources, can be analysed as a ResourceAssemblage (**Figure 6**).[61] Considering the different rhythms of change in the workshops examined here, it is possible to observe that socio-natural networks tended to be resilient to change: The workshop's location maintained a stronger prioritisation of the availability of raw material, ecological considerations such as winds and seasonality, and integration into the infrastructure of supply and demand, even in the context of growing urbanisation. So, for example, many pottery workshops in Marzabotto are situated on the terrace at the Reno river or on the main *plateia*, giving access to the transport routes across the Apennines, connecting the city with the other two major urban centres of the time: Gonfienti and Felsina.[62] Seen diachronically, local *knowledgescapes* are neither completely conservative nor exclusively innovative, as Matthiesen remarked for local knowledge: 'In good practice-contexts it can function as a source for strengthening local self-organising capacities and social forms of creativity, in other contexts it may foster lock-in and exclusion processes, strengthening non-innovativeness'.[63] The rhythms of change and innovation in the workshops of the Iron Age northern Apennines and surrounding areas were different for each layer of local knowledge described. Change would have been triggered by internal and external, supra-regional factors, as well as by occasional encounters resulting from migration, exchanges of objects and the circulation of ideas. Macro-regional or supra-regional events can be reconstructed by correlating data for other cities and settlements in the Arno valley and Po plain, and sometimes also by cross-referencing different sources, for example literary testimonies. However, occasional encounters and exchanges can only seldom be proven in the archaeological record, mostly thanks to pottery inscriptions. Some of the macro-regional or supra-regional factors that accelerated changes in pottery production seem to be linked to the economic and political challenges arising from the loss of power of the Etruscan cities on the Tyrrhenian coast, following their battles against the Greek poleis. These challenges are normally interpreted as triggers for the increased strategic and economic importance of the Adriatic commercial routes.[64] Following this connection, the frequency of imported pottery from Greece, particularly Attic pottery, in the Po plain, along the Adriatic routes, and in the Arno valley along the Tyrrhenian routes, as well as the immigration of potters from Greece and the Eastern Mediterranean could have provided strong agencies for change – both human and object agency – in local *knowledgescapes*. The personal mobility of craftsmen, documented in the coastal cities of Etruria throughout the epigraphic records,[65] also probably played a relevant role in the changes to pottery production in the region under consideration and, in addition, may explain the introduction of new forms of kilns, for example the rectangular one in Marzabotto, at Tina temple.[66] Another supra-regional trigger for change must have been the growing urbanisation, with the conurbation of minor centres and the restructuring of the major centres, which also occurred in the plains. This seems to have impacted the layer of knowledge linked to infrastructure, particularly in terms of the number of pottery workshops embedded into urban contexts. Moreover, the societal turn brought by the urban 'revolution', especially the altered distribution of power and the consequent changes in consumption patterns and literacy, had a strong impact upon the local *ergasteria*.[67] These changes did not only consist of new shapes and decorative schemes, but also of broader cultural innovations such as the spread of writing on pottery, incised before the firing. One of the first attestations of such literacy, with a clear diacritical function, is the long inscription on a small amphora (the 'anforetta Melenzani') found in a necropolis of Felsina. This object, dated to the end of the seventh century BC, displays a long inscription incised before firing,[68] mentioning the name of the dedicant as well as the name of the potter who had made the vase, or perhaps the name of the scribe – Giovanni Colonna suggested that potter and scribe could be the same person.[69] The existence of proprietary inscriptions on tools for pottery production during the Archaic period in the urban workshops of Marzabotto is still under discussion, since the clay discs frequently found within workshop buildings mention the names of members

[59] Loney 2007: 198-202.
[60] Morpurgo 2017: 360-361.
[61] Bartelheim *et al.* 2021: 13-15; Teuber and Schweizer 2020.
[62] Gaucci 2016; Morpurgo 2017; Nijboer 1998: 119-126. For the workshop adjacent to Tina temple: Sassatelli 2011.
[63] Matthiesen 2005: 8.
[64] Sassatelli and Macellari 2009: 118-119.
[65] On Cerveteri, see Bagnasco Gianni 2007. On Pisa, see Bruni 2013. On Populonia, see Romualdi 2004.
[66] The presence of immigrant craftsmen in the urban metal workshops of Marzabotto has been suggested by Locatelli 2005: 232. For the relationship between the mobility of craftsmen and specialised pottery production, see also Locatelli 2013b: 38.
[67] This is the case, for example, with the workshop adjacent to Tina temple in Marzabotto (Sassatelli 2011: 152-153), the workshops at the '*regiae*' at Figline, La Rotta (Giroldini 2022), and probably those at Fossa del Lupo.
[68] Morigi Govi 1981: 78-79.
[69] Morigi Govi 1981: 79-93.

of the gentry, showing no traces of use compatible with production activities.[70] In any case, since the inscriptions are incised before firing, these attestations also indicate the introduction of some form of literacy to the workshops.

The overall spread of literacy on pottery probably served purposes like the former use of impressed decoration to indicate ownership or specify the use of a pot; it represented a huge innovation within local *knowledgescapes* of pottery production and consumption.[71] The increase of literacy in pottery workshops, corresponding to a general turn in society, must have taken place in parallel in metal workshops, too.[72] Although the increased urbanisation and the new infrastructural networks could be considered as a trigger for the cross-skilled integration of workshops practicing different crafts (pottery, metal and textile working),[73] these activities already co-existed in some sub-urban or pre-urban contexts, such as these at San Piero a Sieve I Monti (2), Trebbio Spinellina (3), and Cortona Fossa del Lupo (24).[74] In a ResourceAssemblage model, changes in a single material or immaterial resource are sufficient to impact the assets of the whole network. The rhythm of changes in local *knowledgescapes* vary widely across different geographical and chronological contexts, and archaeological observation has detected factors (such as workshop locations) that are long-enduring despite innovation, as well as factors that display a medium endurance (firing technology) and those which are subject to a more rapid change (styles and ornamentation/decoration).[75] These different rhythms of change and innovation fuse the geographical borderlines between local *knowledgescapes*, which also shifted and changed over time, and can only be defined with certainty for a given period, rather than treated as absolute. These *ergasteria* can be thus considered as entities released from any geographical or ecological determinism and rather embedded into complex socio-natural interactions, choices and negotiation processes.

Local *knowledgescapes* and the 'ResourceCulture' of *ergasteria*

Although geographically localised, local *knowledgescapes* present us with synchronic and diachronic dynamics, according to both the conception of local knowledge as a routine practice, and the understanding of the *knowledgescape* as a social resource.[76]

Pottery workshops were constitutive parts of these local *knowledgescapes* and were embedded in socio-natural networks. These networks shaped 'subcultures' of production, which could cross over between different cultural and social identities and eventually developed clusters of regional peculiarities. These 'subcultures' should not be considered as the expression of ethnic identities, but rather as the result of local processes, since they grew from the frequent and repeated contact between *technitai* (artisans/craftsmen), producers, distributors, and users or consumers of the final products.

This perspective on networks of knowledge in pottery production and the related socio-natural interaction invites us to consider these *ergasteria* as laboratories in which innovation did not emerge in a linear way but rather underwent a continuous renewal as the outcome of trial and error, and imitation. This innovation was not a forced introduction or appropriation of techniques and skills, but it rather resulted from encounters between the (traditional)[77] competences of local communities and new competences, which may have been perceived and chosen as an improvement of the local know-how.

By observing the technological, ecological and ergonomic characteristics of the production sites in a region, it is possible to better understand the assimilation of new ideas and technical skills within local workshops. The shared custom of excavating a depression into the ground in front of the kiln mouths, for example, is attested in the workshops of Trebbio Spinellina (3) and Florence Cinema Apollo (1) in the south and in these of Savignano sul Rubicone (4), San Zaccaria-Maiano (7), and Forcello di Bagnolo San Vito (23) in the north, and seems to have been widely adopted during the sixth century BC.

The presence of shared practices and their chronological development is one of the many elements which invite us to question the historicity of an Etruscan colonisation of the Po plain as it is described in the

[70] Sassatelli 1994: 19-21.

[71] The letter signs and short inscriptions engraved after firing, which have been found in these centres, have been variously interpreted, but mostly accepted as an indication of ownership (for Marzabotto, see Sassatelli 1991: 704; Sassatelli 1994: 12; for Adria, see Gaucci 2021: 32) and more rarely as indicators of the volumetric capacity of the vases (Gaucci 2010: 357-358).

[72] For the connection of literacy and societal change in pottery-consumption in Etruscan sanctuaries, see Krämer 2022: 117–120. For the introduction of writing in the workshop of San Piero a Sieve I Monti, see Sarti 2020: 227. For observations concerning literacy in the workshops of Marzabotto, see Morpurgo 2017: 367.

[73] In general, see Quercia and Foxhall 2014: 69–79. About Forcello di Bagnolo San Vito (23), see De Marinis and Rapi 2007: 79–88. About Gonfienti, see Rastrelli 2002: 125-126. For a recent review of cross-crafting contexts in Etruria, see Salvini and Salvadori 2022: 482.

[74] For San Piero a Sieve I Monti (2), see Salvadori and Salvini 2022; Sarti 2020: 121. For Trebbio Spinellina (3), see: Gliozzo *et al.* 2011. For Cortona Fossa del Lupo (24), see Da Vela and Krämer 2022; Fedeli *et al.* 2007.

[75] Buoite and Zamboni 2017: 377; Morpurgo 2017: 360-361.

[76] Schweizer 2021.

[77] 'Traditional' here does not mean something pertinent to the identity of local communities or to their values, but rather – as the Latin root of the word suggests – something which has been '*traditus*', that is, transferred or transmitted, possibly during a teaching-learning process within the workshop.

ancient literary sources. The introduction of innovation in pottery workshops of the region cannot any longer be considered as a 'cultural import' of colonisers. The modalities of interaction in this region can be described as a complex system of encounters, mutual exchanges, and fragmented personal mobility. The supra-regional transmission of innovation across the workshops analysed should be considered as a constitutive element of the local knowledge and local production practices. In many of the case-studies analysed here, the *ergasteria* played a central role, not only as economic and productive hubs, but also as places of power. The use of impressed decoration during the seventh century in suburban workshops, such as at San Piero a Sieve I Monti (2), and later the use of inscriptions written on the vases before firing are both forms of conversion of economic and cultural capital, related to practices of social distinction. In the *ergasteria* social models were on the one side, reproduced and, on the other, altered. The introduction of new techniques, for example the use of the above-mentioned vacuoles, was limited to certain localities but also geographically discontinuous, suggesting forms of control over the spread of cultural content and technological innovation. The high social evaluation of these places, confirmed by the social investment involved in their construction and use, as well as by the ritualisation of their abandonment and disposal, as in the cases of Trebbio Spinellina (3), Savignano sul Rubicone (4), San Zaccaria-Maiano (7), lead us to consider the *ergasteria* as a 'ResourceCulture' of the region, since they were hubs of multiple constitutive aspects of social life of local communities, such as religion, social identities, economic activity, and technological transfer. This 'ResourceCulture' contributed to the creation of local *knowledgescapes*, defined here as dynamic networks of material and immaterial resources, and related socio-cultural dynamics changing in time and space.

From this perspective, the dichotomy of tradition and innovation can be rethought as a normal dialectic belonging to the daily life of a workshop, since the introduction of new techniques and ideas was a formative element of local potting traditions. Local *knowledgescapes* in pottery production and the *ergasteria*, as their place of establishment, maintenance and innovation, could not exist without this dialectic. In the 'ResourceCulture' of the *ergasteria* of the northern Apennines, cultural belonging and tradition, encounters and innovation are no longer contrasting attitudes or traumatic changes, but part of a daily routine producing pots, social meaning and values.

Acknowledgments

I am very thankful to Constanze Graml and Elena Partida for accepting my contribution in their inspiring volume. The research on the 'ResourceCultures' of the Etruscan mobility in the Apennines is financed by the Deutsche Forschungsgemeinschaft (DFG, German research Foundation) within the collaborative research centre SFB 1070 'ResourceCultures' – Project number 215859406 – Subproject B 04. I am particularly grateful for the frequent and fruitful exchanges on the conceptual frame of 'ResourceCultures' with my colleagues Beat Schweizer and Wulf Frauen, and for his constructive comments concerning my studies to Robinson P. Krämer. A special acknowledgment is due to Rubymaya Jaeck-Woodgate of A Second Pen for her careful revision of the original text and to my colleague Attila Dészi for the accurate revision of the tables.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

Construction sites, open-air workshops and building workforce

Chapter 17
Athenian architecture abroad in the fifth century: Fashion or imperialism?

Jacques des Courtils

Abstract

It is widely known that a temple built in the sanctuary of Apollo at Delos in the 420s was named 'the temple of the Athenians' in the local inscriptions. As this building is made of Pentelic marble and displays many Attic features in both style and technique, it can reasonably be linked with Athenian architecture, without prejudice to the commissioner. In addition to that temple, this paper investigates two less well-known cases, the temple of Athena in Thasos and a group of buildings in Argos (the so-called *theatron*, the hypostyle hall and the South Stoa in the Heraeum). Despite the striking differences between them, all these buildings were built in the fifth century BC and share some features that relate them, in one way or another, to Athens and Attic architecture. After clarifying the exact nature of these features, which refer to the building tradition of Attica, the reasons behind will be scrutinised, in an attempt to assess the exact influence of Attic architecture upon these different places. Seeing that some of the discussed monuments were erected in places with a solid, age-old local building tradition, as well as access to high quality stone supply, one wonders why the indigenous architects unexpectedly forsook their own, established tradition, to adopt a foreign one. Was it because they acknowledged the superiority of Attic building techniques? Was it, maybe, out of desire to imitate the masterpieces of the Athenian architects? Or perhaps for political reasons that need to be clarified? This paper argues for the explanation that the political relations between Athens and its allies may have played an important role in the voluntary or forced adoption of Attic construction traits by other cities throughout the fifth century.

Περίληψη

Είναι ευρέως γνωστό πως ο ναός που κτίστηκε στο ιερό του Απόλλωνα στη Δήλο περί το 420 π.Χ. αναφερόταν στις τοπικές επιγραφές ως 'ο ναός των Αθηναίων'. Καθώς το συγκεκριμένο μνημείο είχε κατασκευαστεί από Πεντελικό μάρμαρο και παρουσιάζει πολλά αττικά στοιχεία, τόσο υφολογικά όσο και τεχνικά, μπορεί εύλογα να συνδεθεί με την αθηναϊκή αρχιτεκτονική, με επιφύλαξη ως προς τον αναθέτη. Επιπλέον αυτού του ναού, η παρούσα εργασία διερευνά δύο λιγότερο γνωστές περιπτώσεις, το ναό της Αθηνάς στη Θάσο και μια ομάδα οικοδομημάτων στο Άργος (το λεγόμενο θέατρο, την υπόστυλη αίθουσα και τη Νότια Στοά στο Ηραίον). Παρά τις 'κτυπητές' διαφορές ανάμεσά τους, όλα αυτά τα κτίσματα οικοδομήθηκαν στον πέμπτο αιώνα π.Χ. και μοιράζονται στοιχεία που, με τον έναν ή τον άλλο τρόπο, τα συνδέουν με την Αθήνα και την αττική αρχιτεκτονική. Αφού διευκρινισθεί η ακριβής φύση αυτών των στοιχείων, τα οποία ανάγονται στην οικοδομική παράδοση της Αττικής, θα εμβαθύνουμε στις αθέατες αιτίες, σε μια προσπάθεια να αξιολογηθεί η ακριβής επιρροή της αττικής αρχιτεκτονικής στους διαφορετικούς αυτούς τόπους. Παρατηρώντας ότι κάποια από τα μνημεία υπό συζήτηση ανεγέρθηκαν σε μέρη με μακροχρόνια εδραιωμένη τοπική οικοδομική παράδοση, καθώς επίσης με πρόσβαση σε υψηλής ποιότητας λίθο, αναρωτιέται κανείς γιατί οι αυτόχθονες αρχιτέκτονες απροσδόκητα απαρνήθηκαν την δική τους καθιερωμένη παράδοση, για να υιοθετήσουν μια ξένη. Ήταν, άραγε, επειδή παραδέχονταν την ανωτερότητα των αττικών οικοδομικών πρακτικών; Ήταν, μήπως, λόγω επιθυμίας να μιμηθούν τα μεγαλουργήματα των Αθηναίων αρχιτεκτόνων; Ή ίσως εξ αιτίας πολιτικών κινήτρων που χρήζουν διαλεύκανσης; Η παρούσα εργασία υποστηρίζει ότι οι διπλωματικές σχέσεις μεταξύ της Αθήνας και των συμμάχων της πιθανότατα έπαιξαν σημαντικό ρόλο στην είτε οικειοθελή είτε επιβεβλημένη υιοθέτηση των αττικών κατασκευαστικών τρόπων από άλλες πόλεις καθ' όλη την διάρκεια του πέμπτου αιώνα.

Keywords: Athenian architecture; Cycladic architecture; T-clamps; Argos; Thasos

Taking advantage of particular economic and political conditions, the Greek world gave rise to many creative workshops of architecture in several cities during the Archaic period. The most famous examples are to be found in Ionia and in western Greece, under the regime of tyrants.[1] Athens was by no means a leader in that field at the time. Athenian architecture of the Archaic times has left few traces apart from the temple of Olympian Zeus that was supposed to rival the giant temples of eastern Greece, but was abandoned in the course of construction, dragged in the fall of the tyrants who had ordered it. Indeed, the Alcmaeonids undertook the reconstruction of the temple of Apollo at Delphi (Herodotus 6.62-63) but this was a private initiative and the marble was imported not from Athens but from Paros. A few years later, the

[1] Mossé 1993.

Athenian treasury, a symbol of the city's gratitude to the Pythian god, was also built of marble of Paros and in the Cycladic architectural tradition.[2] However, after the upheaval of the Persian Wars, Athens experienced a brilliant revival in the fifth century, especially in the second half of the century, with the temples on the Acropolis, while building activity was declining on the other side of the Aegean Sea and, in the west, it continued its trajectory without experiencing much renewal. I would like to explore here a particular aspect of the success of Athenian architecture of that time: the export of its technical know-how, which, for the modern scholar, signifies a marker of the influence exerted abroad by the new Athenian workshop. Rather than following a chronological order that would lead us to complicated back and forth, I will start from the best-known examples, the Athenian temples in Delos, and then consider buildings of which the links with Athenian architecture are more or less obvious but, in some instances, difficult to explain, at first sight. The examination of the architectural facts will therefore be followed by an attempted interpretation.

Case studies

Athenian architecture in Delos

Thanks to the reputation of its sanctuary dedicated to the Apollonian trinity, the tiny island of Delos blossomed in the Archaic times, in terms of religious buildings and statues. This floruit actually reflected the vitality of the building workshops of her big neighbours, Naxos and Paros, as the scarcity of building materials and the thin population on Delos did not allow, as it seems, the development of a local architecture, even though the island had probably a few craftsmen. Two notable buildings emerge in this period: the Oikos of the Naxians and the *Porinos Naos* (poros temple). Although the attribution of the former to Naxian builders is beyond any doubt and confirmed by Delian inscriptions attesting to it, only modern studies made it possible to ascribe the paternity of the latter to the Athenians, suggested, if not demonstrated, by the use of a material, the poros stone, for which the best experts agree to propose Attic provenance, and endorsed by the employment of T-clamps, which were used by then in Athens whereas they were completely unknown in the Cyclades.[3] The construction of the *Porinos Naos* took place probably after the first purification of the island, that is, in about 540-520 BC (one does not know the precise date of the purification and, even less, the duration of building).

A century later, the Athenians undertook the construction of the building explicitly referred to as 'the temple of the Athenians' in the Delian inscriptions. It is a totally Athenian building: built of Pentelic marble,[4] it features all the stylistic and technical characteristics of Attic architecture of the second half of the fifth century, carefully identified by Fernand Courby[5] and René Vallois.[6] Only the *amphiprostyle* plan of the temple, reputedly unparalleled in Doric architecture, seems to pose a problem. Nevertheless, similar examples can be found only in Attic architecture: the temple near Ilissos river and the temple of Athena Nike, as regards Ionic architecture, to which one may add the Erechtheum, which is 'pseudo-amphiprostyle' (its rear colonnade being embedded in a wall) and even the Parthenon itself, which is Doric, like the temple of the Athenians on Delos, but displays a hexastyle *amphiprostyle* plan within its peristyle. Vallois also noted that the dense spacing of the colonnades of the temple of the Athenians is the same as that of the Parthenon (2.25 lower diameter).[7] Considering the technique or certain details of manufacture of the temple of Delos, Vallois detected several features characteristic of the architecture of Attica: the perfect equidistance of the joints in the walls (unknown until then in Delos),[8] the presence of *parastades* (same as in the temple of Athena Nike),[9] the non-parallel beds of the lower drum of the columns,[10] the capitals with three rings instead of four (see the Parthenon, temple of Nemesis, Sunium),[11] the systematic use of lewis.[12] Roland Martin also pointed out that the use of T-shaped dowels is a purely Athenian specificity (**Figure 1**). Furthermore, the dimensions of the Doric capital of the Delian temple equal exactly the reduction to one eighth of the capital of the Parthenon.[13] As Courby wrote: '*C'est une construction de la meilleure époque attique que ce temple*'.[14] We can take it for granted that the stonemasons who built the temple of the Athenians in Delos were Athenians, and it is difficult to escape the idea that the architect himself may have been an Athenian, too.[15]

Turning briefly to the fourth century, one will note that another Delian building is unmistakably stamped with the mark of the presence of Athenian builders: it is the Ionic building of atypical plan and form, which includes

[2] Schuller 1985.
[3] Martin 1965: 261-273.
[4] With the exception of the foundations in local tuff, which could have been made by island craftsmen.
[5] Courby 1931: 107-205, 220-225.
[6] Vallois 1966; Vallois 1978.
[7] Vallois 1966: 286.
[8] Vallois 1966: 64.
[9] Vallois 1966: 78.
[10] Vallois 1966: 111.
[11] Vallois 1966: 138.
[12] Vallois 1966: 512. According to this author, the lewis was introduced in Delos by the Athenians at the time of the construction of the Great Temple and generalised at the time of the temple of the Athenians.
[13] Courby 1931: 205.
[14] Courby 1931: 204.
[15] Vallois 1978: 587. Contrary to this scholar, I do not find in this temple 'an adaptation to the local aesthetics': the 'ionising' evolution of the Attic architecture of the end of the fifth century seems to me to be a sufficient explanation.

Figure 1: Delos, Temple of the Athenians: T-clamp (© École française d'Athènes / Jacques des Courtils).

a lantern and has been identified with some certainty as the Pythion (*Guide de Délos* 42)[16] mentioned in the inscriptions and often in archaeological literature, too.[17] The inscription *ID* 104-4 or *IG* II^2 1678, concerning the Pythion, is of particular importance. It has been the subject of various studies, the most recent one by Marie-Christine Hellmann.[18] As she points out,[19] the σπείρας mentioned in line 4 of the text provide evidence that it was an Ionic building. This detail matches *Guide de Délos* 42, which is the only Ionic building in the Delian sanctuary. Several other references in the same inscription point to mainland and, more precisely, to Athenian origins: construction was supervised by a committee of *naopoioi* (line 23), a college of magistrates, as Hellmann pointed out, that was in office only during the Attic-Delian amphictyony and was in charge of the sacred buildings; the model (παράδειγμα/paradigm) of the capital was transported from Athens to Delos (lines 10-13); the successful bidder and the guarantors are from Thespiae, Aphidnae, and Anagyrous, respectively. Last but not least, the document is dated by the reference to the *prytaneia* of the Athenian tribe Aigeïs (lines 26-27), the tribe associated with the eponymous hero Aegeus. It is unfortunately not possible to restore the year when this decree was passed. However, another text (*ID* 104-25) refers to the construction of this building in progress during the year 345/4 BC.

After studying yet another epigraph (*ID* 104-4) Hellmann concluded that this text surely refers to the building *Guide de Délos* 42, identified with the Pythion, in spite of a last difficulty that has already caused much ink to flow. The text of the inscription stipulates the precise dimensions, measured in the Attic foot, of 472 blocks. Translated in cm, these dimensions are: 88.8cm in length, 64.8 in depth and 29.6 in height. However, the examination of the numerous preserved blocks of *GD* 42 reveals discrepancies that are noticeable albeit rather small: the preserved blocks are 1.7cm longer, 0.8cm shallower and 1.1cm lower than the measurement specified in the inscription. The scholars who admitted the identification of these blocks with those mentioned in the inscription generally considered these differences to be not very significant, without however being able to provide an explanation. I would propose the following: it is highly probable that, during construction, ancient stonemasons would not refer to the prescribed measurements of the epigraphic text each time they started cutting a new block. Instead, they referred to the actual model (παράδειγμα/paradigm) that had been cut first and was permanently available on the worksite. They could copy it either with a template or with simple pieces of string. Thus, it seems safe to assume that, for some reason unknown to us, the contractor of the Delian temple slightly altered the dimensions of the model-block (perhaps simply in the process of cutting it) and thus effectuated the same alteration to all blocks subsequently cut.

In sum, three buildings in Delos, the *Porinos Naos*, the temple of the Athenians and the Pythion, bear the mark of Attic architectural techniques of the respective periods. Their construction was carried out during periods when Delos was closely associated with the destiny of Athens. The first period corresponds to the reign of Peisistratus on Delos and the first purification of the island (Herodotus 1.64; Thucydides 3. 104), in the years 540-528. The second period, over the last quarter of the fifth century, dates after the second purification of Delos and the expulsion of the Delians. It is the so-called amphictyonic period during which the sanctuary was ran by Athenian magistrates. The third period (second quarter of the fourth century) falls in the time of the second Confederation during which Athens regained control of the island. During each of these three periods, Athens left her imprint on the sanctuary by building major religious edifices that materially and stylistically alluded to her presence. Since the Archaic period, as Yves Grandjean and François Salviat have demonstrated, the Athenians constantly took interest in promoting the cult of the Delian Apollo and, by consequence, in his sanctuary on Delos. The temples they built there testify to this.[20] Particularly the third one, the Pythion (*Guide de Délos* 42), shows that, in the sanctuary of Apollo of Delos after the fifth century, Athens also played the role of ambassador of the cult

[16] Bruneau and Ducat 2005.
[17] References to the hesitations of scholars about the exact identity of the monument are listed in Bruneau and Ducat 2005: 204 footnote 93.
[18] Hellmann 1980.
[19] Hellmann 1980: 156.
[20] Grandjean and Salviat 2006.

of Apollo of Delphi, the Pythian god.[21] The observations we have made concerning the three Athenian buildings thus confirm without surprise what we knew already, thanks to the historical sources, about the influence of Athens upon the island of Apollo.

The architecture of Argos in the middle of the fifth century

Figure 2: Argos, Heraeum, South Stoa: orthostates of the east wall (© École française d'Athènes / Jacques des Courtils).

The city of Argos experienced a first glorious period in the Protogeometric and Geometric period, evident in the rich tombs dating from this time, as well as the high rank of the Argives in Homer's Iliad. This period was for Argos that of splendour in which myth and reality were inextricably intertwined. In the years to follow, the city's fate would be less glorious, not sharing the architectural splendour of other cities of the Greek world, with the exception of the architectural setting of the buildings still visible in the Heraeum of Prosymna.[22] The only large monuments preserved within the walls of the city are the Classical theatre, carved into the hillside of the acropolis (named Larissa), and the Roman baths. However, a group of monuments built in the city and the Heraeum around the years 460/450 BC, stands out, although nowadays in a ruined state. In this brief time-span of approximately one decade, the Argives cut out of the slope of their acropolis a large theatre with rectilinear seats whose stage-building was remodelled on several occasions.[23] They also built a large hypostyle hall on the west edge of the Agora, the roof of which was supported by 4 rows of 4 equidistant columns, and opening out to the agora through a Doric colonnade.[24] In parallel, they built a large portico (called the pi-shaped portico or building P) rigorously aligned with the hypostyle hall and bordering the south side of the agora, for the first time. The date of this last building in around 450-425 BC is surprising, as its perfect alignment on the south side with the hypostyle hall gives the impression that these two edifices were built simultaneously or, at least, laid out in accordance with a rigorous overall plan.

Outside the city, in the famous sanctuary of Hera, the period 460/450 BC also witnessed the realisation of a significant building program, which marked the sudden rebirth of the sanctuary. The program included the construction of the south and east stepped walls, the construction of the west *analemma* (retaining-wall) and the great South Portico. These last two works, which were particularly important, may have been carried out simultaneously or, at least, as part of a broader remodelling project carried out in a relatively short period of time. It is worth noting that the South Portico in the Heraeum has exactly the same stylistic (orthostates with drafted edges) (**Figure 2**) and technical (T-clamps) (**Figure 3**) characteristics as the hypostyle hall (**Figures 4 and 5**), which imply the involvement of the same team of workers. In these two buildings, the T-clamp makes its appearance at Argos.

However, it is not necessary to press the argument too far, as Argos remained a Peloponnesian city. In fact, it is tempting to trace in some of the aforementioned buildings the presence, at least in some way, of the architectural legacy of Arcadia coming to be combined with another, probably Attic, influence. For example, the plan of the hypostyle hall may have borrowed from the hypostyle layout of the Telesterion of Eleusis, still unique in its kind at the time. On the other hand, one can also attribute to the interior columns of the Argive hall two atypical Ionic bases, of which one finds its equivalent only in the Arcadian temple of Bassae. Moreover, the diffusion of the T-clamp is not limited to Argos but it also appears sporadically in the Peloponnese during the fifth century. The eclectic character of the Argive buildings fits the political situation in Argos over the years 460/450 BC, with the city being torn between its Peloponnesian origins and its recent alliance with Athens. It is therefore preferable to suffice to a cautious observation: building activity in

[21] For the later development of this one in Delos, see Bruneau 1970: 125-139.
[22] De Polignac 1998.
[23] Ginouvès 1970.
[24] Bommelaer and des Courtils 1994.

Figure 3: Argos, Heraeum, South Stoa: T-clamp of the north wall (© École française d'Athènes / Jacques des Courtils).

Figure 4: Argos, hypostyle hall: orthostates of the south wall (© École française d'Athènes / Jacques des Courtils).

Figure 5: Argos, hypostyle hall: T-clamp of the south wall (© École française d'Athènes / Jacques des Courtils).

Argos experienced a sudden floruit towards the middle of the fifth century, in which it is possible to discern a certain influence of Attic architecture.

The temple of Athena in Thasos

We will close this brief overview with a less known case that may shed light on, or even consolidate the above hypotheses. Having just published a paper on this monument, I will suffice to summarise the main conclusions.[25] The people of Thasos launched, probably in the aftermath of the Persian Wars, the construction of a new temple dedicated to Athena *Poliouchos* (patron-goddess of the city), one of the main cults of the city, to replace the temple that had been destroyed in around 500 BC. This edifice, located at the top of the acropolis, required the construction of an extensive terrace with embankments contained by a marble wall of considerable dimensions. The construction of the temple itself was abruptly interrupted after the *euthynteria* (levelling-course) had just been completed. The blocks of the *krepis* had been prepared but not yet laid into position. The construction of the temple, which for a number of reasons is tentatively placed in the decade 480-470 BC, was never resumed. Its ready-made blocks remained for some time abandoned on the construction site, and were subsequently reused to build, not the temple of Athena, but a section of the rampart. Some of them were ultimately used in a medieval fortress. The very place of the temple yields scarce traces of reoccupation and the following indicates that the cult of Athena itself lost its importance in Thasos.

The scanty remains *in situ* are limited to the foundations of the exterior walls and colonnades, to which we should add approximately fifty blocks of the *krepis* reused in the Classical rampart, as well as in the Medieval fortress. This does not

[25] Des Courtils 2020.

Figure 6: Thasos, Temple of Athena: T-clamp in the foundations (© École française d'Athènes / Jacques des Courtils).

allow us to reconstitute in detail the appearance of the planned out temple but provides, nevertheless, some valuable information. First of all, the temple of Athena would have been the largest building ever built at the time in Thasos: its length of 37m exceeds by far the dimensions of the temples of other deities built in the Archaic period, which were without exception simple *naiskoi* in accordance with the tradition of small-scale architecture characteristic of the Cyclades, wherefrom the inhabitants of Thasos originated. Even later on, no temple comparable in size to the planned out temple of Athena was ever built in Thasos. The *krepis* blocks, too, were of dimensions completely unusual to Thasos, with the exception, of course, of the rampart, which constitutes by its very nature a case apart. Finally, while the Thasians had systematically used the dovetail clamp throughout the Archaic period and the beginning of the fifth century, the foundations of the temple of Athena employ T-clamps at the four corners (**Figure 6**). After the abandonment of this construction site, T-clamps will never be used again in Thasos.

Due to the condition of the temple, it is impossible to determine its order. It features an *amphiprostyle* ground-plan, which is known in the Cyclades in the Archaic period but not foreign to Athenian architecture, either, as we have seen above. On the other hand, the presence of T-clamps at such an early date can only be explained by a direct influence of Athenian architecture. This is all the more probable, given that the beginning of the construction of the temple coincides, as we shall see, with a brief period of good understanding between Athens and Thasos.

Comments

The aforementioned monuments bear – to different extents – the imprint of Athenian architecture. In order to try to understand how this influence reached Delos, Argos and Thasos, and in what circumstances it affected the architecture of these three places, I will now briefly analyse the respective buildings' context of construction.

The case of Delos is particularly clear: the *Porinos Naos*, the temple of the Athenians and the Pythion were all constructed in periods when Athens exerted a rather tight control over the Delian sanctuary. At the end of the sixth century, the *Porinos Naos* was built while Peisistratus proceeded to the first purification of the island and imposed the control of Athens upon the sanctuary. The third quarter of the fifth century, during which the temple of the Athenians was built, in turn, coincides with another manifestation of firm Athenian control upon the island (second purification, expulsion of the Delians). At the beginning of the fourth century, the construction of the Pythion postdates the establishment of the Second Delian League, dominated by Athens. Built in Athenian materials,[26] style and technique, the three temples represent monuments of Athenian architectural tradition, even though built outside Athens. In the eyes of their contemporaries, they were clear symbols of the Athenian domination.

The case of Argos is less obvious and more subtle. We have seen that the decade 460/450 BC saw the city and its sanctuary endowed with buildings that bear some traces of possible Athenian influence. However, history and the epigraphic evidence clearly suggest that, precisely in this period, two important political changes occur in Argos. On the one hand, taking advantage of an unexpected dispute between Athens and Sparta (Thucydides 1. 107-108), Argos allied with the former, taking this coalition to the extreme: the Argive citizens joined the Athenians at the battle of Tanagra and their dead warriors received funerals in Athens. This brief period of animosity against Sparta and good understanding with Athens can be dated precisely from 464 to 450 BC.[27] On the other hand, the democratic constitution implemented in Argos, at the time, matches in many aspects that of Athens.[28] The political and architectural innovations which appear in Argos in the period 464-450 BC thus seem, in the respective fields, strongly inspired by or modelled after the prototype of the Argive people's new ally.

Finally, the example of Thasos delineates, in a particularly clear manner, the reverse situation of what has just been described. It is factually known that Thasos joined without reluctance the First Delian League, as soon as this was established (478/7 BC) but, due to a rupture in its relations with Athens shortly afterwards, she decided to secede. This provoked

[26] The origin of the *Guide de Délos* 42 marble is however not certain.
[27] Charneux 1953: 396 footnote 7.
[28] Charneux 1953, 1956, 1958. The decree of *proxeny* in honor of Gnostas of Oinous (Charneux 1953: 395) is the oldest text (fifth century) attesting to the existence of the *Aliaia*. Concerning the *Bola*: Piérart and Thalmann 1980: 256.

the rage of the Athenians, who responded with a prolonged siege of Thasos (465-463 BC), resulting in the ruining of the island (Thucydides 1.100-101). These circumstances enable us to outline both a precise chronological framework and a coherent explanation why the construction of the temple of Athena was suddenly abandoned at an early building stage, especially as the worshipped deity of this temple was *par excellence* the protector of the executioners of Thasos! Odd and noteworthy about this case is, obviously, not that an economic crisis induced by a political and military upheaval caused the disruption of a building site. One could name tens, or even hundreds of examples of analogous situations in the course of history. The strangest thing is, firstly, that the building in question bears the very stamp of Athenian architecture and, secondly, that its construction was never resumed, even when the Thasians reconciled with Athens. One is inclined to think that the temple of Athena was actually, in the eyes of the Thasians, the very symbol of the Athenian people in a negative way. The architectural findings suggest that there was much more than symbolism here: the temple of Athena appears to be, strictly speaking, an Athenian temple, probably designed by an Athenian architect and perhaps carried out, at least partly, by an Athenian workforce. In this respect, this temple is ranked slightly behind that of the Athenians in Delos, which, in addition to its architectural design and realisation, was built of marble imported from Athens! But the builders of the Thasian temple of Athena must have thought that it was enough that the building was in marble and that it would be really absurd to transport marble from Athens to an island so distant and so rich in marble.[29] It appears that, even if built of local marble, the temple of Athena, which was meant to be erected on the acropolis of Thasos was identified with the Athenian policy to such an extent, that the one and the other were rejected at the same time by the Thasians.[30]

To conclude, it should be stressed that the situation of Delos and that of Thasos and Argos were obviously not symmetrical. Delos, the island of Apollo, was the seat of the Delian League over which Athens presided, whereas Thasos, a free and independent city, was but an ally of Athens within the frame of the League, and Argos was a recent ally of Athens as well, but not a member of the League. Building Athenian temples in the seat of the League did not have the same impact as doing it in a free city: the Thasians became aware of this in the aftermath of the catastrophic siege of 465-463 BC and they turned their back on the goddess at the same time as they did on Athens. If, according to Thucydides, Pericles declared Athens 'the school of Greece', the three examples reviewed here show that her pedagogy was not equally successful with all of her students: Delos underwent it, Argos admitted it partly, Thasos received it with fervour and then rejected it with anger...

Acknowledgements

This research benefited from the scientific framework of the University of Bordeaux IdEx 'Investments for the Future' program / GPR 'Human Past'.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[29] Yet, this is what they would do in the following century while building the façade of the dedication of Philip III and Alexander IV at Samothrace, in Pentelic marble and with an Attic technique (T-clamps). Wescoat *et al.* 2017: 96-115.

[30] It would be interesting to compare the case of Lemnos with that of Thasos, following the studies of Culasso Gastaldi 2010, and Greco and Ficuciello 2010, who have highlighted the presence of Athenians settled in Lemnos.

Chapter 18
More on Athenian architecture abroad: Xanthos as a case study

Laurence Cavalier

Abstract

This contribution aims to determine the influence that may be attributed to a possible Attic workshop upon the evolution of architectural techniques and decorative patterns that were used in a region on the fringe of the Greek world, between the Archaic period and the conquest of Asia Minor by Alexander. Two cases will be considered: Xanthos, in western Lycia, and Limyra, in eastern Lycia. At Xanthos, both the architecture and the decoration of the Nereid monument probably reflect the participation of Attic craftsmen in the project. Such a contribution is perhaps even more striking in the case of Limyra, as regards both the Heroon of Pericles and the building that we know from only a few blocks recycled in the city wall. The particular architectural and decorative features of these Lycian monuments, studied in this paper, suggest that the completion of major construction projects on the Athenian Acropolis prompted Attic workshops to move to the margins of the Greek world, perhaps at the request of local dynasts.

Περίληψη

Η παρούσα συμβολή αποσκοπεί στον προσδιορισμό της επιρροής που μπορεί να αποδοθεί σε ένα πιθανό αττικό εργαστήριο στην εξέλιξη των αρχιτεκτονικών τεχνικών και των διακοσμητικών μοτίβων που χρησιμοποιήθηκαν σε μια περιοχή στις παρυφές του ελληνικού κόσμου, μεταξύ της Αρχαϊκής περιόδου και της κατάκτησης της Μικράς Ασίας από τον Αλέξανδρο. Θα εξεταστούν δύο περιπτώσεις: η Ξάνθος, στη δυτική Λυκία, και η Λίμυρα, στην ανατολική Λυκία. Στην Ξάνθο, τόσο η αρχιτεκτονική όσο και η διακόσμηση του μνημείου των Νηρηίδων ανακλούν πιθανότατα την συμμετοχή τεχνιτών από την Αττική στο έργο. Το αποτύπωμα μιας τέτοιας συμβολής είναι ίσως ακόμη πιο έντονο στην περίπτωση της Λίμυρας, τόσο στο Ηρώον του Περικλέους, όσο και στο κτίριο που γνωρίζουμε από λίγες μόνο λιθοπλίνθους που ανακυκλώθηκαν στο τείχος της πόλης. Τα ιδιαίτερα αρχιτεκτονικά και διακοσμητικά στοιχεία ετούτων των λυκιακών μνημείων, που μελετώνται στην παρούσα εργασία, υποδηλώνουν ότι η ολοκλήρωση των μεγάλων οικοδομικών προγραμμάτων στην Ακρόπολη των Αθηνών ώθησε κάποια αττικά εργαστήρια να μετακινηθούν στα όρια του ελληνικού κόσμου, ίσως κατόπιν αιτήματος των τοπικών δυναστών.

Keywords: Xanthos; Limyra; architecture; Nereid monument; Athens

Since its rediscovery in the nineteenth century, the Lycian civilisation has been the focus of numerous studies that gradually have come to illuminate certain aspects of this very special culture. However, archaeology has faced two major problems in this endeavour: despite the seminal studies of Emmanuel Laroche and, more recently, of Heiner Eichner,[1] Ignasi Adiego[2] and Diether Schürr,[3] the Lycian language is still not fully understood. Moreover, despite numerous studies, beginning with the arrival of the Lycian blocks at the British Museum, and which continue today, the origin of Lycian funerary architecture is not well understood either. However, today it is generally accepted that Eastern and Greek influences were mixed with an indigenous Anatolian substratum to yield the Lycian style. This paper will examine the influence that may be attributed to a possible Attic workshop on the evolution of the architectural techniques and decorative patterns that were used in this region, on the fringes of the Greek world, between the Archaic period and the conquest of Asia Minor by Alexander. Two cases will be considered: Xanthos, in western Lycia, and Limyra, in eastern Lycia.

Greek ceramics were imported to Xanthos at the end of the eighth century.[4] The quality of such vessels, discovered in the ruins of the most ancient buildings of the Lycian acropolis, undoubtedly marks an ostentatious impulse on the part of the Xanthian sovereigns. It was not until the second quarter of the sixth century that the first Athenian imports started

[1] Eichner 2017.
[2] Adiego 2015: 2018.
[3] Schürr 2007.
[4] The oldest examples are of Cycladic origins. In the seventh and sixth centuries, the majority of ceramics were imported from Rhodes and, to a lesser extent, from Samos. Corinthian imports are rare (Metzger 1972: 188-191).

to appear. These were not very abundant and probably transited via Rhodes.[5] It seems, at least in the case of Xanthos, that imports of Attic ceramics became scarce from the second half of the fifth century onwards, and almost disappeared in the following century. This phenomenon is attributed by Henri Metzger[6] to the near-total destruction of Classical Xanthos and to the withdrawal of Lycia from the Delian League. The first commercial contacts between Xanthos and Athens, which resulted in the import of a substantial number of black-figured vases with a clearly ostentatious purpose,[7] would therefore have lasted only a short time, between 570 and 450 BC.

At the Letoon, the suburban sanctuary of Xanthos, the chronology is unsurprisingly almost identical: imported black-figured ceramics can be dated to the middle or end of the sixth century,[8] although the proportion of red-figured Attic ceramics is greater than at Xanthos.

The Lycians of this period spoke and wrote a language of Indo-European origin, which has still not been completely deciphered. However, it has been established that the Lycian alphabet borrowed some of its letters from the Greek alphabet,[9] which necessarily reflects contact between the two worlds. The oldest surviving example of Lycian script is a fragment of an olpe from the Lycian acropolis, which can be dated to the end of the sixth or the beginning of the fifth century BC.[10] As for the inscriptions on stone, most of which are funerary, these range from the middle of the fifth to the fourth century, before disappearing with the conquest of Alexander the Great.

The first example of Lycian script that we have exists on a coin dating from the first half of the fifth century.[11] However, the Greek language was already known at this time: the oldest Greek inscription in Lycia is the epigram of twelve verses in Attic dialect engraved on the Inscribed Pillar of Xanthos, considered by researchers to have been the tomb of the 'dynast' Kheriga (Gergis) or Kherei,[12] and dated to the end of the fifth century BC, while Greek script already appears on dynastic coins dated around 500.

Greek cultural influences were therefore continuously exerted in Lycia from the end of the eighth century but, apart from the importation of luxury ceramic vessels, a direct relationship with Attica is only discernible from the reign of Kheriga, which began around 440 BC. This 'dynast' first minted coins bearing a 'Lycian' goddess' head, inherited from the coins minted by his father Kuprlli, and an owl, whereas on his last issues, a purely Greek Athena and her owl appear.[13]

It is therefore logical that the first hint of Athenian influence on Lycian architecture is to be found on the emblematic 'Inscribed Pillar' mentioned above, if one accepts that Kheriga was its patron. This monument is built of local limestone and consists of a two-storey, roughly square base (2.60m x 2.50/55m) in the centre of which rests a monolithic pillar over 4m high, bearing on all four sides the longest known Lycian inscription[14] and the aforementioned Greek epigram. Above the burial chamber, at the top of the monolith, rested a cover slab that was crowned by a statue of a dynast seated on a throne framed by two lions. The sides of the burial chamber, made of local limestone blocks, were decorated with reliefs representing the victories of the dynast and thus illustrating the Greek epigram already mentioned.

As is the case with the Harpyies pillar, another famous funerary pillar of Xanthos, dating to *c.* 480-470 BC, the mortise-and-tenon system was used everywhere for vertical fastening, the tenons being sealed with lead. However, for the first time in Xanthos architecture, double T-clamps are utilised for horizontal fastening between the corner blocks and the adjoining blocks, which form the sides of the funerary chamber of the Inscribed Pillar. This technique is also used to tie a patched block to the cover slab that caps the monument.[15]

In the Archaic period, only dovetail clamps were known in Xanthos.[16] The double-T clamp technique was developed by an Athenian workshop at the end of the sixth century and spread rapidly throughout the Greek world during the fifth century.[17] However, its appearance in a non-Greek region such as Xanthos, in a monument probably erected by Kheriga and bearing an inscription in Attic Greek that mentions 'Athena, Taker of cities',[18] is explicit evidence of Athenian influence on the architecture of Lycia at the end of the fifth century.[19]

[5] Metzger 1972: 193.
[6] From 546 BC, Lycia came under the control of the Persian Empire but, between 452 and 445 BC, it formed part of the Delian League. The tribute was no longer paid at an unspecified date, which led to the expedition of Melesandros in 430-429, which ended in his death.
[7] Des Courtils 2007: 11-23.
[8] Lemaître 2007: 125.
[9] Adiego 2018: 152: 'Both the shapes of Lycian letters and the chronological evidence point to a Greek origin.'
[10] Metzger 1972: 164.
[11] Adiego 2015: 13.
[12] Gygax and Tietz 2005: 91; Müseler and Schürr 2018.
[13] Gygax and Tietz 2005: 91.
[14] *TL* 44.
[15] Demargne 1958: 91-99.
[16] Archaic reliefs (Demargne 1958: 33-35). This technique is still used in the Classical period, especially in monuments F, G and H of the Lycian acropolis (Metzger 1963: 49-75). On the sarcophagus of the lion and the bull, dated 430-400 (Demargne 1974: 60) both techniques co-exist. The whole of fourth-century funerary monuments (rock-cut tombs and sarcophagi) feature double-T clamps.
[17] The first clamps of this type appear at Athens in the times of Peisistratus. They are used in all the great monuments of the fifth century BC, especially on the Acropolis of Athens (Martin 1965: 261).
[18] Bousquet 1975: 139.
[19] The inscription on a statue base for Erbinna, son of Kheriga, is by his 'pedotribe' (educator). An elegiac poem engraved in honour of

A few decades after the construction of the Inscribed Pillar, a 'dynast', who may have been Erbinna,[20] decided to have a sumptuous tomb built for himself, which is conventionally called the 'Nereid monument'.[21] This monument consisted of a high base made of limestone blocks for its lowest courses, while the three upper courses, one of orthostates and two courses with superimposed reliefs, were made of marble blocks. Above the uppermost relief course or 'small frieze' was a cornice. This cornice served as a stylobate for a small edifice in the form of a peristyle tetrastyle Ionic temple, with female statues initially identified as Nereids placed between the columns.[22]

A masterpiece of Greco-Lycian architecture, according to Georges Roux,[23] it is a very complex, hybrid monument combining Lycian forms and techniques, as well as oriental and Greek influences. Some characteristics of its construction and decoration connect it, in particular, to Attica and the Peloponnese.[24]

- The plan of the *naos,* practically square, is compared by Anastasios Orlandos to that of the temple of Athena Nike and that of the temple on the Ilissos.[25] The resemblance, as regards the form of the monument, to the west façade of the Erechtheum is noted by Roux.[26] Poul Pedersen points out that the very location of the monument, on a terrace overlooking the south gate of the Xanthos city wall, is comparable to that of the temple of Athena Nike on its bastion overlooking the propylaea.[27]
- While the dowels of the limestone courses of the podium are of the Lycian type – they contain stone dowels engaged in large square mortises – the clamps, from the first marble course onwards, are Greek double-T clamps.
- Above all, T-shaped dowels were also used (**Figure 1**), a much more exceptional technique, even in Greece.[28] Few buildings feature this type of dowels and they are all Athenian: the temple of Athena Nike[29] and the Erechtheum[30] in Athens, as well as two Delian buildings, the 'North Building'[31] and the temple of the Athenians.[32]

Athenian influence is also visible in the ornamentation and sculptural program of the monument. It has long been accepted that the Ionic capital of the Nereid monument was a copy of that of the Erechtheum. Following Roux[33] and Roland Martin,[34] we must temper this statement, but the guilloche pattern that appears sculpted on the *torus* of the *echinus* is similar to that of the capital of the Erechtheum. This strongly suggests Attic influence, especially in combination with the other characteristics mentioned above.

To these clues we may add other references to Attic sculpture: the representation, on the east pediment of the monument, of the dynast seated facing his wife, the latter unveiling herself in the gesture of *anakalypsis*;[35] the representation, on the west pediment, of the dynast on a rearing horse, according to a design used on the stele of Dexileos; and the style of the statues representing the Nereids, which are reminiscent of the Iris statue on the west pediment of the Parthenon.[36]

Can we imagine the presence, at Xanthos, of an Athenian workshop responsible for the construction and decoration of the Nereid monument? Pierre Demargne and William A.P. Childs concluded that there were two masters, a Greek M1 master, 'd'inspiration insulaire',[37] and an M2 master, perhaps Xanthian,[38] which would explain the differences in the quality of the reliefs. It should be noted that Jürgen Borchhardt thought that the M1 Master belonged to the same workshop that produced one of the Lycian sarcophagi of Sidon.[39]

The statues of the Nereids are sculpted in marble imported from Paros, so one is tempted to imagine that Parian sculptors accompanied their marble to Lycia. But according to Francis Prost, this is not the case: he has in fact observed on some statues a particular technique of attaching elements unknown both in Parian sculpture and in Greek sculpture, in general.[40] The presence of

Erbinna on another statue base in Letoon was written by a Greek poet, Symmachos of Pellana (Bousquet 1975).

[20] Or maybe not, see Müseler and Schürr 2018.

[21] Childs and Demargne 1989; Coupel and Demargne 1969.

[22] But who, according to Jean Bousquet, would rather be the 'Elyanas' (Bousquet and Gautier 1994: 358-361).

[23] Roux 1975.

[24] The Peloponnesian influence is obvious according to Roux: the columns have only 20 flutes, the corner Ionic capital is a so-called 'diagonal' capital, with four volutes, a morphology of which the origins go back to the Ionic half-capitals of Bassae (Roux 1975: 187).

[25] Orlandos 1947: 11, no. 1.

[26] Roux 1975: 188.

[27] Pedersen 2013: 133.

[28] The earliest T-dowels appear on the base of the statue of Athena Parthenos (Dinsmoor 1934: 93-106).

[29] Mark 1993: 74.

[30] Stevens *et al.* 1927: 194-195.

[31] Courby 1912: 78-79.

[32] Courby 1931: 191-200.

[33] Roux 1975: 187.

[34] Martin 1971: 330.

[35] Inspired by the representation of Zeus and Hera on the Parthenon frieze (Demargne 1981: 590).

[36] Jenkins 2006: 199.

[37] Childs and Demargne 1989: 403.

[38] Childs and Demargne 1989: 398.

[39] Borchhardt 1975: 138.The Lycian sarcophagus dates to the late fifth century, between 450 and 350 BC (Houser 1998: 285).

[40] Prost 2015: 215.

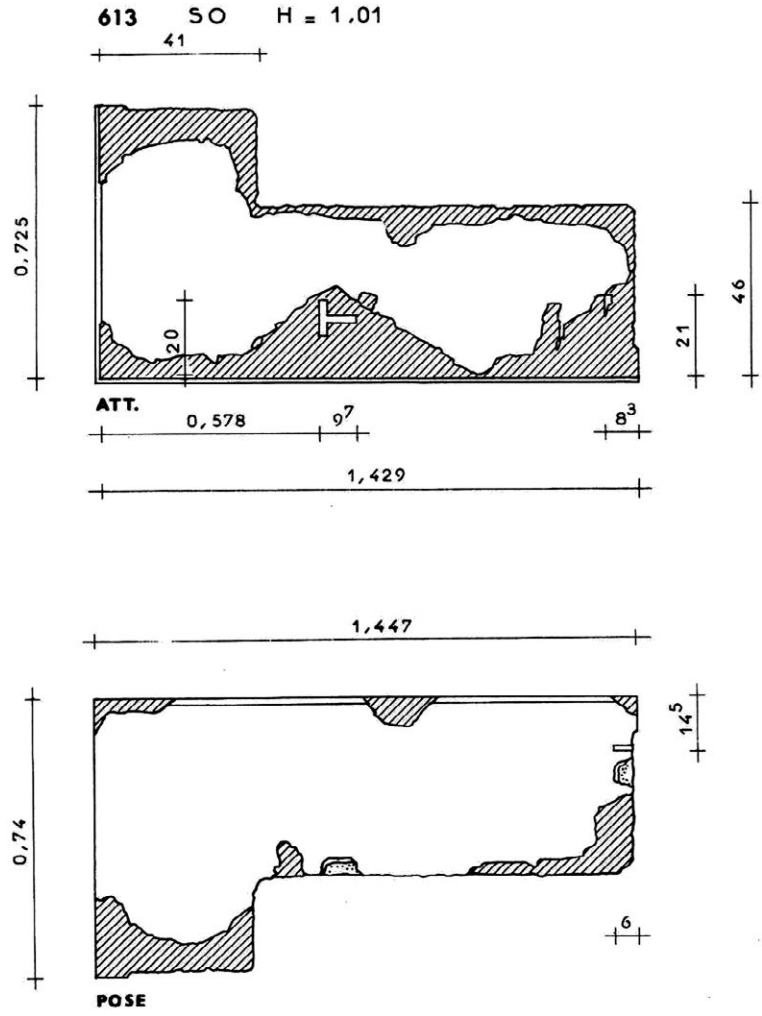


Figure 1: T-dowel: Nereid monument, block no. 631 (Coupel and Demargne 1969: pl. VII).

two workshops, at least one of which is local, the other being Greek, seems to be ascertained.

But the decoration of the Nereid monument may also have something to do with the sculpture of monuments more modest than the Erechtheum. In an illuminating article, Yannis Papaoikonomou[41] compares the warrior motif of the Attic stele of Stratocles, housed in the Boston Museum, with that of the plaque 853 of the Nereid monument, kept in the British Museum, and hypothesises a common workshop, or even the same hand.[42] The awkwardness discernible in the sculpture of the reliefs of the Nereid monument could be attributed to one of these Attic grave stelae workshops, more accustomed to executing 'small autonomous paintings' than large extended friezes of oriental inspiration.

We can therefore propose, with caution, the hypothesis of the arrival in Xanthos, at the request of the dynast, of an Attic architectural workshop, in need of projects after the end of the great works on the Athenian Acropolis, and of an Attic grave stelae workshop, in need of clients after the conclusion of the Peloponnesian War.[43]

Another, more discreet, marker of Athenian influence on Lycian architecture might also be the introduction of trapezoidal masonry in the fortifications. The 'irregular' trapezoidal known in Greece from the end of the fifth century is quite frequent in Lycia, but particularly in the central and eastern Lycia, during the first half of the fourth century. Thomas Marksteiner[44] believed that the Lycian trapezoidal, utilised in Lycia in fortifications as well as in domestic architecture and funerary buildings, was influenced by the Greek, possibly Attic, trapezoidal masonry. It does not seem to have been used in Lycia after the middle of the fourth century.[45] Only one Lycian wall with trapezoidal masonry is dated by stratigraphy: the southern gate of Limyra, which dates back to the beginning of the fourth century.[46]

One of the dynasts of Limyra, known by his coinage[47] and inscriptions, is named Pericles. It is difficult not to see in this name a reference to the great personage of Athens. The Lycian Pericles, whose reign spanned the years 380-342 BC,[48] probably commissioned a heroon built on a plateau overlooking the city, conventionally called the 'Heroon of Pericles'. The architecture of this monument, which is largely ruined, is less well-known than that of the Nereid monument.[49] However, it can be stated that the dimensions of the two buildings are similar and that the monument consists of a podium of 10m x 7m carrying an *aedicula* in the form of a tetrastyle *amphiprostyle* temple. The façade columns are replaced by caryatids. The latter carried an entablature comprising an architrave

[41] Papaoikonomou 1983.
[42] Papaoikonomou 1983: 321.
[43] Papaoikonomou 1985: 324, no. 49.
[44] Marksteiner 1997: 125-132.
[45] Marksteiner 1997: 130 footnote 39.
[46] Marksteiner 1997: 59-62.
[47] Pericles' coins feature on the obverse the three-quarter-view portrait of a bearded man with exuberant curly hair, while a helmeted naked hoplite is represented on the reverse, in association with the Lycian *triskeles*.
[48] Keen 1998: 166-167.
[49] The sculptural program has been studied in detail by Borchhardt 1975 and most recently by Şare 2013, with previous bibliography.

Figure 2: Fragment of an Ionic capital from Limyra and drawing of an Ionic capital from the Erechtheum (Photomontage by Didier Laroche).

with two *fasciae* surmounted by dentils. The plan and dimensions recall the temple of Athena Nike on the Acropolis, whereas the caryatids and the entablature they carry refer to the Erechtheum porch.

Borchhardt, who noted the resemblance between an *acroterion* (apex figure) of Limyra and one of the Nereids of Xanthos, considered that Pericles could have been directly inspired by the Nereid monument, which he would have seen at Xanthos[50] during his expedition against Artumparra, Erbinna's successor.[51] But the reference to the caryatids of the Erechtheum indicates a direct Athenian influence, as does the use of the Attic foot in the construction of the Heroon.[52]

The likelihood of an Attic workshop in Limyra is further reinforced by the existence of a series of architectural blocks that were recycled in the city wall.[53] Their workmanship and dimensions suggest that they belonged together, as part of another monument. With our present state of knowledge, it is not possible to accurately reconstruct the building to which they belonged. These blocks may be divided into several categories: Attic-Ionic bases, column shafts, capitals, architraves and cornices. The Ionic order is inferred from the two very fragmentary capitals that have been preserved, featuring characteristics comparable to those on the capitals of the Erechtheum. The presence of a carved guilloche on the *torus* of the *echinus* of one of them indicates that the sculptor was familiar with this particular decoration. He chose to carve it on the Lycian capital, which he gave exactly the proportions of the Athenian capital (**Figure 2**). The architrave that was meant to surmount this capital is as high as that of the Erechtheum. Finally, the Lesbian *cyma* that adorns the cornice which completes the entablature, apparently without a frieze, is typical of the fourth century and shows a form unknown at the time in Asia Minor.[54] It therefore seems that there was a large building at Limyra, which copied the Erechtheum but left no traces other than these *disjecta membra*. We may thus conclude that, in the

[50] And, perhaps, to have decided to surpass the model (Borchhardt 1993: 47).
[51] Borchhardt 1975: 109.
[52] Mühlbauer 2006: 508-509.
[53] Cavalier 2012 and 2020.
[54] Rumscheid 1994: 258.

first half of the fourth century BC and during the reign of the Hellenised dynasts Erbinna and Pericles, three monuments, including two tombs, were built in Lycia, demonstrating influence by the great Classical architecture of the Athenian Acropolis.

Borchhardt has observed that the style of some of the reliefs of the Nereid monument shows close affinities to that employed in the Lycian sarcophagus of Sidon, and proposed that they might be attributed to the same workshop. However, in the sanctuary of Eshmun at Sidon, Rolf A. Stucky detected blocks belonging to an Ionic colonnade that seems to be derived from the Erechtheum:[55] the Attic bases are decorated with a guilloche pattern, while the upper parts of the column shafts bear anthemion/palmette motifs. The building has been restored by Stucky as an *amphiprostyle* temple dating between 390 and 370 BC, that is, within the same chronological range as the anonymous monument of Limyra, the Nereid monument and the Heroon of Pericles. Could we then be talking about two itinerant Attic workshops, specialised in architecture and sculpture, operating in Sidon as well as in Lycia? The ending of the major projects of the Acropolis could have prompted these craftsmen to leave Attica and to find commissions on the periphery of the Greek world. Alternatively, they may have been invited/summoned there by the local Hellenised sovereigns, who sought to adorn their cities and sanctuaries with monuments reflecting the local past glories, yet, displaying the impressive grandeur of Athens.

Acknowledgements

This research benefited from the scientific framework of the University of Bordeaux IdEx 'Investments for the Future' program / GPR 'Human Past'.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[55] Stucky 2005.

Chapter 19

Contextualizing the scaffold: Workspace within cult space and the dynamics of construction sites at Delphi

Elena C. Partida

Abstract

Votive offerings in a panhellenic sanctuary formulated historic and cultural 'hubs' of collective memory as a public statement by means of art. In this respect, a major religious centre turned into a political and cultural map of the time, while it also fostered mutual influence and interaction among craftsmen. The consecutive and often running in parallel building programs offered grounds for artisans to merge, to exchange and diffuse modes, as well as technical knowhow. The occasional merging of crews may account for stylistic combinations and experimentation in new modalities. Within the architectural landscape of a *temenos*, the manpower of quarrymen, stonecutters and builders was a pivotal driving force of development. Specialists and labourmen in collaboration were the agents that forged a site's evolution. Therefore, a religious architectural complex is worth viewing in the making, rather than as a *fait accompli*, so that we gain insight into its changing aesthetic/visual impact and its accordingly mutating perception by contemporaries. The picture may be quite different from what we tend to reconstitute today. Building crews relocated within the *temenos*, thus converting it into an extensive 'perennial' worksite with repercussions for the overall outlook, the sightlines and the accessibility of monuments. In this paper we envisage the Delphi sanctuary as growing, and not in the frozen perfection of a maquette, which represents only a moment in history. The sequence of building programs, in conjunction with the position and orientation of certain monuments, can be revealing as to the choice/concession of a particular locality. It becomes evident that, in terms of spatial layout, the site was treated as an entity with forethought on behalf of its planners.

In short, we approach the role of the polyvalent workforce within hieratic premises, its synthesis, coherence and mobility, the whereabouts of workshops, matters of nuisance, machinery and equipment, specialisation, synergy and coordination. The signature of this invaluable manpower is legible in what they shaped with their tools and their labour.

Περίληψη

Στα πανελλήνια ιερά τα αναθήματα διαμόρφωναν ιστορικο-πολιτιστικούς θύλακες δημόσιας έκφρασης της συλλογικής μνήμης. Έτσι ένα μείζον θρησκευτικό κέντρο θα λέγαμε πως αντικατοπτρίζει την πολιτική και πολιτιστική γεωγραφία της εποχής ενώ παράλληλα αποτελούσε πεδίο καλλιτεχνικών αναζητήσεων και αλληλεπιδράσεων. Τα επάλληλα και συχνά παράλληλα οικοδομικά προγράμματα πυροδοτούσαν την σύγκλιση και μίξη των τεχνιτών των εργοταξίων, με συνέπεια την ανταλλαγή και διάδοση τεχνογνωσίας και τεχνοτροπιών. Η περιστασιακή σύμπραξη συνεργείων ίσως εξηγεί ορισμένους στυλιστικούς πειραματισμούς και νέους μορφότυπους. Για την ανάπτυξη του δομημένου περιβάλλοντος ενός τεμένους, η σημαντικότερη κινητήρια δύναμη ήταν οι μάστορες, οι λατόμοι, κτίστες, λιθοξόοι, ειδικευμένοι τεχνίτες και χειρώνακτες. Ως αρχιτεκτονικό συγκρότημα, ένα ιερό όπως οι Δελφοί αξίζει να ιδωθεί στην πορεία πραγμάτωσής του, ώστε να αντιληφθούμε τη μεταβαλλόμενη αίσθηση και επίδραση του χώρου στους τότε προσκυνητές. Προκύπτει ότι η εικόνα ήταν διαφορετική από αυτήν που ανασυνθέτουμε συνήθως. Τα οικοδομικά συνεργεία μετατοπίζονταν εντός του ιερού, καθιστώντας το ένα μόνιμο εργοτάξιο, αλλιώτικο από την στατική μακέτα με τα ολοκληρωμένα άψογα κτίρια που έχει αποκρυσταλλωθεί στις συνειδήσεις μας. Οι μεταβαλλόμενες όψεις του τεμένους μετέβαλλαν αντίστοιχα τον αισθητικό αντίκτυπο, τη θέαση και προσπέλαση των μνημείων. Ο εργοταξιακός σχεδιασμός και οι μετακινήσεις των συνεργείων βοηθούν να ερμηνεύσουμε ακόμη και ζητήματα μνημειακής τοπογραφίας, κατανομής και διάταξης στο χώρο, αφού, συναρτώντας την αλληλουχία οικοδομικών προγραμμάτων με τον προσανατολισμό ορισμένων μνημείων, μπορεί να αιτιολογηθεί η επιλογή της θέσης τους. Διαπιστώνουμε πως, σε επίπεδο σχεδίασης, το ιερό αντιμετωπιζόταν ενιαία, ως ολότητα, με τις λεπτομέρειες να έχουν προβλεφθεί από νωρίς.

Στην παρούσα εργασία προσεγγίζουμε το ρόλο των πολυδύναμων οικοδομικών συνεργείων μέσα σε ιερατικό περιβάλλον, την σύνθεση, συνοχή και κινητικότητά τους, τους εργαστηριακούς χώρους, ζητήματα όχλησης, μηχανικού εξοπλισμού, ειδίκευσης, συνέργειας και συντονισμού. Το αποτύπωμα εκείνων των ακούραστων ομάδων ζωντανεύει μέσα από τα ίχνη των εργαλείων τους.

Keywords: worksites/workforce; building process; sanctuaries; space perception; craftsmen synergy

'One of the temptations of the artist is to believe himself solitary, and in truth he bears this shouted at him with a certain base delight. But this is not true. He stands in the midst of all, in the same rank, neither higher nor lower, with all those who are working and struggling. His very vocation, in the face of oppression, is to open the prisons and to give a voice to the sorrows and joys of all. This is where art, against its enemies, justifies itself by proving precisely that it is no one's enemy. By itself art could probably not produce the renascence which implies justice and liberty. But without it, that renascence would be without forms and, consequently, would be nothing. Without culture, and the relative freedom it implies, society, even when perfect, is but a jungle. This is why any authentic creation is a gift to the future.'

Albert Camus, *The Myth of Sisyphus* (1942)

Entrenched traditions within changing surroundings

By analogy to the term 'setting', which applies to both the overall geophysical environs and the immediate surroundings, the term 'space' affords several readings, such as site, locus, landscape, scenery, surroundings, ambience. A gear/mechanism in the creation of the appropriate ambience in mystic sanctuaries, for example, was the handling of light; during the initiation ceremony at Eleusis, darkness helped construct a specific locus.[1] In antiquity, the impact of the site of Delphi accrued from the natural landscape but also from the spatial arrangement, the premeditated positioning of artworks – whether collocations of bronze statues, or edifices – with construction materials playing a salient role, too. In the Archaic era, the influx of Aegean marble and an East Greek style in architecture (Aeolic/Ionic order, carved door-frames with consoles etc.) created a recognisable ambience. So, the dynamics of Delphi owes to the overwhelming eternal, perennial physical space (the natural environment), which embraced a constantly transforming and growing space (the votive landscape) fraught with symbolism and allegory. The oracular sanctuary exemplifies how the constant evolution of the architectural setting and overall spatial layout contrast – and, in fact, balance – the steady, firm, unaltered religious tradition. The ritual of divination and the components of the mantic procedure remained pivotal and unchanged throughout the centuries, as evident also in the temple layout. This entrenched tradition signifies continuity that crossed time periods. Instead of ordained by sacred laws, this was – to a large extent – compelled on account of the geological origins of the oracle, namely the vapours exhaled from the underground intersecting faults.

A sense of motion is given out by the incessant building programs and the shifting of focal points within the sanctuary, in accordance with contemporary socio-political and historic circumstances. Following the era of the great colonial expeditions, when gifts were amassed at Delphi in gratitude of the oracle authorising colonies, major changes to the constructed landscape were triggered by the earthquake of 373 BC, the inauguration of local limestone quarries, the repulse of the Gauls in 279, and the Pergamene benefactors in the second century BC. With the passing of the Archaic zenith, the affluence of the sanctuary might be expected to shrink somewhat. Yet, the booming fourth century (post-373 BC), featuring an upsurge in building activities and followed by a new resurgence in the Hellenistic age due to the special offerings by the Aetolian *ethnos* and the Pergamene kingdom, disprove this. The outlook of the site changed and so did the various sight-lines within it.

The distinctiveness of hieratic premises: Mutating perception of architectural space, opportunities for synergy and merging crews

Each dedication was the material monumental annotation to a particular occasion, a commemoration expressed via high aesthetic standards and principles. Offerings became ambassadors of the respective city-states, often manifesting regional artistic identities.[2] Their arrangement, often in clusters or agglomerations and sometimes in tight proximity, may bespeak political incentives[3] but, first and foremost, it bespeaks the preconceived planning of the respective sector and its visual impact, the *vista*. Thereby, monumental topography and, in particular, the plotting of offerings in the sanctuary, forged individual votive and historic subspaces as hubs[4] to publicise and to preserve collective memory, to make socio-political statements and, at the same time, to mark a stage in the evolution of art and to stimulate the development of new styles. Steady and changeable factors, alike, were the formative agents of these hubs.

From such a viewpoint, the site can be appreciated as a workspace animated by settled and indigenous

[1] This we attempt to recreate/reconstitute with John Goodinson in his 3D renders <https://www.anasynthesis.co.uk/index.php/articles/eleusis-the-telesterion> accessed 31 January 2024. For the effect of darkness in ritual experience and memory, see Boutsikas 2017.

[2] The diversity/variety in design, structural forms and materials suggests that, at least usually, commissioners hired artists from their homeland.

[3] To accentuate social prominence, military supremacy or an alliance/coalition. See the amalgam of *ex votos* by Argos and Arcadia opposite to the Laconian dedication at the beginning of the Sacred Way. The votive installations of the Pergamene kings extended over an entire terrace.

[4] Such regional hubs in a sanctuary endorse its definition as panhellenic.

craftsmen;[5] their relocation from worksite to worksite within the *temenos*, and the merging of crews instigated mutual influence. The involvement in the new temple of Athena Pronaia of Boeotian craftsmen employed in the Theban treasury,[6] suggested by modes and details of workmanship, demonstrates that the teams of masons were not secluded. The contribution of Pergamenes to operations in the theatre of Delphi is inferred epigraphically but also from the architectural remains.[7] In other cases, and earlier times, the collaboration of craftsmen nurtured in different traditions is implied from the interplay of styles and design.[8] Opportunities were fostered by the multiple construction projects running in parallel and, more specifically, by the simultaneous presence of artisans of various origins on the site.

Sculptors of friezes could be working either individually or in teams. Perhaps less personalised was the fluting and refinement of a column, where stonemasons worked in teams of four to seven.[9] The quest for the 'signature' or the 'hands' of different craftsmen employed in the architectural ornamentation of a single monument calls for the application of the method introduced by Giovanni Morelli,[10] whereby we analyse forms and morphological details, recurring modes in the rendering of motifs, the use of specific tools, the accurate axial alignment or freehand execution, the visual rhyme in a moulding's constituent elements, the syntax, autonomy and three-dimensional effect of motifs, the plasticity of modelling, the detachment from the background, etc.

In the chiselling of the architectural sculpture of the Siphnian treasury, a milestone in the evolution of Archaic art, different 'hands' or 'schools' have been recognised; more specifically, a conservative, Ionicising 'Master A' on the west and south sides of the Ionic frieze, and a more innovative, Atticising 'Master B' on the east and north.[11] By analogy, stylistic variations/discrepancies in the metopes of the Parthenon are justified by the collaboration of fifty sculptors, whereas 45-65 sculptors worked on the Ionic frieze.[12] Even though these numbers are to a large extent hypothetical, the collaboration of many artists in a presumptuous monument can be explained as an expedient to speed up the process. At Hierapolis of Phrygia, where the allocation of craftsmen was predicated on different criteria (and at much later times), the most skillful and experienced stonemasons were entrusted with the architectural decoration of the most 'visible' parts of the Severan temple, namely those positioned closer to the viewer.[13] Hierapolis, with an oracular sanctuary of Apollo situated on a geological fault, is an interesting comparandum for Delphi, all the more so, as an εὔσειστος site (Strabo 12.8.17), where the consecutive (re-)construction operations allow us to chart a broad range/typology of rectification modes.[14] As concerns the occupation of different teams in an edifice as small as the Siphnian treasury, it may be explained as a progressive attitude on behalf of the commissioners, allowing contemporary trends to be represented in their *ex voto*.

Panhellenic sanctuaries afforded and enabled the convergence/merging of artisans from different worksites. This is illuminated at Olympia, where a non-homogeneous crew of masons replaced the wooden peristyle of the temple of Hera.[15] According to Philip Sapirstein, all of the stone columns were installed at once, when the roof was temporarily removed, with the collaboration of several teams of craftsmen, which justifies the variations and discrepancies in workmanship. Such a convergence was feasible at Olympia, as at Delphi, due to the availability of teams from all over Greece (occupied, for example, in some of the treasuries). By a modern analogy, specialised marble-workers in the Acropolis Restoration Project relocate at different reconstruction sites, depending on the needs. Such merging in the ancient sanctuary of Delphi instigated the exchange of stylistic traits and technical know-how. An example of 'contamination' – or synergy – is the Ionic baldachin,[16] an inner compartment of the temple of Apollo with a relief moulding that falls into place, only if ascribed to craftsmen by then employed in the Siphnian treasury. It represents a tint of *Ionicism* in a predominantly Doric environment – given the Doric ναοδομία at Delphi – to be observed also in Argos.[17] Another possible mutual influence may be detected in the pairing of isodomic with polygonal masonry, visible in the Alcmaeonid temple and its terrace-wall but also in the (earlier) front platform of polygonal stones, which

[5] Partida 2011.
[6] Partida 2000b.
[7] Partida 2015a: 30 with bibliography.
[8] See the Cycladic moulding of the baldachin supposedly in the temple of Apollo (Partida 2013: 479-483), and the incised/painted or carved palmettes on Aetolian votive monuments (Laroche and Jacquemin 2016: fig. 3, fig. 8; Partida 2009a: 281, 285).
[9] Marginesu 2010: 68.
[10] On the Morelli method, see Ismaelli 2016: 341-342.
[11] Neer 2001: 291 with bibliography.
[12] The sculptors assessed to have been occupied here range from 20 to 80, on a remarkably low salary per day. Marginesu 2010: 73 footnote 305.
[13] Ismaelli 2016; Ismaelli 2017.
[14] Ismaelli 2013.
[15] Sapirstein 2016. The wide variations/stylistic discrepancies in the peristyle of the Heraion have been accounted for by the conviction that each rotten/decayed wooden column-shaft was replaced at random, thus reflecting the contemporary fashion. The periodical donation of stone columns by individual patrons, which would result in mixed wooden and stone columns – for reasons of economy – is a preposterous conjecture. Sapirstein argues for an experimental nature of this ambitious early project, attaching importance to the crescent-shaped slots on stylobate slabs for the removal of the monolithic wooden shafts. Incidentally, his observation on repairs after 400 BC, possibly after some catastrophic damage (fig. 3), supplements our interpretation of the 373 BC earthquake repercussions/implications for Olympia (Partida 2016).
[16] Partida 2013: 479-483.
[17] Des Courtils 1983; Des Courtils 1997.

Figure 1: East pediment of the Siphnian treasury, Delphi Archaeological Museum (© Ephorate of Antiquities of Phocis, Hellenic Ministry of Culture / photo by the author).

Figure 2: East pediment of the Siphnian treasury, Delphi Archaeological Museum
(© Ephorate of Antiquities of Phocis, Hellenic Ministry of Culture / photo by the author).

the Siphnians coupled – and aesthetically contrasted – with the isodomic masonry of their treasury.

Just like the *dromos* in the sanctuary of Apollo on Delos turned into a 'portrait gallery', which advanced the development of new styles in sculpture,[18] the Ionic/Aeolic treasuries in Archaic Delphi gave birth to idiosyncratic forms in the history of art, such as the caryatids which substituted for columns, and the column-capital with drooping leaves, a precursor of the Pergamene type. Such innovative creations were bound to have a loud impact, already in the making. A singularity in architectural sculpture – invented, too, by the creators of the Ionic/Aeolic treasuries at Delphi – is the ribbed echinus, modelled on either a floral theme (a daisy) or the shape of the phiale (bowl for libations).[19] Still in the field of architectural sculpture, but with significant implications for engineering, is the carving of pedimental figures, so as to be detached from the gable. This practice, noticeable in the Siphnian treasury (525 BC), 'pushes' the sculpted figures to the front edge of the gable, while the mass of marble behind them forms a solid, low median wall (**Figures 1, 2**). In this way, the sculpture is disconnected from the structural, load-bearing skeleton of the building – an expedient that might have tackled the issue of stability discussed in the nearly contemporary temple of Artemis at Corfu.[20] Yet another unicum, obviously reflecting the

[18] Dillon and Palmer Baltes 2013.

[19] Homolle 1909: 62. fig. 32: Wilson Jones 2016.

[20] Herdt *et al.* 2014. The distribution of stresses shows that the sculpted figures would not have been able to take them. The figures ought to have been placed closer to the front of the pediment, with a load-bearing wall at the back.

Figure 3: Triangular pillar drums, Delphi (© Ephorate of Antiquities of Phocis, Hellenic Ministry of Culture / photo by the author).

craftsman's oestrus, is the triangular dowel-sockets in the triangular pillars dedicated by the Messenians and the Naupaktians (**Figure 3**).

A further facet of evolution affecting (the perception of) space is the 'transliteration' of a religious symbol into an architectural modality. A primordial ritual object was given the form of free-standing votive architecture, thus converted into a monumental particle of the setting. Along the same lines of encrypted symbolism, the omphalos/navel-stone and the baetyls of Sibylla and Cronus had been integrated in the sacred landscape. So, the prophetic tripod[21] rose on the temple esplanade in the guise of triangular shafts dedicated jointly by the Naupaktians and the Messenians in the fifth century BC. The symbol had been petrified already in the seventh century BC, as the poros tripods from the Athenian Acropolis[22] and the ones from Plataea[23] indicate. The Archaic trilateral *perirrhanterion*[24] at Delphi is likely to represent an analogous intention.

The triangular shafts broke new ground by introducing bichromy in religious surroundings. A couple of almost identical shafts, one of dazzling white marble and the adjacent one of blue-black limestone, constitute a reference-point in landscape.[25] At roughly the same time (mid-fifth century BC) painting competitions were introduced into the Pythian Games,[26] with Phidias's brother being among the contestants.[27] Besides effectuating an aesthetically pleasing canvas of colours and textures, the rich repertoire of lithotypes[28] imported at Delphi (Pentelic marble, dark marble possibly from Chios, white marble from the Cyclades, pink stone from Mylasa,[29] reddish poros from the northeast Peloponnese, oolitic stone, blue-black limestone, breccia/conglomerate) along with local titanolithos from Mount Parnassus and fine limestone from Prophet Elias, presuppose an equally broad spectrum of foreign and indigenous stonecutters/masons with the appropriate expertise in working with these lithotypes. The role played by the Ionic Cycladic workshops in major building sites of the mainland and the development of Doric Cycladic architecture could be a corollary of the growing demand for marble.[30] The combination of stones in a single monument (see the Clazomenean treasury featuring monolithic marble column-shafts and a wall-crown of marly poros)[31]

[21] Celebrated in the pedimental composition of the Siphnian treasury, which represents the struggle of Apollo with Heracles for the possession of the tripod. On the philosophical connotations, see Lernould 2000. The tripod is thought to have influenced the modelling of triglyphs, too: Wilson Jones 2002.

[22] Scholl 2010: 79, fig. 9.

[23] With engraved decoration: Pharaklas 1970.

[24] Durm 1910: 241.

[25] Partida 2019: 67 fig. 1.

[26] Pliny, *Historia Naturalis* 35.35.

[27] Corso 2016. Regardless of who won, the artworks were dedicated in the respective sanctuary. About the announcement of contests and the candidates/nominees we learn from Pliny (34.53) and Herodotus (8.123).

[28] In the Roman imperial period, marble from Thasos and blue-grey limestone from Lebadea were employed. The team responsible for the remodelling of the xystus probably worked also in the Roman Agora and the peristyle mansion. Déroche *et al.* 1989: 405.

[29] Proposed for the pillar of the Rhodian chariot: Jacquemin and Laroche 2012.

[30] Partida 2000c. The dissemination of preference particularly for marble roofs is thought to have required the presence of Cycladic workshops on building sites of the mainland: Rocco 2016.

[31] On the column-shaft, see Demangel and Daux 1923: 65. On the texture of 'calcaire marneux' and the corrosion-free condition of the wall-crown, which justifies its restoration indoors (as an interior

reasonably necessitated the collaboration of craftsmen. Indicative is the worksite of the Erechtheum, manned by Athenians, free citizens and slaves, who were outnumbered by metics, while foreigners too were enlisted in the specialised manpower.[32] The dynamics of a composite workforce lies precisely in its synthesis of small groups/crews of specialists collaborating.

The phenomenology of the unfinished

Evidently builders, artisans, site-planners and commissioners constituted a major kinetic force. The interaction of changeable and change-provoking factors, of entrenched traditions and a constantly developing architectural landscape weaved the unique radiance of the Delphic *temenos*. The above incite us to reflect firstly on the mobility within the sanctuary, also in eras wherefrom no building accounts have survived, and secondly on the phenomenology of the unfinished, namely, the impact and the experience of a major sanctuary[33] while work was in progress in the sound of hammering, chiselling and winches squeaking while heavy structural parts were being elevated. The perception of space and the experience of the site by contemporaries merit our attention because the original (ancient) appearance, with construction, repairing or maintenance operations ceaselessly in progress, may have been quite different from what we tend to reconstitute today.

Given the consecutive construction, remodelling or expansion, the picture inside the *temenos* would not be one of stillness and completion. Our ancestors were probably accustomed to the long-term presence of scaffolding, cranes, hoisting machinery etc. Practical issues were bound to emerge from the authorities' decision to build from scratch or to conduct (often large-scale) repairs. After some natural disaster, the situation would be chaotic[34] but even under regular circumstances building operations could affect a large part of the sanctuary. By realising that building activities often ran in parallel at different sectors, we begin to understand that the site was treated – and experienced – as an entity, with studious forethought on the part of the site-planners. Collateral issues surface, such as the timing, the reasoning and the symbolism potentially integrated in the spatial layout.

Understanding the spatial layout, the vista and the vision

Owing to an archive of building accounts from the fourth century BC, we learn about the adventurous, painstaking reconstruction of the temple of Apollo after some natural calamity in 373 BC and the several disruptions of the building process, which eventually lasted four decades. In addition, the accounts alert us with regard to expectable finds, such as the metopes, testified by the epigraphic reference to their doweling.[35] Although no relevant inscriptions are available from the Archaic period, the situation does not seem to have been much different. After the temple of Apollo was devastated by fire in 548 BC, its reconstruction in poros with a façade of Parian marble took almost thirty years. This long time-span was spent not only on raising the necessary funds, which eventually were supplied by the Athenian family of the Alcmaeonids, but also on the ambitious enlargement of the temple terrace, contained by a monumental wall in lesbian polygonal masonry. Just as the *Ischegaon* wall contained the sloping ground and bracketed the Classical temple from the north, the Archaic worksite had coped with an equally difficult task of infrastructure, to expand the temple terrace and to contain it from the south. With John Goodinson's invaluable help, we may pictorialise the situation (**Figure 4**), which in fact looks too neat, compared to the restoration projects carried out nowadays.

Reasonably, work-in-progress at the heart of the sanctuary hindered human traffic by obstructing both accessibility and vista/sight-line. More important, it inhibited any activity around the temple (until 510 BC), it shifted new construction to the south and it razed some earlier edifices privileged to have been erected near the old temple. Traces underneath the polygonal retaining-wall[36] suggest that a number of oikoi or treasuries were demolished for the sake of the terrace expansion and their substructures were embedded as a means of reinforcement – systematically practised at Delphi. These edifices rest unidentified and probably unrecorded throughout antiquity. A legitimate assumption is that they had been damaged in the conflagration of 548 BC and were therefore dispensable. Obviously, this was a major remodelling operation, analogous to the aftermath of the destructive earthquake/landslide in 373 BC. As inferred from the Sicyonian treasury and the re-usage in its foundations of elements from predecessor-edifices, the commissioners of the (at least five) dismantled treasuries were probably granted permission to (re-)

architectural element), see Partida 2000a: 224-237, esp. 229; Partida 2015a: 32; Vallois 1939: 55.

[32] Marginesu 2010: 75-76.

[33] 'Panhellenic' in the sense of being frequented by people from various places and representing various regional traditions. On the weaving of interregional relations by artists from many different homelands and how this forged the development of the religious setting, see Partida 2011.

[34] Collapsed monuments, debris, detached rocks, deformed foundations. For catastrophic events at Delphi and their aftermath (measures taken, restoration etc.), see Partida 2017b.

[35] Bousquet 1989: 56 II lines 27-28 and 59 II line 68.

[36] Projecting wall-corners, a distyle *in antis* substructure crossed through by the return of the grand polygonal wall near the opisthodomus, remains of an apsidal and a rectangular building buried under the esplanade: Partida 2000a: 264-278, pls 39-42.

Figure 4: Proposed 3D rendering of the Apollo temple under construction, by John Goodinson (scientific advisor: E. Partida, © J. Goodinson).

erect votive offerings elsewhere in the sanctuary, as we have proposed for the Sicyonian treasury and the one of tyrant Cypselus, renovated after the fall of tyranny in Corinth.[37] The latter is considered to be one of the earliest treasuries at Delphi (**Figure 5** no. XXIV) and it flanked the *Halos*, a space in-the-open reserved for ritual performances and re-enactments[38] (**Figure 5** no. XXXIII). A clue to the treasury's orientation is offered by topography: we would restore its entrance on the north short side, in accordance with both the contour lines and the customary principle of facing the temple.

From a practical viewpoint, the management, disposal and adaptive reuse[39] of building material was early rationalised at Delphi. Rather than stacked in depots, reusable pieces from demolished or damaged edifices were recycled. Apart from the aforementioned case of the Sicyonian treasury, poros blocks from the Alcmaeonid temple were re-exploited in the foundations of the Theban treasury and the *Ischegaon* wall, while blocks from older buildings were immured in the fountain on the south esplanade and the corner buttress of the Classical temple. The reshaping, trimming and adaptation of blocks required skillful and efficient stonecutters. The above answer the question whether a team of workers was charged with maintenance.[40] In a sanctuary of the caliber of Delphi, with relentless construction programs, emergencies could be dealt with on the spot. Considering that rectification is a skill-demanding craft on its own, the case of Hierapolis stands out: local crews of masons are credited with a series of repairs,[41] where they implemented what they had learnt from experience on the site. In Classical sanctuaries, on the other hand, where most of the available (epigraphic) evidence involves works of sculpture, specialists from different regions could offer their services. The value of restoration becomes evident in the case of Delos, where an Athenian sculptor was proclaimed benefactor because, in addition to making the statues he had been assigned with, he repaired gratis several others in the Apolloneion.[42]

Of the earliest southern boundary of the *temenos* (prior to the so-called *Hellenikon* precinct) only a segment remains in polygonal masonry,[43] no different from a terrace-wall. The Siphnian treasury is situated beyond this old south precinct (**Figures 6, 5** no. IV), incongruous with the centripetal arrangement of its

[37] Partida 2000a: 87-91, 173-184.

[38] The political character of the Halos as a civic Agora (Jacquemin and Laroche 2014) was conjectured basically because of the presence of the *bouleuterion*, which also entailed the break-up of the Corinthian treasury's outline into two separate edifices parallel to the polygonal wall. We opt for the traditional ground-plan of a single oblong building, on the physical evidence of two aligned foundation corners: Partida 2000a: figs. 6-10.

[39] For reflections on the decay and reuse of ancient monuments, see Laroche 2018.

[40] Foreshadowing the *curatores operum publicorum* appointed later by the Roman emperor to be in charge of the maintenance and repairs of all public buildings (Suetonius, *Augustus* 37; Zink *et al.* 2020: 417-419).

[41] The wealth of information provided by εὔσεισος (prone to earth tremors) Hierapolis constitutes an open-air database on the technology of restoration: Ismaelli 2013.

[42] Chankowski 2014: 43.

[43] Bommelaer 2014: 133-135, 152-155.

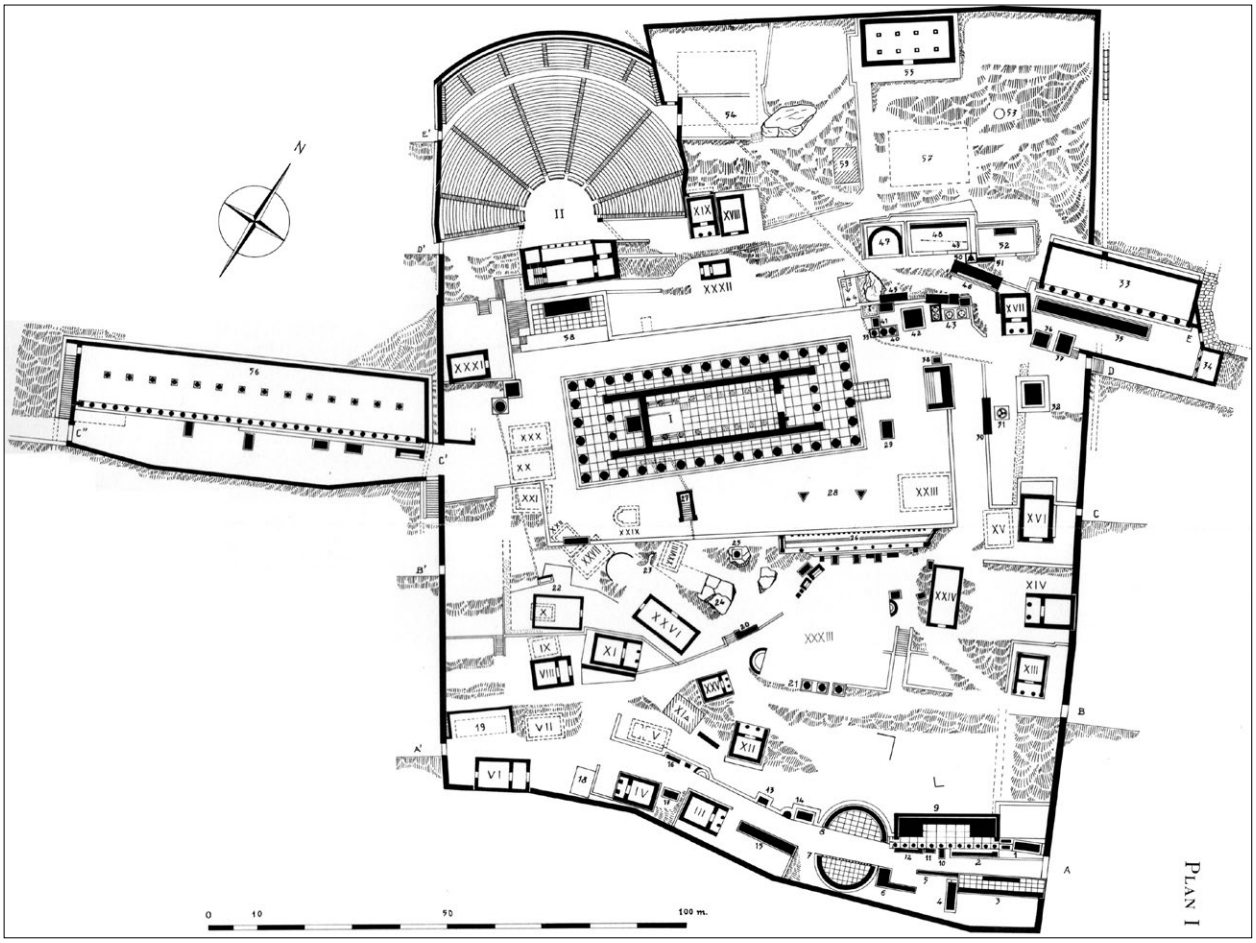


Figure 5: Plan of the sanctuary of Apollo at Delphi (after Roux 1987: plan I).

Figure 6: Proposed 3D reconstitution of niche (atlas *230) and the Siphnian treasury under construction, by John Goodinson (scientific advisor: E. Partida, © J. Goodinson).

earlier counterparts that faced the temple, but axially positioned as if anticipating the new south precinct. Should we presume foresight and awareness of the plans for expansion 25 years before the *Hellenikon* was constructed in circa 500 BC? The treasury faces west, in the direction of the modern cemetery of St Elias, where we tentatively place the Pylaea (**Figure 7**), assembly venue of the Amphictyony and the only spot offering

Figure 7: Locality of niche (atlas *230) in Apollo sanctuary, Delphi. St Elias cemetery and buttressed wall visible in the background (D-DAI-ATH-Delphi-0032, photo by Georg Karo?, courtesy of the Deutsches Archäologisches Institut).

view to the sea, the harbour of Krissa.[44] The position of the Siphnian treasury deviates from the arrangement of the rest of the monuments. What was it 'addressing'?

At the dawn of the sixth century BC the Amphictyony's conflict with Krissa, a powerful city in control of the oracle and the valley of Pleistos, triggered the First Sacred War, which ended with the city's destruction. Although its location rests unknown, remnants of Archaic date at Agia Barbara, on the trail connecting Delphi with the port of Kirrha, are situated close to the oracle and overlooking the valley (**Figures 8, 9, 10**), so, topographically fitting Homer's description of Krissa.[45] Having been re-occupied for domestic purposes in the Roman times, the site was not mentioned by Pausanias, yet, the gap in the stratigraphy befits the fate of the, razed to the ground, Archaic city of which the elimination had implications also for political geography. Henceforth the valley of Pleistos was declared sacred, dedicated to Apollo and no longer arable, marking a nodal change to a seemingly unaltered scenery.

In most of its course, the trail linking Delphi with Kirrha coincides with the ancient cart-route for the transportation of building material from the harbour (**Figure 10**). This path would have been taken by the Cretans who escorted Apollo in establishing the oracle and, later, by pilgrims, inquirers, delegations, athletes, but also workmen and artisans. The treasury of the Siphnians commemorated the inauguration of silver mines on their island.[46] In addition to precious metals, a special kind of carvable green steatite was mined there, later to be termed 'lapis siphnius'.[47] With such a mineralogical background, it seems likely that the Cycladic treasury faced the 'route of raw material' and saluted those arriving by the sea. In about 530 BC the scaffolding for the Siphnian treasury[48] at a fair distance from the temple terrace *to be* fully configured in two decades' time (*c.* 510 BC), and its erection on a relatively vacant so far 'crossroad'[49] suggest that the localities of votive monuments were plotted and allocated with forethought/foresight while an overall site-plan was being laid out. Apparently, the drastic remodelling of the esplanade, which entailed the demolition of oikoi or treasuries closer to the old temple, had been drafted as early.

Tracing the whereabouts of masons' workshops

The Pylaea, assembly venue of the amphictyonic council known from epigraphic and literary sources,[50] is sought west of the sanctuary and conjectured as an open-air theatrical construction on the terrace contained by the robust conglomerate wall with buttresses still visible in the modern cemetery of Delphi (St Elias) (**Figures 7, 11**). Although not excavated, this area has been associated[51] with the toponym Θυίη known from Herodotus (7.178), who mentions an altar to the Winds erected by the Delphians for Thyia, in her *temenos*. Thyia, who lent

[44] Bourguet 1914: 6, fig. 2, 288, fig. 97.
[45] In his *Hymn to Apollo*. On the proposed identification of the site, see Skorda 1992; Skorda 2003.
[46] Herodotus, *Historiai* 3.57.2.
[47] Pliny, *Historia Naturalis* 36.159; Theophrastus, *Περί Λίθων* 73-74. In the Classical period, steatite was procured from Siphnos and Como (Italy): Rapp 2013: 122.
[48] Daux and Hansen 1987: 41, fig. 26.
[49] Neer 2001: 289.
[50] Referred to by Aeschines, *Κατὰ Κτησιφῶντος* 118-119 (Roux 1979: 38-39).
[51] Bourguet 1903: 25-29.

Figure 8: 'Agia Barbara' between Delphi and Chrisso. Aerial view of the excavated site (courtesy of the excavation director, Despoina Skorda, © The Archaeological Society at Athens / εν Αθήναις Αρχαιολογική Εταιρεία).

Figure 9: 'Agia Barbara' between Delphi and Chrisso. View of polygonal retaining-wall (after Skorda 2003: pl. 3).

her name to the place, was the daughter of Kephissos river. An atelier at Θυίαι/Thyiae comes up in fourth-century building accounts pertinent to the preparation by carpenters of voluminous angular ceiling elements, ordered by architect Agathon.[52] Elsewhere in the corpus of accounts, the toponym Thyiae occurs in association with workshops,[53] possibly a portico,[54] some route/path[55] and a deposition of λατύπη (marble chipping/flakes).[56] The atelier re-emerges epigraphically in the context of the delivery of a large quantity (20,000) of mud-bricks.[57] If the supposed oikos of the Thessalians, presumed to have encased the statuary complex of Daochus (contemporary with the account in question, 337 BC) and theoretically restored with a mud-brick superstructure, required approximately 3000 bricks,[58]

[52] Roux 1979: 224; Roux 1989: 34, 61.
[53] Bousquet 1989: 56 I A lines 11, 21, 47-48, and 59 I.
[54] Bousquet 1989: 46 B II line 7, and 47 A II lines 9 and 15. Let us note, however, that the term παστάς (portico) is only inferred and not actually legible.
[55] Bousquet 1989: 59 I lines 26-27.
[56] Bourguet 1903.
[57] Bousquet 1989: 56 I A lines 44-48.
[58] On the grounds of the estimated wall-height (Jacquemin and Laroche 2001: 319).

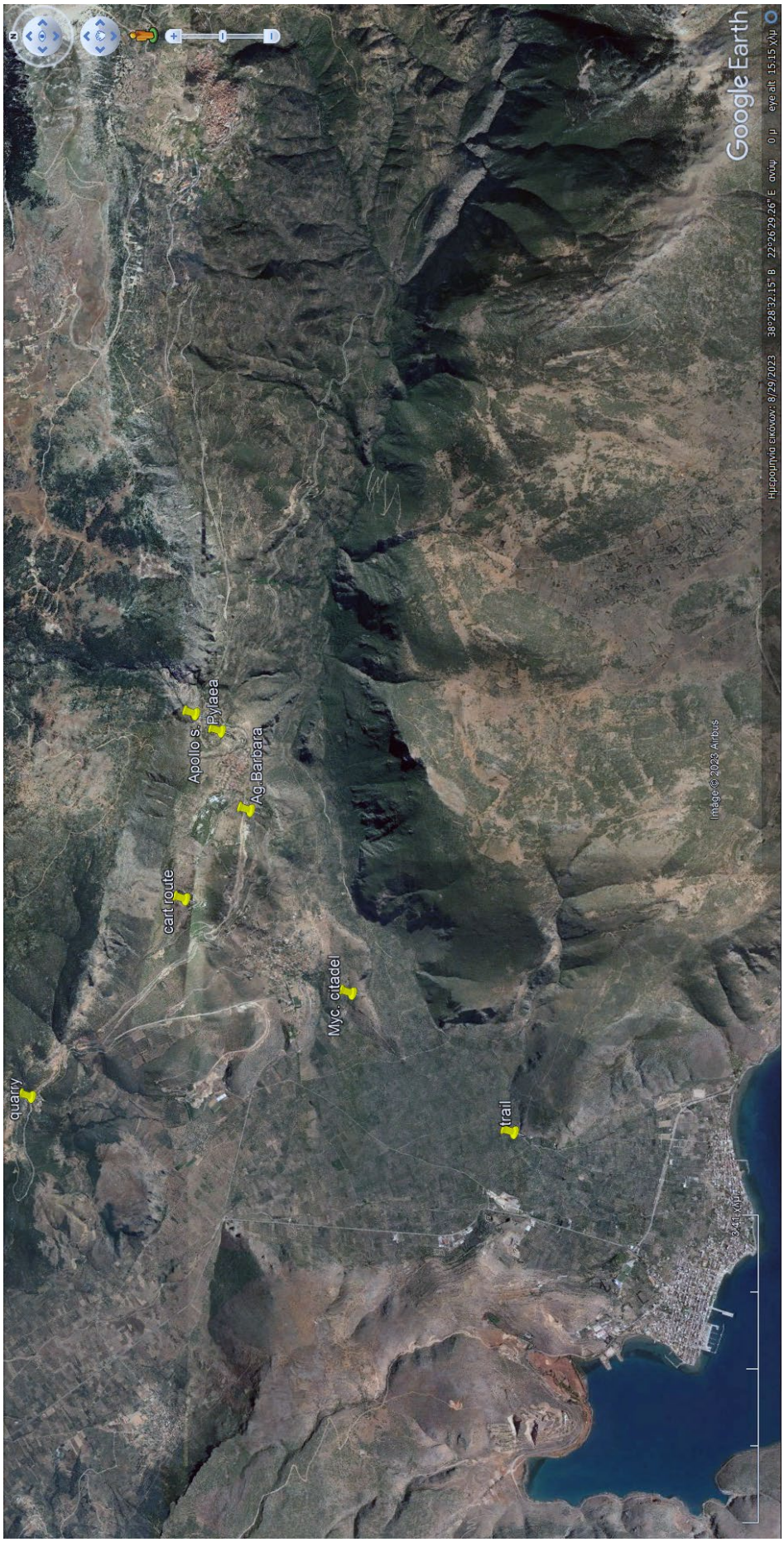


Figure 10: Trail connecting Kirrha with the Apollo sanctuary, passing by the Mycenaean citadel at Chrisso and Agia Barbara (Google Earth map, edited by E. Partida).

Figure 11: Ancient buttressed wall at the modern St Elias cemetery, Delphi (© Ephorate of Antiquities of Phocis, Hellenic Ministry of Culture / photo by the author).

we proportionately gather the vast size of the atelier,[59] or an agglomeration of workshops (?).

No less, the brick-yards that supplied substantial quantities of fired bricks for the various *opera* in Roman Greece can be as elusive (in spatial terms) as the studio of a scribe/lapicide,[60] which, by definition, is not expected to leave traceable physical remains. Surprisingly, however, a stonemasons' studio often proves equally difficult to spot. As a provisional, utilitarian and probably makeshift shack, destined to shade stonecutters, carpenters, engravers, ivory-workers, sculptors *et al.*, and to shelter them from the heat and rain, the studio was not supposed to raise the budget, so a light construction of perishable material would suffice. Thin foundations for an unpretentious construction can be a means of identifying an atelier. Another means is the presence of stone chipping/flakes. In a building account from Epidaurus, Euterpidas from Corinth was assigned with the extraction, transportation and accumulation of τὸν σκῦρον ἰς τὸ ἐργαστήριον.[61] Σκῦρος designates λατύπη (stone chipping/flakes), as well as bigger chunks extracted from the quarry, usable as wedges in polygonal masonry or in the foundations of light structures. So, σκῦρος from the worksite of the temple of Asclepius would be utilised in the construction of the workshop. Actually, foundations made of σκῦρος were found very close to the temple, outlining a portico or porch/προστώον that fronted an oblong partitioned chamber. A modest edifice like this, in the middle of the sanctuary, can reasonably be interpreted as a workshop, even if later converted into a venue for administration by the clergy, as Georges Roux surmised. Roux (1989) generally attacks the postulation/assertion that ateliers were ephemeral, short-lived constructions and he opts for their repurpose, on the analogy of that of Phidias at Olympia. The foundations of a stonemasons' workshop excavated beside the temple at Molykreion in Aetolia (**Figures 12, 13**) delineate a double stoa almost as big (38.80m by 11.40m), running parallel to the temple's long axis, as if duplicating it. The thin-walled stoa was lengthwise divided by a median wall opening out to a colonnade on either side, with wooden posts standing on square stone bases. Of exemplary location, size and ground-plan, which factually determine its function, this workshop[62] is instructive as to the whereabouts of stonemasons' studios on other sites.

Located marginally in the Delphi sanctuary of Athena Pronaia, a polygonal socle outlines a pair of adjacent chambers fronted by a common vestibule. The building was obsolete in the first decades of the fourth century BC, when the new temple of Athena and the tholos had been erected, and its function remains uncertain, ranging from a cult-place for σύνναοι deities to a priests' house or even a dining-hall. A thick layer of marble flakes and powder, and an unfinished block indicate that – at some point – masons worked therein, possibly engaged in the erection of the tholos.[63] Judging from its moderate size and the date of its polygonal masonry, the workshop seems likely to have served the building of the treasuries for Athena Pronaia or, alternatively, the stuccoing/plastering

[59] Bousquet 1989: 106.
[60] Mulliez 1998.
[61] Roux 1961: 86-89.
[62] Its preservation is thought to endorse the excavator's opinion that the temple was unfinished. Orlandos 1924-25: 62-63.
[63] Bousquet 1984.

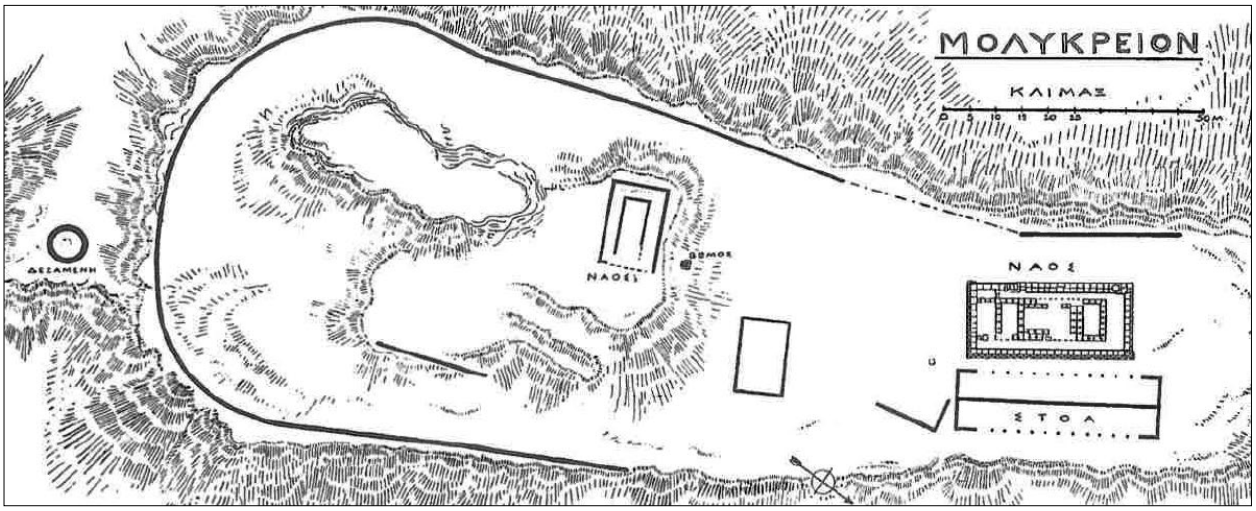


Figure 12: Topographical diagram of the acropolis at Molykreion (after Orlandos 1924-25: fig. 2; drawn by A. Orlandos).

Figure 13: Aerial view of the double stoa beside the temple at Molykreion (© Nikos Kaltsas / photo by Kostas Xenikakis).

(κονίασις) of her Archaic poros temple.[64] Structurally, however, the socle suggests a firm construction, destined to be long-lived.

The residues of another polygonal stone footing, awaiting a mud-brick superstructure in the form of a niche, just inside the west precinct by the southwestern gate[65] (**Figure 5** no. 19) may have had a secular function. This niche fits the specifications of a builders' workplace, given its spacious and plain ground-plan, which facilitates the maneuvering and carriage of blocks with the least possible zigzagging. The style and date of its polygonal masonry suggest that it probably sheltered craftsmen engaged in the construction of the Archaic treasuries at the 'crossroad' (**Figure 6**).

Further north, another gateway near the grand West Stoa[66] apparently served the construction site of the oracular temple. In fact, the West Stoa is supposed to have taken up the area previously occupied by an extensive studio of stonecutters[67] (**Figure 4**). As we have seen, the atelier of Thyiai, too, is theoretically restored west of the sanctuary, near the Pylaea. Emile Bourguet[68]

[64] Roux 1989: 63-64 opts for a hestiatorion.
[65] Atlas *230 (Hansen and Algreen-Ussing 1975).
[66] About the west sector in relation to the cart-route, see Partida 2009b: 531-532; Partida 2015a: 38-39. Probably driven by the Hermeion terrace, Perrier (2019) monumentalises this gateway, which she relates with Hermes Propylaios in the form of a herm, disregarding the marble relief that represents Hermes and Helios (Partida 2017a). Bommelaer and Laroche (1991: 219) had already considered/discussed the gate to the west of the temple as a principal entrance.
[67] Bousquet 1985: 726.
[68] Bourguet 1914: 289.

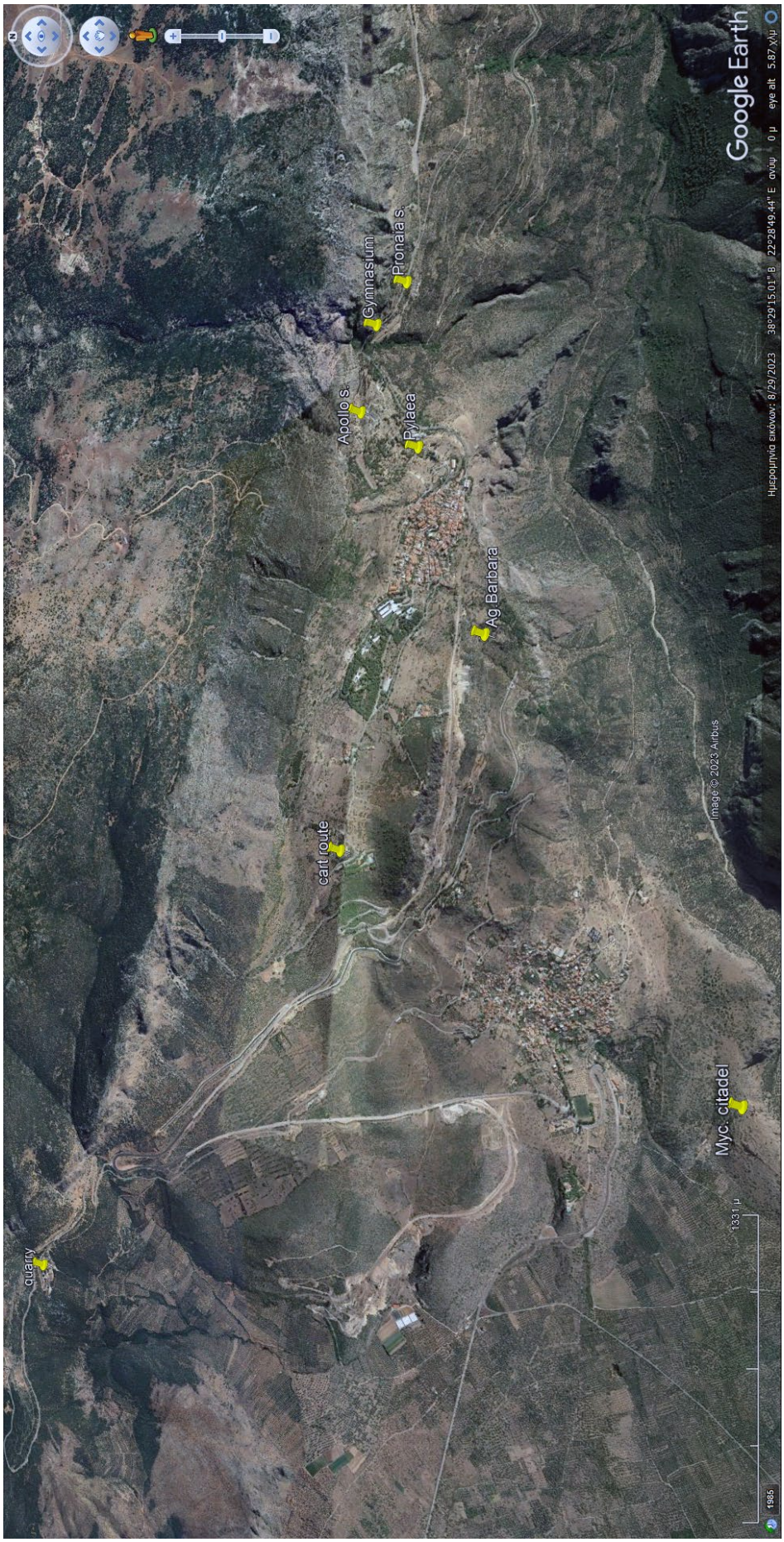


Figure 14: Sites discussed in the paper, plotted on Google Earth map (edited by E. Partida).

was the first scholar to propose that this spacious area, termed 'αλώνια' (threshing floor) in modern times, could have accommodated the workshop (built of mud-bricks) where the architectural elements of the Classical temple were being prepared. This western sector is where the building material unloaded at Kirrha was eventually delivered. Moreover, here was the terminal of the cart-route (δρόμος λιθαγωγίας) from the quarries of Prophet Elias (**Figure 14**), inaugurated in the fourth century BC. This refutes the hypothesis that the atelier of Thyiae was situated on the Gymnasium terrace, east of the Apolloneion,[69] on the assumption that Θυία and Castalia occupy the same mythological position. At any rate, such a hypothesis is gravely enfeebled by the distance and the acclivity.

References to workshops come up in epigraphic testimonies but it is not mandatory that all of them relate to the temple of Apollo. Mentioned in the same context as the crane at Kirrha and repairs to the cart-route is the construction of workshops presumably for artisans engaged in the temple construction.[70] The same has been speculated for the workshops referred to in the honourary decree for Akidon,[71] apparently because of the phrasal context, which includes the *naopoioi* bureau (ναοποῖον). Akidon, at the end of the third century BC, undertook the repairs or maintenance of a number of edifices in the sanctuary – a task that normally burdened the Amphictyony and the town of Delphi.[72] The specified edifices were: the *hoplotheke* in the sanctuary of Pronaia, the lower Gymnasium, the grand stoa, the bureau of *naopoioi* and the ateliers (τὰν ὁπλοθήκαν τὰν ἐν Προναία, τὸ γυμνάσιο τὸ κάτω, τὰν παστάδαν τὰν μεγάλαν, τὸ ναοποῖον καὶ τὰ ἐργαστήρια). One of these ἐργαστήρια is theoretically located at Thyiae.[73] Notably, so far, 'τὸ ἐν Θυίαις' is the only atelier distinct by its place-name. However, granted the shortage of space due to the ever-increasing votive monuments in the *temenos*, the maintenance of the atelier of the temple more than one century after the temple had been completed makes little sense, unless the atelier was repurposed. Reasonably the workshops mentioned in the decree related to monuments *concurrently* under construction. A couple of details in the inscribed text, however, merit our attention because they reveal the honoree's identity: honorific privileges were conferred by the city of Delphi upon Akidon for repairing (most probably, roofing) the aforementioned edifices. Considering, on the one hand, that the necessary quantity of tiles was supplied by the *polis*[74] and, on the other hand, that besides his other privileges he was also exempt from the so-called χειροτέχνιον or χειρωνάξιον[75] – a tax levied upon craftsmen/artisans or labourmen – we infer that Akidon not only undertook but also carried out the work. In other words, Akidon was a craftsman.

The synthesis, coherence and mobility of the workforce

Numerous masons' marks, incised guidelines and pry-holes for the leverage and maneuvering of heavy blocks unravel the fervent construction operations carried out by a huge workforce instructed by the architect. The architect directed the worksite, coordinated all faculties and guaranteed the quality of execution. Epigraphic building accounts of the temple reconstruction in the fourth century BC provide a fair idea of the verve on the worksite, its organisation, logistics and financial records. In parallel, they allow us glances at the manpower, namely the polyvalent contractors/entrepreneurs (ἐργώναι), the numerous stonecutters, masons and craftsmen. Argos and Corinth stand out as the places of origins of a large number of specialised artisans. Next are the rest of the Peloponnesians, Boeotians and Athenians, while Cnidus and Croton also contributed to manning the temple worksite.[76] Delphians are recognised in the accounts, being usually referred to by their name without an ethnic. Indigenous masons were familiar with the terrain and their contribution is evident both in the consistent mode of laying foundations[77] and the special tooling of the bedrock (afterwards clad with poros) – a common practice at Delphi, in an effort to incorporate the rocky outcrop, perhaps in order to reinforce the substructure.[78] Inversely, cases of exposed bedrock amid elaborately finished marble surfaces in Hellenistic Miletus and Priene served the aesthetics of contrast. The visibility of bedrock in its rough and unwrought state,[79] intentionally juxtaposed to an architectural landscape (the natural versus the artificial), was a means of showing that the ancient Greeks were keen on disparity. In default of proportionately detailed archives concerning building operations in the post-Classical period, we rely on structural remains, epigraphic testimonies and historic circumstances which suggest that architects from Pergamum arrived at Delphi in the Hellenistic age, to supervise the installations dedicated

[69] Jacquemin 1992: 171-173.
[70] Roux 1989: 52.
[71] Bousquet 1985: 722.
[72] Roux 1989: 36. As we learn from an amphictyonic decree of 270 BC (Roux 1989: 56; *Syll*^{3} 419), Eudoxos from Argos donated shields for the hoplitodromes at the Pythian Games. The decree stipulates that the city of Delphi should designate or concede a treasury for the shields to be deposited (δοῦναι δὲ τοὺς Δελφούς Εὐδόξῳ καὶ θησαυρόν ὅπου τὰ ὅπλα θήσει). Apparently they could not be placed in the *hoplotheke* – an arsenal for the armours regularly dedicated to goddess Athena. Jacquemin (1993: 219) interprets this as the city's obligation to construct a treasury for the specific purpose.
[73] Roux 1989: 61.
[74] Bousquet 1988: 172.
[75] Lefèvre 2019: 204-205.
[76] Feyel 1998: 575, fig. 2.
[77] Especially observed in treasuries. Partida 2000a: 293-297.
[78] Partida 2017b: 232, 244.
[79] Dietrich 2016.

Figure 15: Unfinished column-drum at Kirrha (© Ephorate of Antiquities of Phocis, Hellenic Ministry of Culture / photo by the author).

by the Pergamene kings. For their conservation some decades later, painters from Pergamum would be dispatched.[80]

A renowned contractor from Delphi, Passion, was assigned with the construction of the *Ischegaon* wall just before the Third Sacred War, re-employing blocks from the old (Alcmaeonid) temple. He was paid 1580 drachmas in two installments.[81] Passion collaborated with Nicodamos, a quarryman who extracted poros at Corinth. The question 'what scope of freedom did the individual craftsmen have in relation to the instructions provided by the architect?' is difficult to answer; sometimes an initiative or improvisation could jeopardise the outcome. However, the entire manpower of a worksite was valuable and esteemed because all the craftsmen involved were small creators. Manolis Korres[82] rejects the arbitrary discrimination between low-ranked labourmen or managerial components and high-ranked intellectuals at the worksite. He advocates that a good quarryman would often mentally process the problems faced by the architect and make calculations that demanded a sharp mind. He had to comprehend the complex interaction of geology, geometry, art and engineering. Fortunately, these factors operated within a well-organised system of production, an undertaking achieved by teamwork.

Although we know nothing about the limestone quarries of Prophet Elias prior to the Third Sacred War (356 BC), things are quite lucid as concerns sea-borne stone transportation via Lechaion and Kirrha, thanks to the building accounts from Epidaurus,[83] as well. The famous timber from Sicyon, suitable for carpentry, facilitated the construction of strong, resilient rafts[84] towed by large ships and carrying heavy loads of building material over sea-routes or in navigable rivers. One should allow for an amount of timber destined for scaffolding, too. Overland transportation followed up, with the voluminous blocks loaded in wagons with reinforced wheels. With reference to the Periclean project on the Acropolis, Plutarch and epigraphic testimonies[85] describe λιθαγωγία (stone transportation), λιθουλκία (stone hauling/traction), λιθοτόμους (stonecutters), λιθουργία (stone working); the phrasing alludes to walled structures serving as workshops on the Acropolis, probably besides open-air ones. Stone transportation raised the budget,[86] given that (already in the mid-sixth century BC) the shipping of marble from the Cyclades round the Peloponnese, into the Corinthian Gulf towards the harbour of Kirrha, and then by wagons/carts all the way up to the Delphi sanctuary, was painstaking and time-consuming. Perhaps this explains the exaggerated cost of the pedimental compositions carved in Pentelic marble for the Classical temple of Apollo, estimated to have amounted to 5000 drachmas per figure,[87] excessively more expensive than their counterparts of the Parthenon, where 54

[80] Partida 2019: 69 with bibliography.
[81] Amandry and Hansen 2010: 492-494.
[82] Korres 1994: 7-8.
[83] Kritzas and Prignitz 2016.
[84] Tree-trunks/logs for the construction of rafts were hoisted by means of ice-tongs (καρκίνος), a lifting device used in the building procedure.
[85] Marginesu 2010: 74-75.
[86] The quarrying, transporting and maneuvering of voluminous elements of excessive weight was a laborious and costly enterprise. For this reason, at Epidaurus they preferred to recover/retrieve poros blocks from the bottom of the sea (after some wreck), rather than quarrying new ones (Kritzas and Prignitz 2016).
[87] Croissant 2003: 176.

sculptors were paid 16,392 drachmas for 300 days.[88] The inauguration of a local quarry of fine quality limestone at (Prophet Elias) Delphi propelled building activities in the fourth century BC, if not also the construction of the theatre. Timing was perfect, considering the need for repairs and reconstruction after the earthquake of 373 BC. Vestiges of a cart-route from the quarry to the sanctuary, probably distinct from the path taken by pilgrims, have been investigated (**Figure 14**). Although nearly all evidence has been eliminated by modern road construction, rock-cuttings, curbs and a couple of pole-sockets for the traction of loaded carts uphill have been traced beyond the sanctuary.[89]

Equipment and specialised operators

A crane was probably permanently installed at the port of Kirrha, as also at Epidaurus.[90] The solitary column-drum with lifting bosses still standing near the ship-sheds at Kirrha is a testimony (**Figure 15**). Calliteles is epigraphically known to have rectified a crane at Delphi.[91] Much earlier, however, simpler hoisting devices were used in the sanctuary also for maneuvering a block into position, tight up against the blocks already in place, with the aid of ropes and levers.[92] A single off-centre V-shaped hole near one end of a block attributed to the seventh-century BC treasury of tyrant Cypselus probably served manoeuvring rather than lifting.[93] Concurrent with the development of lifting devices was the shift from monolithic to drum-built shafts, which has been associated with an effort to reduce the weight of the blocks, keeping it within the crane's lifting capacity.[94] A pair of V-shaped suspension holes occurs on the top of a column-drum attributed to the treasury of Cypselus,[95] while similar cuttings can be seen on column-drums and capitals from the early temples of Athena Pronaia and Apollo, both dated to the first half of the sixth century BC.[96]

Construction industry demanded state-of-the-art machinery and sophisticated apparatus (pulleys, block and tackle, two-legged or four-mast cranes, respectively δίκολον and τετράκολον, etc.), as well as accordingly specialised craftsmen and haulers, in addition to labour-force. The epigraphically attested assistants (ὑπουργοί) would be assigned with roadwork (ὑπουργοί Πεντελῆθεν ὁδοποιοῦντες)[97] or with carving the simpler and repetitive mouldings, to help accelerate the work.[98] Foremen, known as ἐπιστάτες on the Athenian Acropolis (ἐργεπιστάτες in Roman Lydia),[99] had managerial and organisational responsibilities.[100]

Our knowledge on scaffolding (timber poles fastened with ropes and dowels) is restricted.[101] Large nails and beam sockets remain from a scaffold in a building of Byzantine Thasos.[102] Reference to the montage and mounting of a scaffold is made in building accounts; characteristic are the ἰκριώματα/ίκρια, vertical poles and stepped platforms set up for the erection of the statue of Athena Parthenos.[103] Much earlier evidence in the form of circular pockets/holes below floor level, either for wooden scaffolds or marking the positioning of a crane, comes from the early temple at Isthmia.[104] The alignment and consistent spacing of holes in the bedrock underneath the floor of the oikos of the Naxians on Delos led to their interpretation as marking the position of two-legged/two-mast cranes.[105] Given that the columns of the oikos were wooden, possibly no crane was needed, so the holes might have accommodated a scaffold, instead. Archaeological evidence is further supplemented by an interesting find at Delphi: At the top of the pillar of the Rhodian chariot of Helios, sockets for metal rods round the edge/brink and beyond the surface occupied by the chariot, are interpreted by Didier Laroche as having fastened the scaffold.[106] Their presence at three sides of the pillar top suggests how the wooden platform/landing (*ξύλωμα* ἰκριώματος) expanded the working area.

Nuisance overcome

The Delphian metalworker Kleudamos forged clamps specifically for the capitals and epistyles of the Classical temple of Apollo.[107] A large amount of clamps, which cost 450 drachmas in 356 BC, would be used plausibly in the entablature, estimated to have been fastened by 532 clamps.[108] In total 10,000 clamps were calculated

[88] Marginesu 2010: 73.
[89] On the route to/from Prophet Elias quarries, see Bourguet 1914: 334, fig. 121; Hansen *et al.* 2016; Partida 2009b: 531-532. The route is expected to allow for two lanes, in opposite directions.
[90] Kritzas and Prignitz 2016: 27-29.
[91] Feyel 1998: 570.
[92] Cuttings may be associated with suspension from a rope, when one appears over a block's centre of gravity, or when two appear symmetrically on either side of it. Pierattini 2019: 194.
[93] Because if such a cutting were used for suspending a block, this would hang almost vertically. Coulton 1974: 2.
[94] Coulton 1974: 14-16.
[95] Østby 2000: 242; Partida 2000a: 173-185.
[96] Coulton 1974: 3.
[97] Carusi 2021: 137; Marginesu 2010: 74.
[98] As in the case of the Severan temple at Hierapolis. Ismaelli 2016: 356.
[99] Kantirea 2023.
[100] With Phidias being the ultimate supervisor, ἐπίσκοπος πάντων, according to Plutarch. Marginesu 2010: 65-66.
[101] For examples from Egypt, see Golvin 1993. For the testimony of Vitruvius, see Ginouvés and Martin 1985: 116-118.
[102] Sanidas *et al.* 2014.
[103] *IG* I^3 472.152-160.
[104] Five rows of circular holes below floor-level might have accommodated wooden scaffolds, on the grounds of their size, depth and spacing. Broneer 1971: 11; Pierattini 2019: 184-185, fig. 11.
[105] In this early-sixth-century building. Kalpaxis 1980; Kalpaxis 1990.
[106] Jacquemin and Laroche 2012.
[107] Feyel 1998: 566-567.
[108] After the Third Sacred War, in 335 BC, 1010 drachmas were paid for 1212 clamps, each weighing 1.72kg, and 200 drachmas for 320 dowels, each weighing 1.29kg. Amandry and Hansen 2010: 491-492.

by Erik Hansen to have girdled the temple blocks and the pouring of 170 tons of lead would be needed to fix them in position. The pertinent account attests the purchase of 10 tons for the price of 1100 drachmas. Where should we look for the metalworkers' facilities? A brief comparative review of the evidence from other sanctuaries suggests that they were established *ad hoc*. The prodomus of the Classical temple at Tegea was superimposed upon a metallurgical workshop. The workshop had been set up[109] in the second half of the eighth century BC, at a distance of 6.5m from one of the earliest apsidal cult buildings in Arcadia (late eighth-early seventh century BC), identified amid the foundations of the Archaic temple. The facility operated while the cult buildings were in use and it was obliterated after their destruction.[110] The blacksmiths could have worked at the service of goddess Alea, creating votive objects for the worshippers to offer her. The special bond between craftsmen and the divinity is further revealed at Kalapodi, where tools originally used in the Archaic temple's carpentry were considered to belong to the sanctuary and therefore forbidden to be removed. So, they were ultimately (re-)exploited as wedges beneath the temple stylobate.[111] In the Classical era, besides the enormous bronze foundries for the casting of colossal statues associated with cult places (indicatively, the χαλκουργεῖον on the Athenian Acropolis south slope), smaller-scale metalworking facilities were installed close to major sanctuaries.[112] Furnaces and kilns of simple design were built as needed (e.g. in sanctuaries which hosted athletic festivals) and obliterated when work was completed. At Isthmia, foundry operations and castings took place in the vicinity of the temple of Poseidon, sometime during the fifth and the early fourth century BC.[113] Before and after the great festivals, itinerant craftsmen carrying their tools are thought to have worked there, supplying *ex votos* or commemorative statues of the victors. We consider it equally plausible that clamps, dowels, grilles/rails and other metal parts of the respective temple were produced in these workshops, which would explain both the adjacency and the ephemeral nature: once the destination-building had been completed, facilities were redundant.

In sanctuaries, the lifetime of workshops equated to the duration of the respective construction, repairing or maintenance operations.[114] In this respect, religious premises differ from urban environs, where a permanently established workshop could be a source of nuisance (smoke, pollution, noise, implications for health and environment).[115] But can we talk about nuisance in sanctuaries like Delphi, where the density and tight sequence of building programs hardly permitted a scaffold-free condition? Following the Archaic feverish building enterprises, the rock-fall supposed to have deterred the Persian invasion in 480 BC generated reconstruction work in the sanctuary of Athena Pronaia. The fourth century BC witnessed a radical remodelling and blossoming of both sanctuaries whereas, immediately after the oracular temple's completion in 334 BC, scaffolding was transferred to three different sectors: the east precinct, the Gymnasium and probably also the West Stoa. Especially the epigraphically elucidated[116] segmentation of the precinct's renovation in vectors assigned to respective architects/contractors shows the minute ergonomic planning. In fact, the cause of the precinct's partly ruined condition could have been, in our opinion, the natural catastrophe that struck during the erection of Daochus's monument in circa 337 BC,[117] shortly before the worksites by Pancrates and Euainetos opened *at that level* of the *temenos*. The surmised intentional rupture of the precinct by the Delphians and the Amphictyons, to facilitate transportation of building material from the east (where the atelier of Thyia is conjectured),[118] is untenable and inconsistent firstly with the steadfast ergonomic planning that we have argued for above, secondly with the locality of the quarry in directly opposite direction, and thirdly with the traces of the respective cart-route. In the third century BC the – changed again – hieratic landscape reflected the rise of a new political force, the Aetolians, whereas an upsurge of votive offerings by the Hellenistic kings was meant to transform the site anew in the second century BC.[119]

Versatility, coordination, team spirit… and the builders' signature

In the case of Delphi, it may be more accurate to speak of relocated – rather than temporary – worksites, since both sanctuaries can be viewed as permanent/perennial ἐργοτάξια, where a huge workforce engaged in stonecutting, preparing structural or decorative parts in various materials, transporting, hoisting and laying the blocks. Co-ordination and synchronisation sky-rocketed the manpower's potential and optimised its performance. Quality in execution was stipulated in contracts[120] not to be compromised in the pretext of saving time; moreover, competitions[121] prior to authorising a building project underline the high standards and professionalism in ancient Greek

[109] Østby 2014: 18-20.
[110] Østby 2014: 30, 50.
[111] Hellner 2018.
[112] On Delphi, see Rolley 2002.
[113] Rostoker and Gebhard 1980.
[114] Financially covered mainly by the town of Delphi (Jacquemin 1993: 219).
[115] Sanidas 2020.
[116] Bousquet 1989: 181-182.
[117] Jacquemin and Laroche 2001: 329-330.
[118] Jacquemin 1992: 173.
[119] Partida 2009a; 2012; 2015b; 2018; 2019.
[120] Choisy 1884: 197-199, 208.
[121] Corso 2016; Marginesu 2010: 66-67.

construction industry. In particular the division ἐπί τὰ ἱερά was distinguished among public works, and this mentality is echoed in the unfinished state of buildings[122] to be completed when circumstances would be favourable. Interestingly on Thasos the unused blocks destined for the (unfinished) temple of Athena were later used in a rampart, whereas at Delphi, when the Phocians needed building material for the fortification during the Third Sacred War, they kept off the construction site of the temple of Apollo. Apparently the Thasians had consciously given up on the prospect of completing the temple, which indirectly corroborates that politics were tied with the fortune of this monument.[123]

Having laid down the specifications, measurements, ratios, *syntax* and allotment of ornamental elements, the architect probably gave the stonemasons sketched or schematically drawn instructions.[124] The architect of the Classical temple of Apollo at Delphi, too, is unlikely to have drafted execution drawings to scale.[125] Instead, he instructed the masons step by step and in detail, as inferred from marks on the blocks, guidelines and pry-holes for the lever. Erik Hansen[126] has shown that the placement of blocks could be repeatedly tested before they were definitively laid into position, which necessitated adjustments and corrections during the building process. The remarkable precision in montage did not result from the blocks' standardised shape but, instead, from the perfectionism that transpired the team at work. The masons made amendments and improvements *during* the erection of the temple; they multiplied the clamps, they repositioned and refined the stylobate blocks as many times as necessary for them to be coherently joined.[127] The marks *in situ* are the builders' signature bespeaking the endeavour, the struggle for perfect fitting. That certain details were coped with while construction was underway, is corroborated by the Archaic South temple at Kalapodi, where twelve unusual iron tools for peeling the bark off tree trunks, therefore originally employed for the wooden superstructure of the temple, were found wedged below the inner part of the stylobate blocks.[128] Their find-spot suggests their use to adjust the level of the stylobate, which rest on uneven substratum and was therefore susceptible to settling under the load of the columns. As aforementioned, however, they also represent an act of veneration on behalf of the craftsmen.

An architect built his biography through directing projects in different locales/cities,[129] which earned him the reputation of a cosmopolitan creator. Likewise, the artisans' professional specialisation was built experientially. The training of a craftsman was, in fact, his expertise gained from different worksites. Throughout the centuries, the mobility of specialised manpower and the mixed synthesis of work teams fueled the diffusion of traditions, styles, iconography, technical know-how.[130] René Vallois concluded that ancient Greek architecture grew beyond confines or stereotypes, as it constantly developed forms and modalities.[131] We may add that its non-standardised nature owes to the *in situ* experimentation and fermentation of knowledge, the impulse and spark of the human spirit, and essentially the valency of worksites.

Acknowledgements

Sincere thanks are due to Despoina Skorda, Nikos Kaltsas, Joachim Heiden, Eleni Tzimi and the Deutsches Archäologisches Institut for their willing permission to publish photos from their archives. John Goodinson's 3D renderings literally bring ancient sites to life and I am grateful for our prolific, exciting collaboration since 2016. For steadily facilitating my research at Delphi, the Ephorate of Antiquities of Phocis and the Director, Nancy Psalti, deserve my gratitude. Last but not least, I cordially thank my colleague, co-editor and friend, Constanze Graml for her thoroughness, professionalism and optimism throughout the materialisation of this book, as well as for the many rewarding discussions during this shared endeavour of ours.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[122] Partida 2016: 299, 310 footnote 4.

[123] Des Courtils (2020) observes marked Athenian influence in the architecture of this temple, which deviates/detours from the Archaic Cycladic tradition. A spacious artificial terrace was prepared at the top of the acropolis of Thasos to receive the biggest temple on the island manifesting prosperity and alliance with Athens, which however did not last long, and the project was abandoned. Des Courtils discerns a shade of vengeance in the manner that the temple blocks were eventually used.

[124] Ismaelli 2016: 357. By no means do we disregard the architectural models or paradigms, namely miniature building elements, which served as didactic templates (παραδείγματα) for designing and demonstrating, if not also as votive offerings by construction workers. For a relevant discussion, see Herrmann 2014/2015.

[125] Amandry and Hansen 2010: 464.

[126] Hansen 1991: 72-79.

[127] Bommelaer 1996: 145; Laroche and Jacquemin 2017: 136, fig. 4 (team at work).

[128] Hellner 2018.

[129] On the artists' mobility, cf. Feyel 2006: 332-336.

[130] For the Roman period, see Ismaelli 2016: 364; Plattner 2014; Plattner 2017.

[131] Vallois 1939.

Chapter 20

Building procedures of the fortification at Kastraki on Milesian Agathonisi: Quarrying and construction sites as open-air provisional *ergasteria*

Konstantinos Sarantidis

Abstract

A new trend in the research of buildings has developed in recent years, oriented towards the organisation of construction sites, among which fortifications preserving all their architectural features. This approach scrutinises mainly the calculation of man-hours (according to the building materials in use) and the reckoning of the appropriate time and economic planning for the completion of a particular construction project. The calculation of these quantitative data allows for further reading of the organisation of the construction site, which, in the case of fortifications, acts as a large open-air and provisional '*ergasterion*'. A fortified site, preserving all its architectural features and thus suitable for such an analysis with valuable results, is the Milesian installation at Kastraki on Agathonisi. Based on the available data, the stages of the chaîne opératoire, the necessary manpower involved, and the operational duration of the construction site for the completion of the fortifications at the Milesian installation on Agathonisi are determined.

Περίληψη

Τα τελευταία χρόνια μία νέα τάση, που έχει αναπτυχθεί στην έρευνα οικοδομημάτων και προσανατολίζεται στην οργάνωση του εργοταξίου, περιλαμβάνει – μεταξύ άλλων – οχυρώσεις που διατηρούν όλα τους τα αρχιτεκτονικά χαρακτηριστικά. Η συγκεκριμένη προσέγγιση εστιάζει κυρίως στον υπολογισμό των εργατοωρών (σύμφωνα με τα υλικά δομής που έχουν χρησιμοποιηθεί) και στην αναγνώριση του σχετικού χρονικού και οικονομικού προγραμματισμού για τη διεκπεραίωση ενός δεδομένου κατασκευαστικού έργου. Ο υπολογισμός των ποσοτικών αυτών στοιχείων επιτρέπει την περαιτέρω ανάγνωση της οργάνωσης του εργοταξίου που, στην περίπτωση των οχυρώσεων, δεν είναι παρά μεγάλα υπαίθρια και προσωρινά 'εργαστήρια'. Μία οχυρωματική θέση, της οποίας τα αρχιτεκτονικά χαρακτηριστικά τεκμηριώνονται και προσφέρεται για διερεύνηση προς αυτή την κατεύθυνση με αξιόλογα αποτελέσματα, είναι η εγκατάσταση της Μιλήτου στη θέση Καστράκι στο Αγαθονήσι. Με βάση τα διαθέσιμα στοιχεία, προσδιορίζονται τα στάδια της γραμμής παραγωγής, το απαραίτητο ανθρώπινο δυναμικό και η επιχειρησιακή διάρκεια του εργοταξίου για την αποπεράτωση των οχυρώσεων της Μιλησιακής εγκατάστασης στο Αγαθονήσι.

Keywords: Miletus; Milesian islands; Agathonisi; Classical fortifications; building procedures

Introduction

In the recent years, a new research trend has emerged in the field of architectural studies oriented towards the organisation of construction sites. Commonly, the relevant researches lead to the calculation of the required man-hours for the completion of a building project and, therefore, its financial budget depending on the building materials used, their procurement, and the techniques employed in construction. The calculation of such quantitative data allows us to approach the organisation of the worksite, which can be regarded as a large open-air and provisional *ergasterion*. How provisional, however, such worksites were, and what kind of facilities was required for their entire chaîne opératoire to develop are issues still under research and will probably remain elusive for most sites.

The Milesian fortified installation at Kastraki on Agathonisi provides for a case study of the generating processes involved in the construction of fortifications, since its layout preserves its basic dimensions and features; the missing ones can be extrapolated from an ancient drawing, found on the site, which actually depicts with accuracy elements of the fortification and has been published in detail.[1] Nevertheless, this venture – as all similar ones – should be viewed as a practical exercise, rather than a presentation of 'an infallible research method, which, in any case, does not exist',[2] due to the fact that there will always be imponderables, and, practically, we can never attain knowledge of the actual manpower numerically. As Janet DeLaine, one

[1] Sarantidis 2020: 229-244; Sarantidis 2024.
[2] Bessac 2016: 130.

of the pioneers in this field, remarks: 'like modern quantity surveyors who calculate figures for projects in advance, we can only provide estimates, because we can never know for sure how fast men actually worked, allow for accidents or missing materials holding up construction, and can rarely recognise the impact on labour requirements'.[3] Above all, it needs to be stressed that the calculated figures become increasingly hypothetical as they get further from the measurements taken from the actual construction.

Econometric approaches to the ancient building process can be criticised exactly for the inability to reach precise figures and thus to estimate the 'true' costs of construction projects. However, it is often constructive to give an approximate estimation of a quantity, which either cannot be measured directly or is very difficult to measure. Thus, all quantities and sizes of building materials presented here have to be considered as estimations, rather than exact calculations. Nevertheless, the fact that we are dealing with ranges, rather than exact numbers as a basis for comparison, does not make the interpretation and economic implications less valuable since ranges of labour, too, add a new dimension to matters of efficiency and economic value.[4] This approach emphasises the process of how these questions can be tackled in different ways. It also facilitates the evaluation of whether a significant amount of further research, to reach a more precise estimate, could conceivably give new results.[5] Therefore, a quantitative approach of the construction is valuable for what it tells us about the building process itself and the implications for the cost of specific structures. The ramifications of such analyses are wide-ranging. Quantitative analyses can be used to initiate discussions of the structure and scale of past economies at a series of levels, of an individual, a city, a state or an empire.[6] They are as much informative about the dynamics of past societies, as they are about their purely financial actions: not just the availability of resources at the upper classes of society, but the will to expend them with a constant tendency to minimise the construction effort and expenses.

Methodology

The economic aspects of Greek architecture have been the subject of study since Alison Burford's work in the 1960s and 1970s on craftspeople and their lives;[7] yet, a coherent set of analytical practices for assessing the cost of ancient buildings is still lacking. However, a crucial factor that characterises the construction of a public or a private building as successful is the speed of its completion, so that it can be functional, even for ideological purposes. Fundamental element within this mechanism is the workforce. Ancient workers constitute a spectrum ranging from unskilled and unpaid labour on the one end to highly specialised and professional craftsmen on the other. Within this range, workers act as repositories of technical knowledge and working processes, ensuring smooth performance throughout the construction process.[8] The logistics and organisation of labour, of workers and their tasks, as well as of materials, is – and was – therefore critical in ensuring the success of a construction site.[9] During the initial stages of any project, such as its design, systematisation was fundamental, and the various aspects of the organisation had to be interrelated in the simplest possible way, so as to create a set of gears that worked and communicated with each other in a fluid, dynamic and above all rapid manner. Fortifications were often the most elaborate, complex, resource-consuming and labour-intensive construction projects undertaken in antiquity, and, hence, many building contracts are preserved, offering precise information with regard to materials, construction, organisation of labour, and cost.[10] In such large-scale projects the need for systematisation was even greater, with respect both to construction and to decision-making, and this is one of the main reasons why they were built either collectively by a city or a community or individually by a king or a centralised state.

In tracing the generating processes of a building project, the primary element of the economic evaluation is an estimate of the amount of time needed to build a wall; directly related to this is an assessment of the workforce necessary to complete the project. The necessary information for someone to reach these estimates can be collected through a close examination of the materials used to build the wall, and the techniques used to shape those materials.[11] The observation of building materials, dimensions and elevations will be assessed against the information provided by nineteenth-century building manuals, such as the fundamental manual by Giovanni Pegoretti.[12] Methodologically, this approach closely follows the pioneering works of DeLaine and Paolo Barresi.[13] Despite the debate on the use of Pegoretti's manual to the detriment of other nineteenth-century building manuals, on the one hand, and the application of his figures to ancient buildings, on the other, comparative research demonstrates that Pegoretti's

[3] DeLaine 2017: 14.
[4] For an assessment of the range of studies and principles used in econometric studies in Classical Greek contexts, see Pakkanen 2013.
[5] Pakkanen 2021: 59-60.
[6] DeLaine 2017: 18.
[7] Burford 1965; Burford 1969; Burford 1972.
[8] For labour in ancient Greece, see Burford 1972; Burford 1993: 182-222.
[9] Ottati and Vinci 2021: 1.
[10] Maier 1959; Maier 1961.
[11] The steps of this procedure are firmly analyzed in De Staebler 2016.
[12] Pegoretti 1863.
[13] Barresi 2014; DeLaine 1997.

figures compare well with those from the other authors and, overall, any problems with Pegoretti's text lie not with his individual figures but with how we apply them.[14] In the domain of fortifications, particularly, a great deal of Pegoretti's figures seems to align with the experimental results at Dura-Europos and Messene of Jean-Claude Bessac. The latter's work by establishing clear methodologies related to the integration of ethnographic studies and ancient monuments for the calculation of labour and cost has moved the discipline many steps forward.[15] Based on this reservoir of comparative data, the construction effort for the fortifications can be estimated in man-hours and man-days. By correlating the resulting estimate with the available space on site, the probable maximum number of workers can be assigned to individual steps of the construction process, which is conceptualised as a coherent chaîne opératoire, following the basic rules of physics and applied logistics.[16] To sum up, the complementary use of building manuals, documentary evidence from pre-industrial building projects and ethnographic or experimental parallels enable us to assess how many days of physical labour would have been necessary for certain tasks to be completed, even if specific epigraphic data concerning the construction of a monument are not available.[17]

These steps must be calculated in relation to workforce and time, i.e. how long each step took per worker and unit and how many people were employed, in order to estimate the total expenditure and time for the construction of the wall.[18] In estimating the financial investment in a construction project, most variables are uncertain. Most importantly, we do not know if unpaid workforce, e.g. Milesian soldiers or slave labour were available, in addition to the fact that inflation and regional differences in drachma standards complicate the calculation of day-wages, as Robert Spenser Stanier has pointed out.[19] DeLaine proposed that financial calculations should focus on converting money values into equivalent quantities of grain, a method that finds some support in recent research.[20] Since further nuance is necessary in the way these data are used, and to avoid departure from safe ground, our primary aim in this paper is the calculation of workforce and the relative time needed for the project's fulfillment. For the sake of brevity, the focus has been firmly set upon the stonework as the most important part of the construction. Therefore, the model does not include the usage of timbers or metals for the scaffolding or the construction of the tower's floors. The computation of the building materials is based on the volumetric dimensions of the walls (length, width, estimated height), while the estimation of the man-power required to supply or produce them is based on the basic units for building activities provided in Pegoretti's manual.[21] We have systematically followed the procedure of using the precise figures in multiplications, for example unrounded figures have been used in the calculations and rounding takes place at the end of the process, whereas the intermediary results are rounded to the nearest full number of stones or man-hours in the relevant tables.

There is only a limited number of ways that a project is likely to be completed without mechanisation since stone-working is a highly conservative craft.[22] Construction is also subject to local conditions, particularly in terms of building materials and their associated technologies,[23] of which Vitruvius was conscious.[24] This is especially true in Mediterranean climates, where sustained stone-working activity without breaks is practically impossible.[25] Based on literary and epigraphic evidence, it may be assumed that the working day in antiquity comprised 10 hours, and that the average working year in the construction site consisted of eight months (from the beginning of April to the beginning of November), totaling about 220 days.[26] Most of the theoretical texts written in the nineteenth century assume a ten-hour working day, as well;[27] moreover, early twentieth-century ethnographic parallels of quarrymen from the island of Lesbos, in the Aegean, verify this average working year period.[28] Considering the geographical position and the climatic conditions of the Aegean region, this time frame seems reasonable.

The fortifications at Kastraki

The fortified installation at Kastraki[29] is arranged in three terraces, each of them defined by a fortification wall encircling an area approximately 2080sq.m

[14] Barker and Russell 2012: 89. For a critical assessment of Pegoretti's manual, see also Barker and Russell 2020; Russell 2013b: 30-35, 228-232.
[15] Bessac 1988; Bessac 1997; Bessac 2004; Bessac 2016; Bessac *et al.* 1997; Bessac and Müth 2020.
[16] Calculations are mainly based on Pegoretti 1863.
[17] Barker and Russell 2012: 94.
[18] De Staebler 2016.
[19] Stanier 1953: 70.
[20] In this way labour figures turn into something easier to compare with diverse sources or other economic data of the ancient world (see further DeLaine 1997: 207-224; DeLaine 2017: 16).
[21] Pegoretti 1863.
[22] For an overview of stone-working tools and their development over time, see Bessac 1986; Korres 1995: 76-77; Rockwell 1993.
[23] DeLaine 2006: 238.
[24] Vitruvius, *De architectura* 1.2.8.
[25] Barker and Russell 2012: 85.
[26] This is the average working year reported by Frontinus with regard to concrete construction, see Frontinus, *De aquis* 122-123. These values (working hours/year) have been put forward by DeLaine 1997: 104-107 and followed by many scholars later dealing with the subject: Bessac and Müth 2020: 30 no. 15; Bonetto and Previato 2018: 316; Maschek 2016: 398; Pakkanen 2021: 59-60. Cf. Fachard *et al.* 2020: 518, who use a model based on an eight-hour working day.
[27] Barker and Russell 2012: 85.
[28] Chatzilias 2009: 189-190, no. 487.
[29] For the site, see Sarantidis 2020: 155-166; Triantafyllidis 2010; Triantafyllidis 2015.

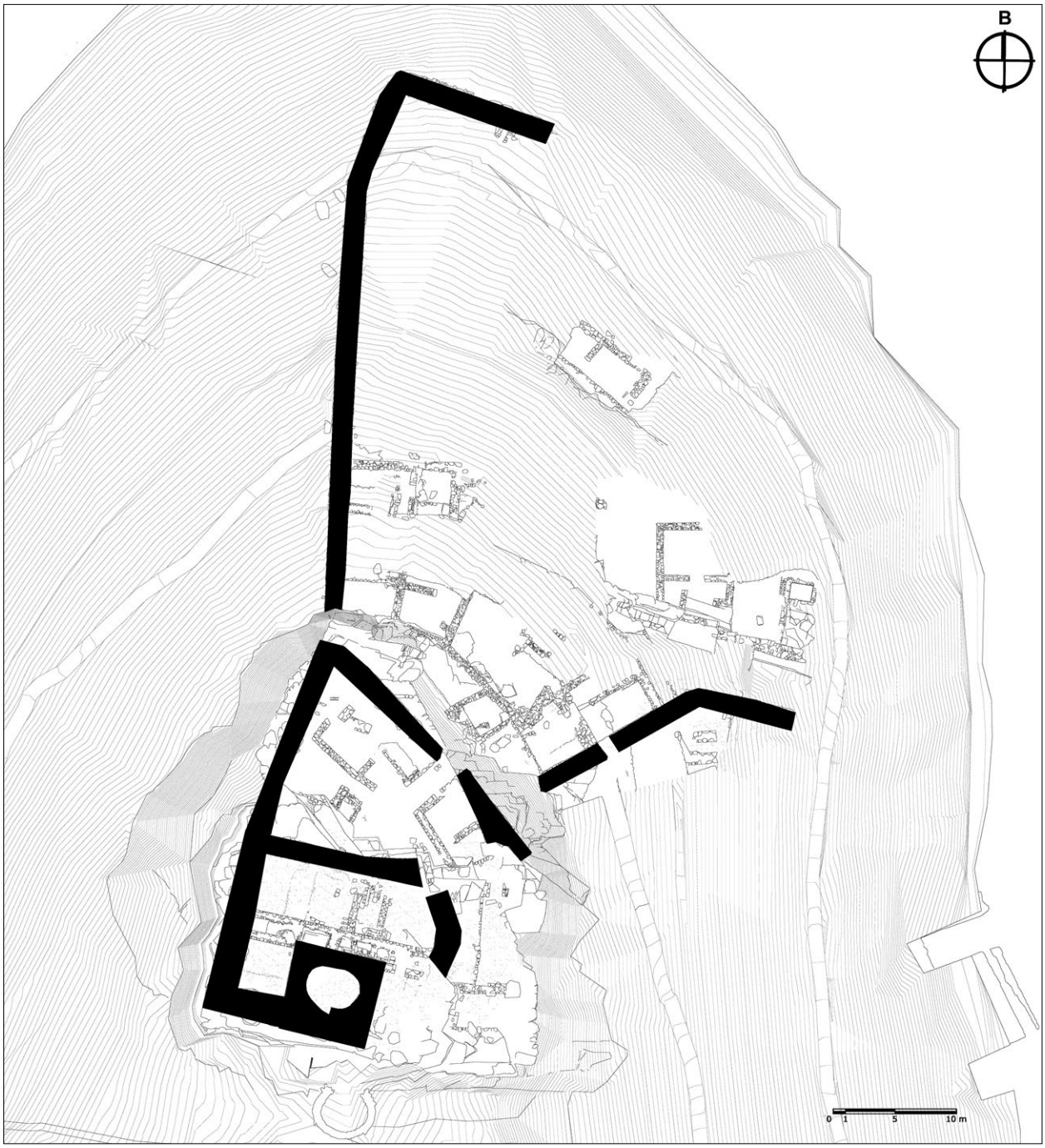


Figure 1: Topographical plan of the fortification at Kastraki on Agathonisi (Sarantidis 2020: 327, plan 5a).

(**Figure 1**). The fortification has been dated on the basis of excavation finds and constructional criteria, in the late fourth century BC.[30] At the upper terrace (terrace 1), on the highest point of the promontory, a rectangular tower is situated. The tower measures 7.49×5.88m, on an east-west orientation. A large cistern, 2.20m height, occupies the tower's basement and, being oval in plan, measures 4.45×3.54m. The inner face of the cistern is coated in hydraulic plaster and its south part has been constructed on the appropriately worked natural bedrock. The same is true for the tower. Despite the fact that the wall at the south side of the tower is not preserved, the artificially leveled bedrock implies its foundation. The north side of the tower, which is better preserved, survives at a height of 1.70m and is also founded upon the natural bedrock. Based on an ancient drawing find from the site depicting the tower and its adjusted curtain wall (**Figure 2**), the four-storey-high tower can be restored

[30] Sarantidis 2020: 157, 231-243; Triantafyllidis 2010: 21, 38; Triantafyllidis 2015: 98.

Figure 2: Photo and drawing of the inv. K644 incised roof-tile from Kastraki on Agathonisi (Sarantidis 2020: 232, fig. 124).

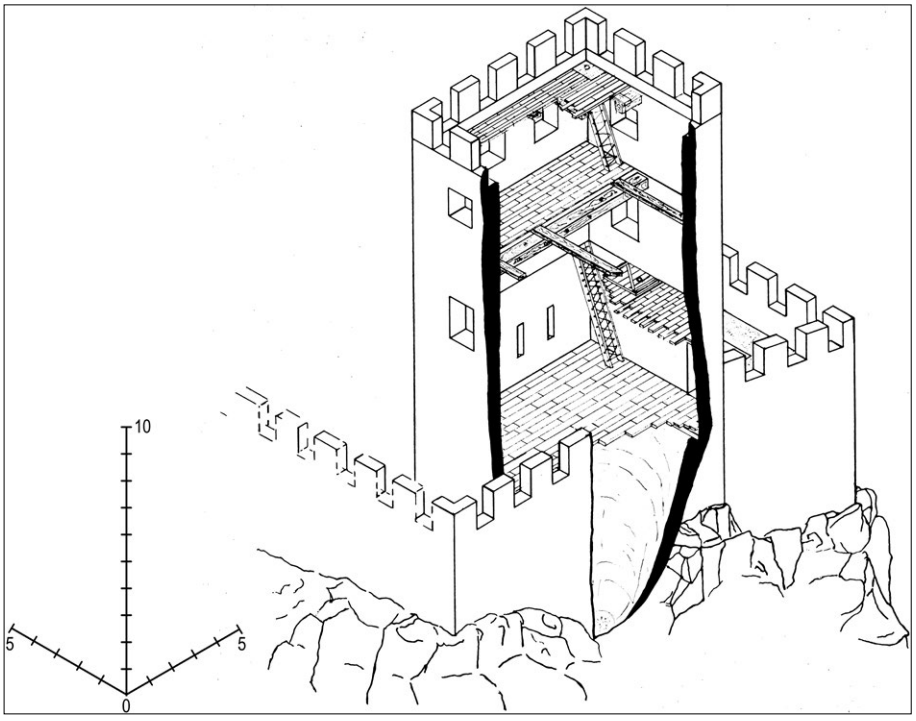


Figure 3: Isometric restoration proposal of the tower and the fortification on terrace 1 at Kastraki, based on the architectural remains and the incised drawing on the roof-tile inv. K644. View from the southwest (Sarantidis 2024: 355, fig. 6).

as 17-18m high from its foundation to the battlements (**Figure 3**).[31]

The tower is located approximately in the middle of the south edge of terrace 1, leaving a 6m long stretch, where a fortification wall can be restored until it meets the east fortification wall of terrace 1, according to the wall's trace that has been identified further north (**Figure 1**). The southwest corner of the tower joins with a short stretch of the fortification wall 4.62m to the west, which then turns north at an almost right angle. From this point, the west fortification wall stretches for 78.14m, descending the three terraces of the site and ending 18m before the shoreline. There, the wall's trace turns east at a right angle and follows a southeast course that can be traced for another 22m running parallel to the rocky shoreline located 11m northwards. The total length of the north fortification wall in the lower terrace (terrace 3) should have been about 66.40m up to its intersection with the south fortification wall. The latter, forming the installation's southern boundary, stretches on terrace 3, connected at its beginning to the almost perpendicular face of the rocky headland that rises for approximately 7.5m. The

[31] Sarantidis 2020: 229-243; Sarantidis 2024.

wall is preserved for an about 15m long course, forming an acute turning point almost in its middle towards the south. The south fortification wall should have measured 26.62m length in total, until it met the north fortification wall. Each terrace was also fortified. Two fortification walls, connected at their beginning to the west curtain-wall, run at the edge of the last contour of each higher terrace, encircling their north/northeast part accordingly. The east edge of the middle terrace (terrace 2) remained unfortified since the altitude difference from the lower terrace is large enough to render the construction of a fortification wall rather superfluous. At terrace 2, the fortification follows a 33m long course, while the preserved wall at the higher terrace (terrace 1) would be 31m long. The architectural components of the fortifications at Kastraki are constructed in the same manner, featuring the same characteristics; just the wall's width varies. The wider sections, 2m thick, are located at the wall's north, east and south sections on terrace 1. The west fortification wall that stretches through all three terraces and the north wall of terrace 3 are 1.90m wide. Narrower is the north and east wall on terrace 2 and the south wall on terrace 3, which measure 1.20m.

Usually, the fortification survives in one to three courses' height, except for the tower's north wall preserved at 1.70m, which is up to 6-7 courses high. Large trapezoidal or occasionally polygonal blocks of unequal height are laid upon the leveled bedrock. Irregular coursing is performed by laying medium stones, while in some cases, instead of a medium block, small blocks are piled up to reach the course's height. Rabbeting, the carving of recesses or grooves, destined to receive mating pieces, is common in large blocks. Binders are also placed – though not regularly – every 5 or 6m, penetrating nearly half-way through the thickness of the wall, while compartments in the masonry have been constructed only in the west fortification wall, at intervals of 4.80m. The surface of the joints is treated flat and most of the joints are slanting at various angles. The outer face of the blocks is left quarried and slightly pulvinated, so that the faces usually project 0.10m from the joints. Drafting appears only in the corners of the tower and in the side jambs of the only postern that has been identified so far, located at the south fortification wall. The vertical drafted bands are usually 0.04m to 0.06m wide.

The masonry can be described as coursed trapezoidal, constructed in the local dolomitic limestone, which is a crystalline stone of the metamorphic sequence, resembling white-grayish marble.[32] Stones of large, medium and small dimensions have been used (**Table 1**). Large stones are commonly employed in the lowest courses of the wall's outer face and in the tower's corners. The inner face of the wall is constructed by medium and small stones, while the masonry is filled with rubble, chips, and earth. Small stones are usually 0.20-0.50m long, 0.10-0.30m wide and 0.10-0.20m high. Stones of medium size measure approximately 0.60-0.80m in length, 0.30-0.50m width and 0.20-0.60m height. The largest ones are 1-1.50m long, 0.40-0.70m wide and 0.60-1m high. This classification practically highlights that small stones weighing up to 80kg could be handled and maneuvered by one or two labourmen or masons with their bare hands, whereas stones of medium and large classes, weighing approximately 150-700kg and 1200-1500kg respectively,[33] could be maneuvered with levers, transported with rollers or sledges,[34] and lifted with cranes.[35]

From the available data, the entrance to the installation must have been located south. The only surviving opening is situated 5.80m east from the west edge of the south fortification wall on terrace 3. The opening was built up at some point during the Roman period, as its configuration indicates: on the interior, the ancient route was occupied by a building. Nevertheless, since the clear opening is merely 1m wide, it can be regarded as a postern, rather than a gate – much less, as the main entrance. The central access is expected further south, close to the shore and perhaps near the intersection of the south with the north fortification wall, which unfortunately is not preserved. Two additional reasons suggest the positioning of the main gate here: the location of the nearby ship-sheds and the remains of an earlier gate mechanism.[36] From the postern at the southern fortification wall a route led to the middle terrace,

[32] Kokkorou-Alevras *et al.* 2014: no. 63; Sarantidis 2020: 157 no. 956; Triantafyllidis 2010: 20; Triantafyllidis 2015: 97.

[33] Special weight: 2.70gr/cc see ELOT standard 583 for marble.

[34] For short distances or for maneuvering a block around the construction site itself, rolling or dragging using ropes or levers was sufficient. Sledges were more prone to friction and required more motive power than wheeled vehicles, but they were more easily maneuvered. A fragment of Heron's *Mechanics* (3.1 translated by Drachmann 1963: 94-95) elucidates the proper form of the device, which he called a tortoise: 'The tortoise is a solid body made of a square piece of wood whose ends are turned upwards.' The upturned ends facilitated the easy placement of rollers or boards underneath to help alleviate friction as the sledge was pulled by ropes. This was appropriate even for the very largest loads, see Bernard 2013: 108. Quarrymen from Lesbos, working in the early twentieth century testified the survival of this method of transportation. They referred to this kind of sledge as ξυλογαϊδάρα, which practically translates into a 'wooden donkey' (Chatzilias 2009: 190).

[35] Bernard 2013: 103 with further bibliography. Vitruvius classifies various configurations of cranes by the number of pulleys employed and by the number of wooden masts comprising the frame. Heron of Alexandria (first century AD) mentions cranes with one to four masts. A single-mast variety offered the skillful operator a higher range of lateral maneuverability, but was insufficient for heavy loads. The two-mast variety was more likely the workhorse of the building industry and consisted of two poles splayed at the bottom and lashed together with ropes at the top. For evidence on the use of the lifting devices described by Vitruvius and Heron at ancient stone quarries, see Pensabene 1998: 368-373. For the early use of cranes in architecture during the Archaic and Classical periods, see Coulton 1974.

[36] For the gate mechanism, see Sarantidis 2020: 159-162, fig. 88.

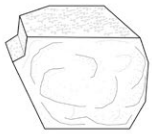
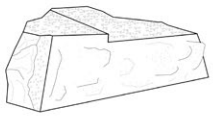
	Minimum	Maximum	Length	Width	Height	Volume	Maximum Weight
Small			0.25m	0.17m	0.08m	0.003cbm	9kg
			0.50m	0.32m	0.20m	0.032cbm	86kg
Medium			0.64m	0.34m	0.25m	0.054cbm	147kg
			0.86m	0.46m	0.64m	0.253cbm	684kg
Large			1.23m	0.45m	0.84m	0.465cbm	1255kg
			1.58m	0.58m	0.60m	0.550cbm	1485kg

Table 1: Stone classification.

through the zigzag staircase carved on the bedrock at the edge of the middle terrace. The steps are usually 0.16m wide and 0.50m long. The remains of this staircase are meagre, since rock corrosion and dilapidation allowed only three steps to survive. The staircase then turned southwest at a right angle, leading to a 2.5m wide and 5.75m long corridor that crossed the fortification of terrace 2. From there a paved plateau stretched westwards, facilitating access to the several buildings of the terrace, as well as the last staircase leading to terrace 1, carved in the natural bedrock, as well. This last staircase, 2.75m long and 0.50m wide, comprises seven steps of irregular height. From there the upper terrace and the tower could be reached through some preserved apertures at the buildings occupying the plateau around the tower.

Building material procurement and stone quarries

Two ancient quarries have been identified so far on Agathonisi, at Kavi and Kastraki, respectively. Based on the implemented extraction methods and their operational duration, both of them can be classified as temporary open-air quarries.[37] Their exploitation was not long-lasting and quarrying took place on the surface horizontally, stepped, or vertically in depth. The quarry at Kavi is located northeast of Mount Kephala, in the vicinity of the open-air Isis sanctuary and provides much information about the extraction process. Quarried blocks are still visible, and quarried rock surfaces wherefrom blocks had been extracted are quite impressive.[38] On the bedrock surface four pointed life-size foot impressions have been recorded, among which one displays the dedicatory inscription ΑΡΧΕΛΑ.[39] Eirini Poupaki maintains that quarrying activities should, presumably, be dated before the establishment of cult there, in which case, the quarry was probably abandoned.[40]

The building material for the erection of the fortification had been quarried at Kastraki,[41] as is usually the case with extra-urban defensive installations.[42] Once building material of good quality could be found within easy reach from the construction site, it was of course preferred for fortifications, as it would considerably diminish transportation cost, the construction of the necessary infrastructure (road networks, jetties, etc.) included. The quarry at Kavi is located 2-2.5km south of Kastraki, which is a manageable distance. However, since fine building material could be sourced literally on the construction site, its exploitation was decided.[43] Apart from the macroscopic similarity in colour, grading size and grain distribution between stones used in the fortification and the site's natural bedrock, important traces of quarrying techniques have been noted, mainly at the excavated slopes of the hill. The evidence of quarrying comprises: stepped extraction, sphenoid and rectangular wedge-holes (**Figures 4, 5**), series of point marks (*pointillé* technique), quarrying trenches around detached blocks, pole holes for braking the sledges with ropes while moving on the sledding-path (**Figures 6, 7**), a circular print from a detached column-drum, etc. The vertical faces of the quarried bedrock from terrace to terrace, as well as the artificially leveled surfaces, where extraction ceased,

[37] For the classification of ancient quarries, see Kokkorou-Alevras *et al.* 2010: 34.
[38] Kokkorou-Alevras *et al.* 2014: no. 63; Triantafyllidis 2006: 185-186.
[39] Triantafyllidis 2006: 185-186, fig. 9.
[40] Poupaki 2021a: 138-139.
[41] For the Kastraki quarry, see the relevant entry in Kokkorou-Alevras *et al.* 2014: no. 63a.
[42] On the rest of the Milesian islands quarrying evidence has been identified at the following fortified sites: Xerokambos on Leros, Kastro on Leipsoi, Kastelli on Patmos (see accordingly Sarantidis 2020: 126, 133, 147).
[43] The criterion for choosing a location for the operation of a quarry was not solely the quality of its rock; often the distance between extraction and construction site played a crucial role, since the use of the local stones reduced the cost of extraction and transportation (see further Kokkorou-Alevras *et al.* 2014: 34).

Figures 4 and 5: Carved wedge-holes at Kastraki, 4: series of wedge-holes on terrace 1 (Poupaki 2021a: fig. 22), and 5: wedge-holes positioned at right angles on terrace 2 (© photo by Konstantinos Sarantidis).

found in all excavated areas and along the northeast rocky shoreline in a course parallel to the north fortification wall (**Figures 8-10**), bear witness to the intensive quarrying activities that took place during the erection of the fortification, which is the only construction project of such magnitude known on the island. In support of this, particularly striking is the fact that, as it seems, the final form of terrace 1 is the result of intensive quarrying, at the end of which the respective terrace was shaped into its almost square layout (**Figure 11**).

Taking into account the aforementioned quarrying evidence, Poupaki has argued that probably the Kastraki quarry started operating for the construction of the fortification, and was abandoned after the project's completion, when the site became inhabited.[44] The quarried rock had served both the construction of the fortification and the formation of the terraces within, where buildings were installed.[45] Based on a late, securely dated, semi-finished mortar (*holmos*) carved in local stone, Poupaki has further assumed that no stone-working activities took place on the site later than 275 BC.[46]

Quantifying construction and labour

Although no building accounts are known from Kastraki, we can nevertheless turn to relative analogies, in order to estimate the volume of stone needed for the construction, the time needed for quarrying, processing and placing that volume of stones in the walls, and the human resources involved. The results and their interrelation are illustrated in the relative tables following the same reasoning. We distinguish the construction between the fortification wall and the tower, so the respective figures and sums are presented separately (**Table 2**). To avoid complexity in the tables, the construction of openings, such as gates, windows etc., which in any case is limited, has not been included;[47] therefore, the volumetric calculations represent the fortification and the tower in their full geometry, as solid shapes. In the end of this process we will reach an estimation of the time needed for the accomplishment of the construction project and the worksite's operational duration (**Table 3**).

The starting point for an approximation of the material necessary for the fortification is the knowledge of the dimensions of the wall, and the number of stones needed to build it. The fortification and the tower walls preserve their respective length and width, whereas their height can be restored according to the ancient drawing (**Figures 2, 3**). The total length of the fortification in all terraces measures 246m. This includes the wall's actual ruins and the extrapolated wall sections, based on the fortification's trace to complete the enclosure. The wall's width in the preserved sections varies; however, the weighted average of the measured values is 1.75m.[48] The wall comprises two faces and fill, with the latter measuring 0.60m on average. The tower measures 7.49×5.88m and its walls would be maximum 1m wide. Height has been restored to 17-18m for the tower, and to 7-7.5m for the fortification wall, battlements included in both cases.[49] The battlements' height on

[44] Poupaki 2021a: 139.

[45] A number of 31 to 33 roofs has been identified, representing the maximum number of buildings situated within the walls during the installation's whole historic course (Sarantidis 2017: 77-79).

[46] Poupaki 2021a: 139, and for the stone vessel (inv. no. ΛΘ142, fig. 5) 130, 142, table 1.

[47] It has been assumed that in terms of man-hours the value needed to prepare stones for the apertures' frames, counterweighs stone quarrying and construction of a regularly build wall for the same volume.

[48] The result is calculated by applying the weighted average equation: $\bar{x} = \frac{\Sigma^{n}_{(i=1)} x_i p_i}{\Sigma^{n}_{(i=1)} p_i}$.

[49] These values derive from the interpretation of the ancient drawing find (Sarantidis 2020: 229-244; Sarantidis 2024), but besides this, for the fortification wall in particular, an indication implying the wall's height is the altitude difference between the terraces. Between terrace 1 and 2, the altitude difference is 4-5m, and between terrace 2 and 3 is 7-7.5m. The latter practically pinpoints the wall's height in terrace 3, whereas the former in terrace 2. The wall in terrace 1 basing on the drawing find can be restored to about 7m height.

Figures 6 and 7: Carved pole-holes at Kastraki,
6: terrace 1, and 7: terrace 2
(© photos by Konstantinos Sarantidis).

the fortification wall was approximately 2m. Since they are constructed only on top of the exterior side of the wall, we could count their height as if the wall were 1m higher in both faces, without them, which is about 6m.[50] From these data we calculate the façade surface area 2952sq.m for the fortification wall, and 773.16sq.m for the tower, exterior and interior sides included in both cases (**Table 2**).

The next step is the calculation of the number of stones that would be needed to materialise the surface area of the wall's and the tower's facades. Since the fortifications are nowhere preserved in their entirety, we need to quantify their best parts preserved at an average height of 1m. For this, the most suitable samples are: a 10m long section of the south fortification wall in terrace 3 (**Figure 12**), and the 7.49m long north tower wall, which is excavated to its foundation (**Figure 13**). The result of this process yields the number of stones implemented on a surface 20sq.m with respect to the fortification wall (inner and outer façade), and 7.49sq.m for the tower's north wall. So, based on the stone classification for Kastraki (**Table 1**), we count on both faces of the fortification wall 88 small, 43 medium, and 3 large stones, while on the exterior face of the tower's north wall 80 small, 14 medium and 4 large stones.[51] On this basis, we can further extrapolate the number of stones needed for the total surface area of the fortification wall and the tower, and to translate this into the necessary stone volume for constructing the faces of both fortification and tower (**Table 2**). So, for the fortification, the total number of stones needed would be 19,779 and for the tower 9909, in other words, a sum of 1904cbm of stone. To this we should add another 885.60cbm of stone rubble and chips for the wall's fill to meet the total stone requirements for the construction. However, the material for the wall's fill need not be calculated as if quarried, since these materials – as byproducts – are regularly produced during stone quarrying, shaping and dressing.[52] Obviously aware of this fact, Pegoretti advises to calculate ×1.5 the volume to be quarried, compared to the desired quantity of stone for a certain construction.[53] Indeed, by applying Pegoretti's formula to 1904cbm stone volume, we get 2856cbm of rock to be quarried. In this value, there is a surplus 952cbm of stone, which is bound to end up in stone-byproducts suitable for the wall's filling, and exceeds by almost 100cbm the desired quantity.

Besides quarrying, what we further need to estimate before proceeding to the calculation of human

[50] This would not have been necessary for ashlar masonry, but since the mode is trapezoidal irregular, this facilitates calculating the number of stones implemented in the wall.

[51] Since the tower is a closed shape in terms of ground plan, and the large stones are commonly placed at the tower's corners, which in turn means that stones of the corners are countable twice (once from each respective side), it would be erroneous to make the following calculations based on this value. Therefore, in the relevant entry in **Table 2**, we have placed 2, which is half as much.

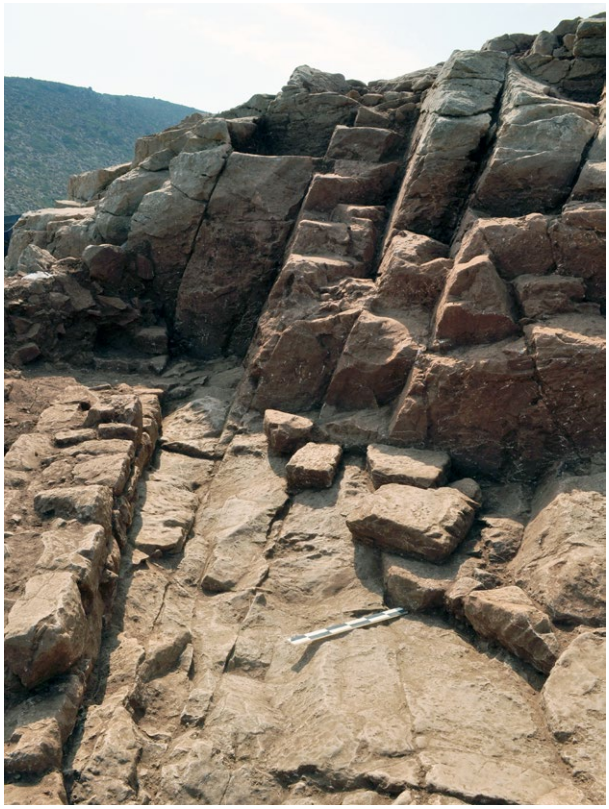
[52] For example, the ratio of the chip-volume to the useful product for handmade marble roof tiles is on average about 5:1. If for the circumferential detachment of a stone from the bedrock, trenches have to be carved around it, then the volume of rubble and chips produced is not much smaller than the actual volume of the stone itself. A large quantity of chips is produced after the blocks' detachment from bedrock as well, namely, during the surface treatment. As the stone-working processing progresses, the size of the chips becomes smaller. Studying the marble quarries at Penteli, Manolis Korres maintains that the careful observation of the quarries themselves and the accumulated ancient chip-layers leads to an estimation of a ratio between 3:4 and 1:1 for ancient chip-volume compared to the quarried bedrock volume (Korres 1995: 99). This premiss, however, has not been followed unanimously by scholars dealing with the subject, cf. Fachard *et al.* 2020: 518-519, table 3, who add the wall's fill volume to the one to be quarried.

[53] Pegoretti 1863, vol. I: 42.

		Length (m)	Width (m)	Height (m)	Façade surface (sq.m)	Volume (cbm)
Quantified section	South fortification wall	10	-	1	20	
	Tower's North wall	7.49	-	1	7.49	
Actual/extra-polated dimensions	Terrace 1-3. West fortification wall	78.14	1.90			
	Terrace 1. North & East fortification wall	31	2			
	Terrace 1. South fortification wall	10.62	2			
	Terrace 2. North & East fortification wall	33	1.20			
	Terrace 3. North fortification wall	66.40	1.90			
	Terrace 3. South fortification wall	26.62	1.20			
Sum	**Terrace 1-3.Fortification wall**	**246**	**1.75**	**6**	**2952**	
	Terrace 1-3.Fortification wall fill	**246**	**0.60**	**6**		**885.60**
Actual/extra-polated dimensions	Tower. North/South wall	2×7.49	1			
	Tower. East/West wall	2×5.88	1			
Sum	**Tower. Exterior sides**	**26.74**	**1**	**17**	**773.16**	
	Tower. Interior sides	**18.74**		**17**		

Stone Class		**Average stone volume (cbm)**	**Average surface dressing (sq.m)**	**Average surface chiselling (joints) (sq.m)**	**Actual stone number**	**Extrapolated stone number**	**Total stone volume (cbm)**	**Total surface dressing (sq.m)**	**Total surface chiselling (joints) (sq.m)**
Small	Fortification wall	0.018	0.340	0.280	88	12,989	229.91	4417.56	3638.22
	Tower				80	8258	146.17	2808.55	2313.07
Medium	Fortification wall	0.154	1.348	0.993	43	6347	976.12	8554.49	6300.03
	Tower				14	1445	222.23	1947.57	1434.31
Large	Fortification wall	0.507	3.187	2.196	3	443	224.77	1411.62	972.78
	Tower				2	206	104.52	656.42	452.36
Sum	Fortification wall				**134**	**19,779**	**1431**	**14,384**	**10,911**
	Tower				**96**	**9909**	**473**	**5413**	**4200**
						Stone volume sum	**1904**		
						Total quarried volume (×1.5)	**2856**	**} (-) = 952 (cbm)**	

Table 2: Stone quantification.



Figures 8, 9 and 10: Artificially leveled surfaces, 8: terrace 2, 9: terrace 3, and 10: quarried shoreline (© 8 and 9: photo by Konstantinos Sarantidis, 10: Triantafyllidis 2010: fig. 44).

resources is the surface area of stone processing. Pegoretti gives the relevant values in man-hours/sq.m compared to quarrying and transportation, which he calculates in man-hours/cbm. After extraction, two are the main stages of stone-working: the first is performed immediately after quarrying and regards the shaping and rough dressing of the blocks, while the second involves the surface chiseling as regards mainly the treatment of the joints before placement (**Table 3**, process order: 2, 6). At the first stage, the roughing out and dressing take place in all sides of a block except for the rear, which is left quarried throughout the entire processing and placement procedure.[54] The second stage involves all sides except for the face and the rear one. The former remains as it was at the previous stage, namely treated with a stone sledgehammer. The

[54] Note the illustrations in **Table 1**.

Process order	Task	Workforce		Working-hours per 1cbm or 1sq.m	Quantities (cbm or sq.m)	Working-hours	Man-hours
		Skilled	Unskilled				
1	Quarrying stone	1	2	40	2855.57	114,223	342,669
2	Shaping and dressing stones	1		12.5	19,796.20	247,453	247,453
3	Piling up rubble and chips		1	2	951.86	1904	1904
4	Short-distance transport	1	2	0.465	2789.32	1297	3891
5	Loading and unloading	1	2	0.75	2789.32	2092	6276
6	Surface chiselling (joints)	1		20	15,110.76	302,215	302,215
7	Fortification wall construction (facades)	4	2	8.71	1430.80	12,464	74,781
	Tower construction			11.20	472.92	5297	31,780
8	Shovelling fortification wall's fill		1	0.56	885.60	496	496
9	Ramming fortification wall's fill		1	0.312	885.60	276	276
i	Stonecutter's assistance		2	1/4 of stoneworking (2 and 6)		137,417	137,417
	Total	**9**	**13**			**825,133**	
ii	General supervision	1		1/10 of total time		82,513	82,513
	Sum		**23**				**1,231,671**
						Man-days (10-hour working day)	123,167
						Man-years (220-day working year)	560
						Man-years for applied workforce 23×4	6
						Man-years for applied workforce 23×6	4

Table 3: Labour estimate.

average surface area for both stages is illustrated (**Table 2**), based on the dimensions, according to the relevant stone class (**Table 1**). This allows us to measure the total surface area for shaping and dressing the blocks on the one hand, and chiseling on the other: the former amounts to 19,796.20sq.m, and the latter to 15,110.76sq.m (**Tables 2, 3**).[55]

Pegoretti describes in detail every action that might take place in pre-industrial construction sites, assigning the respective tasks to the minimum number of workers (skilled and unskilled) necessary for its fulfillment for a certain quantity. For stone-working, he notes different figures, according to the hardness and workability of the stone type. We follow his figures for dolomite marble, as most suitable to the stone from Kastraki.[56] He divides stone-working into the following nine main categories of work: (1) quarrying (*tagliare, cavare e separare*); (2) rough squaring at the quarry (*abbozzatura/sgrossatura semplice*); (3) roughing-out (*sbozzatura grossolana*) or sawing (*segatura*); (4) preparatory dressing (*apparecchio o taglio rustico*) with the point; (5) claw-chisel or bush hammer work (*martellinatura o gradinatura grossolana*); (6) fine claw-chisel work (*gradinatura mezzana o fina*); (7) flat chisel work (*cesellatura*); 8) rubbing/rasping (*orsatura*); (9) polishing (*pulimento a lucido*).[57] Pegoretti's aim is to draw up a complete corpus of data for all types of work. Not all these steps apply to all kinds of stone workmanship; in other words, the stone processing of a statue or a column is quite different from that of a fortification block. Based on his classification, the tasks involved in the chaîne opératoire, particularly for the construction of the fortifications, are sorted out and illustrated in consecutive order (**Table 3**).

First and foremost, quarrying takes place. Quarried stones become roughed out and shaped with a preparatory dressing on the site of the quarry, during which all stone-byproducts have to be collected

[55] The referred total values comprise the sum of the relevant entries in Table 2.
[56] *Marmi dolomitici*.
[57] Pegoretti 1863, vol. I: 159-161 for quarrying and 280-286 for stone-working.

Figure 11: Kastraki from above in 2010. Notable is the artificial rectangular shape of terrace 1 (© Pavlos Triantafyllidis).

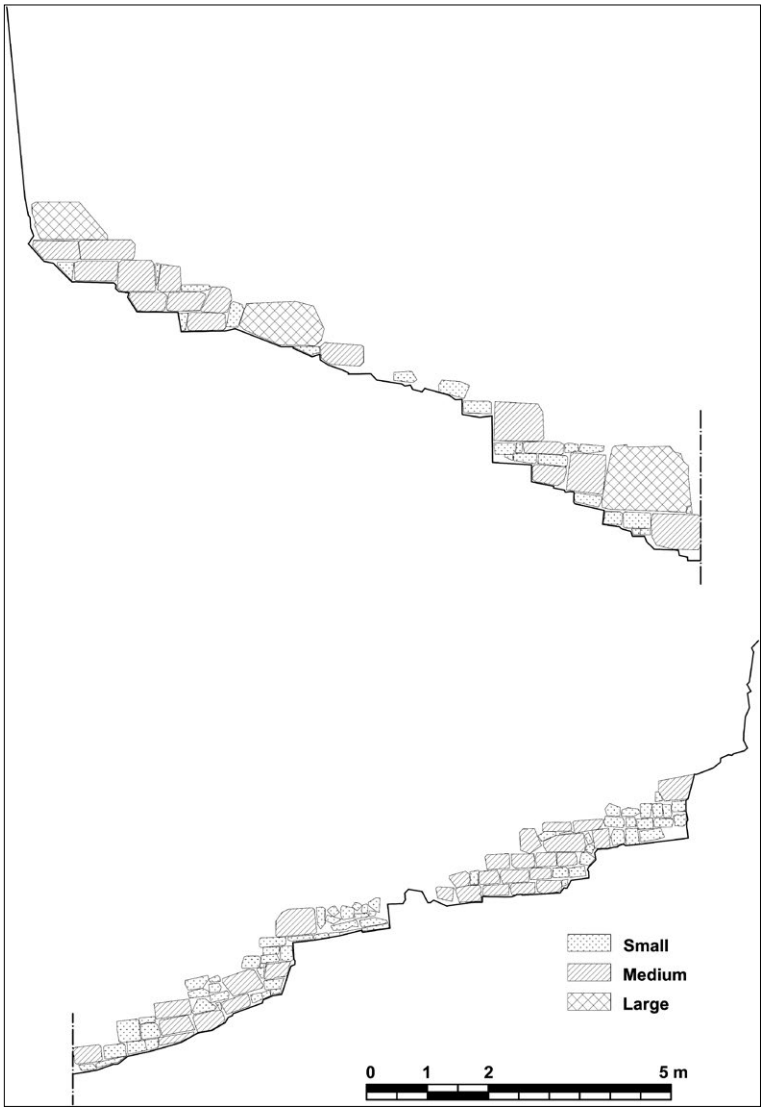


Figure 12: Terrace 3. South fortification wall section sampling and stone quantification: exterior face (up) and interior face (down) (© drawing by Konstantinos Sarantidis).

and stacked in piles. Then all quarried stones have to be loaded, transported and unloaded, from the quarry near the construction site, located at about 30m away, on average.[58] There the surface of the joints gets dressed with chisels and picks;[59] upon completion of this task, the blocks are ready to be placed in the wall. The working-hours necessary for the latter task can be calculated according to Pegoretti's formula for the construction of fortifications.[60] However, this formula involves only the construction of the faces, so, we must add the necessary time for shoveling and ramming stone rubble, chips and earth in the wall's fill to complete the construction. To all steps of stone-working, Pegoretti adds assistance equal to the quarter of the stone-cutter's working-hour sum, and general supervision equal to the tenth of the total working-hour value of the project.[61]

[58] Pegoretti 1863, vol. I: 157. The distance of 30m is a quarter of the site's width, and represents the average distance over which materials would need to be carried from a depot on the periphery. The same reasoning has been followed by DeLaine 1997: 268 (for loading and unloading), and 269 no. 12 (for transportation distance).

[59] Pegoretti 1863, vol. I: 283.

[60] See Pegoretti 1863, vol. II: 99. The formula is:

$h = \frac{t}{2} + 0.015t(a - 1) + \frac{t'}{2g}$, where t = 15 hours for polyedric blocks, t′=0,30 hours for walls of large blocks in two faces, a= wall's height, and g denotes the average wall's width.

[61] Pegoretti 1863, vol. II: 99.

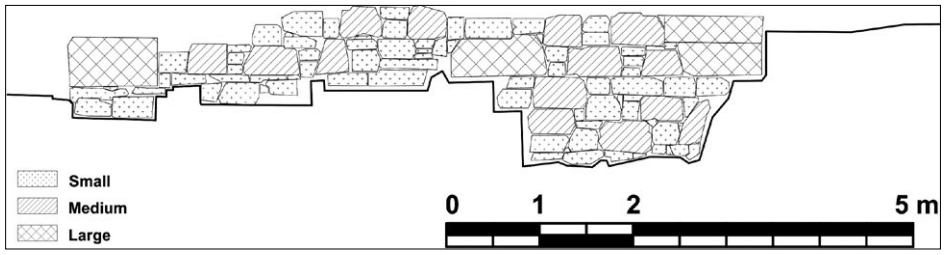


Figure 13: Terrace 1. Tower's north wall sampling and stone quantification (© drawing by Konstantinos Sarantidis).

At this point, by multiplying the working-hour values per 1cbm or sq.m with the sum of the quantities already presented (**Table 2**), we get the working-hour values for Kastraki. However, since in certain tasks more than one person is engaged, these values do not, actually, represent the man-hour values. To arrive at the desired man-hour calculation, we should multiply the working-hour values by the number of people engaged in the particular tasks which Pegoretti assigns to more than one person.[62] Following this reasoning, the total man-hour value for Kastraki equals 1.231,671, that is, 123,167 man-days or 560 man-years. This result seems reasonable, compared to other man-hour calculations for fortifications.[63]

As stated above, the delineated tasks include the workmanship of 23 persons for the particular chaîne opératoire, according to Pegoretti's figures. In case all tasks took place at the same time, which is most likely, this value then signifies an average minimum standard number of persons for each crew involved in the construction site. With the assigned tasks ranging from quarrymen to stonemasons, each crew had its internal hierarchy and balance. The building inscriptions from Didyma spreading across eighty years of the third and into the second century BC, offer a glimpse into the internal organisation of such teams or crews.[64] In the inscriptions, the slave workers of the sanctuary (*ἱεροί παῖδες*) speak about their work in the construction of the temple and the Milesian quarries.[65] Particularly the group of *λατόμοι* (quarrymen) and *λευκουργοί* (stonemasons) with their *ἡγούμενος* (master builder) refer to those in charge of financial administration (commission of *ἐπιστάτες* or *νεοποιοί*). The price of every operation, burdening/charging the city of Miletus, was fixed by *ἐγλογισταί*, and the master builder only had to state the amount of work done by the slaves, who belonged to Apollo. The god would pay only for the maintenance cost of the working slaves (food, clothes, tools, and sea transport) – an amount subtracted from the total expenses.[66] The same hierarchy-pattern among the working crews emerges from the narration of Diodorus Siculus, with regard to the construction of the fortification at Epipolai.[67]

At Kastraki, given the dimensions of the site, we assume that four to six such teams could operate side by side during the construction, involved in different sections of the fortification. This estimation roughly corresponds to 100-150 people, engaged in a four- to six-year long period for the project's completion. However, this number includes neither the placement of scaffolding nor the operation of cranes; therefore, even for the stone-working, the model presented here is rather generalised. Nevertheless, the inclusion of these extra operations, and many more to fill the model's *lacunae*, would not dramatically change the calculated man-hour values, which – as stressed already – must be regarded as the minimum estimates for the project.

Conclusions

What our analysis highlights is that construction is highly site-specific. Each worked example needs to be based on a carefully argued and validated reconstruction of the structure, its materials, and the specific construction processes. At the same time, a detailed, archaeologically correct reconstruction, rendering all the observed irregularities/peculiarities is not essential; a simplified model using solid schemes can give a reliable result, saving us a great deal of time.[68] In order to calculate absolute quantities of manpower, it is necessary to identify the whole process of construction (chaîne opératoire), noting the sequence of actions. While, inevitably, there will be elements which must have been part of the process but cannot be quantified, it is important for subsequent arguments that these are at least identified.

[62] This step applies to the following tasks according to the process order in **Table 3**: 1, 4, 5, 7.

[63] For all the urban fortifications at Doura-Europos, Bessac (1997) has estimated just over 1000 workers and a minimum working time to about three years. Cf. Bessac and Müth 2020; Fachard *et al.* 2020: 519, table 3 with cost estimates for stone portions of the fortress at Eleutherae.

[64] Barresi 2014, with previous bibliography.

[65] For the Milesian quarries and their identification, see Peschlow-Bindokat 1981.

[66] Haussoullier 1919: 223.

[67] Diodorus Siculus 14.18.5-8 (English translation by Oldfather, C.H. 1989. *Diodorus Siculus: Diodorus of Sicily in Twelve Volumes*. Cambridge, MA: Harvard University Press, viewed 8 November 2023, <http://data.perseus.org/citations/urn:cts:greekLit:tlg0060.tlg001.perseus-eng1:14.18.5>): 'For each *stade* he appointed a master builder and for each *plethron* a mason, and the labourers from the common people assigned to the task numbered two hundred for each *plethron*. Besides these, other workers, a multitude in number, quarried out the rough stone, and six thousand yoke of oxen brought it to the appointed place [...]. As a result, contrary to expectation, the wall was brought to completion in twenty days.'

[68] DeLaine 2017: 14.

The defense work at Kastraki proved suitable for a case study on the generating processes and the human resources involved in construction, yielding valuable results. Even though the fortification is not preserved to its full extent, its surviving parts, in association with excavation finds, permit the calculation or extrapolation of the basic dimensions of its architectural components. In addition, the *in situ* quarrying evidence and the layout of the site in terraces attest to the heavy exploitation of the natural bedrock that was quarried for the needs of the construction project. Stone classification and quantification of the building material used in the fortification, supplemented by pre-industrial building manuals, allow us to estimate further the total expenditure in time necessary for the completion of the project. Particularly interesting is the fact that construction itself represents a very small percentage, in terms of man-hours, compared to stone-working or even transportation of the material. The workforce engaged in the project was probably organised in crews, each one with its own internal organisation and hierarchy. Based on the site's configuration and the distances within it, a group of four to six such crews could have completed the fortification within six to four years, respectively.

Acknowledgements

Many thanks I owe to Constanze Graml and Elena Partida for inviting me to contribute in this volume and for their support in overcoming certain obstacles I faced during writing up. The elaboration of this paper would have been practically impossible without the support and multifold help of Athanasia Konsoula, MSc. Surveyor-Civil Engineer. I am indebted to her willingness for help in all working stages of this essay, her useful criticism and observations with regard to the methodology employed and the presented calculations, and, above all, her patience.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

Repair, re-use and spolia: Concepts of chaîne operatoire

Chapter 21

Less piety, more pragmatics: Some diachronic observations on the re-use of Greek funerary monuments

Constanze Graml

Abstract

Ancient Greek funerary monuments form a group of material evidence where traditions and transitions are clearly legible. Thanks to the high number of known objects and a long history of research, they offer insights on many aspects of ancient Greek societies. The material has been mainly studied with regard to its systemic context, i. e. their original location, as testimonies for visual culture or for the prosopographical insights into ancient communities. Concerning their initial context of use in funerary precincts, the grave markers were subject to space-bound dynamics, being affected by factors or circumstances such as the change of proprietorship or urbanistic development. A change in proprietorship alone could render the grave furnishings of the precinct's previous owner obsolete. Moreover, with the successive growth of cities and the conversion of burial areas for residential, industrial or other uses, entire necropoleis were converted and, in consequence, masses of worked stones and other materials became available for re-use. Since these monuments had marked graves, sacred spaces protected by societal values and laws, the re-use of funerary monuments is described as exceptional in ancient historiography, occurring only in emergency situations, such as immediate military threats. The attested legal protection of graves in the Roman period and the historiographic tradition have caused the re-use of funerary monuments to be perceived as a form of sacrilege, a perception which persists until today and has certainly shaped scholarly opinions.

Based on several case studies of re-worked and/or displaced ancient Greek funerary monuments, this paper aims to strengthen the pragmatic aspect of re-using funerary monuments, since they were available in large quantities and were easy to re-use in multiple ways due to their state of elaboration. The specific case studies will bring us closer to understanding the pragmatics and aesthetics of ancient recycling circuits for material originating from funerary precincts, aiming for a more nuanced perception of religious piety towards the deceased.

Περίληψη

Τα αρχαιοελληνικά ταφικά μνημεία αποτελούν μια ομάδα υλικού πολιτισμού, όπου οι παραδόσεις και οι μεταβάσεις είναι ευκρινώς αναγνώσιμες. Ο μεγάλος αριθμός γνωστών αντικειμένων και η μακρά ιστορία της έρευνας μάς επιτρέπουν να υπεισέλθουμε σε πολλές πτυχές των αρχαίων ελληνικών κοινωνιών. Το υλικό έχει πρωτίστως μελετηθεί από την άποψη των συστημικών συμφραζομένων, δηλαδή την αρχική τους θέση, ως μαρτυριών εικαστικού πολιτισμού, ή τις προσωπογραφικές πληροφορίες όσον αφορά αρχαίες κοινότητες. Όσον αφορά το αρχικό περιβάλλον χρήσης τους σε ταφικούς περιβόλους, τα επιτύμβια σήματα υπόκεινταν σε μια δυναμική άμεσα συναρτώμενη με τον χώρο, αφού επηρεάζονταν από παράγοντες όπως η αλλαγή του ιδιοκτησιακού καθεστώτος ή η αστική ανάπτυξη. Μια αλλαγή στην ιδιοκτησία και μόνο αρκούσε για να παροπλίσει/αχρηστεύσει όλα τα συστατικά στοιχεία του ταφικού περιβόλου του προηγούμενου ιδιοκτήτη. Επιπλέον, λόγω της διαδοχικής ανάπτυξης των πόλεων και της μετατροπής ταφικών περιοχών σε οικιστικές, βιοτεχνικές ή άλλης χρηστικότητας, ολόκληρες νεκροπόλεις μετασκευάστηκαν και, κατά συνέπεια, μαζικές ποσότητες από επεξεργασμένους λίθους και άλλα υλικά τέθηκαν στη διάθεση επανάχρησης. Εφ' όσον τα συγκεκριμένα μνημεία είχαν σηματοδοτήσει τάφους, χώρους ιερούς/καθαγιασμένους και προστατευόμενους από κοινωνικές αξίες και νόμους, η επανάχρηση των ταφικών μνημείων περιγράφεται στην αρχαία ιστοριογραφία ως ένα εξαιρετικό γεγονός, που συνέβαινε μόνο σε περιπτώσεις έκτακτης ανάγκης, όπως για παράδειγμα οι άμεσες στρατιωτικές απειλές. Η τεκμηριωμένη νομική προστασία των τάφων κατά τη ρωμαϊκή περίοδο και η ιστοριογραφική παράδοση οδήγησαν στη θεώρηση της επανάχρησης ταφικών μνημείων ως μια μορφή ιεροσυλίας – αντίληψη που επικρατεί μέχρι ακόμη και σήμερα και οπωσδήποτε έχει διαμορφώσει τις επιστημονικές απόψεις.

Βάσει αρκετών περιπτώσεων μελέτης ξαναδουλεμένων ή/και μετατοπισμένων αρχαιοελληνικών επιτυμβίων μνημείων, η παρούσα εργασία στοχεύει να ενισχύσει την πραγματιστική και πρακτική οπτική της επανάχρησης ταφικών μνημείων, δεδομένου ότι ήταν διαθέσιμα σε μεγάλες ποσότητες και εύκολο να ξαναχρησιμοποιηθούν/μετασχηματιστούν με ποικίλους τρόπους, χάριν στην επιτηδευμένη μορφή τους. Οι συγκεκριμένες περιπτώσεις μελέτης θα μας φέρουν εγγύτερα στην κατανόηση της πρακτικής αλλά και της αισθητικής της αρχαίας ανακύκλωσης υλικού προερχόμενου από ταφικούς περιβόλους, με στόχο να αντιληφθούμε λεπτές διαφοροποιήσεις στη θρησκευτική ευλάβεια προς τον μεταστάντα.

Keywords: ancient Greek funerary monuments; re-use; re-work; export; iconographical re-interpretation

Everybody dies, that is a fact. In ancient and modern[1] societies, caring for the deceased was/is of great importance, since the bereaved will inevitably share their fate. Apart from caring for the remains of the deceased in burial customs, the creation of places for mourning and commemoration at the burial site is widespread in many societies throughout history. Designating these places, often with durable grave markers,[2] is also a widespread practice.

The durability of these markers, however, does not necessarily lead to a permanently enduring need for commemoration. On average, the mnemonic cycle within family groups seems to end after three to four generations,[3] and, as a result, burial places cease to be kept up. Tomb stones and other components of the burial plot, such as further markers or ritual objects/ paraphernalia are no longer needed, since the plot might have changed proprietor and/or function,[4] and the furnishings may no longer be considered fashionable.[5]

In recent times, maybe due to an increasing 'environmental mindset'[6] or in an attempt to cut down on expenses, a tendency to re-use grave monuments is noticeable in many countries.[7] Nevertheless, many of the examples listed in the footnote below lay emphasis on a certain reservation and even strong emotions, when it comes to the actual practice of re-use. In this paper, I would like to demonstrate – through the analysis of highly selective case studies on the re-use[8] of ancient Greek funerary monuments and a critical re-assessment of previous scholarship on funerary archaeology, often unduly influenced by ancient historiography[9] – that a strong Christian bias[10] has led to an overemphasis on the idea of disturbing the eternal rest of a deceased person.[11] The focusing on the physical archaeological remains[12] allows a more nuanced view of the entangled processes of abandonment and re-use.[13]

As remarked above, the inevitability of death has resulted in a hardly imaginable amount of funerary

[1] Highly inspiring as regards matters of burial and funerary culture are the five volumes of the Großes Lexikon der Bestattungs- und Friedhofskultur, curated by the Zentralinstitut für Sepulkralkultur in Kassel, which covers the German-speaking areas from the Middle Ages to the present.

[2] The paper presented here is largely based on the fundamental scholarship of Bernhard Schmaltz on Greek funerary reliefs and funerary lekythoi (Schmaltz and Salta 2003; Schmaltz 1983, 1998, 2001, 2010a and 2010b). His publications provide numerous examples of potential object biographies of Greek funerary markers, some of which are briefly sketched here. Melpo Pologiorgi has studied in depth the re-working and re-use of funerary stelae from Piraeus and Salamis, cf. Pologiorgi 1999, Eva Christof the funerary reliefs from Hellenistic and Roman Asia Minor, cf. Christof 2022, and currently, Ralf von den Hoff is undertaking a project on the re-use of Athenian funerary reliefs in the Hellenistic and Roman period. Epigraphic recycling practiced in the Coan necropoleis has e.g. been studied by Jan-Mathieu Carbon, cf. Carbon 2022: 195-197.
This paper does not aim to present a complete list of all examples for the multiple strategies of re-use, but instead gives a general, diachronic idea of the potential chaînes opératoires, while taking into account spatial, religious and economic considerations. On the limitations of the chaîne opératoire model with regard to identifying points in time for production and re-use cf. Bosche in this volume. Strategies of re-use that were specific to certain periods will be stressed explicitly, cf. also Sitz in this volume on re-use in Late Antiquity. For later periods with a focus on the Roman culture cf. the research project and resulting publications of Cristina Murer (Murer 2016, 2018 and 2022), who also stresses the economic factor. The emotional dimension of the re-use of Roman monuments has most recently been studied by Valentina di Napoli, who presented on the topic at a workshop on re-use at Copenhagen, viewed 25 October 2023, <https://www.academia.edu/107513530/Emotions_in_context_an_attempt_at_interpreting_reused_funerary_markers_in_Roman_Greece_and_beyond_>. On the aspects of emotion in Greek funerary sculpture, see most recently Estrin 2023.

[3] Based on the fundamental work of Aleida and Jan Assmann, Welzer (2001: 13) names a period of three to four generations for the end of the 'kommunikatives Gedächtnis'. Fraser (1977: 7) assumes two to three generations. Most recently on the mnemonic aspects and capacities of inscribed artefacts with regard to used material and also materiality: Allgaier *et al.* 2019.

[4] Zelnick-Abramovitz 2015 on the complex legal aspects of grave plots.

[5] Kuntz (1994: 895) underlines that written evidence for this practice is lacking and, thus, she assumes that this was only done in exceptional circumstances. However, she inadvertently happens to give the correct explanation as well, namely that such re-use was simply 'nicht berichtenswert' ('not worth mentioning').

[6] <https://www.tellerreport.com/news/2019-10-22---here-old-tombstones-are-reused--%22must-have-an-environmental-mind%22-.SkkPMl3tB.html> (accessed 31 May 2023).

[7] A brief selection from websites from Germany: <https://www.deutsche-handwerks-zeitung.de/grabaufloesung-wohin-mit-dem-grabstein-161456/> (accessed: 31 May 2023); USA: <https://pittsburghorbit.com/2017/05/09/a-graveyard-for-gravestones/> (accessed 31 May 2023) and <https://pittsburghorbit.com/2017/05/14/where-do-gravestones-go-to-die/> (accessed 31 May 2023); Australia: <https://theconversation.com/losing-the-plot-death-is-permanent-but-your-grave-isnt-33459> (accessed 31 May 2023); UK: <https://www.theguardian.com/environment/2016/may/06/re-using-graves-means-uk-cemetery-will-never-run-out-of-space> (accessed 31 May 2023); Sweden: <https://www.tellerreport.com/news/2019-10-22---here-old-tombstones-are-reused--%22must-have-an-environmental-mind%22-.SkkPMl3tB.html> (accessed 31 May 2023);
I thank Elena Partida, Annarita Doronzio and Vincenzo Capozzoli for enquiries regarding Greece, Italy and France. In these countries, each cemetery and municipality can handle the matter of re-using burial monuments individually. No legal interdiction has been issued.

[8] Most recently on re-use and sustainability in antiquity, see Schliephake *et al.* 2020.

[9] Especially attestations from the Roman period cannot be back projected on ancient Greece. For collections of legal texts concerning ancient tombs and funerary culture, see Thomas 2004. Also Harter-Uibopuu 2012 and 2014; Harter-Uibopuu and Wiedergut (forthcoming), accessed 26 October 2023, <https://www.academia.edu/87728799/VORSORGE_VERBOTE_UND_SANKTIONEN>. On Greek laws: Engels 1998 on funerary expenses.

[10] Cf. Bergemann (2022: 58) referring to a seemingly eschatological content in the iconography: 'Daher dürfen wir auch nicht neuzeitliche Erfahrungen an die antiken attischen Gräber applizieren, wie es nicht selten geschehen ist.'

[11] This is evident in the etymology used for burial grounds, e.g. English cemetery, French cimetière and Italian cimitero deriving from the Greek κοιμητήριον meaning 'sleeping place'. German Friedhof emphasises the peacefulness of the deceased, who is resting. On examples of exhumation in antiquity, see Lindenlauf 2001: 92-93.

[12] Cf. here the archaeological context, i.e. their find spot, in contrast to the systemic context, meaning their place of erection for the intended purpose, as differentiated by Schiffer 1972.

[13] The Deutsche Handwerkszeitung (cf. footnote 7 for Germany) lists six options: disposal and shredding, selling to a mortician, personal re-use, creation of a place of memory at a different site, re-working, selling it privately.

monuments being produced over time, even if we consider that a lower social status and/or lack of financial means inhibited the erection of a funerary monument for everyone. Simply looking at Athens[14] or any other ancient Greek settlement over the timespan of several hundred years and considering the several thousand individuals,[15] who might have received a grave marker made from stone, the actual amount of preserved grave markers is small,[16] even when we assume that only a fraction of them has so far been discovered. Irrespective of the diverse shapes of the primary material considered here – commonly explained by shifting fashions and the occasional influence of legislation –,[17] stone funerary monuments are generally speaking objects that have been worked by human hands. Their surfaces have received various levels of treatment, ranging from roughly straightened sides to perfectly smoothed out surfaces and intricately modelled relief decoration or sculpture in-the-round. The ancient Greek repertoire ranges from more or less rectangular block-shapes (plain stelae [Namensstelen], relief stelae, naiskoi, trapezai) to cylindrical-column-like forms (column supporters, kioniskoi) or three-dimensional representations of humans (kouroi, korai), mix-anthropoi (sphinxes), animals (lions, dogs, bulls, etc.) or vessels (lekythoi, loutrophouroi, basins). The intrinsic value of the material and the labour, funds, and time invested all call for the object's re-use.[18] While the funds, labour and craft expended upon the fabrication of each object thus raised its multifaceted value, only the ownership of a plot of land actually allowed it to be set up as a monument. Purchasers therefore needed sufficient funds to meet this challenge.

The association of the costly monuments[19] with the likewise costly plot of land needed for a burial, however, is not necessarily an enduring one, except for burial forms which directly exploit, alter or transform the natural landscape (e.g. rock-cut tombs, chamber tombs, grave mounds, etc.). Nevertheless, this does not prevent later forms of re-use.[20] The ancient Greek world provides examples of large-scale conversion of necropoleis within the frame of urbanisation measures and city planning, such as the successive extension or planned re-allocation of urban land. Ancient Athens has been exhaustively analysed in this regard, with scholars being able to show that the successive growth of the *asty* at the end of the Iron Age gradually put an end to the later Agora being used as a cemetery.[21] An example of profound, planned changes being made to the urban structure might be the city of Rhodes, where after the synoecism of the older settlements, burials seem to stop there, whereas in the area of the new city, only one burial is attested prior to the city's founding.[22] Nevertheless, Rhodes is a peculiar case due to its tectonic features, which may have affected the number of extant funerary markers.[23] Besides the urbanistic considerations, observations on the grave markers themselves and their find-spots/contexts reveal different stages of life, allowing insight into economic as well as aesthetic deliberations. It is therefore clear that both intentional and unintentional processes of human intervention could indeed lead to grave markers turning obsolete on a large scale.

Potential scenarios for a tombstone's second life – chaînes opératoires

Thinking about the re-use of stone monuments automatically takes us to the concept of spoliation or upcycling,[24] terms which have to be used with care and accuracy, since they entail the attribution of a specific meaning to the re-used object. Most common is the practice of re-using funerary monuments as building material, be it visible or invisible. The highly diverse objects are sometimes reshaped, meaning that they are trimmed to fit their new purpose, with any relief decoration being hammered off. Testimonies to such practices of re-use and re-shaping are ubiquitous[25]

[14] Cf. the fundamental works based on epigraphical interests by Conze 1893, 1900, 1906 and 1911-1922. Benchmark catalogue by Clairmont 1993. On the works of Schmaltz, see above. For a summary of research history, see Grossmann 2013. Recently on Athenian funerary sculpture and architecture: Scholl 2020; Walter-Karydi 2015.

[15] Named individuals from Athens in the period from the late eighth century BC to about AD 600, listed in the LGPN (<http://clas-lgpn2.classics.ox.ac.uk/place> [accessed: 31 May 2021]): 64,893 persons.

[16] In comparison: Clairmont 1993. Cf. the introduction of Grossmann 2013. For the material composition of early grave monuments, see Scholl 2020. The decorative elements (stone reliefs, funerary plaques/*pinakes*) might be the only components with a recognisable first use in the funerary context. Cf. sculpture in the round, e.g. kouroi and korai in sanctuaries. Only depictions of sphinxes can be clearly identified due to their heads being turned.

[17] On the difficulties in dating Late Archaic funerary monuments at Athens, such as the dating of kouroi on stylistic grounds, their relation to the 'aristocracy', and the Persian Wars as a chronological 'watershed', see D'Onofrio 2020. Cf. Papapostolou 1993 and Schmidt 1991, with emphasis on regionality in the Hellenistic period.

[18] Cf. splendidly Harrison 1965: v-vi: 'Stone, being a partly re-usable material, is far less apt than terracotta to lie quietly in the bed of its destruction.'

[19] For the actual cost, the question of prefabrication or single order is not relevant. On the costs and historically transmitted legal countermeasures cf. Hochscheid 2015: 229-230; Schmaltz 1983: 136-148.

[20] Cf. on the re-use of Greek tombs in the necropolis of Cyrene, Cherstich *et al.* 2018: 122-123. Rock-cut tombs were at a later time transformed into cisterns, martyria or even modern houses or stables. This practice still continues today.

[21] Most recently Rönnberg 2021: 111-117 with previous bibliography.

[22] Cf. Fraser 1977: 84-85 footnotes 1 and 8.

[23] Fraser (1977: 7) assumes that funerary monuments were re-used on a large scale after the earthquake of 225 BC. Patsiada (1996: 101) points out that monuments from marble or Lartian stone were seldomly used in the fourth century BC. Instead, Poros stone and built trapezai dominate in the Rhodian necropoleis, the preservation of which is much more difficult. Despite this, all types of markers were easily re-usable building and construction material.

[24] Cf. Sitz in this volume on terminology. Rous (2019: 176-212) stresses the value of the term upcycling.

[25] Cf. the catalogue of funerary sculpture found in the Athenian Agora, with certain secondary use. Their state of preservation suggests re-use as building material, Grossmann 2013: 65-67, 69.

Figure 1: The funerary monuments discovered at the Sacred Gate in the Kerameikos at Athens, *in situ* (after Niemeier 2002: fig. 26, with permission of W.-D. Niemeier).

and some rather recent finds have gained scholarly prominence, such as the group of Archaic funerary monuments found in the area of the Sacred Gate in the Athenian Kerameikos in 2002 (**Figure 1**). The monuments were used to reinforce the canal of the Eridanos river in the course of the erection of the Sacred Gate under the auspices of Themistocles.[26] As part of this project, many Archaic funerary monuments were embedded in the foundations and walls.[27] All pieces of the group of monuments detected in 2002 show traces of damage inflicted prior to their re-use. Having spent several decades serving as grave markers, all of these objects suffered some form of battle damage, which caused their biographies to take a new turn and entailed their burial in this damaged but un-re-worked state.[28] In contrast, the analysis of other funerary monuments from the Athenian circuit wall indicates that the re-shaping of a monument so as to match the shape of an ashlar block by chiselling off its relief decoration was much more common. Since grave markers were available in the Kerameikos at every corner and in every shape, the area also offers many less prominent examples of grave markers re-used as building material. For example, within the sanctuary[29] of Artemis Soteira in the eastern part of the excavation site, kioniskoi/colonettes and other grave markers have been used for underground structures connected to water conduits.[30] The fragment of a stone lekythos and a kioniskos base were visibly (**Figure 2**), but without ambition for aesthetics embedded into a low wall structure.[31]

The simplest way of re-using a funerary monument, namely by retaining its original function as a tombstone, yet with the identity of the previous owner removed/erased/eliminated,[32] is attested in many cases. While the original form of the monument is being kept, the only personalising agent, i.e., the inscription naming the deceased, is altered[33] or erased.[34] Of course this was only necessary when the step of individualising the grave marker had even occurred. The Athenian Kerameikos necropolis offers good examples, such as the palmette stele from the Koroibos precinct (**Figure 3**). This stele bears a list of deceased persons spanning three generations, which was later augmented by adding an Euthydemos and his son.[35] It appears that, in this case, the precinct had in fact remained with the family, but Euthydemos had probably been married into it and was thus given a place on the family stele, on top above the initially defined inscription field and below the three previous generations. As such, the stele kept its original function and place of erection, even though, at first glance, it appears to have been re-used.[36] A slightly different form of re-use is provided by cases in which the original inscription was erased and a new one was engraved, either over the erasure

[26] Niemeier 2002. Stroszeck 2014: 43-44.

[27] Niemeier 2002: 19-22. Stroszeck 2014: 78.

[28] Niemeier assumes that they were damaged either in the course of the Alcmaeonids' eviction or in the course of the ravaging of Mardonios' troops.

[29] Kokkorou-Alevras 2020 with examples of re-used funerary monuments in the sanctuary of Apollo Pythaios at Halasarna, Cos. Their secondary contexts, however, date to the Byzantine period.

[30] Graml 2020: Cat. 2, 5, 7, 10, 12, 13. Another funerary relief from the Kerameikos site used for canalisation in Stroszeck 2020.

[31] Graml 2020: 115.

[32] Fundamental iconographical and epigraphic analysis in Pologiorgi 1999.
The process of de-identification was only necessary in cases of incised or painted names of the proprietors.
For the second use, one has to assume that at least the sex of the deceased was the same in order to re-use an iconographically specific grave marker. For gender-unspecific grave markers, this step could be omitted. Cf. Bergemann (2022: 53-55), who stresses the discrepancies between image and text.
A second stage of use can only be detected if the grave goods also referred to the deceased through inscriptions that contradict the name on the stele or if the skeletal remains indicate a different sex than the name. However, at least in the Classical periboloi, the stelae are positioned so as to be visible, i.e. oriented towards the main roads, while the bodies are buried slightly offset. Thus, they are not necessarily positioned above the bodies, making correlation difficult.

[33] Schmaltz 1983: 104-05 with the successive addition of further deceased on the stele of Koroibos.

[34] Schmaltz 1983: 101-23. Schild-Xenidou 2008: 152-57 with listed examples.

[35] IG II² 6008: 'Σωσικλῆς / Εὐθυδήμου / Εἰτεαῖος./ [rosa rosa] / Κόροιβος / Κλειδημίδο / Μελιτεύς./ Κλειδημίδης / Κοροίβου / Μελιτεύς./ Κόροιβος / Κλειδημίδου / Μελιτεύς./ Εὐθύδημος / Σωσικλέους / Εἰτεαῖος.'

[36] Schmaltz 1983: 105 with reference to IG II² 6008. Schmaltz and Salta 2003: 49. On the so-called Namensstelen: Hildebrandt 2006.

Figure 2: Wall 8 of the *temenos* walls of the Artemis Soteira sanctuary in the Kerameikos at Athens showing the immured body of a funerary lekythos (photo by the author).

Figure 3: Palmette stele of the Koroibos precinct in the Kerameikos at Athens (D-DAI-ATH-Grabrelief-0339; courtesy of the Deutsches Archäologisches Institut in Athens).

or slightly off-set. The relief of Korallion in the Kerameikos (**Figure 4**), where the initial inscription was erased and altered to honour Korallion, wife of Agathon, substantiates this highly pragmatic practice of re-working grave markers due to biographical changes.[37]

The procedure of de-identifying stone funerary monuments may have been even more widespread than the large amount of erased inscriptions already attests. Since stone stelae could also receive painted decoration,[38] the application of painted inscriptions was equally common.[39] As the removal of paint does not require destructive intervention on the surface, the re-naming and re-using of a painted grave marker may not be identifiable today.

De-identification regarding the depiction of the deceased is also not necessary, when it comes to the re-use of a grave monument for another person. The Greek iconographical tradition for the depiction of the deceased is highly standardised, i.e., it does not render facial features of the deceased (actually portraying him/her) but, instead, refers to rather standardised/stereotype/idealised social roles (young women, old women, young warrior-like men, old citizen-like men) or the depiction of types (e.g. banquet scenes).[40] As such, the re-working of the depiction – when used in a

[37] Schmaltz and Salta 2003: 51-52.
[38] Cf. Schmaltz 1983: 81-101.
[39] Schmaltz 1983: 102.
[40] This fact becomes especially obvious in the case of foreigners. While the inscriptions mention the foreign origin of the deceased, the depictions follow Greek principles in many cases. Cf. Stroszeck 2003 with prominent exceptions.

Figure 4: Architrave of the Korallion relief, kept in the Kerameikos Museum in Athens (D-DAI-ATH-1999-0430, photo by Gisela Fittschen-Badura; courtesy of the Deutsches Archäologisches Institut in Athens).

close temporal, secondary context – was not necessary, if the stele was meant to retain its use as a funerary monument. Iconographic schemes of role models only changed over the long term.[41] Yet, several examples show the re-working of dresses, hair, or body parts,[42] such as the relief of Krito and Timarista from Kamiros on Rhodes (**Figures 5 and 6**). Above the outline of Krito's hair, the background of the relief is less well smoothened, which indicates that the coiffure of the female figure was later re-shaped into the short haircut visible today.[43] Moreover, part of Krito's neck seems peculiar, since the fingers of Timarista's right hand are positioned there in a striking arrangement. In comparison to the arrangement of Krito's fingers on Timarista's neck, where the tip of the thumb forms a slightly curved line with the knuckles of the other fingers, Timarista's thumb juts out awkwardly and her index finger is weirdly bent. We consider it likely that, initially, her hand was placed on the drapery. The re-working consisted of hammering off the four fingers and reworking the drapery so as to depict them directly on Krito's neck. The reason for this re-working cannot be specified. Moreover, the temporal relation of the inscribed names to the depiction remains unclear. While the stylistic traits of the relief suggest a date in the late fifth century BC, the letter forms (palaeography) might

Figure 5: Grave stele of Krito and Timarista, kept in the Archaeological Museum of Rhodes (© Hellenic Ministry of Culture – Ephorate of Antiquities of the Dodecanese).

date later.[44] Nevertheless, the depicted women had to be differentiated more explicitly in age/status for the last phase of use as a grave marker.[45]

The standardised iconographic repertoire of the Greek funerary monuments did not limit their re-use to funerary contexts, likely often in close proximity,[46] but also permitted their re-use as dedications. Certain regions, such as the area between Strymon and Nestos, in ancient Macedon, show a well-studied iconographical overlap of funerary and votive reliefs in the rendering of the so-called 'Thracian rider' or *heros equitans*.[47] Their original context being unknown, many such reliefs, including those exhibited in the

[41] Schmaltz and Salta 2003: 169. On exceptions: Schmaltz and Salta 2003: 124-31. For a critical view on the dating of changes in the representation of kouroi: D'Onofrio 2020.

[42] Cf. Schmaltz 1983: 112-14. In detail: Schmaltz and Salta 2003: 102-24, including attributes. Even the number of depicted persons could be altered. Also Pologiorgi 2003 with examples from Athens and Kokkorou-Alevras 2020 on the relief from Halasarna.

[43] On the discussion of hair initially added in stucco or re-worked hair, see Fraser 1977: 89 with previous literature.

[44] Mielsch 1982: 577 in the review on Fraser 1977.

[45] Re-working depictions entails critical rethinking of funerary markers as prefabricated or individual models. Some of the alterations might be due to a need to adjust the image to the identity and biography of the deceased. Only a clear delay within the funerary marker's configuration (e.g. a later inscription and re-worked figures) attests the personalisation for the final user. Since the focus of this paper lies on the re-use of funerary monuments, no further hypotheses will be attempted here.

[46] On exports, e.g. to the Italian peninsula with unclear re-use see below.

[47] Cf. the polyvalent use of the so-called Thracian rider reliefs: Fol 2017; Proeva 2017.

Figure 6: Grave stele of Krito and Timarista, detail (© Hellenic Ministry of Culture – Ephorate of Antiquities of the Dodecanese).

Figure 7: The so-called Charon relief with its foundation exposed (D-DAI-ATH-Kerameikos-06005, photo by Eva-Maria Czakó; courtesy of the Deutsches Archäologisches Institut in Athens).

local museums, cannot unambiguously be assigned an initial function and potential re-use(s). The debate on the original use of certain reliefs however, is not limited to these seemingly peripheral areas, as several Athenian examples show.[48] Again, the sanctuary of Artemis Soteira in the Kerameikos offers two interesting examples for the contextualised re-use of Classical funerary reliefs. Judging by their substructures, as exposed during the excavation, the so-called relief of Charon (**Figure 7**) and the relief of a Hydrophoros (**Figure 8**) were certainly re-erected secondarily at their current places.[49] Both lie in the area of a Hellenistic makeshift sanctuary for Artemis Soteira[50] and their incorporation in spatial relation to the sanctuary seems to bear a particular meaning. The Charon relief does not show any traces of re-worked surfaces; its foundations, however, are too wide for the actual relief.[51] Given that it is placed where a small passageway branches off, it may have been positioned there as a sort of entrance marker. The initial iconographical meaning, likely chosen by a metic family to highlight their business and source of wealth in grain transport,[52] may have been re-read or become irrelevant at the time of its relocation. The second relief of a veiled woman making a greeting gesture and carrying a vessel, the so-called Hydrophoros, probably shows some minor re-working.[53] The contour of the vessel, and especially the vessel's elongated handle, indicates that the woman carried a jug, comparable to oenochoai of the fourth century BC. Drill-holes on the jug, however, suggest that a horizontal bronze handle was attached. This additional handle characterises the vessel as a hydria. It is plausible that it was added at

[48] Cf. Schmaltz 2010. Stroszeck (2021: 277 in the review on Graml 2020) on the Hydrophoros relief argues that re-working is out of the question by comparing the bronze attachments to the Dexileos relief. Bergemann (2022: 56) is certain that the Hydrophoros is a funerary relief and I fully agree with him.

[49] The original of the Charon relief and the Hydrophoros are kept at the Kerameikos museum and casts are presented in the archaeological park.

[50] On the complex archaeological record of the sanctuary: Graml 2020. Most recently on further epigraphic evidence: Clinton 2023a and 2023b.

[51] Already noticed by Brueckner 1909: 26-27 and 84; Graml 2020: 45-46; Stroszeck 2014: 100. In **Figure 7**, the foundation of the Charon relief is visible. It differs in its proportion from the relief.

[52] Cf. Scholl 1993 with full argument vs. Stroszeck (2014: 100), who adheres to the idea of an actual depiction of Charon.

[53] **Figure 8** shows no substantial foundation below the Hydrophoros relief, apart from rubble stones; it was erected above a stone cist grave. The contemporaneous Classical funerary reliefs in the Kerameikos, at least in their majority, were based on neatly finished ashlar blocks, which served as a levelling course.

Figure 8: The Hydrophoros relief, with rubble-stone foundation, overlaying a stone cist grave (D-DAI-ATH-Kerameikos-00087; courtesy of the Deutsches Archäologisches Institut in Athens).

some later phase, turning the jug-bearer now into a hydriaphoros, which means that the woman was initially depicted as carrying wine, likely for sacrifice, but was now turned into a water carrier. In the context of sanctuaries, however, this iconography is hardly attested. Cult staff was very rarely depicted in votive reliefs, yet, more commonly on grave reliefs.[54] The assumption of a re-worked and re-used funerary relief can be further strengthened by taking the relief's new placement into account. Due to its position – facing a massive well (Well B 18) inside the *temenos* – the horizontal handle was probably attached when the relief was relocated into a context, to which a water-transport vessel was far more fitting. The slight effort to modify the image-field thus seems to have redefined the image-message. Thinking about the chaîne opératoire for their re-use, both reliefs clearly attest measures/preparation of re-use which demanded only minimal effort, though certainly some logistics: the specific reliefs may not have been immediately replaced but, instead, stored until their re-use.[55]

The case of rendering the second use obvious brings to the forefront another aspect of practicality, tightly related to aesthetics and careful planning: Greek funerary sculptures were understood as pieces of artistic beauty, strongly influenced by and sometimes even created by great master sculptors (and their workshops), who did not sign their products.[56] Therefore, the inclusion of sculpted Greek funerary monuments in a ship cargo and in distant locations would be expected. However, amongst the cargo of ancient shipwrecks published so far, no Greek funerary markers have been listed.[57] Yet, at least 16 Greek funerary reliefs are known from Rome and its surroundings, which were not transferred there only in the Renaissance, but already in Roman times.[58] While some of these seem to originate from the Greek settlements in southern Italy, the so-called Albani rider relief (**Figure 9**),[59] an Attic grave stele in the Museo Barraco[60] and the stele of an athlete in the Vatican[61] are stelae that were transported from the Greek mainland, namely from Attica, to Rome. The export procedure demonstrates that these standardised funerary markers were expected to find buyers abroad. Whether they were bought to decorate private estates or even to be re-used as funerary markers, however, remains unclear.[62] Their original context and relation to death does not appear to have limited their decorative re-use as pieces of art and they were treated much like the Greek votive reliefs, which were taken from sanctuaries and exported in larger numbers.[63]

In summary, all potential second lives of funerary markers clearly show that interpreting the removal of grave furnishings for any kind of re-use as desecrating a grave fail to account for the complexity of the evidence. Whether the re-use violated a burial depended gravely on how recent the burial/inhumation was.[64] Only while the mnemonic cycle remained intact, that is, while the burial plot was being cared for and thought of as a memorial of the deceased,[65] was contamination

[54] In detail: Graml 2020: 144-146 Cat. 19.

[55] This can only by hypothesised on the basis of the time span (several decades) between the creation of the reliefs and the establishment of the sanctuary. On storage see below. For further re-use within the family, entailing the original position see above on the palmette stele in the Koroibos precinct.

[56] Pausanias (1.1.3) mentions a funerary monument made by Praxiteles. Schmaltz 1983: 129-130 on the actual involvement of great master sculptors and missing signatures.

[57] Cf. Oxford database on ancient shipwrecks: <http://oxrep.classics.ox.ac.uk/databases/shipwrecks_database/> (accessed 2 June 2023).

[58] Kuntz 1994: 889, 891-893. I thank Francesca Diosono for pointing me also to the Renaissance examples from Venice.

[59] Inv. 985. Assumed to originate from a state burial in the Kerameikos, dating around 430 BC, see Fuchs 2008. On the discovery of the relief at Rome and earlier research, see especially Bol 1989: 246-251 cat. 80.

[60] Inv. 73.

[61] Inv. 559, said to be made of Pentelic marble and dated to 450 BC.

[62] Kuntz 1994: 895.

[63] Cf. Kuntz 1994. Cf. Baumer 2001a and 2001 b. Most recently on collecting Greek antiquities in Rome: Cirucci 2020.

[64] Cf. Kuntz 1994: 895 with reference to Iulius Paulus, *Digest* 47.12.4: The Romans did not consider Greek funerary reliefs as *res religiosae*. This may be due to the temporal distance and the limitation of sacrilege to the burial. In contrast, Roman law was very clear about the legal status of Roman funerary monuments, which were not to be inherited or sold. See the detailed and splendid outline by Thomas 2004: esp. 40-41 on the written evidence.

[65] Cf. Hochscheid 2015: 333-334 summarising measures of taking care of tombstones. Cf. footnote 3 on the assumed generations involved

Figure 9: The so-called Albani rider relief (Villa Albani Torlonia, Relief of the Cavaliere of Villa Albani, © Fondazione Torlonia - PH Massimo Listri)

considered problematic. Contamination entailed littering, but also ritual defilement through the burial of curse tablets.[66] As the aforementioned examples have shown, the decontextualising of a grave marker required planned work Although the testimonies about the practice of placing curse tablets imply the violation of a tomb while in its primary use (and still venerated),[67] the deconstruction of a tomb monument (not the actual burial of the corpse!) was not necessarily regarded as a violating intervention once the need for commemoration had ended.[68] Only the mis-treatment of the burial itself or of grave monuments in active use actually incurred accusations of impiety.[69] If scholars often assume re-use and sacrilege to be one and the same, this accrues from an exaggerated emphasis on legal texts from the Roman period, of a lack of differentiation with regard to the biographies of grave markers, and of bias introduced by modern (Christian?) views on the burial culture.[70] With the deconstruction of a grave monument, the – often pragmatic and legitimate – cycle of re-use and potential adaptation began.

Considering the chaînes opératoires of re-using Greek funerary markers

Based on the selection of examples given above, it becomes evident that tombstones were treated as sources of multifaceted value (**Figure 10**). Owning a stone grave marker meant that the financial means were available to acquire a suitable stone, have it shaped into a monument, and being granted a plot of land where it might be set up. While the first two aspects pertain to the monument itself and were therefore exclusively personal/family/kinship group matters, the ownership of a burial plot, especially in highly contested places close to the city and adjacent to important roads, certainly entailed the involvement of a centralised institution. Many officials occupied with tasks for the collective benefit are known from textual sources on ancient Greek cities.[71] Reasonably the care for the dead was also a centrally organised matter, though this is extensively attested only for the Roman period.[72]

Regarding the potential second life of a grave marker, some form of organising the transfer of land ownership is necessary. Either privately kept accounts or even burial site managers are legitimate to assume. The latter, which are not attested in the Classical period,[73] overseeing the change of proprietorship, possibly in some sort of cadastre, might have had an overview of the furnishings of a burial plot. This does not necessarily mean that they were in charge of clearing the grounds for a new owner, but they most probably administered all the groups involved with a burial site. Unfortunately, few workshops for funerary monuments have been detected so far[74]

in commemorating the dead. On the concept assemblage in archaeological scholarship: Hamilakis and Meirion Jones 2017.

[66] Burials themselves were not necessarily contagious, since they were sometimes in close vicinity to the living, cf. Parker 1983: 71-72.

[67] Manipulating the dead however, was considered sacrilege, cf. Ogden 2009: 275 on curse tablets.

[68] Cf. summary of the discussion by Niemeier 2002: 47-50.

[69] Of course, funerary epigrams disavowed this potential destiny of the burial, e.g. by referring to heroization of the deceased or to a relationship with gods and goddesses, cf. Wypustek 2012. I thank Elena Partida for pointing this out.

[69] An interesting comparison for the re-use of stone blocks from sacral contexts, cf. Lindenlauf 2000 and 2006. On the pragmatic use of debris from the Persian Wars and especially the striking accounts of sale from Athenian sanctuaries, cf. Sioumpara 2020: esp. 96-100. Despite being the property of a deity, the building materials could be sold off to generate income. Therefore, even sacred property belonging to a god or goddess could pragmatically be included in the cycle of re-use.

[70] Scholarship tradition on ancient Greek burials seems especially strong in western culture(s).

[71] Cf. Höcker 2006a and 2006b; Walter 2006.

[72] On the potential organisation/management of land use in the Kerameikos necropolis as an area of mixed-use: Graml 2020: 38 with footnotes 4, 5, 7 and 10. Hochscheid 2015: 334 on regulation of the necropoleis. I thank Henry Heitmann-Gordon for the fruitful discussion, which helped me clarify my argument.

[73] The Classical *polis* knew officials governing infrastructure and public buildings, cf. footnote 71. With regard to land owned by the *polis* or in the course of being purchased by the *polis,* a state involvement is evident. In the Kerameikos, a mixed-use area, state ownership and relating obligations are e.g. traceable at the stelae of the envoys, erected by the *polis*, or the sanctuaries and shrines, which were either established by the *polis* or upon permission (*enktisis*) by the *polis.*

[74] Cf. Papapostolou 1993: 22 on the localisation of Achaean grave stelae workshops based on the used material. No actual atelier/worksite has been identified. Moreover, he correctly points out that ready-made stelae as well as workmen could travel.

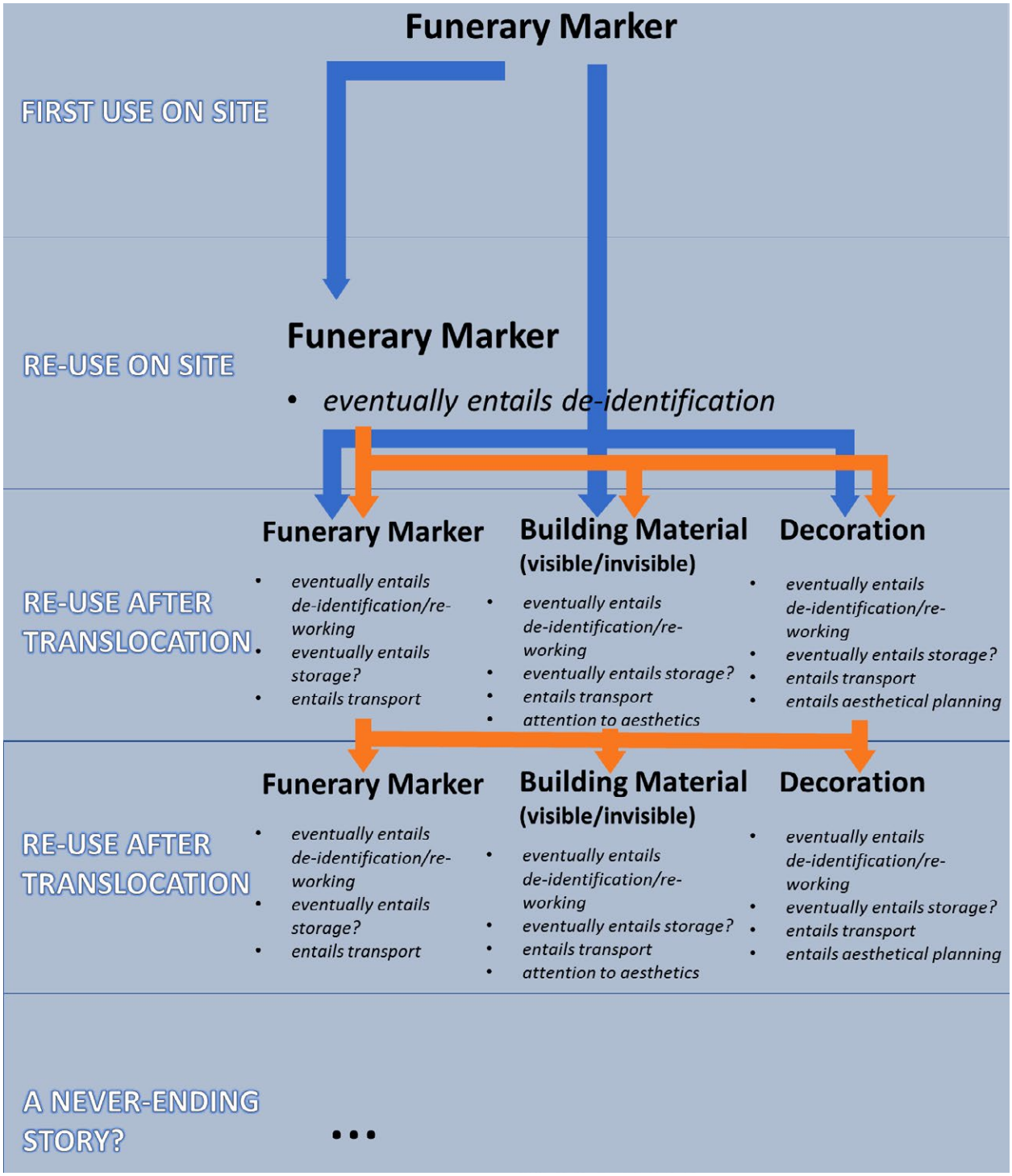


Figure 10: Diagram of the outlined in the text potential chaînes opératoires while re-using funerary monuments (drawing by the author).

and it is difficult to assess whether a stone mason's workshop had a narrow specialisation of production.[75] Since industrial production, despite any generated noise and disturbance, was not restricted to specific, marginal areas of a Greek city,[76] the placement of stone cutting and sculpting workshops cannot be narrowed down. Yet, some pragmatics in handling the pre-worked material might be universal.

Regarding re-use in close proximity to and without deviating from the original context, three potential avenues seem plausible. For the re-use as grave markers in the same plot with a slight alteration of the inscription, obviously no transport was necessary;

[75] The unfinished funerary relief fragments from the Agora likely indicate a workshop, but they were used as building material, Grossmann 2013: 69 Cat. 362-365.
[76] Cf. Sanidas in this volume with further bibliography.

specialised workmen would travel there and execute the task on the spot. Even slight alterations to the decoration (painted or sculpted) seem plausible, but no example has yet been identified or found *in situ* in a burial plot. As concerns the space of grave markers, namely, the plot where they had been erected and its proprietorship, this remained in private hands, as did the marker itself.

For re-use in a different spatial and/or temporal context, the relation to the first use as well to the state of land proprietorship is crucial. The examples from the Kerameikos shed light on how different circumstances impact our interpretation of such re-working:

If the city was under military threat and urgently trying to reinforce its fortifications, the long-distance transportation of monuments would be highly impractical and improbable. The Archaic monuments detected in the Athenian city walls were only roughly re-worked for their re-use[77] and, due to the sheer size of some of the sculptures, they would only have been moved within a short distance.[78] Sourcing the material from a nearby area, therefore, saved time in a state of emergency.[79] The proprietorship of the 'provenance plot' was not necessarily altered, if the plot was situated at a fair distance from the fortification.

If, however, the monument was re-used as a grave marker or as visible or invisible building material in an obvious or less obvious position, and not in urgent circumstances, the situation is quite different. Grave markers were re-used *inter alia* in public infrastructure projects, such as the construction and upkeeping/maintenance of drainage and canal systems.[80] Their use within the frame of a civic infrastructure building program raises the question of the legal status/proprietorship of the funerary plots, where the markers had originally been erected. If the plots had turned into land owned by the *polis*, it is reasonable to assume that the respective grave furnishings, in turn, constituted public property and, so, were eligible and available for re-use on the occasion of some public work. Unfortunately, the evidence at hand cannot verify or disprove our reasoning. Moreover, the other crucial issue, of interim storage before repurposing, cannot be resolved on the available, insufficient testimonies. As the re-interpreted Charon relief and the Hydrophores or the grave lekythos in the surrounding walls of the sanctuary of Artemis Soteira suggested, an organised deconstruction with subsequent storage of the material could be afforded.[81] The actual re-working probably took place at the final destination. Another path to a second life, being exported abroad, likewise certainly entailed some degree of storage, since the cargo of a ship had to be laid out in a way suitable to the vessel's capacity and also aiming to maximise the mercantile success of the ship's owner.[82] Although no example of a storage place is known so far from Greek archaeological contexts, yet, the stonemasons' workshops, even if provisional, could offer a sheltered place like a stoa, to accommodate storage. Storage, however, implies that the objects were accessible to potential re-users (buyers?) prior to their intended re-use. Therefore, after a brief assessment on the burial plot during the change of ownership, the grave marker either stayed on site and was re-used or was transferred and stored, and therefore removed from its original context. With this act, the bond between marker and the buried deceased was also dissolved, the deceased now being buried in oblivion. The stone was then either transported to its new location or to a stone masons' workshop for its de-identification and re-working (if necessary) or, alternatively, to facilities close to transportation routes for re-sale and export; harbours most certainly offered space for preparing shipments.

Conclusion: Re-using funerary markers – why would it even be impious?

Everybody dies, this is a fact. Our analysis of several grave markers has further revealed that only very few of these innumerable dead received durable commemoration. Besides famous figures of history, whose graves are not necessarily known,[83] only a small number of ancient grave markers actually accomplished the task of 'eternal' commemoration. Hailed for their artistic beauty or due to fortuitous circumstances of being still *in situ*, some tombstones have preserved the memory of non-historically known individuals like the youth from the Ilissos relief, Sosibios or Hegeso. However, the majority of the known Greek funerary markers have been spatially disconnected from their original placement in close proximity to the deceased they commemorated. Nevertheless, the disconnection of a memorial from the commemorated individual

[77] The cutting of the Dipylon head off its kouros neither entails a great amount of work nor requires great technical knowledge.

[78] Niemeier 2002: 50 with comparison to Lindenlauf's observation on the Perserschutt on the Acropolis.

[79] On the tearing down and re-use of tombstones for fortifications in times of emergency, see Thucydides 1.93.2 who lays emphasis on the great haste, Aeschines 3.236 who refers only to public tombs and Lycurgus 1.44 who also underlines the overall contribution – even of the deceased – to save the city.

[80] Cf. Stroszeck 2020 presenting a Classical relief fragment, which was likely re-used several times before ending up in the drainage of the Sacred Road. For the canals below the Artemis Soteira sanctuary and the re-use of funerary markers: Graml 2020: Cat. 2, 5, 7, 10, 12, 13.

[81] Cf. Murer 2016, 2018 and 2022 on Roman contexts.

[82] This especially fascinating journey to a second life of a funerary marker can only be properly substantiated for greater temporal distances, specifically for Roman contexts. Due to the lack of analyses of stone material and the looseness of stylistic comparison, it cannot be excluded that the often-attested strong Athenian influence on single monuments, might actually attest Athenian production being exported abroad or travelling Athenian craftsmen.

[83] And their identification sometimes resembles serious quests, such as for the tombs of Alexander the Great.

does not necessarily mean the end of remembrance; instead, it means that commemoration was transferred to a mental sphere, irrelevant to the mundane domain or material means.[84] The period of active, attended commemoration is estimated to have lasted no longer than three/four generations.[85] From this perspective, the often-stated sacrilegious overtone of the handling and re-exploitation of furnishings related to burials becomes questionable. The examples from Greek antiquity outlined above, the detailed studies on Roman contexts conducted by Cristina Murer,[86] and the brief survey on the contemporary handling of recycled tombstones offer insight into a deeply-rooted pragmatism as concerns the worked stone. The effort of dressing this hard raw material required time and skill (moreover, the order anew of fresh volumes from the quarry would be expensive), whereas re-working meant firstly saving time and secondly acknowledging the skill of the workpeople of past generations. Pragmatics rooted in economic thinking – sometimes even in the common benefit – was a fact. Since stone outlasts sentiment, religious obligation, and even memory, such economic pragmatism is quite understandable.[87]

Acknowledgements

I thank Elena Partida for taking me aboard on this editing adventure; scholarly exchange and discussion, as well as a great sense of humour, have kept the ergasteria alive through the pandemic. Thanks are due to Annarita Doronzio and Vincenzo Capozzoli for their enquiries regarding re-use of modern tombstones in Greece, Italy and France and to Georgia Kokkorou-Alevras for her lively interest in the topic, helpful suggestions and bibliographical hints. Wolf-Dietrich Niemeier granted permission to reproduce his photo from the finds at the Sacred Gate in the Kerameikos and the Fotothek of the DAI Athens and its friendly staff helped in all possible ways to find the necessary information. Henry Heitmann-Gordon discussed matters of ancient Greek funerary law and finalised the English text. All remaining errors are fully and exclusively my own.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[84] In the sense of a *lieu de mémoire*, cf. Nora 1990.

[85] Exceptions do of course exist, e.g. the *polyandria* at Marathon and Salamis or the *demosion sema* in the Kerameikos, all of which continued to be present in ritual activity of the Athenian youth centuries after their establishment.

[86] See footnote 81.

[87] On reception of ancient iconography with regard to the suitability for funerary contexts, cf. Bergemann 2022: 59: 'Jenseitsvorstellung ist keine anthropologische Konstante, sondern sie ist historisch und mutiert parallel zu gesellschaftlichen, sozialen und religiösen Tendenzen.'

Chapter 22

The practicalities of spoliation: Tool marks, craftspeople, and building logic

Anna M. Sitz

Abstract

Previous approaches to spolia (reused building material) in Late Antiquity have been primarily art historical in nature, concerned with interpreting the 'meaning' of spolia or its aesthetic desirability. Fundamentally, however, reused blocks were cold hard stone, as researchers – Jon M. Frey, for instance – have recently argued while exploring the practical aspects of building with spolia at sites in Greece, especially fortification walls. Spoliation was in fact a multi-step process, which is often overlooked in studies focusing on spolia as the result of this process.

This paper examines the process of spoliation through case studies from rural Late Antique Asia Minor: Labraunda, Claros, and the Corycian Cave in Cilicia. These sites provide scope for the exploration of three practical aspects of spoliation: storing, transporting, and designing. At Labraunda, in the Carian mountains, the storing of spolia-to-be is indicated by a marble block excavated in 2014, which originated from the temple of Zeus but was uncovered inside a nearby building. An attempt had been made to cut this block in two. At Claros, the transporting of ancient blocks from the famous sanctuary of Apollo is visible in the rough re-working of stones *in situ* and the crumb-like trail of abandoned marbles littering the path to the coast, where other stones presumably continued their journey by sea. At the Corycian Cave Clifftop Temple-Church in Cilicia, the designing of a building project based on the available spolia is obvious. The builders took into account an inscribed list of names as they planned the construction of the church from temple blocks. Moreover, they attempted to conceal beam-holes that had been carved into the temple's exterior wall prior to its conversion.

It is clear from these sites, as well as others, that decisions about how to treat spoliated stones were made at a local, perhaps even personal, level and often responded to more practical factors than concerns about the 'meaning' of ancient marbles. Observing the tool-marks on the stones, as well as the construction logic of the reuse, offers more insight into the agents carrying out the spoliation and their individual thought-processes as they engaged in a widespread and emblematic Late Antique activity.

Περίληψη

Κατά το παρελθόν, τα σπόλια (επαναχρησιμοποιημένο δομικό υλικό) της ύστερης αρχαιότητας είχαν προσεγγισθεί κυρίως από άποψη Ιστορίας της Τέχνης, με στόχο να ερμηνευθεί το 'νόημά' τους ή ο λόγος για τον οποίον ήταν επιθυμητά αισθητικά. Κατά βάση, όμως, τα ξαναχρησιμοποιημένα μέλη ήταν ψυχρές πέτρες, καθώς πρεσβεύουν ερευνητές όπως ο Jon M. Frey, διερευνώντας τις πρακτικές πτυχές της δόμησης με σπόλια σε θέσεις του ελλαδικού χώρου, και ιδίως σε οχυρωματικά τείχη. Στην πραγματικότητα η λαφυραγώγηση/λεηλασία δομικού υλικού ήταν μια πολυεπίπεδη διαδικασία – κάτι που παραβλέφθηκε στις μελέτες οι οποίες εστίασαν στα σπόλια ως απότοκο αυτής της διαδικασίας.

Η παρούσα εργασία εξετάζει τη διαδικασία προσπορισμού δομικών μελών διά λαφυραγώγησης/λεηλασίας μέσα από περιπτώσεις της μικρασιατικής υπαίθρου κατά την ύστερη αρχαιότητα: τα Λάβρανδα, την Κλάρο και το Κωρύκειο Σπήλαιο της Κιλικίας. Οι θέσεις αυτές προσφέρουν πεδίο διερεύνησης τριών πρακτικών πτυχών της οικοδομικής λεηλασίας: της αποθήκευσης, της μεταφοράς και του σχεδιασμού. Στα Λάβρανδα, στα βουνά τις Καρίας, η αποθήκευση υποψήφιων/μελλοντικών σπολίων υποδηλώνεται από μία μαρμάρινη λιθόπλινθο που ανασκάφθηκε το 2014, προερχόταν από το ναό του Δία αλλά αποκαλύφθηκε μέσα σε ένα κοντινό οίκημα. Η λιθόπλινθος είχε επιχειρηθεί να κοπεί στα δύο. Στην Κλάρο η μεταφορά αρχαίων μελών από το διάσημο ιερό του Απόλλωνα είναι ορατή στην αδρή επανεπεξεργασία των λίθων επί τόπου και στο μονοπάτι που σχημάτιζαν τα εγκαταλελειμμένα μάρμαρα στο δρόμο προς την ακτή, όπου άλλες πέτρες υποτίθεται συνέχιζαν το ταξίδι τους διά θαλάσσης. Στο Κωρύκειο Σπήλαιο της Κιλικίας και το ναό-εκκλησία στην κορυφή του γκρεμού, η σχεδίαση ενός οικοδομικού προγράμματος βασισμένου στα διαθέσιμα σπόλια είναι εμφανής. Οι κτίστες έλαβαν υπ' όψιν έναν ενεπίγραφο κατάλογο με ονόματα καθώς σχεδίαζαν την κατασκευή εκκλησίας από μέλη του αρχαίου ναού. Επιπλέον, επεχείρησαν να καλύψουν δοκοθήκες που είχαν διανοιχθεί στον εξωτερικό τοίχο του ναού πριν την μετασκευή του.

Από αυτές τις θέσεις, καθώς και άλλες, καθίσταται σαφές πως οι αποφάσεις για τη διαχείριση των σπολίων λαμβάνονταν σε τοπικό, ενδεχομένως ακόμη και σε προσωπικό επίπεδο, και συχνά αφορούσαν πιο πρακτικούς παράγοντες από τον προβληματισμό για την 'έννοια' των αρχαίων λίθων. Η ενδελεχής παρατήρηση ιχνών εργαλείων πάνω στους λίθους, καθώς επίσης η κατασκευαστική λογική της επανάχρησης, είναι πολύ πιο διαφωτιστική όσον αφορά τους φορείς της λαφυραγώγησης και το κατά περίπτωση σκεπτικό τους, καθώς επιδίδονταν σε μια διαδεδομένη και εμβληματική δραστηριότητα της ύστερης αρχαιότητας.

Keywords: spolia; reuse; Asia Minor; Late Antiquity; construction

Introduction: Perspectives on reuse and workshop traditions from the New World

The coastline of New Brunswick, Canada, may seem a strange place to start a paper on the spoliation (reuse) of building materials in the ancient Mediterranean. But these small coastal communities provide a glimpse, in the more recent past, of the relationship between craftspeople, workshops, and spoliation. In the nineteenth century, shipbuilders here were world-famous for the quality of their wooden merchant and transport vessels, which enabled the economic expansion, exploitation, and migration of that era. But by the latter part of the century, the age of great wooden ships was past, and the consummate craftspeople who constructed them had to find other work. Many of them took their experience with wood-working and structural innovation to the construction industry, resulting in unusually high quality carpentry in the buildings around the Bay of Fundy.[1] The Saint John City Market of 1876, for example, was constructed by unemployed shipbuilders with an interior roof structure in the form of an inverted ship's keel.[2] In other cases, the builders reused wooden elements from older ships to strengthen architecture on land. Houses in the area made savvy use of old ship knees – the V-shaped piece of wood used to brace boats – to support timber-built joins.[3] It was only the advent of mass-produced, standardised building elements that brought this habit of creatively recycling skills and materials to an end.

How should we interpret this reuse, this spoliation? Certainly, the impressive aesthetics of the Saint John City Market's wooden trusses were intentional. We can also tease out statements about the past – about the region's proud history of shipbuilding – as broadcast in this structure's appearance, which was the product of an architectural design competition. Economics were certainly at play in the decision to reuse already-shaped, high-quality wood from ships in domestic architecture, and the well-off individuals (patrons) who decided to embark on a construction process had a say in determining the end result. But obviously, we cannot tell the story of New Brunswick's ship-inflected architecture without considering the craftspeople and workshops who applied their technical know-how, tools, and materials from the ship building industry to architecture on land. It is them we must credit for the innovative built landscape of the Canadian coast.

[1] Smith 2009: 35-39.

[2] Leroux 2008: 87, fig. 112; Smith 2009: 36. Cf. the Église Sainte-Catherine de Honfleur in Normandy, which has a fifteenth-century inverted-keel roof structure. My thanks to the editors of this volume for this comparandum and for their many helpful comments and corrections.

[3] Smith 2009: 37.

Spoliation: The meaning of reuse

The same issues of interpretation, comprehension of building logic, and attribution of agency are at stake when we consider a very different construction context: the many Greek and Roman buildings of the Mediterranean that reused construction material, especially marble.[4] For that region, however, we have far fewer sources to tell us about the craftspeople and workshops engaged in acts of reuse. Instead, the reused building material itself (sometimes called spolia) has beckoned to scholars with the tantalising promise of meaningful, ideological appropriation, especially in the Late Roman period (fourth to seventh century AD).[5] Building material was reused in earlier eras, as well, but this was the period of intensive and visible reuse of older building materials in both public and private building projects, and it coincides, with almost remarkable tidiness, with the Roman Empire gradually turning Christian.[6] This was also the era when substantial political, social, environmental, and economic challenges confronted the empire, bringing about far greater changes in the Roman world than even those faced by the unemployed shipbuilders of New Brunswick.

Reused marble blocks, columns, and carved sculpture have primarily been studied in the Late Antique monuments of Rome itself, where these spoliated stones have been viewed either as a sign of the decline of Roman artistic traditions or as an ideological appropriation of the Roman past in the service of the Late Roman present.[7] The Arch of Constantine (AD 315), ambiguous in its inscription referring to an 'instinct of divinity' and in its use of spolia – and it now appears that even most of the supposedly newly-carved, Constantinian panels on the arch are actually Diocletianic spolia – has inspired numerous interpretations of the 'message' of the arch and its framing of the first Christian emperor

[4] I do not consider here the medieval western, Byzantine, or Islamic uses of spoliated building material, which in some cases took place amid very different discourses (often polemical) about the past and very different workshop traditions. It should be noted, however, that spoliation – and workshops focused on reuse – may have been even more prominent in this period. Cf., for example, the 'great spoliation' of the Fora of Rome in the ninth century AD: Kinney 2013: 266; Menegheni and Santangeli Valenzani 2007: 123-124.

[5] The term 'spolia', which was applied to reused marbles in the Renaissance, has fallen into disfavour with many scholars because of its connection with triumphalist narratives and the 'spoils' of war. For the historical use of the term, see Kinney 2001: 138; Kinney 2006. Dumser 2018 and Greenhalgh 2011 prefer simply 'reuse', while Rous 2019 uses 'upcycling.' I continue to use 'spolia' in this paper as a convenient scholarly shorthand for connecting a pre-existing body of scholarship.

[6] For Greek/Roman uses of spolia, see Duckworth and Wilson 2020; Frey 2015b; Ng and Swetnam-Burland 2018; Rous 2019; Sioumpara 2020.

[7] Brandenburg 1996; Brilliant and Kinney 2011; Elsner 2000; Kinney 1997; Kinney 2001; Liverani 2004; Pensabene and Panella 1993/1994; Pensabene 2015; 2017.

as either a conqueror or continuator of the Roman past.[8] The frequent use of older columns in the early Christian basilicas of Rome, such as Old St. Peter's, has further strengthened the association of the new religious outlook with meaningful appropriation: either appreciation of the classical past or triumph over it, or a more complex yet sophisticated relationship with the past.[9]

If we zoom out from the rhetorically-charged space of Rome, however, other approaches to spolia become possible. Scholarship increasingly contextualises reused blocks within the changing aesthetic tastes of Late Antiquity.[10] The mismatched, pastiche-effect, so anathema to the architectural canons of classical Greece and Rome, seems to have been desirable for Late Roman viewers, who had developed a taste for *varietas*. Both newly-carved architectural elements (especially those coming from workshops in the eastern Mediterranean) and spoliated marbles played to this taste for variety within monuments.[11] Indeed, Philipp Niewöhner argues that spoliated marbles in some cases may not have been recognised as such, subsumed as they were in the wider aesthetic display of a marble façade or interior. The material properties of marble itself – the 'sparkling stone' with its varied colours and veining – was also a factor in its reuse: regardless of its availability, the substance itself was of a semi-precious nature, invoking luxury, potentially distant quarries, and even divine 'painting in stone'.[12] At the same time that older marbles became desirable building elements despite, or at times because of, their reused nature, imperial legislation took a more conservative approach, attempting to protect the traditional aesthetics of cities by controlling who could demolish and reuse older buildings and under what circumstances.[13] In AD 458, Emperor Majorian wrote to the prefect of the city of Rome, complaining that public buildings were being destroyed in order to extract their valuable building material; from then on, petitions for demolition had to be obtained from the senate and, when granted, further approved by the emperor himself.[14] The spoliation of existing buildings became largely a state-sponsored activity in Rome, at least for a time.[15] We must remember, however, that such laws were aimed towards specific contexts rather than universal application and, more importantly, their reach was limited.[16]

Finding craftspeople and building teams among the spolia

Many prior approaches to spolia, then, have developed from the field of art history, focused as it is on meaning-making, aesthetics, and urban development.[17] Research has often taken a top-down approach, centring the intentions of the elite patrons/rulers for whom monuments were built or the aesthetic and/or patrimonial importance of older monuments for urban elites. My contribution, however, focuses instead on the craftspeople and workshop traditions that produced the spolia-laden built landscapes of Late Antiquity. By turning towards the question of who carried out spoliation and how, physically, they did it, I engage with a wider body of literature dealing with practical aspects of using spolia: the nitty-gritty of day-to-day building needs, of waste management within cities, of economic impulses encouraging the recycling of older building materials rather than sourcing new ones. The role of individual workshops and craftspeople in this building practice is only now starting to become clear.

Fortification walls have proved to be fertile grounds for scholars to reconsider spolia from this perspective. While older carved images could be incorporated into city walls for apotropaic purposes (as at Hierapolis or Sagalassos) or even with an eye to aesthetics (Aphrodisias), fortifications were fundamentally functional structures and carried less rhetorical baggage than churches, for example.[18] The reuse of older stones in these walls has therefore received more attention from a construction/workshop point of view. Funerary monuments frequently ended up in city walls, in part because they already stood at the fringes of cities, where walls were being constructed.[19] At Agedincum (Sens, France), several grave monuments were discovered in the city wall; they had apparently been re-worked on-site, as indicated by the extraordinary find during excavation of a stonemason's axe, which matched the type of tool marks found on some of the re-worked stones.[20] Other stones built into the wall showed evidence for approximately twenty different tool types, including points, chisels, and mason's axes; P.-A. Lamy and M. Ribolet suggest that this diversity is due to different stone-working teams employed on this single fortification wall or due to different phases in re-carving. Jon M. Frey has produced an extensive study of the construction logic employed

[8] Rose 2021, with earlier bibliography.
[9] Brilliant and Kinney 2011; Kinney 1997; Liverani 2013.
[10] Brenk 1987; Brenk 1996; De Staebler 2008: 312-318.
[11] Niewöhner 2018.
[12] Barry 2020; Greenhalgh 2009.
[13] Alchermes 1994; Baldini Lippolis 2007: 219-224; Barker 2018: 52-60; Barker and Marano 2017; Geyer 1993; Noethlichs 2013.
[14] *Novels of the Sainted Majorian Augustus* 4.1; Pharr 1952: 553-554; Orlandi 2017: 217-218; Underwood 2019: 169.
[15] Ward-Perkins 1984; Underwood 2019: 171-172.
[16] Underwood 2019: 62-63.
[17] For example, see Hansen 2003.
[18] On Hierapolis, see D'Andria 2003: 112-114; on Sagalassos, see Jacobs 2010: 277-278; on Aphrodisias, see De Staebler 2008: 298-301. More generally, see Greenhalgh 1999; Intagliata *et al.* 2020.
[19] Pallis 2019: 61-62. Although authors in earlier periods of antiquity may have viewed the use of grave stones in walls as a sign of desperation, by the Late Antiquity, the habit of reuse was so prevalent that the appropriation of grave stones was not necessarily viewed negatively.
[20] Lamy and Ribolet 2020: 106.

by the 'common builder' in the use of spolia in several fortifications in Late Roman Greece.[21] He identifies distinct building teams employed simultaneously to construct the Hexamilion fortifications at Isthmia in the early fifth century AD (just as different teams were used at Agedincum); each team had its own way of incorporating spolia and disguising it in the wall, given that there seems to have been a directive from higher up to the effect that spolia should not be on display in this building project.[22] Frey draws an important distinction between spolia, as the *product* of reuse (the stones themselves, which remain on display in the new structure), and spoliation, as the *process* of selecting, storing, cutting, and employing those stones.

There were naturally pragmatic reasons for building teams to recycle locally-found stones, bricks, and broken pieces of marble (which could be processed into lime mortar), rather than to pay the transport costs to ship in new elements from distant quarries or production sites – especially as quarries gradually closed in Late Antiquity (particularly in the west, perhaps in part because sources were exhausted or there was already so much marble in circulation).[23] Exploring these practical aspects of using spolia further, Simon Barker and Yuri Marano have each documented the connection between regular demolition and the salvaging of material as a part of Rome's construction economy, both in earlier periods and in Late Antiquity.[24] The use of spolia was not only beneficial for the *new* structure but also a convenient way of tidying up a demolished or decaying site. Beth Munro has made a similar argument at villa sites: older, defunct villas were taken apart and recycled by skilled workshops most likely working with the permission of the villa's owner.[25] She bases this conclusion on the regular locations of workshops (lime kilns; metal working facilities; glass working installations) within older villas in the western part of the Roman empire and the technology they employed. Seth Bernard has argued that considerations of how to move very heavy loads, including spolia, impacted urban development in Rome.[26] Douglas Underwood proposes that there was no significant loss of building technology or skills prior to *c.* AD 600 across the Mediterranean, so building with spolia should not been viewed as a definite sign of 'decline' or 'decadence'.[27]

This previous work has done much to illuminate the practical aspects of spolia and to turn our attention to the individuals actually carrying out these building projects, especially in Rome and in Greece. In the present contribution, I offer three case-studies from rural Late Antique Asia Minor, which further demonstrate the importance of paying attention to process, toolmarks, and the movement of spolia. The sites are Labraunda, Claros, and the Corycian Cave Clifftop Temple. These case studies correspond with three important phases in building with spolia: storage, transport, and design. I wish to acknowledge my indebtedness for this approach to the local workers on various archaeological projects who have taught me a thing or two about moving, reusing, and managing stone resources, as well as my indebtedness to colleagues who have learned from contemporary workshop and craft traditions and have dialogued with me about it. I do not purport here to make any overarching statements about spoliation as a widespread practice in the ancient Mediterranean, but rather to investigate the particular challenges and opportunities that greeted specific individuals involved in spoliation at a small scale. Doing so adds to our picture of the workshop traditions and individual craftspeople engaged in this common Late Antique building practice.

Storing: Labraunda

At Labraunda (Muğla province, Türkiye), an ancient marble block was abandoned midway through an apparent spoliation attempt – allowing us to catch a glimpse of the storing and re-working of older stones before their reuse. The site of Labraunda in the Carian mountains historically centred on the sanctuary of Zeus Labraundos, monumentalised by members of the Hecatomnid dynasty between approximately 377 and 344 BC. The area around the sanctuary filled with feasting halls, baths, and other venues related to the functioning of the sanctuary through the subsequent Hellenistic and Roman periods (**Figure 1**). The various buildings at the site were constructed both of local gneiss and marbles from quarries near Mylasa or other western Anatolian sites, such as Heraclea Latmia (ad Latmum).[28] By the fifth century AD, two churches were built at the southern fringes of the site, and domestic occupation in some of the former monumental spaces began.[29] Labraunda therefore became a village located along a mountain-road – a settlement that grew organically out of, and within, the substantial remains of the ancient sanctuary and surrounding buildings. As is to be expected, this rural settlement efficiently cannibalised the structures and building materials of the ancient built environment.

In the midst of this wholesale reuse and the appropriation of older stones, *ad hoc* spaces for storing and modifying ancient marble blocks emerged around the former Temple of Zeus. The temple either collapsed

[21] Frey 2015a.
[22] Frey 2015a: 128-174.
[23] Marano 2016; Underwood 2019: 183.
[24] Barker 2010; Barker 2018; Barker 2020; Marano 2020. See also Baldini Lippolis 2007: 231, who suggests that lime burners were valued for providing an essential service in Rome.
[25] Munro 2011; Munro 2020.
[26] Bernard 2013. See also Biermann 2013.
[27] Underwood 2019: 3.
[28] Freccero 2015.
[29] Blid 2016.

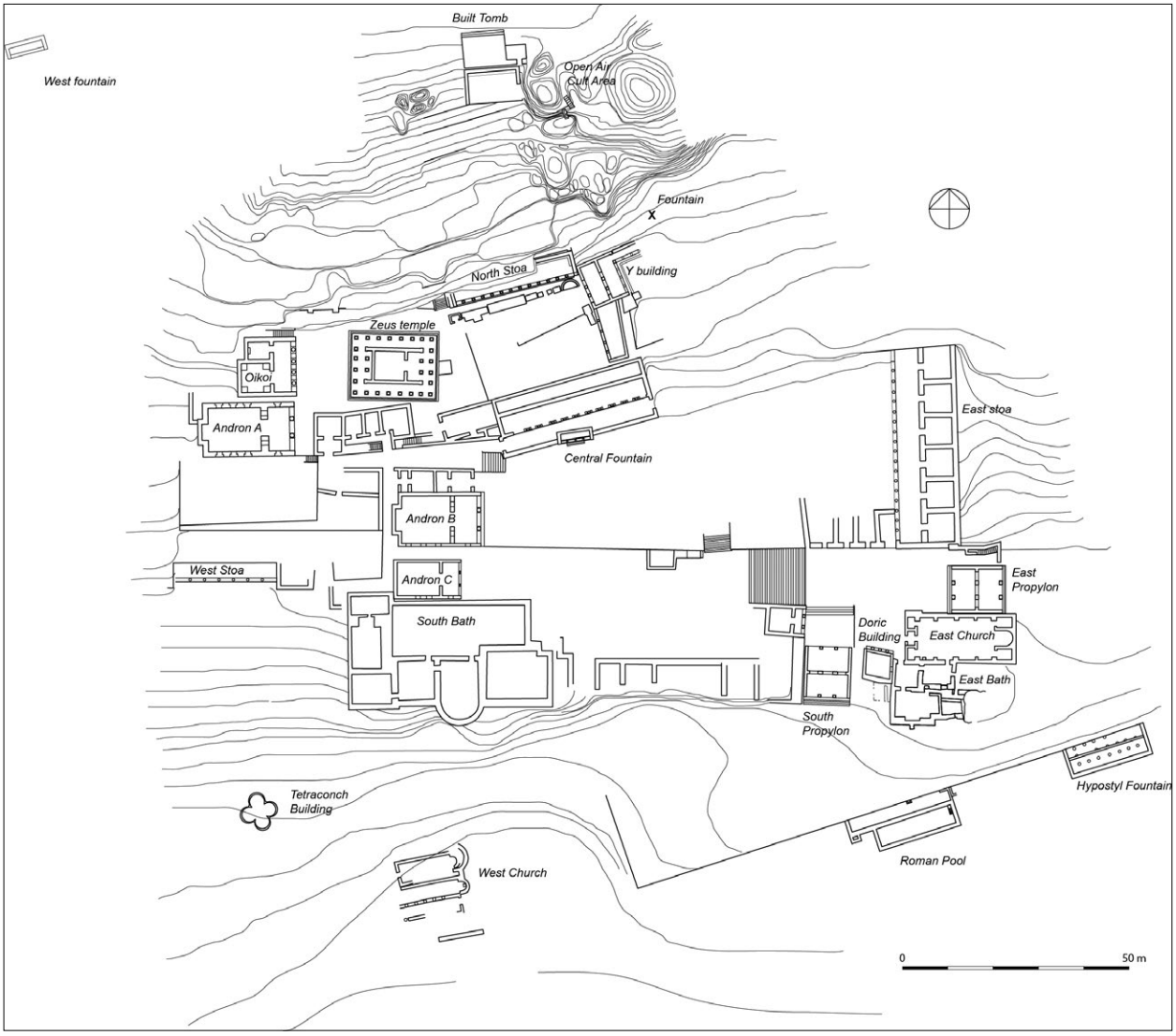


Figure 1: Plan of Labraunda (drawn by Olivier Henry, © Labraunda Excavations).

or was dismantled at some point after pagan worship ended in presumably the fourth century AD; some of its architectural marbles and gneiss blocks were found where they had collapsed, but many marble parts of the superstructure are missing.[30] The mid-twentieth century excavators recorded the discovery of lime kilns in this area, but they were not documented. We can expect that many marble elements from the temple ended up in these kilns in order to produce lime mortar. Interestingly, no recognisable elements from the temple have been found in the two churches constructed at the southern edge of the site in the fifth century, suggesting either that the temple was still standing (albeit disused) at that point, or that the temple's marbles were not needed/desired for those building projects.

But some of the temple's blocks were nonetheless subject to moving, probably in Late Antiquity. Directly behind the temple at Labraunda stood Andron A, a monumental feasting room also of the Hecatomnid period.[31] Excavations in Andron A starting in 1948 have produced four marble *anta* blocks, which came originally from the rear southwestern *anta* of the Temple of Zeus.[32] They were found below the level of a Middle Byzantine (*c.* tenth century) gneiss floor and in the same strata which also produced elements of a wine or olive press (counterweight stone; pits with *pithoi* fragments), which probably date to Late Antiquity and which in part sat upon the preserved section of the ancient plaster floor in the building's northwest corner (**Figure 2**).[33] The marbles from the temple were therefore moved into the Andron during our period, although no direct

[30] Hellström and Thieme 1982: Pl. 28.

[31] The dedicatory inscription is fragmentary and does not preserve the name of the founder. It may have been Idrieus or Artemisia (siblings of Maussollus): Hellström and Blid 2019: 175-176.

[32] The blocks are AB 3 (*I.Labraunda* 1), M02 (*I.Labraunda* 137), M03 (*anta* capital), and M50 (uninscribed *anta*-block); see Carless-Unwin and Henry 2016: 38, n. 53; Hellström and Thieme 1982: 31; Henry and Aubriet 2015: 676-678; Sitz 2023: 191-194.

[33] Henry *et al.* 2015: 334-355; Henry *et al.* 2016: 416-424.

Figure 2: Labraunda. Interior of Andron A with marked find-spot of block M02 (*I.Labraunda* 137) (© Labraunda Excavations, photo by Olivier Henry).

connection with the press can be established. The four marble blocks are fairly well preserved: they include an ornate *anta* capital, an uninscribed block, and two inscribed ones. The Greek texts on these stones (and on others, found near the temple and on other buildings) comprise a dossier of letters carved around 220 BC. The letters detail a conflict over control of the sanctuary between the local priest of Zeus Labraundos and the nearby city of Mylasa, moderated by Seleucus II, Philip V, and an official named Olympichos.[34]

One of these inscribed marbles (block M02 originating from high up on the temple *anta*; *I.Labraunda* 137; 69.8 x 31.9 x 75.1cm) came to light only in the 2014 excavation, and it provides further insight into the process of spoliation at this non-urban site – and the abandonment of this process *in medias res*. The well-preserved stone was found upside down in a pit near the southern wall of Andron A. Before it was deposited in the pit, an attempt had been made to separate the front face of the *anta* block, which bore the inscription, from the larger bulk of the stone (**Figure 3**).[35] A v-shaped quarrying channel can be seen on the block's upper face, about 30cm behind its front and extending onto the left and right sides (**Figure 4**). The cut appears to have been made by a point-chisel, a masonry tool used for shaping blocks before the finer details were worked (**Figure 5**).[36] This was not an amateur attempt at breaking up a stone with a blunt object or a marble worker's punch (as we might expect if the marble was to be burnt for lime). Rather, it was a co-ordinated effort at making a clean break using a specialised carving tool and thereby separating the block into two parts. Nonetheless, the cut is not especially careful. Large flakes of marble have spalled off at the edges of the stone, and the entire attempt may have taken a single individual only a couple of hours.[37] It is impossible to say whether this stone worker was a member of the construction team(s) engaged in building the basilicas to the south or was simply a resident of Labraunda with some experience with marble.

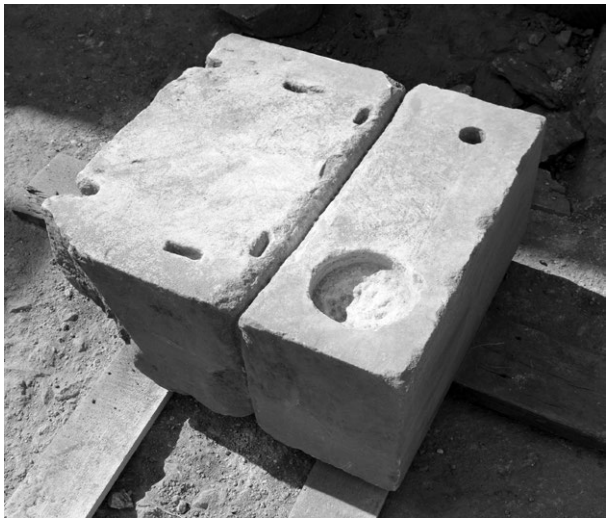


Figure 3: Labraunda. Top view of block M02 (*I.Labraunda* 137) (© Labraunda Excavations, photo by Olivier Henry).

The cut may have aimed at removing the inscribed face of the stone from the rest of the block, perhaps to

[34] Crampa 1969.

[35] Carless-Unwin and Henry 2016: 37, no. 46.

[36] Personal communication with Samuel Holzman. See 'Point' in Wooten *et al.* 2013 for this type of tool. For other blocks reworked with a point-chisel, see Brown 2016: 167 on Corinth; Tchekhanovets 2016: 283, fig. 13 on Jerusalem; Tsivikis 2020: 43, fig. 6 on Messene. It is not clear whether these blocks were intended to be used as spolia or as raw material for making mortar.

[37] For this analysis of the tool marks on the stone, I offer Samuel Holzman my thanks. For the photos and permission to discuss this stone, I thank Olivier Henry.

Figure 4: Labraunda. Side view of block M02 (*I.Labraunda* 137) showing the quarrying channel (© Labraunda Excavations, photo by Olivier Henry).

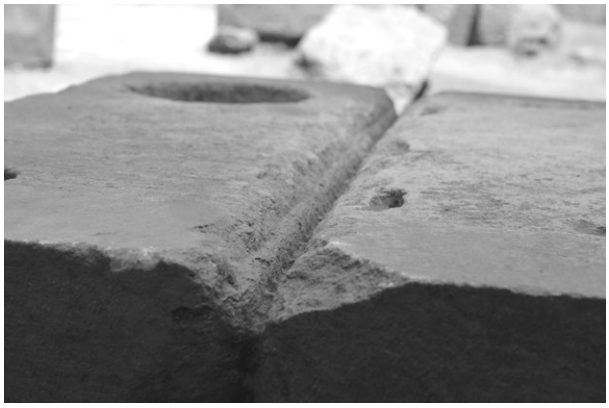


Figure 5: Labraunda. Close-up view of the quarrying channel on block M02 (*I.Labraunda* 137) (© Labraunda Excavations, photo by Olivier Henry).

preserve or reuse it in a particular way; alternatively, the goal may have been to produce two, unevenly-sized marble blocks. For whatever reason, this attempt was abandoned.[38] The same block also shows a large circular cavity (22.5cm diameter) on its upper face, made by expanding the left dowel hole; it is unclear what the purpose of this cavity was, or how it relates temporally with the quarrying channel. We witness on this stone the physical traces of one or more attempts at reuse carried out by at least one individual versed in stone-working tools but not very invested in a particular final product. Marble was apparently not in short supply and could be treated almost carelessly at Labraunda.

In Late Antiquity, then, Andron A at Labraunda appears to have been a multi-functional productive space, serving as a storage and preliminary working area for marble blocks from the Temple of Zeus while also holding an olive or wine pressing installation. At the Oikoi next door (a smaller complex of two rooms of uncertain function, founded by the Hecatomnid ruler Idrieus, as confirmed by an architrave inscription), heterogeneous architectural marbles and broken pieces of inscriptions were also found, although the exact archaeological context of these materials is uncertain due to the early date of the excavations (**Figure 6**).[39] The southern room of the Oikoi had been re-roofed with a substantial brick dome in Late Antiquity, accompanied by a brick floor that was later largely removed, before the dome collapsed.[40] Broken marbles, including an Augustan-era frieze with meander-pattern and fragments of a *geison* (cornice) and roof-block from the Temple of Zeus, were found below the floor level when this collapsed brick dome was removed by archaeologists (**Figure 7**).[41] The marbles did not originate from the Oikoi, so they must have been brought there to form an assemblage of broken pieces. It is unclear whether they functioned as fill below the brick floor, or were deposited here subsequent to the floor's near-complete removal. If they were an intentional deposit, they may have served as raw materials to be burnt in a limekiln found on the Oikoi's porch, as attested by the excavation notebook of 1948.[42] Regardless, the high density of broken, mixed marble elements found in the Oikoi probably indicates the intentional assembling and storing of this potentially useful building material.

[38] Sitz 2019a: 214, no. 47.

[39] For the Oikoi, see Dahlén 1955; Hellström 2007: 119-125; Westholm 1963: 90-93. For the marble finds there, see Notebook Oikoi I 1950-1951; Notebook Oikoi II 1951-53: esp. 17-33; Fotoregister II 1951, XXXI 7. My thanks to Pontus Hellström for making the notebooks available to me and to Görkem Cimen for her translation work.

[40] Blid 2016: 197-202 dates the dome to the sixth century but notes that the latest published ceramics found below the level of the brick floor can be dated to the late third or early fourth century AD: Hellström 1965: 83, lamp cat. nos. 69 and 71.

[41] Temple: Hellström and Thieme 1982: 86, G10; 104, RB 16. Notebook Oikoi II 1951-53: 67; 73. Fragments of inscriptions were found in the Oikoi as well: Crampa 1969; Crampa 1972: *I.Labraunda* 1B, 2, 10, 53, 55, 87, 88, and 102.

[42] Notebook 1948: 36. For broken marbles found near limekilns at other sites, see Bonnie 2016; Munro 2016.

Figure 6: Labraunda. Aerial view of Andron A and the Oikoi (© Labraunda Excavations, photo by Olivier Henry).

Figure 7: Labraunda. Collapse of the Oikoi dome (photo by G. Eriksson, 1951. Uppsala University Library, Alvin-record: 346585). CC BY-NC-SA.

professionalism of the individual engaged in re-working the marble), the ancient anta-block was treated somewhat carelessly; the cut did not need to be perfect. Another example of spoliation from the site of Alt-Kibyra (Uylupınar), near the ancient city of Cibyra in southwestern Anatolia, shows an inverse relationship of tools/professional skills and deliberateness. A Late Antique baptistery from this small site, now in the Burdur Museum, is entirely built from Roman marble spolia, but largely without indications of professionally joining or re-working the stones (**Figure 8**).[43] The exception to these unmodified spolia elements is an inscription built into the side of the baptistery. The text is a dedication from a man named Eprios Agatheinos to local gods.[44] This inscription is difficult to read in certain places, and the initial editors of the stone assumed that the damage was accidental. I have argued elsewhere, however, that the

To sum up, spoliation at Labraunda was not a strictly organised affair but was carried out in part by individuals or smaller teams. Even when a standard stone-working tool was used (indicating some level of

[43] Burdur Museum inv. 236.93.94; Research permit: 51544244-155.02-E.158017; 64298988-155.02-E.156523. Sitz 2019b: 648-652, with earlier bibliography.

[44] *I.Mus. Burdur* 184: 'Eprios Agatheinos, to the great *synnaoi* (temple-sharing) gods.'

Figure 8: Burdur Museum. Baptistery from Uylupınar (permit no. 51544244-155.02-E.158017; 64298988-155.02-E.156523) (© Turkish Ministry of Culture and Tourism / photo by the author).

Figure 9: Burdur Museum. Inscribed spolia (*I.Mus. Burdur* 184) in the baptistery from Uylupınar (permit no. 51544244-155.02-E.158017; 64298988-155.02-E.156523) (© Turkish Ministry of Culture and Tourism / photo by the author).

inscription was partially erased in order to obscure the dedicator's pagan identity.[45] The erasure was not carried out by a chisel or other stone-working tool as we might expect: it seems to have been a more amateurish erasure, perhaps done by rubbing a stone or other object on the inscribed letters (**Figure 9**). Unlike at Labraunda, great care and attention was shown towards the older marble, with only select letters of the text carefully removed, but this individual lacked professional tools. Late Roman graffiti too were sometimes scratched with stones or blunt objects instead of carved more neatly.[46] This reminds us that not only craftspeople and workshops were engaged in interactions with their built environment, but 'average joes'/laymen, as well. Within Late Antique cities, spoliation is usually assumed to be a state-controlled activity, or at least an activity which the state attempted to control through legislation.[47] At Labraunda in the rural Carian mountains, however, the storing and occasional re-working of older architectural marbles was a more informal affair, taking place alongside other types of production activity and on an as-needed basis. Nonetheless, at Andron A and

[45] Sitz 2019b: 650. 'Θεοῖς μεγάλοις συννάοις | [[Ἐ[π]ρι̣ο[ς]]] [[Ἀ]]γα[[θ]]εῖ[[ν]]ος.'

[46] For example, at Claros (see below) and at Lagina, where graffiti perhaps made by a stone instrument cover the temple stylobate. A satyr from the nymphaeum at Miletus likewise has two crosses carved on its abdomen, made by a blunt instrument (Maischberger 2009: 104-105). A marble bust of Aphrodite from the National Archaeological Museum of Athens (inv. 1762) bears a rough cross on its forehead, perhaps also made by a stone or other blunt instrument. The nose and eyes have also been damaged, as was also the case on a cross-marked relief from Patras (Sporn 2012/2013: 261).

[47] Leone 2013: 231.

the Oikoi, we can identify attempts to gather and store blocks that might be useful as spolia or as raw material for lime mortar.

Transporting: Claros

Late Antique communities needed not only to store potentially useful older blocks; they also needed to transport them, both within and between sites.[48] At Ostia, spoliated blocks seem to have 'moved freely' around the city rather than accumulating only near abandoned quarters.[49] This may imply a pattern of trade within the city. The same was the case at Ephesus, where spolia from various pagan sanctuaries spread throughout the cityscape, not because of planned dismantling of these structures as a part of 'Christianisation', but in order to clean up the city after earthquakes.[50] Elsewhere, entire structures had their blocks numbered to facilitate a careful process of dismantling, transport, and reuse.[51] At Aizanoi, the Temple of Artemis was taken apart and its architrave re-built into a porticoed street around AD 400. The blocks of the architrave were numbered (from right to left) so that they were put up again in their original order; this was significant because the result was that the dedicatory inscription to Artemis was still legible.[52] If the blocks had been reused out of order, the inscription would have been 'scrambled' or broken up. This text then required an erasure obliterating the name of the older goddess. At Sagalassos too, blocks from the Temple of Dionysus were numbered so that they could be rebuilt into Basilica E1 in the city's former stadium in the second half of the fifth or early sixth century.[53] The numbering of blocks indicates an organised, planned, and carefully executed process of deconstruction and transport.

Not all disassembly/dismantling was so careful, however, nor were blocks always destined to be re-erected in their original configurations or even in their original form. At the famous oracle of Apollo at Claros near the Ionian coast, a Late Antique stone-working team encountered a treasure-trove of architectural elements ready for spoliation. The old sanctuary fell out of use by the mid-fourth century AD, at which time the statues of Apollo, Artemis, and Leto fell in their temple – and were decapitated.[54] Christian activity at the site is indicated by cross graffiti surrounding the former *adyton* of Apollo. But a break in activity at this extra-urban sanctuary is attested by the alluvial deposits that raised the ground level about 0.60m above the sanctuary's paving, even as the Temple of Apollo itself continued to stand. This abandonment may be related to the fact that the nearest *polis*, Notion, was also greatly reduced by this period.[55] With the oracle no longer in operation, there was no reason to visit the old Temple of Apollo. Except, that is, to harvest old marbles.

The entire former sanctuary (what was standing above the new, higher ground level) became an open-air workshop for recycling these well-built structures. As Jean-Charles Moretti and his colleagues have amply demonstrated, it is possible to analyse this process of deconstruction in the same detail that more traditional archaeological methods have analysed construction phases.[56] They date the spoliation to approximately the sixth century. First, there is evidence that the still-standing temple walls and columns were dug into in order to extract metal clamps, dowels, and the lead used to seal them. The precision of the metal recovery efforts (with only one misplaced cavity missing the dowels on a column-drum) indicate that the demolition team was very familiar with the architectural practices of earlier periods: the individuals digging for clamps and dowels knew where to look (**Figure 10**). With these valuable metal joining agents removed, the temple itself was systematically dismantled. The roof or its remains must have been dealt with first; next, the wall blocks of the *cella* were taken apart, as well as the paving of the pronaos and naos.[57] Then the entablature and the columns of the *peristasis* were taken down.[58] Nothing of the superstructure was left in place.

Some of these blocks were found by the excavators on site, where they had been abandoned, but the majority of the temple's blocks were apparently transported overland to the harbour of Notion, about two kilometres to the south. This has been determined by marble blocks that were dropped along the way between the temple and the harbour – transporting the blocks apparently proved more challenging than the team had anticipated.[59] Within the site of Claros, a metope,

[48] Although imperial edicts were adamant that valuable building materials should not be commandeered and moved from an obscure town to a major one (*Codex Theodosianus* 15.1.14 of 365; 15.1.37 of 398), it is questionable how much impact this legislation had in local contexts.

[49] Underwood 2013: 398-399.

[50] Niewöhner 2019: 203. It is, however, not always possible to identify the causes of temple destruction: Ladstätter 2019. See also Jacobs 2013: 300-302.

[51] This practice was already used in antiquity, for example, in the fifth-century temple of Ares in Attica, which had its blocks numbered probably in the Augustan era and transferred to the Athenian Agora, where it was fully rebuilt in its original form with the help of this numbering system: Rous 2019: 61-66.

[52] Sitz 2023: 236-241; Wörrle 1995: 719-720.

[53] Talloen and Vercauteren 2011: 366.

[54] The beheading of the statues may have been carried out by Christians or perhaps by pagans, who may have wanted to save the statue heads. Moretti *et al.* 2016: 304. For the end of the sanctuary, see also Delattre 1992: 35.

[55] Ratté *et al.* 2020: 333.

[56] Moretti *et al.* 2016: 303.

[57] Moretti *et al.* 2016: 304.

[58] For a drawing of the find-spots of the temple columns and other blocks, see Rougetet 1992: 107, fig. 4.

[59] Macridy 1905; Macridy 1912: 37-42; Moretti *et al.* 2016: 306; Rougetet 1992: 103. A few orthostates from the altar of Apollo at Claros were reused in a basilica near Notion. A fire attested at Claros must have taken place after the temple had been deconstructed: Moretti *et al.* 2016: 303.

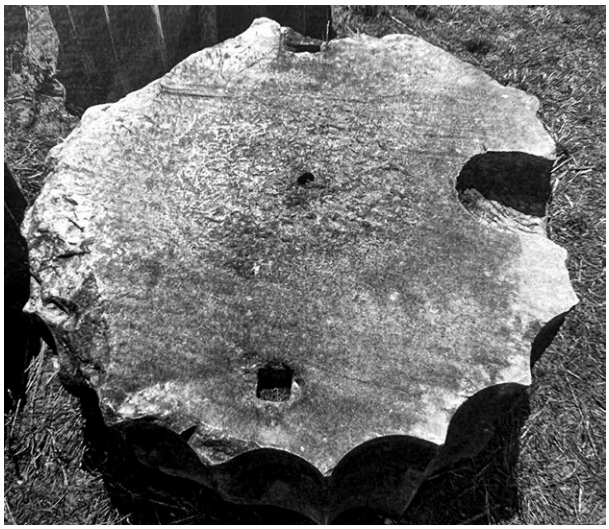


Figure 10: Claros. Column-drum with cavity opened by diggers for metal clamps, who missed the spot (Moretti *et al.* 2016: fig. 8) CC BY-SA 4.0.

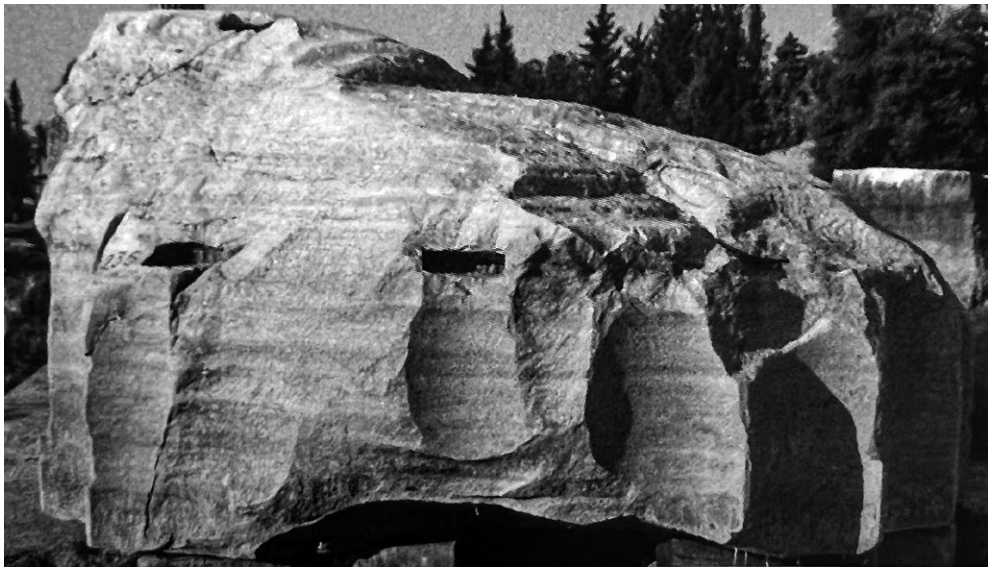


Figure 11: Claros. Column-drum with cutting for metal wedge (Moretti *et al.* 2016: fig. 12) CC BY-SA 4.0.

architrave block, and cornice were found near the Lucullus monument in the direction of the sanctuary's entrance, while a column-drum was found about halfway between the sanctuary and the harbour. Before their overland journey, several of these abandoned blocks or those left behind next to the temple were re-cut in order to ease transport. Two column-drums bear cuttings for metal wedges, which were inserted in an (uncompleted) attempt to split the column-drums at half their height (**Figure 11**).[60] This method of splitting the marble/block is more sophisticated than the point-chisel used at Labraunda for Block M02 and is related to a technique used in stone quarries. Entablature blocks at Claros show similar wedge-cuttings. Wall blocks from the Temple of Apollo, on the other hand, are marked by quarrying channels, similar to what we have seen at Labraunda. The goal of all this re-cutting was to produce cubic, manageably-sized stones: one column-drum left behind at Claros now has two planar (flat) sides, even as the fluting remains in place on the rest of it (**Figure 12**). A careful guideline for shaping the remaining two flat sides of this drum is visible on its upper face. On other stones, a pick was used to create a rougher guideline designating an area for cutting. This demonstrates that a number of individuals were occupied in the re-cutting activity and may indicate different levels of skill or care among them. The open-air working-space in which some of these cuttings were carried out was uncovered by the excavations of 1959.[61]

From the harbour, the marbles from the sanctuary of Apollo at Claros were presumably transported by ship to areas in need of building material. It was a common practice in antiquity to move marbles by sea.[62] The Proconnesian marble had originally arrived at the Temple of Apollo at Claros by sea as well: remarkably, the Kızılburun shipwreck, which dates from the Late Hellenistic period, has revealed original architectural elements meant for this same temple but lost en-route.[63] We do not know the destination of the marbles' second sea journey in Late Antiquity, but shipwrecks from this period too attest the transport of already-worked architectural pieces, most famously the sixth-century

[60] Moretti *et al.* 2016: 306.

[61] Robert 1960: 21. Cf. the Antonine Baths at Carthage, where marble-processing was performed *in situ* after the building's abandonment post AD 638: Lézine 1968: 71-72. A bronze-working furnace was set up in the Forum of Caesar in Rome by the fifth or sixth century, probably indicating spoliation: Meneghini and Santangeli Valenzani 2007: 121-122. For a sophisticated spolia re-working set-up at Jerash (Gerasa, in Jordan), including a water-powered saw mill, see Jacobs 2013: 302–303; Seigne 2002.

[62] For the moving of marbles by sea: Fant 2001; Russell 2011; Russell 2013b; Sodini *et al.* 1980; Wilson 2011: 40.

[63] Carlson and Aylward 2010.

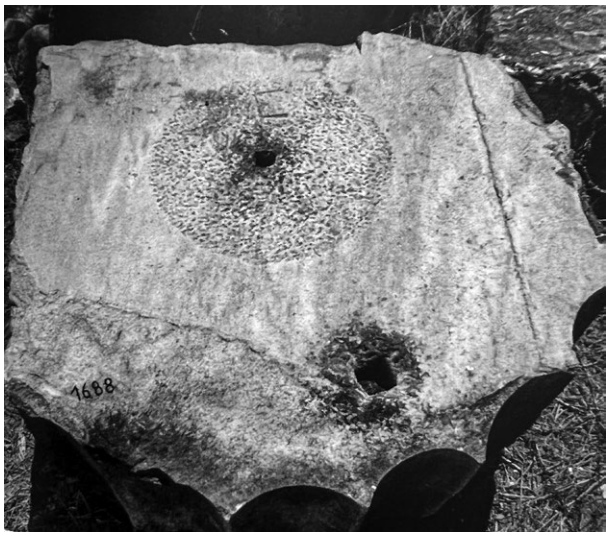


Figure 12: Claros. Column-drum re-cut on two sides into a cubic shape, with visible guideline for the continuation of the re-cutting (Moretti *et al.* 2016: fig. 15) CC BY-SA 4.0.

Marzamemi shipwreck near southeast Sicily.[64] Other shipwrecks may indicate the maritime transport of building material for reuse.[65] Literary sources support the transport of marbles (some probably spolia) over long distances: the Ostrogoth queen Amalsuintha thanked Justinian for sending her marbles (Cassiodorus, *Variae* 10.8), while a bishop from Thenai (in modern Tunisia) is said to have obtained columns, a ciborium, and an ambo by ship in order to build a shrine to St. Demetrios (*Miracula Sancti Demetrii* 313–314).

Although transporting marbles by sea is a known phenomenon, the economics lying behind the marble recycling at Claros are difficult to untangle. Apparently, the stone-working team found it worth their time to engage in an extensive and challenging program of deconstruction, followed by re-cutting the stones, transporting them two kilometres overland, and then shipping them somewhere (perhaps nearby Ephesus, with its thriving Late Antique urban scene?). At the same time, a great many stones from the Temple of Apollo at Claros were left behind midway through the spoliation process, as at Labraunda. Some of the stones left behind at Claros are graffitied with names in the genitive case, interpreted by Moretti *et al.* as the name of the stone-worker or entrepreneur who claimed the stone as his own – but these individuals never came back to continue their work.[66] Perhaps these old marbles, which were roughly re-cut, were not especially valuable after all. On the other hand, our assumptions about economic value and presumed rational motivations for reuse may be out of place here. Claros, and Clarian Apollo, were still famous in Late Antiquity, and the rhetorical value of reusing stones from his temple may have appealed to certain communities or to certain bishops. The names on some of the blocks may not so much claim economic ownership as attest to the pride of the individual stone-workers engaged in this project, who may have seen the temple as an undesirable monument of past paganism in need of disassembly. As much as scholarship on spolia has (rightly) moved away from the interpretation of all Christian-era reuse as a triumphalist appropriation of paganism, we cannot forget that attitudes varied widely and that the rhetorical tropes about spolia, which we occasionally find in the written sources, may have been quite familiar to some of the individuals engaged in spoliation.[67] Regardless of the underlying motivations, we witness at Claros the practical aspects of preparing older marbles for transport.

Designing: The Corycian Cave Clifftop Temple

At the Clifftop Temple above the Corycian Cave in Cilicia (southern Türkiye), the building team did not need to store, transport, or even re-cut ancient stones in order to build a three-aisled basilica around AD 500. The temple at the site was, it seems, still standing, at least up to the architrave, at the time when it was taken apart and used as spolia.[68] This temple *in antis*, the dedication of which is uncertain, had stood on the cliff above the yawning abyss of a karstic sinkhole which opens into the Corycian Cave (not to be confused with the cave of the same name near Delphi in Greece) since the Hellenistic period (probably the mid second century BC).[69] This extra-urban sanctuary belonged to the city of Corycos, located closer to the Cilician coast, and in the period of Augustus, a list probably representing the temple's priests was inscribed in Greek on the front of one of the temple's *antae*. This list was supplemented in following centuries with further names, stretching onto the side of the *anta*. The last name in the list likely dates to approximately AD 270.[70]

[64] Leidwanger *et al.* 2021; Marano 2016: 116-117; Russell and Leidwanger 2020.
[65] Russell 2013a: 355, no. 7 and no. 27.
[66] Moretti *et al.* 2016: 309.

[67] For example, Mark the Deacon, *Life of Porphyry of* Gaza. See also Moralee 2006 for an antagonist reading of spolia at Jerash, which is well-founded upon Late Antique epigraphic, architectural, and hagiographical evidence.
[68] Feld and Weber 1967: 267 *contra* Bayliss 2004: 171, footnote 117. For the dating of the church: Bayliss 2004: 173; Feld and Weber 1967: 277.
[69] Feld and Weber 1967: 268. The temple is sometimes assumed to be dedicated to Zeus Corycos, but as Şahin 2012 has demonstrated, such an attribution is unfounded.
[70] The final column in the list of names (column C) is composed of several names that begin with M. Aur. (Marcus Aurelius). As Blanco-Pérez 2016 has demonstrated, M. Aur. names in Asia Minor typically indicate a date post AD 212 (the *Constitutio Antoniniana*), as this was the date when Caracalla extended citizenship to the empire's peregrine inhabitants. In only a few examples do they indicate a grant of citizenship at an earlier period, under Marcus Aurelius. The palaeography of the list at the Clifftop Temple is also consistent with a third-century AD date, and so I date the first M. Aur. name in the list to a priesthood held in *c.* 212. Note, however, that Reitzenstein 2020 takes a cautious view of the dating of M. Aur. names – these names may conceivably date from somewhat later. For further information on the inscribed *anta*, see Sitz 2023: 155-165, 244-247.

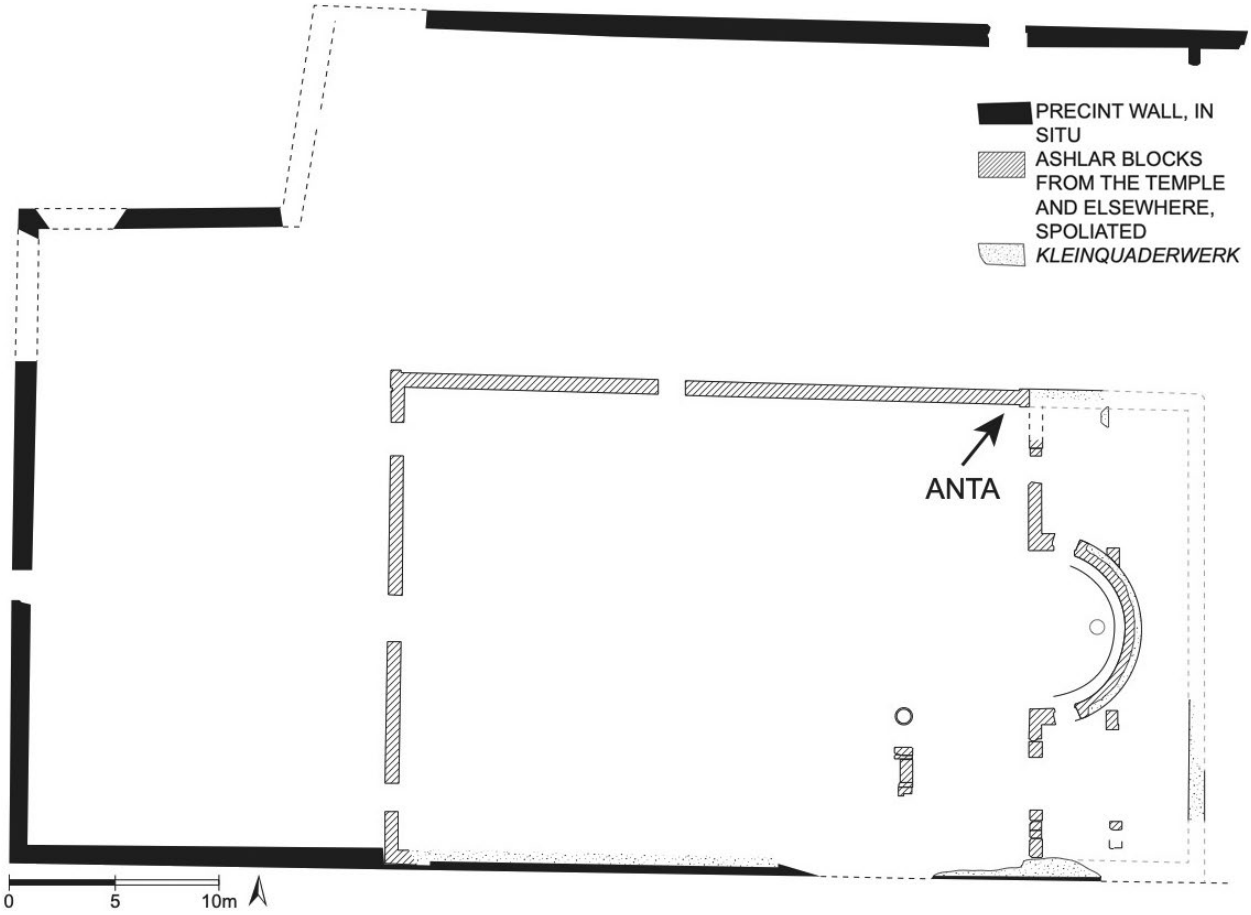


Figure 13: Corycian Cave (Cilicia) Clifftop Temple-Church. Ground plan
(drawn by the author and Yasmin Nachtigall after Bayliss 2004: fig. 110 / © Anna M. Sitz).

When the church builders embarked on their building project in the later fifth century, they faced a series of design decisions: would they simply reuse the temple's *cella*, adding an apse onto the east side and a door onto the other, as in other examples of Richard Bayliss' 'direct conversion'?[71] Or would they disassemble the blocks of the temple and put them back together again as a more typical Christian basilica (Bayliss' 'spolia church')? The builders at the Corycian Cave Clifftop Temple decided for the latter. The ashlar limestone blocks of the temple were taken apart and re-erected as the north wall of the church, probably on new foundations (although the lack of excavation at the site makes this difficult to confirm).[72] As Otto Feld and Hans Weber note in their detailed investigation of the temple-church, this was nothing special: many building teams in this period made similar decisions. But as they further state, the way that stones were reused at the Corycian Cave Clifftop Temple is in fact noteworthy: 'eine partielle Anastylosis' was carried out.[73] Both the northeast temple *anta* (the one with the inscribed list) and the original corner of the *cella* wall were re-erected with their stones in their original configuration (**Figure 13**). Furthermore, in the long wall that now connected these two elements (which was built of spoliated stones out of their original sequence), attention was nonetheless paid to traditional architectural aesthetics. The orthostate course from the temple was dutifully replicated in this northern wall, which still stands to a height of about 7m (**Figure 14**).[74] The remainder of the church, including the substantial apse and gallery level, were built of small blocks (*Kleinquaderwerk*) or other spoliated limestone ashlars from an uncertain earlier building.[75] The limestone blocks were quarried in an earlier period less than a kilometre away.[76]

The Corycian Cave Clifftop Temple-Church reveals the lengths the church builders went to in order to design their basilica based on the constraints of the available spolia. First, the length and height of the northern and western wall was calculated to include precisely all the

[71] Bayliss 2004.
[72] For the results of geophysical investigation, see Şahin *et al.* 2010: 76-77. I thank Hamdi Şahin for his permission to take photos of the temple.
[73] Feld and Weber 1967: 261-262.
[74] With the addition of some blocks not originally from an orthostate, but cut to this same height, as in the case of a column-base with a shallow cutting for a column visible on the north wall. See also Bayliss 2004: 166-168.
[75] There is no indication that any of the stones were brought from the nearby Göztepe temple, as was posited by some early scholars: Şahin *et al.* 2010: 72-77.
[76] Feld and Weber 1967: 270.

Figure 14: Corycian Cave (Cilicia) Clifftop Temple-Church. View to the east (interior) (photo by the author, with permission from Prof. Hamdi Şahin).

available blocks from the temple, beginning with the northeast *anta* and terminating at the southwest corner, where the builders had run out of wall-blocks but could avail themselves of the Doric architrave blocks.[77] The southern wall of the church (facing towards a nearby village) was more coarsely constructed of *Kleinquaderwerk*.[78] The ashlar apse was crowned by an interior cornice, which follows the curve of the apse. Feld and Weber have argued that parts of this moulding were reused from an earlier structure, which must itself have had a semi-circular component.[79] This structure determined the width of the apse opening.

One final element of the temple-blocks indicates the building team's investment in designing their church around spolia. The interior face of the temple-church's north wall (the one built of temple blocks) is riddled with carved holes, which were apparently carved after the temple's construction but before its dismantling and re-construction as a church. Near the top of the wall, a row of substantial beam-holes clearly indicates a gallery in the church, but other holes occur at various heights (meaningless, since the temple-blocks on this wall were, for the most part, used not in their original sequence) and vary in appearance: some are carefully rectilinear and small, others gaping and large, whereas others are roughly hewn and medium-sized. Feld and Weber (followed tacitly by Bayliss) attribute all these disparate cavities to the building team's removal of the metal clamps, which had held the temple-blocks together.[80]

Some of the carved holes on the church's north wall may be attributed to digging for clamps, but I argue that a row of holes located at the wall's northeast section is instead indicative of a separate use phase for the temple, before its conversion into a church (**Figure 15**). As Feld and Weber note, two of the temple's *anta*-blocks, with their list of names in Greek and their carved *anta*-returns, were turned upside down when the *anta* was reconstructed as the north wall of the church. These blocks show small rough, conical cavities (now facing into the church).[81] When the blocks were right-side up, however, these holes would have been on the outside of the temple-wall. The inscribed list on the two *anta*-blocks that were turned upside down was thoroughly erased from the new, outer wall of the church. I propose that the following blocks of the *anta*/church wall, which also show similar holes, have likewise been rotated so that these holes now face into the church. These ashlar blocks did not need to be turned upside down because, unlike *anta*-blocks with their carved *anta*-returns, all faces of these rectangular blocks were the same, and so they could simply be rotated to turn the face with holes towards the interior of the church (**Figure 16**). The holes in this row on the inner face of the wall do not occur only at block corners (where one expects to find clamps), and they extend in a horizontal row in the rebuilt wall (**Figure 17**). Indeed, they have more in common with rough, vernacular beam-holes than with clamp digging, which often proceeds vertically up the *anta* (for example, at the Temple of Augustus at Ankara). When we mentally flip these blocks back around so that these cavities are on the exterior face of the temple wall, it becomes clear that this row of cavities starting

[77] Bayliss 2004: 171; Feld and Weber 1967: 259-260.
[78] For the village: Eichner 2011: 162-185.
[79] Feld and Weber 1967: 269-270.
[80] Bayliss 2004: 83; Feld and Weber 1967: 257.
[81] In addition to a larger, rectangular beam-hole on the lower block.

Figure 15: Corycian Cave (Cilicia) Clifftop Temple-Church. View of the northeast *anta* (interior face) (photo by the author, with permission from Prof. Hamdi Şahin).

Figure 16: Corycian Cave (Cilicia) Clifftop Temple-Church. View of the northeast *anta* (from the east) (photo by the author, with permission from Prof. Hamdi Şahin).

Figure 17: Corycian Cave (Cilicia) Clifftop Temple-Church. View of the northeast *anta* (interior face) (photo by the author, with permission from Prof. Hamdi Şahin).

on the *anta*-blocks and continuing along the wall were in fact beam-holes for moderately-sized wooden poles/beams. These rough holes may indicate a small lean-to built onto the temple's exterior wall before it was dismantled and rebuilt as a basilica. This wooden annex may have been agricultural in purpose and presumably was built after pagan worship ceased (post AD 270, based on the termination of the list of priests) but before the blocks were rebuilt as a church – an interstice of approximately two centuries, during which time a

domestic settlement was located to the temple's south. The evidence of these beam-holes is a rare witness of the gap between the temple's active pagan use and its re-erection as a church, archaeologically invisible at most temple-churches.

When the church builders at the Corycian Cave were faced with the task of designing their basilica based on the still-standing remains of the temple, they went to great lengths to adapt to these beam-holes, turning or flipping the blocks to the church's inner wall and erasing the inscribed names now on the exterior wall of the basilica in order to present a unified, smooth church exterior.[82] They did this in addition to the rather impressive task of calculating how long the north and west wall of the Christian structure could be in order to be built largely of temple spolia. Each of these features at the Corycian Cave Clifftop Temple-Church demonstrates the sophisticated relationship between the building workshop and the spoliated blocks from which they deftly created a new Christian ecclesiastical space.

A fragmentary Greek document on papyrus found at Oxyrhynchus in Egypt may shed further light on the process of architectural design guided by practical aspects of spolia. This recently-re-edited text, *P.Lond.* III 755, is a list of marble columns, bases, and capitals apparently available for reuse in a Late Antique city, along with their measurements and the information of whether they are of local or other stone.[83] The precise locations of the elements are described: 'in the space called *triklinos* [of a certain house]...in another place called *symposion*...in the city... at the place with the vaults called of Theonille....in the houses of Achilleus and Bastas and Arsinoe and Ph[...].'[84] Because this list is written on the *verso* of a papyrus with other, unrelated documents from Arsinoe and dated to AD 303, this text should date some years later – perhaps the mid-fourth century – and, because papyri travelled widely for reuse, the list may have originated from Oxyrhynchus, from Arsinoe, or from somewhere else. In any case, the importance of this document for viewing spoliation in real time has been recognised. Adam Łukaszewicz saw the papyrus as a record of pillage: the searching out and snatching of architectural elements from older buildings, precisely the kind of behaviour prohibited by several fourth-century emperors.[85] Arietta Papaconstantinou takes a more positive view, suggesting that we are witnessing a salvage operation: she proposes that all the houses/columns in the list have been damaged in a catastrophic event, perhaps an earthquake of AD 320 (which hit Alexandria), and someone then made a list of salvageable elements.[86] She points out that some columns, such as those 'at the place with the vaults called of Theonille' are described as 'lying on the ground.'[87]

I question, however, whether all the columns listed in *P.Lond.* III 755 need come from abandoned or damaged buildings. The houses have their columns enumerated within specific rooms: *triklinos*, *symposion*. The specific functions of the rooms seem unnecessary, and maybe even unknowable, if the structure were lying in a state of ruin. Rather, perhaps these homeowners have decided, for whatever reason, to renovate their houses and are willing to sell off unneeded architectural elements. Columns may have lain on the ground in certain sectors of the city for many years and for many reasons beyond a single destructive event. Regardless of the state of the buildings from which architectural elements were to be extracted, the list seems to have been compiled at the behest of someone planning a substantial construction project (a church? a large house? a civic building?) who wanted to know what columns, capitals, and bases were available for local purchase. The more precise architectural design of this building project (how many columns, large and small? how tall could they be?) may have depended on learning what was available. That is to say, it would be unfortunate to design a church with aisle colonnades 5m tall, if there were locally available elements at 4.75m tall – taller columns could of course be shortened, but there was only so much height that could be added to a petite column by an exaggerated capital and base. The locations of some fragments suitable for a lime-kiln are also mentioned in the papyrus – useful information for someone embarking on a construction project. Regardless of the context of this list in *P.Lond.* III 755 and whether it sheds light on someone designing a building project based on available spolia, it is clear that substantial attention was paid to the specific dimensions and qualities of pre-existing architectural elements.[88] They were not to be reused haphazardly.

The success of designing a building based on available spolia is evidenced at the Church of the Apostles in Anazarbos (Cilicia, in southern Türkiye). This central urban church features a rich, reused acanthus-scroll frieze wrapping around the church's exterior at eye-level.[89] This frieze originated from a Roman entablature, and the church builders in the second half of the fifth or the early sixth century must have calculated how

[82] Cf. the concern for a refined, classicising exterior of the east wall of the temple-church at Aphrodisias, which also required the sacrifice of an inscription: a list of male names was plastered over. Sitz 2019c: 156.
[83] Papaconstantinou 2013. *P.Lond.* III 755 = P. Bagnall 43 (<https://papyri.info/ddbdp/p.bagnall;;43>, last accessed 19.08.22).
[84] P.Lond. III 755, *ll.* 31–61 (excerpts). Trans. Papaconstantinou 2013: 222.
[85] Łukaszewicz 1975.
[86] Papaconstantinou 2013: 225-227.
[87] P.Lond. III 755, ll. 40-41.
[88] See also, for example, Basilica I at Sabratha. Leone 2013: 229.
[89] Engelmann and Niewöhner 2010; Posamentir 2008: 92-93. For the urban setting of this church and the continuing classical aesthetics at Anazarbos, see Dey 2015: 206-208.

much of this impressive frieze was available when determining the church's dimensions (and they had to occasionally carve new, matching joining elements to make this frieze reach fully around the church). But their engagement went further: as Niewöhner and Iris Engelmann have argued, the frieze was intentionally incorporated into the church not as an entablature (its original function in the Roman structure), but as a socle low on the wall. Here it was maximally visible to the viewer while also playing with the expectations of ancient architecture: such a frieze *should* have been located high up, in the entablature, according to the rules of classical construction.[90] A similar phenomenon can be seen at a nearby site, Hierapolis Kastabala, where the North Church (fifth/sixth century AD) incorporates an architrave into the lowest course of its apse, where one would expect a base-moulding. This play between antiquated and contemporary building traditions was emphasised at the Anazarbos Church of the Apostles by the addition of a newly-carved central medallion at the apex of the apse, which joins two stretches of the Roman frieze encircling the building. The Late Antique stone-masons did an impressive job of imitating the older frieze in their carving of this medallion, while adding two new features, a cross set within a wreathed crown and a dedicatory inscription to the apostles. The medallion was therefore unmistakably Christian while clearly imitating the older frieze – and serving the practical function of joining the frieze bands of the left and right, which stood at two slightly different heights.[91] At Anazarbos, the same building team was engaged in both spoliation and carving new, Late Antique architectural sculpture; the older marbles were clearly a highly-valued part of the building project and were treated with care throughout the spoliation process. This example, along with that of the Corycian Cave Clifftop Temple-Church and perhaps the *P.Lond.* III 755 document, further supports the close connection between architectural design and spoliation in the Late Roman period.

Conclusion

The case studies of Labraunda, Claros, and the Corycian Cave reveal glimpses of individual craftspeople engaged in the process of spoliation in Late Roman Asia Minor. A few general observations can be made. First, many sites in Late Antique Anatolia were probably blessed with an over-abundance of potential spolia, as we have seen at Labraunda and Claros. The somewhat careless re-cutting of stones at these sites, even by individuals with specialised stone-working tools, should not be understood as a generic indication of 'decline' in building capabilities but as the natural result of this over-abundance. Spolia blocks were, to put it simply, not that special and could be treated in a matter-of-fact way. The many marble quarries in western Asia Minor in antiquity contributed both to this over-abundance of blocks and probably to attitudes towards marble as well: marble was a valued construction element but was not so rare as to be precious. Second, while aesthetic factors were a priority at larger-scale projects, such as at the Corycian Cave Clifftop Temple-Church (where great effort was put into creating a smooth outer façade of the church) and at the Anazarbos Church of the Apostles, at a smaller scale, utilitarian factors played a significant role. We see this, for example, in the re-cutting of architectural elements at Claros to ease transport. Third, it is clear that decisions about how to treat spoliated stones were made at a local, perhaps even personal, level and did not respond exclusively to the legal pronouncements on using spolia nor to assumptions about Early Christian/Late Roman appropriation of the past. While some of their more rhetorically-minded, highly-educated contemporaries may have been concerned with the 'meaning' of such reuse, these stone-workers were likely thinking primarily of the practical aspects of moving, storing, cutting, re-working, and re-deploying older stones. This is indicated in all of the above case-studies.

I have focused in this paper on the particularities of spoliating at specific sites in Asia Minor, rather than attempting to give a Mediterranean-wide synthesis. In order to gain a fuller picture, we would not only need to synthesise an enormous body of data from many regions: we would also need to consider spoliated material alongside older blocks that were not chosen for reuse.[92] Both preservation in place and spoliation were decisions with consequences for Late Antique cities and rural spaces. In every case, local contexts and individual craftspeople impacted the methods and motivations of spoliation. The graffito of a hand and foot on the stylobate of the Temple of Apollo at Claros can probably be attributed to a late pagan worshipper who engaged in the *plantae pedum* tradition to mark his devotion to the god, certainly before the Late Roman demolition team arrived to deconstruct the temple. But the graffito may have had a different meaning for the team who took apart the older temple by the strength and skill of their own hands and feet – and who left behind new graffiti, including crosses and their own names, to make their contribution to the built environment at Claros indelible. Scholars too would do well to keep in mind the strong hands and feet, well-made tools, and team-work needed to reuse the stones of ancient construction projects in new, Late Antique contexts. Rather than straightforward acts of 'salvage' or 'appropriation', the examples of Labraunda, Claros, and the Corycian Cave indicate the careful engagement of building teams and individuals with

[90] Engelmann and Niewöhner 2010: 122-123.
[91] Niewöhner 2018: 254.
[92] Sitz 2023: 270-271.

older stones, including the thoughtful management of construction resources in *ad hoc* storage spaces, the re-working of stones for transport, and the designing of entire building projects around available spolia. In this way, they were no different from the unemployed ship-builders of New Brunswick, Canada, who managed to create innovative architecture from the mixture of their own skills and older materials. Although Late Roman building teams were assuredly constrained by the available material at each site, we may nonetheless identify the agency of these craftspeople in the unique decisions they made in various contexts.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

Chapter 23

Learning by ...? And learning what? Possibilities and limitations of chaîne(s) opératoire(s)-approaches using the example of the Elgin Lyre

Susanne Bosche

Abstract

Approaching ancient technology and craftsmanship is closely linked to the so-called chaîne opératoire. This theoretical concept was formulated and adapted to describe the sequence and connectivity between production steps and the respective participants, including both human and non-human (f)actors. In the course of evolving research, the range of relevant (f)actors and concepts has expanded considerably at both the macro and micro levels. In addition, there are concerns about a certain lack of consideration of individual human perception, sensation and cognition when studying craft activities using chaîne opératoire approaches. Although these voices should be considered highly valuable in terms of general research interest, some epistemological problems arise in their implementation. The paper discusses the theoretical concept with a particular focus on this area of tension using the remains of the so-called Elgin Lyre, one of the best-preserved stringed instruments of Classical antiquity.

Περίληψη

Η προσέγγιση της αρχαίας τεχνολογίας και χειροτεχνίας συνδέεται στενά με τη λεγόμενη λειτουργική αλυσίδα (chaîne opératoire). Αυτή η θεωρητική σύλληψη διαμορφώθηκε και προσαρμόστηκε ώστε να περιγράφει την ακολουθία και την σύνδεση/συνοχή ανάμεσα στα βήματα παραγωγής και σ' εκείνους που μετείχαν στη διαδικασία, συμπεριλαμβανομένων ανθρωπίνων και μη παραγόντων. Κατά την εξελικτική πορεία της έρευνας, το φάσμα σχετικών παραγόντων και αντιλήψεων επεκτάθηκε σημαντικά σε μικρο- και μακρο-επίπεδο. Επιπρόσθετα, υπάρχουν προβληματισμοί για το ότι δεν συνυπολογίζεται η εξατομικευμένη ανθρώπινη αντίληψη, αίσθηση και γνωστική λειτουργία, όταν μελετώνται χειροτεχνικές δραστηριότητες επιστρατεύοντας προσεγγίσεις της παραγωγικής αλυσίδας. Παρ' ότι αυτές οι φωνές θα αξιολογούνταν θετικά σε επίπεδο γενικού ερευνητικού ενδιαφέροντος, ωστόσο κατά την εφαρμογή τους προκύπτουν κάποια επιστημολογικά προβλήματα. Η παρούσα εργασία συζητά την θεωρητική σύλληψη με επίκεντρο αυτήν την περιοχή έντασης, χρησιμοποιώντας τα κατάλοιπα της λεγόμενης Λύρας του Έλγιν, ενός από τα πιο καλοδιατηρημένα έγχορδα μουσικά όργανα της Κλασικής αρχαιότητας.

Keywords: theory of science; craftmanship; embodiment; ancient musical instruments; ancient instrument-making

Introduction

The British Museum in London exhibits the most fully preserved (although partially reconstructed and restored in its current form and state) *chelys* of Classical antiquity (**Figure 1**). The relatively good state of preservation of the musical instrument is quickly revealed to the viewer through the exhibition modalities. Fixed on a board, the viewers encounter the two arms and the cross yoke of the ancient stringed instrument, attached to a plaster cast of a tortoise shell.[1] The only surviving fragment of the original tortoise shell is showcased in a separate installation nearby. As revealed by the graphic documentation on the official museum webpage, seven strings are attached to the back of the yoke at regular intervals. Slightly narrowing radially, they are led downwards into the area behind the carapace.[2] The exhibition presentation does not give us any information on the attachment of the wooden arms and the strings to the carapace, since the back of the instrument faces the visitors.[3] A small plaque reads briefly: 'LYRE of sycamore wood (restored). From Athens. The fragment of tortoise-shell on the right was found with the lyre and formed part of it. The shell now attached to the lyre is a plaster-cast from a similar tortoise. Perhaps fifth century B.C. Elgin Collection.'[4]

Due to its good state of preservation, this ancient stringed instrument, known as the Elgin Lyre, attracted

[1] Dumoulin 1992a: 101; Steinmann 2021: 374. It is not known when this reconstruction was carried out. Bélis 1985: 213; Dumoulin 1992a: 101; Roberts 1981: 303; Steinmann 2021: 373.

[2] <https://www.britishmuseum.org/collection/object/G 1816-0610-501> (last accessed: 17.06.2023). See also **Figure 1**.

[3] Steinmann 2021: 373.

[4] Cited after **Figure 1**.

Figure 1: Today's exhibition of the Elgin Lyre, inv. 1816,0610.501, kept in the British Museum, London (© The Trustees of the British Museum).

the interest of instrument makers and restaurateurs of antique instruments relatively early on. At the end of the nineteenth century (after 1870), Auguste Tolbecque built 'instruments, which were modelled on ancient Greek and Roman instruments with a fair degree of freedom' on behalf of Victor-Charles Mahillon.[5] A second, much better documented reconstruction was carried out in around 1980 by a team led by Helen Roberts, who in her unfortunately unpublished dissertation deals with antique stringed instruments.[6] A third reconstruction was made between 2009 and 2010 by Paul J. Reichlin on behalf of Conrad Steinmann.[7] In addition to – and in interaction with – this practical work, the remains of the Elgin Lyre play a central role in the theoretical reconstruction of ancient instrument-making. Both Roberts and (to a somewhat lesser extent) Steinmann integrate such considerations into their approach and presentation.[8] These are joined by works that dispense with an independently modelled replica, but, instead, in some cases take into account the construction technique of the (or an) antique *chelys* in a very detailed way.[9] The vibrational properties of an (ideal-typical) replica with a (likewise ideal-typical) playing style have been analysed by a team led by Efthymios Bakarezos.[10] Similar analyses are being undertaken by a team led by Nikolaos Koumartzis elaborating on the digital reconstruction of another ideal-typical *chelys* based on 3D scanning and advanced computer-aided design.[11]

Despite their enormous (but also risky) potential for the archaeology of music and sound[12] we do not aim to deal with these replicas, their tonal characteristics and their relations to the 'original' Elgin Lyre in this paper. Instead, we will take a step back and focus on the starting point that makes the sounding of instruments feasible in the first place: their production and their scientific recording. Dealing with technological aspects has been an integral part of archaeological research since at least the second half of the twentieth century. In continental Europe, important impulses have come from the French-speaking world. In this context, the term chaîne opératoire emerged from around the 1950s as a term for a research concept for investigating the raw materials, tools, people and their work-steps that were needed or used to produce an artefact (we will return to this difference). The French archaeologist André Leroi-Gourhan, who is often credited with the term,[13] defined in 1969:

> 'La notion de Chaîne Opératoire sera reprise aux chapitres VII et VIII mais il est nécessaire de l'évoque içi pour comprendre le lien entre technique et langage. La technique est à la fois geste et outil, organisés en chaîne par une véritable syntaxe qui donne aux séries Opératoires à la fois leur fixité et leur souplesse.'[14]

In the following decades, the concept was further developed. Today, it serves as a research concept for creating a (hypothesis about a) chain of work-steps, means of production, production contexts etc., which were necessary and/or used for the production of an artefact.[15]

[5] Steinmann 2021: 380: 'Instrumente, die antiken griechischen und römischen Instrumenten in ziemlicher Freiheit nachgeschöpft waren'. Three series of these replicas are said to be in Brussels, in the Collection du Musée de la Musique in Paris and in the St. Petersburg Instrument Museum in the Sheremetev Palace.

[6] Important aspects of the procedure are presented in Roberts 1981.

[7] Steinmann 2021: 455.

[8] Roberts 1981; Steinmann 2021.

[9] Bélis 1985; Dumoulin 1992a; Dumoulin 1992b.

[10] Bakarezos *et al.* 2012.

[11] Koumartzis *et al.* 2015.

[12] Cf. Grüner 2019: 183.

[13] For example, Bar-Yosef and Van Peer 2009: 104; Sellet 1993: 106-107; Soressi and Geneste 2011: 335. But see also Djindjian 2013: 93-94 with critical comments on this attribution.

[14] Leroi-Gourhan 1964: 164.

[15] See, for example, Soressi and Geneste 2011: 337: 'The chaîne opératoire approach allows archaeologists to reconstruct the time/order arrangement of the different steps used to produce an artifact (Geneste 1991b: 10). Each artifact can be situated within the process through an analysis of the technical stigmata (i.e., nature and location of large flake scars, abrasion traces, or the point of impact) of the previous operations that are preserved on the object (Pelegrin et al. 1988). The chaîne opératoire approach also allows an understanding of the geographical organisation of the technical process, as the location of each stage of the process can be identified by the presence or the absence of its by-products at a particular site (Geneste 1985, 1991a, b). Consequently, the differential management of raw materials and/

In the English-speaking world, theoretical concepts with a similar orientation are developed, sometimes apparently in parallel.[16] For example, the theoretical archaeologist Michael B. Schiffer, who also made important contributions to the particular theory of science of archaeology (Spezielle Wissenschaftstheorie der Archäologie) in general, deals with the sequence of all the activities an artefact was involved in during its time of production and use based on the general principles of his so-called 'Behavioral Archaeology'.[17]

The basic intention of research approaches with such or roughly comparable concepts is relatively easy to grasp (at least at first glance). Their aim is to reconstruct all the factors that played a role in the production of an artefact such as the Elgin Lyre, as comprehensively as possible and, at a second step, to arrange them in a sequential series of 'work-steps'. Those structures are meant to enable us to approach the organisational structure of the production activities and the entities involved. The main concern of my paper is a benevolent but also critical objection: As desirable as the knowledge of this chain may seem, the maximum we can achieve is a (hypothesis about a) chaîne opératoire of an 'artefact like' (the Elgin Lyre). The ('historical') chaîne opératoire of a certain artefact like our Elgin Lyre, however, is only partially accessible to us, regardless of how well-preserved the artefact and/or how extensive the sources may be. In the following sections, we will illuminate this objection from various perspectives. I am particularly interested in the (admittedly partial) discussion of an essay by Constance von Rüden published in 2017 with a similar objection to a point that is essential to my research approach:

> 'Of course, we cannot and should not avoid trying to reconstruct the chaîne opératoire with the help of objectifying research of our archaeological evidence, but we should keep in mind that this will always remain a highly reductive and distorted construction if we neglect the sensual involvement of the craftsperson. I would therefore encourage an attempt to identify and emphasize those moments of the work flow which obviously needed to be guided by a sensual intelligence, or something we might call an extended mind, and to tightly integrate them with our narrative of crafts.'[18]

Considering my following remarks, I would like to emphasise right now that I absolutely agree with this intent and do not wish to dispute or reject any of the points made in this passage. However, I have some concerns regarding the possibilities of its implementation, which I will address in the last section of this paper. While developing the basis for and of my point we will oscillate between three different levels: a highly abstract theoretical level including formal descriptive concepts; a still theoretical, but also content-filled level with concepts related to 'general reality'; and the level of a certain 'historical reality' (such as the one of the Elgin Lyre). We will use aspects of each of those levels to develop our thoughts on the other ones. With this we will formulate a first, basic auxiliary model for argumentation concerning chaîne(s) opératoire(s).

Components

Let us follow the wish of some recent voices of theoretical archaeologists and start with what we are directly confronted with: the 'material', the 'artefact' or its 'remains'.[19] Due to a lack of opportunity to personally inspect the preserved remains before completing this paper, the following explanations must, however, be limited to the information collected from bibliography.[20] The Elgin Lyre can be grasped today by some remains of the wooden construction and the tortoise shell once used for the resonating body. The two arms and the cross yoke are its best-preserved parts. The arms are cylindrical at the bottom; the part protruding above the yoke is flat. The fully preserved left arm is slightly rounded and forms an almost quadrangular shape towards the yoke, which is followed by a 'leafy protrusion' ('blattförmige Ausstülpung'). The transverse yoke was originally placed on the conically tapering end of the arm.[21] The crossbar is almost completely preserved as well, but 'broken into three parts: the two ends protruding beyond the arms and the middle part, to which the strings were attached'.[22]

or blanks can be observed, which allows us to define the economic management of raw-material and/or blanks within a territory (Inizan 1976; Perlès 1980, 1989).' Very comprehensive and far-reaching developments are emerging from the research on prehistoric times, and especially on stone processing. As these processes and methods are beyond the scope of this article, we will not discuss them here. For them, see indicatively, Audouze and Karlin 2017; Bar-Yosef and Van Peer 2009 with further bibliography and very detailed considerations of the possibilities, limitations and weaknesses of the methods; Boëda *et al*. 1990; Sellet 1993; Soressi and Geneste 2011.

[16] For an indication of the similarities and differences, see also Sellet 1993: 107.

[17] Schiffer 1975; Schiffer 1995: 55-66, see also 25-34. Cf. also LaMotta 2012: 74-80; Schiffer 1976: 49-55.

[18] von Rüden 2017: 77.

[19] For this wish, see for example Lucas 2012: explicitly 257. For its application in the archaeological approach to past sensory phenomena and experiences, see for example, Grüner 2019: 176, 179-180.

[20] Yet, even though I do not have direct sensory access to the Elgin Lyre or its replicas while writing these lines and therefore cannot report on my own sensory experiences, translate them into verbal or graphic representations), I can at least fall back on representations of sensory experiences of other direct recipients and sustain my argumentation with this information, provided that corresponding information is available and helpful for our argumentation. For this 'projection' of direct access, see Bosche 2023: 401-474.

[21] Bélis 1985: 213; Steinmann 2021: 374. See also Dumoulin 1992a: 101.

[22] Steinmann 2021: 374: 'ist in drei Teile zerbrochen, in zwei über die Arme hinausragende Enden und in den mittleren, rund 20 Zentimeter langen Teil, woran die Saiten befestigt waren'.

Figure 2: Reconstruction of the Elgin Lyre by the team led by Conrad Steinmann (after Steinmann 2021: 410 fig. 14).

According to the reports, the arms were originally decorated with ornaments. Steinmann speaks of a 'finely chiselled raised ornament like a leafy vein' ('fein ziselierte[n] erhöhte[n] Verzierung [...], einer Blattrippe gleich') on the slightly angular part of the left arm. The conically tapering end of the arm is said to have 'the finest semi-circular and only millimetre-sized decorations' ('feinste[n] halbrunde[n] und nur Millimeter kleine[n] Verzierungen').[23] Annie Bélis also reports small decorative circles on the front of the corner pin, which run along the outer line and may have been painted.[24] In addition, Steinmann mentions minimal traces of paint on the completely worn wooden parts; there may even be traces of gold in the semicircular decorations on the left side arm.[25] Unfortunately, Steinmann provides no further information on those paint residues, meaning that neither the colour tone nor the materials used for their production can be determined. Thus, the relationship between Steinmann's colour reconstruction (**Figure 2**) and the colour traces of the original cannot be reliably established.[26]

The tortoise shell (probably) used as the resonance body of the stringed instrument is much more difficult to grasp. Since only small fragments have survived,[27] merely a small part of the original carapace is actually tangible. Although we have no explicit information about the condition of the instrument remains when they were found, Samuel Birch, an official of the British Museum, in a letter to Karl von Jan as early as 1862 referred to 'pieces of tortoiseshell' ('Stücken von Schildkröten-Schale'), thus suggesting the already fragmentary condition at the time.[28] 'The fragment bears individual perforations'.[29] Those provide clues to the construction and the original function of the natural find, as we will see in the following section. However, the available documentation and presentation of the features do not allow us to determine the exact position and span of the holes without our personal inspection. As far as we know from the reports, some are located in the outer plates of the carapace.[30]

Past and present – definitions of states

Despite its fragmentary state of preservation, we are now in a position to associate the Elgin Lyre with the theoretical concept of chaîne opératoire. In doing so, we will initially limit our considerations to the central core of the research concept and gradually integrate further aspects into the discussion. Fundamentally, the chaîne opératoire describes a neatly arranged sequence

[23] Steinmann 2021: 374. Bélis (1985: 215) describes a fine rib ('nervure très fine'), which is supposed to have a decorative rather than said to have no reinforcing function but was probably intended as a decorative element.
[24] Bélis 1985: 215.
[25] Steinmann 2021: 374.
[26] In the reconstruction, the arms were painted with copper acetate (Grünspan), the arm supports above the yoke and the yoke itself with a glaze of red iron oxide red. Steinmann 2021: 409. The choice of these techniques, materials and colours is not explained.
[27] Steinmann 2021: 373. According to Roberts (1981: 303), the state of preservation of the tortoise shell is said to be so poor that it was never used for a reconstruction until 1981.
[28] von Jan 1882: 17.
[29] Dumoulin 1992a: 101: [Im Fragment] 'sind einzelne Durchbohrungen erkennbar'.
[30] Bélis 1985: 213.

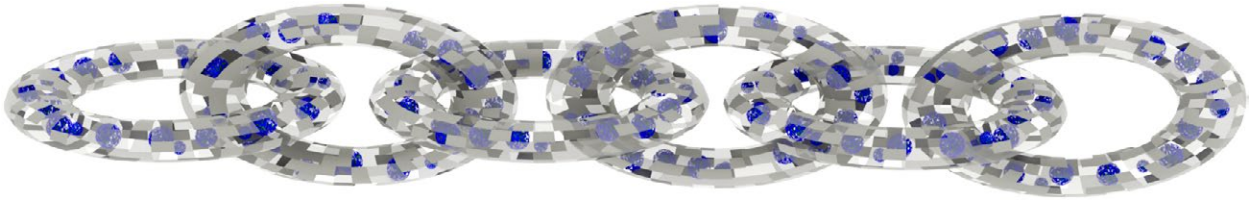


Figure 3: Visualisation of a chaîne opératoire as a simple 'chain' with chain-links (cf. Figure 4) representing single work-steps and/or components (illustration by the author).

(geordnete Reihe) of steps beginning with a certain starting point and leading to the specific state of an artefact[31] (**Figure 3**).[32] At its core, the definition of these two states is flexible. Yet, in most cases it is aligned with specific stages in the production and/or use of an artefact.[33] For dealing with this point, it is sensible to recall some basic parameters of the archaeological sciences. Let us follow the predominant path of archaeological research and start with 'historical artefacts'. In our case, I would use this term to indicate artefacts of which the production we can no longer trace through our own sensory experiences.[34] From this perspective, we might wish to avoid starting our thoughts at the 'first' stage of our chain, but prefer to 're-induce' it from a later state of the artefact – the state that we can actually grasp by our own experiences. In doing so, we can sequentially determine earlier stages, as well as stages of the process and its course (differing between 'stage' as 'ordered step' and 'state' as 'content of a stage'). The team at the Greifenberger Institut für Musikinstrumentenkunde has introduced the term 'reverse engineering', projecting on this procedure a term used in engineering, computing, biology and other fields.[35] Thus, the team has created a terminological basis for an approach that, in my opinion, can be combined well with various scientific-theoretical positions and 'world views'[36] – provided that possible connotations are reflected and integrated into the considerations.

Following this approach, the first step in working out one or more chaîne(s) opératoire(s) is the detailed examination and determination of the state at hand. This step includes firstly a detailed examination of the archaeological remains, which is essential for any artefact-based work. Secondly it comprises the assignment of this state to a relative stage of the chaîne opératoire: Do we start our considerations when an artefact leaves the workshop? Or do we deal with its state some time after leaving the workshop and (possibly) bearing traces of further 'life phases'?[37]

Although this first two-part step is a fundamental and integral part of archaeological research, yet its details (unfortunately) are often partially or even entirely neglected in research papers. In writings on the concept of chaîne opératoire, this one particularly affects the relation of the state of the artefact under consideration to the sequential order of the chaîne. Despite the increasingly strong relativity of time boundaries such as the one between 'past', 'present' and 'future' in theoretical debates, archaeological research remains oriented towards the 'past'.[38] Thus, we should try and choose a state of the past as the 'starting state' of our considerations. The concept chaîne opératoire implies a strong focus on the production process or craft. Following this point and in line with the majority of its applications, our starting point by definition will be the state of the artefact when it leaves the workshop – a choice that may entail some argumentative difficulties despite being quite common.

Following this approach, we first need to capture our desired 'starting state' (or at least parts of it). Looking at

[31] See for example, Balfet 1991: 12; Desrosiers 1991; Lemonnier 1976: 106; Soressi and Geneste 2011: 337; as well as the following definitions and quotations. For the subdivision into discrete steps, see also Sellet 1993: 107: 'It permits a reconstruction of distinct technological strategies through an understanding of the relation between raw material procurement, tool manufacture, tool use, maintenance and discard.'

[32] The chain-links (**Figure 4**) are visualised by using the characteristics of a theoretical 'auxiliary concept' labelled *Assoziator*, cf. Bosche (forthcoming). Without possessing an ontological status, its definition elements (such as its outer demarcation) have three different 'states' depending on the observer's perspective: non-permeable (with the *Assoziator* being a black box), permeable (with the *Assoziator* being a White Box) and non-perceptible (with the *Assoziator* being a web of other *Assoziators*). Each *Assoziator* consists of (a potentially infinite number of) further *Assoziators* (appearing as entities or relations depending on the observer's perspective) graduated (gestaffelt) on distinct levels marking the sequence of reference by the observer. Because of this observer-dependency the levels are not fixed, but observer-dependent as well. For some basic concepts see Bosche 2023; Bosche (forthcoming); Bosche (in preparation).

[33] Frédéric Sellet (1993: 106), for example, defines: 'Consequently, the chaîne opératoire aims to describe and understand all cultural transformations that a specific raw material had to go through. It is a chronological segmentation of the actions and mental processes required in the manufacture of an artifact and in its maintenance into the technical system of a prehistoric group. The initial stage of the chain is raw material procurement, and the final stage is the discard of the artifact.' We will deal with the definition of these two states in the following sections.

[34] The basis of this perspective is a (by no means compelling) differentiation between 'present' and 'historical past' on the basis of our (strictly speaking, my) lifetime. For initial considerations on the justification of this position, see Bosche 2023.

[35] Personal communication with Helmut Balk and Frank Schröder. For an overview, see <https://www.greifenberger-institut.de/dt/reverse-engineering/instrumentenbau.php> (last accessed: 17 June 2023).

[36] For terminology, see Bosche 2023.

[37] For a critical discussion of the use of the term 'object biography' and related concepts, see Bosche (in preparation).

[38] For initial considerations on this topic, see Bosche 2023.

the Elgin Lyre as it is exhibited in the British Museum, the assumption that we do not see the state of the Elgin Lyre when it left the workshop seems very likely. Its remains are fragmentary, show signs of breakage and entire parts of the stringed instrument have been lost. Thus, we are inclined to assume that looking at the Elgin Lyre today, we are not presented with its condition when it left the workshop, but that it has undergone further changes between this 'stage' and the one we observe.[39]

Despite several remarks, this problem surprisingly has only been dealt with very sporadically in previous works on the Elgin Lyre. Bélis, Dorothee Dumoulin and Steinmann report partial deformations of the surviving parts of the stringed instrument. In the area of the right break, the arm is said to be 'slightly deformed' ('leicht deformiert'), whereas the left joint is said to be intact.[40] According to Bélis, due to this change in the shape of the corner pin, the right arm should be off its original axis; the corner pin on the left side of the crosspiece, on the other hand, is well preserved.[41] However, the left wooden arm and the crosspiece show massive cracks.[42] The extent of these deformations reaches beyond individual parts. According to Steinmann, the current fixation 'gives the impression that the bowl and arms had been arranged on the same level in their original state. However, an examination of the wooden structures of the arms indicates that they once must have been inclined forwards.'[43] In the absence of a more detailed explanation, these observations and conclusions can only be assessed with further studies and comparisons, especially with an autopsy of the present-day exhibition of the Elgin Lyre. Bélis makes similar observations and considerations, which unfortunately are not explained in detail, either. According to her, it is 'very likely that the arms had been originally arch-shaped ' ('sehr wahrscheinlich sein, dass die Arme im ursprünglichen Zustand gewölbt waren'), as shown in paintings of instruments in profile on many ancient vases.[44] Despite this additional information, it is unfortunately still not possible either to determine whether the assumption of a curvature is based exclusively on comparison with ancient instrument depictions, or whether observations of (working) traces in the preserved wooden elements were used as argumentative support.

The lack of information both on the reference point necessary to evaluate possible deformations (i.e. the ultimately reconstructed original course of the components) and on the methodological background of the mentioned arguments makes it difficult to integrate these points in our discussion in an elaborate way. Neither can we determine the timing of the (assumed) deformations. For example, we cannot rule out post-depositional processes,[45] or deformations during the period of use in antiquity, i.e. between the time (better, the sequence point) when the processing of the wooden parts had been completed and the time they were buried. Roberts, for example, reports further deformations of her present-day used replicas after completion.[46] Considering the physical forces at work and the changing environmental conditions, this hardly seems surprising. Having not seen the object, I can neither rule out nor assume that forensic examination of the preserved parts can provide (at least partial) information on such questions. We suffice to say that we cannot project the object's current state to another time of its life, without critical consideration – neither to the time immediately after completion, nor during use, deposition, or any other time. Since many of the points that we will deal with in more detail below relate to detailed aspects or at least include them implicitly, we must always keep this point in mind.

Unfortunately, it is very difficult and sometimes nearly impossible to order the single traces observed on the Elgin Lyre either chronologically or sequentially based on the information contained in the records. We do not know when and in what context the possible deformations occurred or could have occurred – a limitation that ultimately affects almost all recognisable traces on the Elgin Lyre. One of the few exceptions is the tortoise shell now connected to the wooden arms, visually hinted as a (probably) modern intervention by the exhibition modalities in the British Museum. Today, the surviving side arms of the Elgin Lyre are associated with a plaster cast of a complete tortoise shell.[47] That this component most likely did not belong to the ancient stringed instrument immediately after this left the workshop can be inferred with little knowledge of ancient instrument-making and without much study. Visitors of the exhibition can easily grasp this intervention from the mode of display of the Elgin Lyre. The fragment of the original carapace found together with the wooden arms is exhibited next to the plaster cast, as if it were an independent artefact, but with some connection to the Elgin Lyre expressed by being

[39] The (potential) degradation and change of artefact remains played an important role in theoretical archaeology in the second half of the twentieth century, with the already mentioned Schiffer playing an important role. Schiffer 1983. Cf. also Schiffer 1976 and Schiffer 1985, contra Binford 1981.

[40] Bélis 1985: 213; Dumoulin 1992a: 101; Steinmann 2021: 373.

[41] Bélis 1985: 213.

[42] Bélis 1985: 213; Dumoulin 1992a: 101; Steinmann 2021: 373.

[43] Steinmann 2021: 373: 'den Anschein, als wären Schale und Arme auch im ursprünglichen Zustand auf derselben Ebene angeordnet gewesen. Allerdings zeigt sich beim Untersuchen der Holzstrukturen der Arme, dass diese nach vorne geneigt gewesen sein müssen.'

[44] Bélis 1985: 219.

[45] On this topic see, for example, Schiffer 1983. Cf. also Schiffer 1976 and Schiffer 1985, contra Binford 1981.

[46] Roberts 1981: 305, 309-311.

[47] It is not known exactly when this intervention took place. Bélis 1985: 213; Dumoulin 1992a: 101; Roberts 1981: 303; Steinmann 2021: 373.

placed nearby. This presentation allows the viewer to draw conclusions about the partially reconstructive intervention.[48] Even if it cannot be conclusively refuted by formal argumentation, the assumption that this plaster cast was connected to the wooden arms during the ancient production process seems highly implausible.

Even if some isolated indications allow a comparatively simple (probable) exclusion of a component and/or a trace on the ancient remains, in most cases it is very difficult, if possible at all, to date components or even individual traces on artefacts independently. Basically, we are dealing with a group of components and traces, which we assume to be a conglomerate of elements and aspects from different time or sequence periods[49] without being able to sort it by explicit absolute or relative chronological or sequential data. On the same artefact, we encounter traces of processes, work-steps, tools, etc. probably related to our desired 'ancient' chaîne opératoire, as well as some most likely belonging to 'later' events. Our task during our second step is to distinguish between those two groups of traces and to identify those that we can use for our further argumentation: we are not just looking for traces, we are looking for traces of events from a certain 'historical period' – the time in which our (hypothetical) chaîne opératoire took place.[50]

The extension of the artefact

Without any independent dating for the production of individual components or even the emergence of certain traces of processing, decorative elements, deformations, etc., chronological value-based sorting methods are not possible. Thus, we might attempt to approach our desired sequence of stages through indirect references and/or extended argumentation approaches. This leads us back to our theoretical research on chaînes opératoires. We will now be dealing with the determination of production steps and the means of production, localities, tools and resources used in their course. If we adhere to our approach, we again have to use the preserved physical/material remains and the traces observable on them as the starting point for our considerations.

If – as in the case of the Elgin Lyre – we have no explicit information about the production context(s), the people involved, the tools and other means of production used, etc., we have to trace the interactions between our artefact or component and 'factors' such as tools, people, other artefacts etc. of its 'environment' from the traces observed in as much detail as possible.[51] For this we have to start from the assumption that our artefact/component contains 'stored' information about its 'environment' and that this environment can be accessed by back-tracing the accessible information contained in the artefact – obviously in reverse direction. Elsewhere, I have labelled this concept based on considerations by John Robb, Chris Fowler and Graham Harman as 'extension' ('Ausdehnung'). The decisive factor for its conception is that by storing 'remnants' (our traces) of past interactions (in the sense of transmission connections in the broadest sense) in/at the artefact we are looking at, a dynamic 'past' process is 'transformed' into a state (current at the time of observation) and can be construed as such. If we succeed in interpreting this (in parts or, ideally, in whole), an approximation to the elements 'connected' with the artefact during the period condensed in the 'storage state' will be possible.[52]

In order to reduce the subjective bias as much as possible, I would use a starting point as broad as possible and reduce assumptions to a minimum.[53] For this, we will not assume without more detailed, critical discussion that all work-steps (the production of all components, the application of the decoration, etc.) were carried out by the same person and in the same workshop. But, at the same time, we will refrain from assuming a priori that the various materials employed in the production of the Elgin Lyre are associated with the activities of different people or workshops.[54] Speaking in terms of the chain metaphor, we are dealing with the question of

[48] Dumoulin 1992a: 101.

[49] For terminology, see Bosche 2023: 401-474.

[50] Formally, we are also facing the argumentative problem, that we have no knowledge whatsoever about earlier states of the Elgin Lyre and that even the determination of an observed aspect as a trace of an earlier event is, strictly speaking, already an interpretation. Since we have accepted some preconditions that touch on this argumentative field, we will refrain from a more detailed discussion of this theoretical argumentative problem at this point.

[51] See, for example, Pelegrin *et al.* 1988: 57-58: 'Des *objets*, qu'il définit uniquement comme *moyen d'action sur la matière*. For l'archéologue, 'il ne s'agit pas de se limiter aux *outils*, souvent absents comme les percuteurs par exemple, mais d'utiliser aussi tous les *déchets* qui marquent les étapes de fabrication et tous les *produits* des actes techniques, dans le sens ou` ces derniers portent les traces des processus de fabrication [...].' As well as Lemonnier 1976: 118 with a reference to the necessity of a 'multi-dimensional analysis'. See also Lemonnier 1976: 137-138.

[52] Sorting the individual transmission connections would be desirable, but is not absolutely necessary. For the terminology and the argumentative basis of this position, see Bosche 2023.

[53] The fact that a completely assumption-free starting point is impossible can be seen at various points in our argumentation.

[54] This opinion seems to be held by Steinmann, for example. According to him, activities of several occupational groups should be combined in the Hermes myth. Outside of the myth, the wooden arms and the yoke are said to have been made by the instrument-maker in his workshop, whereas a tanner was needed to work the animal skin for the top of the resonating body. So 'wissen wir (Anmerkung der Verfasserin: laut Conrad Steinmann), dass auch die Hersteller von Saiten aus Schafsdarm einer eigenen Berufsgattung angehörten'. Steinmann rules out the production of instruments by the performing musician himself. According to him, 'we never read that a performing musician made his instruments himself, as it were by hobbyists' ('lesen wir nie, dass ein ausübender Musiker seine Instrumente, gleichsam hobbymäßig, selbst hergestellt hätte'). Steinmann 2021: 262. None of the points mentioned are further elaborated or explained.

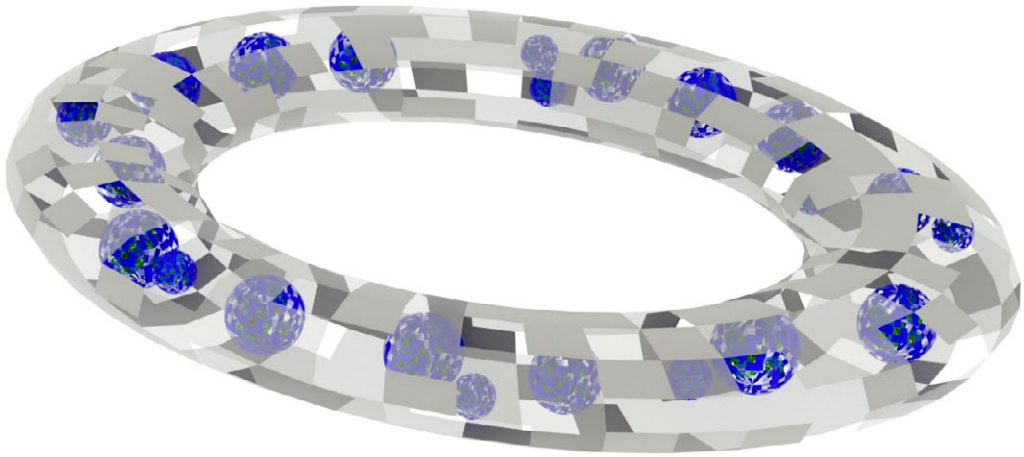


Figure 4: Visualisation of a chain-link as *Assoziator* (without relation between lower-graded *Assoziators*) (illustration by the author).

determining the individual links (**Figure 4**) that make up the chain.

In many theoretical works on the chaîne opératoire, the chain links describe stages in the work and/or utilisation process or successive production steps, which in turn might be composed of several stages/steps as well.[55] The high importance of the sequence aspect in the theoretical conception of chaîne opératoire is reflected by the frequently encountered English translation of the French term 'chaîne opératoire' as 'Operational Sequence', whereas the more literal English translation 'Work Chain' is much less common.[56] Only along the lines of terminology does this translation focus on the creation of a sequence of individual work-steps and the elements, materials, people etc. involved in them. In my opinion, this does not accurately reflect the range of meanings of the theoretical term chaîne opératoire. A similar objection is raised by François Djindian.[57] From the 'sequence perspective', we treat the components of the artefact themselves – in particular, the two arms, the transverse yoke and the carapace of the Elgin Lyre – as individual artefacts with an individual chaîne opératoire, which is subsumed under a chain link of the chaîne opératoire of the artefact as a whole.[58] If we want to approach this 'overall' chaîne opératoire, this perspective allows us to start our considerations with an examination of the individual components and only deal with their connection to the overall artefact in the next step.

Despite the realisation of three replicas, the detailed construction methods (probably) used in antiquity for the construction of the Elgin Lyre have received only little attention. Zoological investigations of the tortoise shell are not mentioned; Roberts seems to assume, based on a formulation, that it is the shell of a *Testudo marginata*. As this is said not to be available in British pet shops, a tortoise shell from southern Russia was chosen for her reconstruction.[59] Steinmann's team also used the bowl of a Greek mountain tortoise (*Testudo marginata*) with a size of 23cm for the replica, as this should correspond to the proportions on the pictorial evidence.[60] A zoological determination of the original is missing in the presentation of the team's work.

The processing of the Elgin Lyre tortoise shell is not explicitly discussed in the publications; in the absence of a detailed description and/or graphic documentation of the holes, we lack any basis for independently substantiated hypotheses that go beyond the collection of general tools (e.g. drills). Such basic processing methods are addressed by Roberts in the course of the presentation of her reconstruction. With regard to the tortoise shell, for example, the Zoology Department of Reading University is said to have removed the animal from the shell and then boiled it for several hours.[61] In the absence of explicit evidence, we do not know whether these techniques might be projected onto production technology in antiquity. Here too, however, we must refer to the unfortunately unpublished dissertation by Roberts, in which a more detailed

[55] Cf. for example the already quoted definitions: Balfet 1991: 12, 14, 17; Leroi-Gourhan 1964: 164; Sellet 1993: 106; Soressi and Geneste 2011: 337. A similar idea can be found in the 'Behavioral Chain Analysis' by Schiffer: Schiffer 1995: 25-34, 55-66. Cf. LaMotta 2012: 74-80; Schiffer 1976: 49-55.

[56] Bar-Yosef and Van Peer 2009: 105. See also the passage quoted below by Monteix 2016: 153.

[57] Djindjian 2013: 97: 'En fait, le mot approprié est '*séquence*' dans la connotation 'suite ordonnée d'opérations', alors que le mot chaîne fait référence à une suite ordonnée de postes de travail.'

[58] **Figure 3** visualises this notion by presenting all chain-links and the entire chain as 'Assoziator'. The highest grade presented is given the shape of a chain-link for metaphorical and visualisation purposes only.

[59] According to her, the fragments preserved from the original have not yet been used for a reconstruction. Roberts 1981: 303-304. The basis for the comparatively short essay by Roberts is her unfortunately unpublished dissertation titled 'Ancient Greek Stringed Instruments 700-220 B.C.', the digital copy of which unfortunately did not reach me before the completion of this paper. It cannot be ruled out that it contains corresponding studies.

[60] Steinmann 2021: 406. According to Steinmann, the shielded claw 'mentioned in the Hermes myth can be identified 'als Breitrandschildkröte, Testudo marginata, deren Länge zwischen 22 und 30 Zentimeter beträgt'; however, this statement is not explicitly substantiated. Steinmann 2021: 262.

[61] Roberts 1981: 303-304.

argumentative justification of her approach may be found.

Statements about the identification of the preserved wooden parts are even more problematic, as the bibliography contains various indications without explicitly addressing material analyses. The 'Report from the Select Committee on the Earl of Elgin's Collection of Sculptures, Marbles &c.' from 1816 contains the unsubstantiated statement that the lyre was made of cedar wood ('in Cedar wood').[62] The same information can be found, again without justification, in the commentary by Dumoulin.[63] Bélis, on the other hand, speaks of sycamore maple ('sycomore')[64] – without further explanation. Roberts uses maple ('sycamore') for her reconstruction because, according to her, the arms of the Elgin Lyre are made of this material.[65] According to Steinmann, 'no expertise' confirms the assumption that the wood is cedar.[66] His reconstruction team used maple to make the side arms and kermes oak for the transverse yoke, although the 1816 report specifies 'Cedar Wood'. Steinmann himself points out this area of conflict.[67] Without more detailed material analyses, which I hope to be able to carry out in the future, the wood species of the Elgin Lyre remains unknown at present.

Information on any tools used, the production techniques and other elements that could have been utilised in the course of making the Elgin Lyre is virtually non-existent in the current bibliography. There are no detailed descriptions of traces of processing, tool marks or similar indications. Again, we encounter only a few rather superficial statements, which are not further substantiated or explored. According to Steinmann, the arms were cut out of a plank and not bent by using heat, which, according to his interpretation, was also due to the needs of the musical instrument: 'The once strong, short arms cut out of a board – i.e. not bent with heat – allow a high string tension, which must have made the lýra a bright-sounding, sometimes virtuosically handled treble instrument.'[68] In the absence of further statements about the background to these observations and the conclusions derived from them, they should only be discussed in more detail after an autopsy of our own. If they are correct, they provide an indication that musical needs might have played a role in the production of the Elgin Lyre.

In some attempts to infer the production context (e.g. the people involved, the tools used, localities, etc.) from traces on the surviving components of the Elgin Lyre, a certain conflict emerges. It is very well expressed in an essay by Nicolas Monteix on the chaîne opératoire of bakeries in Pompeii. Different from our case, his essay does not focus on an artefact but on a local site with specific characteristics and a spectrum of finds that can be integrated into the argumentation.[69] Monteix's work is not centered on deriving the extension of a physically/materially documentable artefact from traces stored in it, but with the reconstruction of a (stereotypical) production process from documentable remains of workshops. Its implementation is based on positive traces in the archaeological findings with references to sources on craftsmanship from other times and places (often without clearly specifying them).[70]

Although Monteix reconstructs a (possible) chaîne opératoire, he encounters a fundamental methodological problem in the course of his explanations:

> 'Nevertheless, I must emphasize that this reconstruction is a theoretical synthesis: of the thirty-nine bakeries included in this study, not one presented all the features discussed above; not one produced bread using all of the possible steps mentioned.'[71]

From a methodological point of view, this statement reveals a logical-argumentative error in drawing conclusions from a lack of testimonies to the non-implementation of work-steps.[72] Monteix himself

[62] Report 1816: xliii.
[63] Dumoulin 1992a: 101.
[64] Bélis 1985: 213.
[65] Roberts 1981: 304.
[66] Steinmann 2021: 373.
[67] Steinmann 2021: 405-406.
[68] Steinmann 2021: 374: 'Die einstmals starken, aus einem Brett ausgesägten – also nicht mit Hitze gebogenen – kurzen Arme erlauben eine hohe Saitenspannung, was die lýra zu einem hell klingenden, bisweilen virtuos gehandhabten Diskantinstrument gemacht haben musste.' See also Steinmann 2021: 407.

[69] Monteix 2016: 153: 'One way of approaching the material remains of Roman workshops is to investigate how they were designed specifically to accommodate the activity that took place within them. Such an approach may be based on the analysis, from a technological point of view, of a specific kind of workshop whose elements are all considered in their spatial context. In terms of theoretical background, such an approach relies on the notion of the chaîne opératoire (operational sequence), which was first defined by A. Leroi-Gourhan, was gradually refined by his successors, and was then applied to archaeology. The idea is that a close study of the different elements that characterise the operational sequence of a workshop, including materials, tools, gesture, knowledge, energy, and actors, combined with an analysis of their interaction, leads to further understanding of social and economic issues, particularly if one tries to take a more systemic point of view aimed at understanding the système technique or the complexe techno-économique.'
[70] Monteix 2016.
[71] Monteix 2016: 169. The individual findings are not presented in detail.
[72] The fact that Monteix is well aware of this argumentative problem is shown, for example, in the exemplary explanations directly after the quoted passage, see Monteix 2016: 169: 'For instance, bakery IX 3, 19-20 contained the main three structures used during grinding–a water system for soaking, four mills, and the L-shaped small wall for sieving–and most of those necessary to knead and form loaves–including a kneading machine, a boiler to warm water, embedded terracotta vessels for the first rising, and a table with two masonry feet. However, there are no clear traces of shelves, neither in the room where the kneading machine and vessels were situated, nor in the space where the table on which loaves were formed stood. In this

explicitly formulates this point only shortly after the quotation and addresses it as a limitation for approaches to the production activities in workshops:[73]

> 'Finally, a last technical point has to be made, despite its triviality: even at Pompeii, only production phases that can be traced through material remains can be reconstructed. Many, sometimes even crucial, operations cannot be studied owing to lack of physical evidence. [...] Some missing operations could perhaps be restored from textual or iconographic evidence, but such evidence should be treated cautiously in order to avoid over-interpretation. [...] In this manner, however precise our reconstruction of the operational sequence may be, it will necessarily always remain incomplete, although this does not invalidate it as a heuristic tool for further analysis.'[74]

In this passage, Monteix takes a position that is very similar to ours: the starting point of the considerations and reconstructions should be the physical/material remains (and the traces recognisable on them) – in his case the remains of the workshops, in our case the remains of the Elgin Lyre. With due caution, it is possible to use additional sources, but this exposes us to a risk of over-interpretation. In my understanding of Monteix's explanations, this objection is by no means the point behind the limitations that Monteix expresses in the passage quoted above. The argumentative limitations addressed there do not refer to the addition of the physical/material remains by or on the basis of further sources/remains, but to the subsumption of a comparatively high number of operations under a single chaîne opératoire:

> 'These two examples clearly exemplify how the apparent uniformity of bakery structures is in fact misleading. *There are no two identical bakeries:* the whole spatial structure depended both on the features used but also, and more importantly, on the evolution of the workshop, and whether or not its owner was able and or willing completely to restructure the existing layout of the building.'[75]

As is explicitly expressed in this passage, Monteix assumes that behind every single, 'individual' bakery there is an independent, specific chaîne opératoire, which differs (to a certain degree) from the chaîne opératoire of every other bakery. This view goes back to the earliest days of chaîne opératoire research.[76] Despite this, Monteix elaborates a chaîne opératoire for a higher number of bakeries and attributes a certain value to it as a 'heuristic tool for further analyses'.[77]

From our current perspective, this 'heuristic value' can be understood if we consider the chaîne opératoire as what Monteix calls it: as a 'theoretical synthesis in the sense of a kind of average' regression of all chaîne opératoires that can be observed or reconstructed on the basis of the findings and sources known to him and which, on this basis, can form the frame of reference for further considerations. Using it, you must always bear in mind that you are working with an ideal-typical 'average model' and that individual stages may be omitted or added in the specific investigation case. Such an approach abstracts the chaînes opératoires of several bakeries into a kind of chaîne opératoire of a type of a bakery, which can be given a case-specific expression – an approach that can be traced back to the beginnings of chaîne opératoire research.[78]

Fragmentary chaînes opératoires

It is not only the extension(s) of the Elgin Lyre that is not accessible to us as a perceptible element; some (hypothetical) components also elude our direct sensory perception. All previous publications agree on the assumption that the wooden arms, the crossbar and the fragmentary carapace do not form a complete artefact even after their addition to complete and undamaged components, but represent a fragmentary state of preservation of such an artefact. Even if I do not want to dispute this assumption (based on the plausibility of common sense), I would like to point out that it is not formally and argumentatively compelling, since we have no information about the earlier states of the Elgin Lyre and alternative explanations for its current state, such as non-completion for reasons unknown to us, can be thought of. We will not deal with this argumentative problem in this paper, but assume (in accordance with previous publications and common sense) that the Elgin Lyre we can perceive today is a fragment of an artefact.

So far, we have dealt exclusively with possible chaîne(s) opératoire(s) limited to the preserved components

particular bakery, the lack of shelves could be due to preservation factors: although shelves identified by holes in walls are the most common type of feature used for rising loaves in bakeries, they might not be the only one.' See also the next quotation for a recourse to precisely this argumentative point.

[73] Cf. also the limitations of his approach mentioned by Schiffer 1995: 62: 'The above discussion, it must be emphazised, presents a framework for describing the interrelations between behavioral and spatial-material aspects of activity performances with reference to the life history of cultural elements. This orientation demands that the description of activities performed at an archaeological site be expressed in terms of highly specific hypotheses on an empirical, behavioral level. The deduce the test implications of so broad an activity category as 'food preparation' is a trying if not impossible task; evidence for such a demonstration is always ambiguous.'

[74] Monteix 2016: 170.

[75] Monteix 2016: 173 (emphasis by the author).

[76] See, for example, Lemonnier 1976; Pelegrin *et al.* 1988: 61.

[77] See the passage quoted above: Monteix 2016: 170.

[78] Leroi-Gourhan 1964: 132-133: 'C'est en effet la règle pour tous les produits de l'industrie humaine aux temps historiques: il existe un stéréotype du couteau, de la hache, du char, de l'avoine qui n'est pas seulement le produit d'une intelligence cohérente mais le produit de cette intelligence intégrée dans la matière et la fonction.'

Figure 5: Visualisation of a chaîne opératoire as a simple 'chain' with chain-links related to preserved (grey) and lost (black) components (illustration by the author).

of the Elgin Lyre. This allows us (ideally) to work out a complete chaîne opératoire of the fragmentary artefact, but only a fragmentary chaîne opératoire of the overall artefact. The latter contains chain-links for the positive elements and/or their extension that we can directly grasp. If our goal is to reconstruct a chaîne opératoire of the Elgin Lyre as a complete, potentially functional stringed instrument, we must significantly expand the range of chain links taken into account and accept hypothetical components as its parts as well. Our decision to subdivide the chaîne opératoire on the basis of the components of the artefact is not affected by this extension.[79] We just have to accept that not every chain link necessarily contains at least one component of the Elgin lyre that is preserved today (**Figure 5**).

Debates about the reconstruction and/or rebuilding of now lost components of the Elgin Lyre make up the bulk of publications to date. The starting point for these considerations is additional sources of information in the form of written, pictorial and/or artefact sources. If we consider the Elgin Lyre as a fragment of an ancient functional stringed instrument with certain characteristics, we can (potentially) draw on all sources from (or about) antiquity that can provide information about such instruments. For ancient stringed instruments, we have a comparatively rich compendium of pictorial sources at our disposal; ancient written sources, some with music-theoretical considerations, provide indications of possible tuning(s) or perceptual impressions of the sound behaviour of the instruments.[80] Of particular importance for this topic is a myth referred to in several writings, which describes the invention and construction of the (first) *chelys* by Hermes.[81] If we continue to focus on a functional (i.e. potentially playable) stringed instrument, we must (at least) restore all components that are absolutely necessary for the performance of this function (i.e. through which sound production is possible).[82]

Based on the information in the ancient sources and current knowledge, the overall structure of the stringed instrument suggests that the tortoise shell at the lower end of the two arms of the Elgin Lyre most probably was a resonance box. We know from physical acoustics and modern instrument-making that a resonance box must be sealed with a vibratory material, for the optimum performance of its function.[83] A similar effect might be assumed for the tortoise shell of the Elgin Lyre. The plausibility of this assumption is reinforced by various illustrations of ancient *chelys* all with a closed tortoise shell, and by the descriptions of the various versions of the Hermes myth, according to which the tortoise shell was covered with a cow-hide after the inner construction had been attached.[84] As far as the Elgin Lyre itself is concerned, the addition of this animal skin is a hypothesis based exclusively on additional sources of the species in question. Traces of an animal skin are not preserved;[85] however, some of the perforations could be interpreted as fastening holes and thus an

[79] For an indication of the 'artificial' (in my terms: observer-dependent) character of decompositions, see already Lemonnier 1976: 113-114; as well as Desrosiers 1991: 23-24.

[80] For an overview, see for example Anderson 1995; Bélis 1985 (with specific discussions of the Elgin Lyre); Hagel 2015; Lynch and Rocconi 2020; Maas and Snyder 1989 (focusing especially on stringed instruments); Steinmann 2021; von Jan 1882 (on stringed instruments).

[81] The written sources referring to this myth are mostly traced back to the Homeric Hymn to Hermes. On the Homeric Hymn and its dating, see (with partial or complete editions, translations and commentaries) Dumoulin 1992b; Schenck zu Schweinsberg 2017; Thomas 2020; Vergados 2013.

[82] In purely formal argumentative terms, other components could also be added which, for example, change or improve individual aspects of this functionality or which have a purely decorative function. We will not deal with these points in more detail in this article, as they are ultimately based on a generalization of the line of reasoning discussed below.

[83] The materials of the resonance box and the air-space inside it absorb the vibrations of the strings and interact with them. See for example Bakarezos *et al.* 2012; Egry 2023: 77; Hutchins 1998: 70-71. For an example of the importance of the sound box, see a short passage on the sound box of modern violins by Hutchins (1998: 70): 'Käme nun zur Saite nichts weiter hinzu, dann wären die Dinge recht einfach und alle Einzelfrequenzen würden gleichmäßig verstärkt. Der hölzerne Geigenkorpus besitzt aber selbst zahlreiche natürliche Eigenfrequenzen, mit denen er schwingen kann. Fällt eine der Korpusresonanzen mit einer Harmonischen der Saite zusammen, so wird sehr viel Energie auf den Korpus übertragen und der entsprechende Ton erheblich verstärkt.' For the amplifying effect of the sound box of the modern concert harp, see also Egry 2023: 77.

[84] (Pseudo-)Homeric Hymn to Hermes 5.49; Dumoulin 1992a: 92. The mention of reed stalks for the stave is only mentioned in the Homeric Hymn. According to Dumoulin, however, it was not needed to support the sound ceiling, and it can therefore be assumed that it only occurred very rarely. Dumoulin 1992b: 228-229.

[85] A few remains of an animal skin are suspected on a shell of unknown origins (today in London, British Museum, inv. 38171), which is also only partially preserved. Dumoulin 1992a: 101 b, with further bibliography; Dumoulin 1992b: 229. A complete acoustic ceiling is also not detectable here.

indication of their original attachment. Similar holes in a matching arrangement are attested on other shield craters from tombs and sanctuaries, where they are usually interpreted in the same way.[86]

From a methodological point of view, we use the same argumentation structure for the addition of components that are no longer directly tangible as we used for the reconstruction of the extent of a preserved artefact (be it a component or an artefact composed of several components). This parallel allows us to discuss the argumentative procedure for the elaborations of this and the last section together. Formally, it is based on the connection of additional information to an observed 'data situation', which is often supplemented by one or a group of initial assumptions and/or suppositions. In the case of our cow-hide, these initial assumptions are (among others) that the Elgin Lyre was originally a functional stringed instrument to which a resonance box was added to improve the sound quality; and that the fragmentary preserved tortoise shell performed this function. As we have no explicit indications of the original design of this (hypothetical) acoustic ceiling, in the next step we set out to search possibilities for the realisation of such a ceiling. We link the results we come up with to the Elgin Lyre and thus postulate that the chosen concept for the state of the Elgin Lyre at the time of its 'completion' in one or more ancient workshops is certain or at least possible – depending on the theoretical positioning. If we are not looking for lost components, but for tools used, means of production and/or the way of thinking and acting of the people involved in the production, we proceed according to the analogous scheme, with the only difference that we do not link hypothetical components to the preserved components of the Elgin Lyre, but elements of the expansion to the Elgin Lyre as a whole and/or to its preserved or hypothetical components (**Figure 6** [components], **Figures 8, 9** [components and whole]). All additions, reconstructions and replicas are based on this approach, provided they are designed as replicas of the Elgin Lyre. If it is – as in the work and analyses of the teams led by Roberts, Bakarezos and Koumartzis[87] – a replica of a type, this type represents the reference point for the connection.[88]

If we focus on reconstructing a functional stringed instrument, we could end our discussion of the soundbox at this point and decide (ultimately at random) on one of the possibilities that we come across in our research. In most cases, however, the decision for a conceivable solution is based on additional parameters such as the sound quality/sound behaviour of the instrument, the efficiency and/or the cost/benefit ratio and/or the (or a) 'historical accuracy' of the solution. Depending on the choice of decision criterion and the rigour of implementation, the other parameters may be completely overshadowed, so that, for example, comparatively high costs and labour costs are accepted, in order to achieve the highest possible historical precision of a replica or a reconstructed chaîne opératoire.[89]

If our goal is the reconstruction of a chaîne opératoire (and/or the production of a replica) with highest degree of historical precision within the framework of a historical (or archaeological) science possible, we have to assess our possible solutions with regard to the plausibility of their application to the Elgin Lyre. Afterwards, this assessment can form the basis for our decisions. Probably the most obvious and widely used classification criterion for the plausibility of a particular aspect, such as the use of a tool or the form of a lost component in historical or archaeological work, is its 'presence' in as close temporal and geographical proximity as possible to the historical production activity that is the focus of the work. To put it differently – and more simply – we often work with the following hypothesis: If a certain component, tool, technique, etc. is attested at a certain time in a certain place, it is more plausible that this component/tool/technique was used at this time in this place in the attested form than a component/tool/technique that is not attested at this place for this time.

In most cases, the implementation of this hypothesis faces two fundamental problems: the predominantly very poor evidence in periods of the distant past, and the spatially as well as temporally localised production activity. In the first case, even if the production activity can be safely dated and localised, no attributions can be made because the information required is either not available or to a limited extent. If the artefact under investigation is affected by the second problem, the working hypothesis cannot be implemented due to the lack of the necessary anchor points (Ankerpunkte)[90] that is, chronological and topographical 'fixed points'. If both problems occur, our working hypothesis can only be applied in a very rough and uncertain way, if at all.

The Elgin Lyre is a good example of this conflict. Given the known facts about its 'life' and research history, any attempt to identify the date of its production or use turns out to be very difficult. According to the known publications, the British Museum in London acquired

[86] Dumoulin 1992a: 101-106 with further bibliography; Dumoulin 1992b: 228 (on interpretation); Holzmann 2016.

[87] Bakarezos *et al.* 2012; Koumartzis *et al.* 2015; Roberts 1981.

[88] Due to this text's orientation, we will refrain from discussing this variant in detail. Basically, in it a concretely tangible (fragmentary or complete) artefact is replaced by a type.

[89] The approach of the Greifenberger Institut für Musikinstrumentenkunde reveals this area of tension in an impressive way.

[90] For terminology see Bosche 2023 and Bosche (in preparation).

the so-called Elgin Lyre on 06.10.1816 together with other pieces from Thomas Bruce, Seventh Earl of Elgin.[91] In the same year, a first 'Report from the Select Committee on the Earl of Elgin's Collection of Sculptures, Marbles &c.' mentions the stringed instrument twice. It informs us that the remains of the lyre were found together with 'two flutes' (the so-called Elgin Aulos, also in the British Museum) during the excavation of burial grounds near Athens.[92] The context of the discovery leads us to the undertakings of Thomas Elgin in the early nineteenth century. Unfortunately, the events relevant to our instruments are only partially documented. Some information can be derived from an essay of Arthur Hamilton Smith in *The Journal of Hellenic Studies* of 1816. His words enable us to deduce some of the stages of the probable transportation route of the instruments after their discovery. Lord Byron and Giovanni Battista Lusieri are said to have left Piraeus on board the 'Hydria' ship on April 22, 1811 and reached Malta on April 30, 1811. Lusieri returned to Athens on July 4, 1811.[93] While the 'Pauline' ship was anchored in the Athenian port of Piraeus from November 26, 1811, two boxes with smaller antiquities were brought on board by Lusieri. These two boxes were delivered from Malabar to Deptford from March 1812 and, according to the documentation, also contained the two musical instruments.[94]

Smith's writings do not contain any further information about the discovery of the instruments. In the 1816 report, they are mentioned in the appendix under Addenda: 'One Lyre in Cedar wood; and, Two Flutes of the same material; found during the excavations among the tombs in the neighborhood of Athens'.[95] The locality of the tomb, its content and examination, and the route of the instruments from this tomb to the port cannot be deduced from the report. This lack of information led to several discussions about the identification of the find's context as early as the nineteenth century. M.A.S. Murray, curator of the British Museum, reported in a letter dated 05.09.1878 that the instruments were found in a grave on the road from Athens to Eleusis.[96] Linked to these statements is a letter by Louis François Sébastien Fauvel, excerpts of which are printed in the second volume of the Magasin Encyclopédique of 1807 (Gevaert erroneously mentions the year 1809).[97] Probably also related to this is a statement by the already mentioned Birch to von Jan: 'the debris of the two lyres were found in a marble urn filled with ashes, together with a golden crown in a funerary hill on the path leading from Piraeus to the Salaminian ferry and Eleusis.'[98]

We will deal with the mentioning of two instruments in Birch's letter in more detail below. While taking a critical look at this problem, Egert Pöhlmann separates the tomb reported by the letters and Fauvel from the finding context of the Elgin Lyre. The latter thus is only attested to by the scarce information in the report of 1816. Their phrasing not only provides no information about the condition and location of the tomb, but also offers no hint as to whether the aulos and the lyre were found in the same tomb. Bélis, for example, assumes that the instruments were found together. However, she also states that the objects and the exact location of this tomb are not known.[99]

This conclusion deprives the date offered by Fauvel, who compared some of the grave's contents with the Erechtheion on Athens, of its argumentative basis, as it is based on grave goods from the tomb he discusses, and not the Elgin Lyre itself.[100] Since almost all previous and later datings are not explicitly justified and have the same or a very similar time-span as Fauvel's proposal, the question is whether we should classify the Elgin Lyre as undated.[101] In research literature we can only find two dating approaches, which refer to aspects of the Elgin Lyre itself. Unfortunately, neither of them is documented in a way that would allow their critical understanding, since in both cases there is no indication of the comparanda the argumentation used.[102] Paul Courbin associates the shape of the arms

[91] Steinmann 2021: 372. François-Auguste Gevaert (1881: 647) reports: 'the lyre and flutes, came to the British Museum with the Elgin collection.' Thomas Elgin had recorded the lyre as number 501 in his collection. Steinmann 2021: 372.

[92] Report 1816: 65, xliii.

[93] Smith 1916: 281-283.

[94] Smith 1916: 283-284: 'A rough list of the objects forming this supplementary collection was supplied by Hamilton to the Select Committee. It included [...] the ex votos from the Pnyx, a cedar-wood lyre, and two cedar flutes, the bronze urn with enclosing marble urn, and a variety of inscriptions. The above list represents the cargo of the Hydriote polacca.'

[95] Report 1816: xliii. See also Dumoulin 1992a: 101; Roberts 1981: 303.

[96] Gevaert 1881: 647.

[97] Fauvel 1807: 363-364. Cf. Pöhlmann 1987: 324. On the reception, see Gevaert 1881: 647.

[98] von Jan 1882: 17: 'die Trümmer der beiden Lyren wurden in einer mit Asche gefüllten marmornen Urne gefunden, zusammen mit einer goldenen Krone in einem Grabhügel auf dem Wege, der vom Piräus nach der salaminischen Fähre und Eleusis führt.'

[99] Bélis 1985: 213 note 27.

[100] Fauvel 1807: 363-364.

[101] In the brief report of the year 1816, we can find only an undocumented dating (Report 1816: 65): 'Of what antiquity do you consider the lyre and the flutes? – I have always conceived them to be of the best time of Greece – the time of the Grecian Republic.' Gevaert (1881: 647) already states that there is no indication of the dating 'unless M. Fauvel was correct in comparing the ornaments of the wood coffin with those of the architecture of the Erechtheum'. Pöhlmann (1987: 319) speaks without justification of a 'instrument of the fifth century BC'. Steinmann reports the fifth-fourth century BC date given in the museum; Dumoulin (1992a: 101), referring to explanations offered by Panagiotis Faklaris, gives the fourth-first century BC. Strictly speaking, we should even ask ourselves whether we should consider the possibility that the find is not an ancient object, given the lack of evidence or sound arguments in bibliography and the lack of precise reference to the find's context. Since, at least in this paper, we deal primarily with the production of the instrument and not with its significance for ancient music or similar questions, we may set the dating aside. However, we must return to it at least briefly at a later point.

[102] For the argumentative background, see Bosche 2023: 247-287.

with unnamed depictions of the late sixth-early fifth century BC.[103] According to Bélis, the technique used to attach the yoke to the arms is also visible on vase-paintings and a relief from the period between 510 and 410/400 BC, whereby the latter could also date to the fourth century BC. This comparability should confirm the dating of the Elgin Lyre to the fifth century BC.[104]

Given this situation, we have only a very thin basis for any assessment of the plausibility of possible additions, reconstructions and extensions of the fragmentary Elgin Lyre by means of 'historical accuracy'. Accepting the aforementioned information, we can associate the stringed instrument with the city of Athens. Yet, strictly speaking, we only know that it was deposited in a tomb near to that city, but not that it was produced nearby – which is the information we actually need for our argumentation. In the end, we are unable to gather any reliable information about the period of its production, as the proposed dates are based either on feeble arguments or perhaps even on a line of reasoning that is to be rejected (since the presentation of the written evidence is only superficial and offering insufficient details for us to expand or even formulate the argument). This means that we lack any frame of reference for classifying the plausibility of a solution on the basis of 'historical accuracy' at a specific place and time – a problem that is common in archaeological research.

If we want to continue with our project, we may need to significantly expand our frame of reference – in the case of the Elgin Lyre, for example, to the 'Greek Classical period' or even 'Greek antiquity' in a broader sense. Since we have no artefact-bound parameters for determining such a chronological extension, the decision can only be made on the basis of 'artefact-external' factors. If we accept the idea that an aspect is temporally and spatially determined, we have to pay a high price, as we will see below. If we postulate that an artisanal solution, which is attested to us for example for the third century BC in Sparta, was used in the context of a chaîne opératoire of the fifth century BC in Athens, we assume that this solution was constant (at least) in the range of the temporal and spatial distance between these two points. If we regard the proposal as certain or as the only conceivable solution, we are in high danger of thereby denying any development of this technology between these two spatial and temporal anchor points. If we concede alternative reconstruction hypotheses, technology development is possible, but would not be observable at least at the two points we considered. In other words, the solution in both cases has a temporal and spatial constancy between the production activity we examined and the additional source associated with it. If we have further sources from this distance range (or at least later time and other location ranges) at our disposal, we can increase the plausibility of such an assumption, but formally and argumentatively it always remains a hypothesis, since it is dependent on interpolations.

Ramifications

Let us briefly recapitulate and draw a conclusion from our considerations so far. From the outset, we focused on the individual components of the Elgin Lyre. In the course of our considerations, we have encountered preserved and (hypothetically) reconstructed parts that form an (overall) whole artefact and can (but do not have to) be treated as independent artefacts. If we want to transfer this notion to a chaîne opératoire and retain its understanding as a description of the production sequence that culminates in the completion of an artefact, we encounter two different 'types' of chaînes opératoires of an artefact: chaînes opératoires of an artefact as a whole; and chaîne's opératoires of a component-as-artefact incorporated into a chaîne opératoire of an artefact as a whole.[105] With this differentiation in mind, we may return to the starting point of our thoughts and take a closer look at the basic/essential concept of chaîne opératoire formulated at the beginning of the first section: the assumption that it describes an arranged sequence of steps between two states of an artefact as visualised in **Figure 3**. With this, we turn our focus to the theoretical background concept implicitly used when talking about the chaîne opératoire of an artefact. By incorporating hypothetically reconstructed components, tools, means of production, processes, people, etc. into our chaîne opératoire, we have already – albeit subcutaneously – dispensed with the possibility of working out a clear chaîne opératoire for the production of an artefact such as our Elgin Lyre. If the available evidence does not allow us to narrow down the spectrum of possible reconstitutions to one historically secure option, we are confronted with the necessity of incorporating case differentiations (hypothesising one scenario for each possible option) into the conception of our chaîne opératoire for all aspects of the artefact's extension and/or components that are subject to uncertainty. Thus, we do not deduce a single chaîne opératoire that describes the production of the artefact under investigation (component or overall whole artefact), but a spectrum of possible chaînes opératoires, which

[103] Courbin 1980: 109 note 51.
[104] Bélis 1985: 215.
[105] See **Figures 3**, **4** and footnote 58. Cf. a passage from the work of Pierre Lemonnier (1976: 106-107): 'Une activité technique peut demander l'organisation relative et la combinaison de plusieurs chaînes opératoires; cette organisation et son d´déroulement dans le temps forment un processus technique.' In my understanding, the same basic idea is expressed in this passage, though not presented as chaînes opératoires. For the thematisation of an ever more progressive 'fragmentation', see also Lemonnier 1976: 117-118.

may or may not include the actual historical one.[106] In other words, we implicitly have used a separation between the 'actual historical reality' and the (content-charged) theoretical model used to describe this reality. While we tend to assume that there was a single, 'true reality' of the past, it is very common to consider theoretical models (at least partially) constructed by research, even though there might be some interconnection between the 'constructed' and the 'real'.[107] All statements and considerations that we deal with in this paper therefore refer to one (and every) possible variant of this spectrum, provided that no case-specific narrowing down is feasible.

Focusing now on a single (possible) chaîne opératoire, we have dealt with the question of its unity. Based on formulations very common in bibliography, our first approach has started from the assumption that the individual chain-links of our chaîne opératoire can be uniquely determined by selecting a certain 'definition element'. For the sake of simplicity (but without justifying it in detail), in the implementation of this assumption we have declared the individual components of the composite artefact 'the Elgin Lyre' to be the definition or 'core elements' (Kernelemente).[108] At the same time, we have associated each one of these components (at least potentially) with its own, separate chaîne opératoire and thus hypothetically composed the chaîne opératoire of the Elgin Lyre of the chaînes opératoires of its components. If we follow a very schematic approach, this seems to suggest the possibility of sorting the components or their chaînes opératoires in order to obtain the order of the production steps of the chaîne opératoire of the Elgin Lyre. This 'simple sorting approach' is based on the assumption that each stage of the chaîne opératoire can be treated as a self-contained unit. Any case differentiations (outside the components and their extension) only affect the order of the stages.

For a further discussion of our preliminary model, we have to turn our focus back to its application dealing with the Elgin Lyre. During the starting paragraphs we have deduced the preliminary theoretical model from argumentation lines present in bibliography and/or common in archaeological research. We have abstracted from the contents discussed there to isolate the structure of a theoretical background model implicitly sometimes applied in them. However, the same argumentation lines will also help us to see why we have to label our model as preliminary and why the simplistic approach indicated in the last paragraph is not appropriate to cover all needs of archaeological research. For this, let us take a closer look at some further points that arise while applying our theoretical model to the discussion of the making of the Elgin Lyre.

The applicability of such a schematic approach to the sorting or sequential ordering of (reconstructed) production steps is determined (among other things) by the connections of the components of the Elgin Lyre. If it were feasible, it would have to be possible that all components had been produced entirely separately and independently without any reference to each other. Only later steps could have included attachments of the components to each other. Even though we only have partial information about the connections of the individual components of the Elgin Lyre, we should take a less schematic approach to the conception of a possible chaîne opératoire of its production in light of the recognisable aspects. Bélis investigated the connection of the transverse yoke with the two arms and documented it both verbally and graphically (**Figure 6**). The transverse yoke lies in the recess of a short fork in the vertical corner pin, which is inserted through a hole in the transverse yoke.[109] This solution requires that the fastening of the elements to each other had to be taken into account during the production of the individual components. In other words, fabrication and later assemblage of the components have been somehow interlinked during the planning and realisation of the instrument. The chaînes opératoires of the wooden parts therefore contain (at least) the intended concepts of the other wooden parts, and/or the overall artefact requires testing of the fitting with the other constituent parts of the instrument in the course of their manufacture.[110] Since all wooden parts are provided with elements of this fastening solution, it is highly unlikely, if not impossible, that one or two of the components were designed after the third one had been made and they adapted their design to it The planning concept of the attachment solution must have been known or developed already before or, at the latest, during the production of all three components for the given assemblage to be possible.

The attachment of the wooden construction to the tortoise shell is far more difficult to reconstitute,

[106] Due to the usual limitations of our knowledge (the state of conservation and research, etc.), we cannot claim to be able to describe a complete spectrum. In addition, the selection of aspects that determine the individual chain is linked to the research question, the approach and the artefact/technology under investigation. For example, see Desrosiers 1991: 23-24; Lemonnier 1976: 113-114.

[107] This depends on the personal epistemological/ontological positioning. In this paper we will skip this discussion.

[108] For terminology, see Bosche 2023.

[109] Bélis 1985: 215; see also figs. 13 and 14 on p. 124. Cf. Dumoulin 1992a: 101: 'Das Joch liegt also praktisch auf dem Absatz auf, der an dieser Stelle der Arme entstanden ist, und war dort befestigt.', as well as Steinmann 2021: 374: 'Das Ende der Arme läuft in einen konisch sich verjüngenden, mit feinsten halbrunden und nur Millimeter kleinen Verzierungen versehenen Teil aus, auf welchen einst das Joch aufgesetzt war.'

[110] On the Elgin Lyre there may be an indication of an earlier planning concept. In a footnote, Steinmann (2021: 408 note 21) reports traces of ('einer im originalen Holz eingeritzten Konstruktionshilfe mit einem Kreis und Punkten'). Unfortunately, having not seen the object, I cannot verify this point.

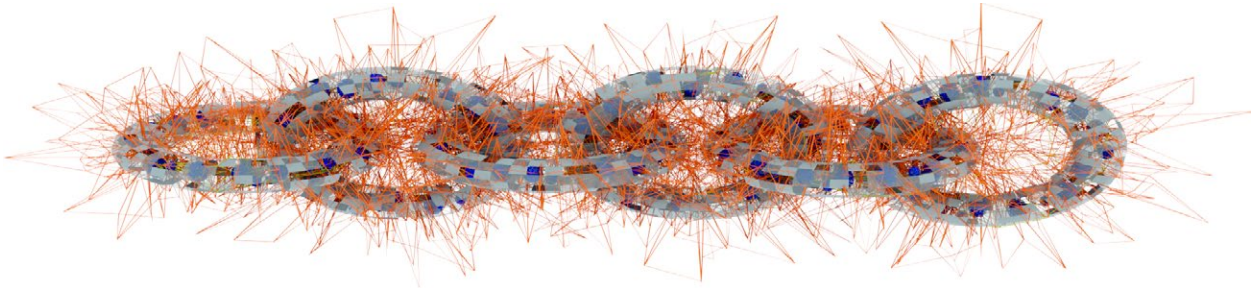


Figure 6: Visualisation of a chaîne opératoire as a simple 'chain' with chain-links embedded into a web of external relations ('extension') (illustration by the author).

since it is only poorly preserved. Nevertheless, we gain insight from a similar/comparable situation. Birch, an official of the British Museum, mentions in a letter to von Jan 'an iron peg or nail by means of which it was attached to the body of the lyre'.[111] However, as we shall see, the statements of this official should be treated with great caution. Steinmann reports after his autopsy that at least one of the two arms of the Elgin Lyre was tapered. This might indicate that the ends of the two arms were fixed to each other in the tortoise shell.[112] If this observation is correct, the conception of the carapace and its intended relationship to the wooden construction would have been incorporated into its production as well. Whether the natural characteristics of the used tortoise shell were used for the attachment, as was the case in the production of the replica by Roberts' team,[113] cannot be traced in detail because large parts of the original tortoise shell are missing.[114] We do not know whether such solutions had also been employed in the construction of the Elgin Lyre in antiquity.

The reconstruction of the covering of the carapace can be classified as somewhat safer, since it might be part of our previous chaîne opératoire, drawing on current knowledge and the information from the Hermes myth. According to the latter, the carapace was covered with cow-hide before the arms were attached to it.[115] However, Panagiotis Faklaris reconstructs a reverse sequence, since according to him the arms are said to have been fastened tightly to the walls of the carapace.[116] For Dumoulin, 'the description of the attachment of the arms and cross yoke [...] is consistent with the traditional image of the *chelys*: the arms are attached to the sonic body and connected to each other by the yoke'.[117]

In the case of an attachment that relies on mechanisms inside the carapace, the cow-hide would necessarily have to have been attached to the shell after the arms and all other construction work inside it. This is due to the technical requirements and the hide's intended function as a sound cover, since once it was attached, it would no longer be possible to work inside the carapace without damaging the sound cover and thus rendering it unusable.[118] If it was really attached to the shell with the aid of holes, this production step would have to be taken into account (at least) during the processing of the carapace, unless the holes were created subsequently (i.e. after the arms had been attached and when the need for fastening options had been determined). At the same time, while creating the holes, the components to be attached to them and their arrangement had to be considered, for the position of the holes to be determined. As the exact fastening mechanism of the acoustic ceiling on the Elgin Lyre is unknown, this question must remain open. Even with our very fragmentary knowledge of the technical and planning solutions applied during the manufacture of the Elgin Lyre, complex interdependencies and interactions between different stages of its (potential) chaîne opératoire emerge (**Figure 7a-c**). These interdependencies make it impossible to work with completely separated, discrete stages similar to chain-links. Turning back to the conception of our theoretical model we therefore have to give up the idea of discrete, sequentially ordered stages resembling the metaphorical image of chain-links. Rather, we have to integrate possible ramifications between the single chain-links, making them only some kind of 'gravity centres' within a deeply ramified nest. For example, if we assume the use of a certain hammer in stages A and B, this hammer acts

[111] von Jan 1882: 17: 'eisernen Pflock oder Nagel, mittelst dessen dieselbe an dem Körper der Lyra befestigt war'.
[112] Steinmann 2021: 373. The procedure for the actual attachment of the arms to the plaster cast of the tortoise shell is not comprehensible to the viewer. Steinmann 2021: 374.
[113] Roberts 1981: 304. The detailed craftsmanship of the replica by the team around Steinmann's team is unfortunately not published. For considerations on the attachment of the arms into the carapace from Argos, see Courbin 1980. For general considerations on this question, see Dumoulin 1992b: 233-235; Faklaris 1977: 226-230.
[114] The inside of five tortoise shells with perforations found in Gordion were artificially smoothed. Holzmann 2016: 548.
[115] (Pseudo-)Homeric Hymn to Hermes, v. 49-50.
[116] Faklaris 1977: 226-230. Cf. Dumoulin 1992b: 233-234. Athanassios Vergados (2013: 259) concludes from this that the myth does not present the steps in the correct order.
[117] Dumoulin 1992a: 92: 'die Schilderung der Anbringung von Armen und Querjoch stimmt mit dem überlieferten Bild der *Chelys* überein: die Arme sind am Schallkörper befestigt und untereinander durch das Joch verbunden.'
[118] Cf. Schenck zu Schweinsberg 2017: 121-122.

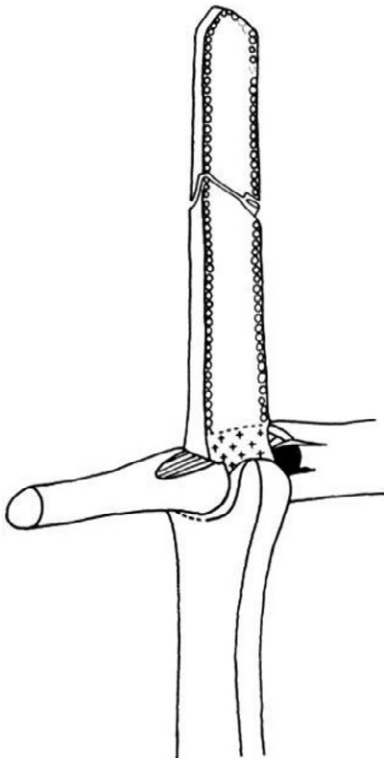


Figure 7: Drawing of the connection between the yoke and the left-side arm (after Bélis 1985: 214 fig. 13, © École française d'Athènes).

as some interweaving connection between these two stages.[119]

Those ramifications make it impossible to limit our case differentiation to several possible sequential orders of the stages (or, as we might now say, the 'gravity centres') of our chaîne opératoire. First of all, their mere presence leads us to integrating possible sequential parallels like two elements being planned and/or executed 'at the same time' (for example by different persons) in our spectrum of possible sequences. Second, since there (at least potentially) are no entirely separate stages, we can only sort their 'gravity centres', if at all. Other aspects connected to them – like our hammer – somehow transcend the sequential ordering since they span the otherwise sequential stages (**Figure 7b** and **c**). Third, those connected aspects are subject to the well-known uncertainties and knowledge deficits, as well. If we abandon the hypothesis of the use of the hammer in Stage A, the associated link between the two stages can no longer be maintained.[120] This does not only mean that it cannot be used as an argument for a sorting procedure; the 'existence' of its 'bridging/spanning function' is also subject to uncertainty. If we want to integrate it into our discussion, we have to accept case differentiations for this point, as well.

Besides the chain-links of a (hypothetical or actual) chaîne opératoire, its overall course, too, is affected by the possible interweaving and interlocking of several stages. In other words, the integrating of possible ramifications in our thoughts might influence the identification of the starting and ending points of our chaîne opératoire. Let us assume for our further discussion, that we intend to deal with a 'functional' stringed instrument, referring to its (potential) playability or use for the intended production of sound events. Neither the joining of the wooden parts and the tortoise shell nor their covering with a sound-board are sufficient to produce intended sound events of the kind we expect from musical instruments. As testified by the additional sources mentioned above, a *chelys* like the Elgin Lyre can only produce its intended sound when strings are attached to it. As far as the remains of the Elgin Lyre itself are concerned, only indirect indications of the presence of strings can be found. The original strings have not been preserved and thus they belong to the reconstructed components of our chaîne opératoire.[121] Whether they were made of sheep intestines, as reported in some versions of the Hermes myth, remains a hypothesis.[122]

As early as in 1862, Birch mentions 'traces of the strings on the crosspiece, but no signs of pegs for tuning or tensioning the strings'.[123] According to him, the lyre should have had nine strings.[124] Since the 'traces' are not described in more detail, it is not possible to deduce what this information is based on – an important point, since Birch's explanations of the strings and the tuning device of the Elgin Lyre contain a number of misconceptions. In addition to the indication of the number of strings, he formulates a hypothesis about a tuning mechanism not otherwise attested in antiquity. This mechanism includes a tuning of the strings 'from below' and not by pegs on the yoke'.[125] Von Jan and several other authors embrace this hypothesis and build on it, partly in combination with further 'observations' – but without having carried out an inspection of the preserved remains themselves. They conclude that they have discovered a 'new' tuning mechanism that is not

[119] If we take up an idea of my dissertation that is only incidentally relevant to this paper, this interweaving 'would not exist from the perspective of the hammer', and we would work with partial delimitations between the stages. For this idea, see Bosche 2023: 401-474. Since the conception of theoretical descriptive units is not discussed in this paper, I will refrain from not elaborating on this topic at this point.

[120] Making the visualisations of **Figures 8** and **9** only one observer-dependent possibility.

[121] Considering the hypothetical character of our assumption of a former playability of the instrument, whether strings ever existed is hypothetical. In the end, we do not know whether the instrument has ever been played. As mentioned, we will not deal with this problem here.

[122] (Pseudo-)Homer's Hymn to Hermes 51. According to Roberts (1981: 311), strings made of other materials are also known. Dumoulin (1992b: 239-240), considers sinews and intestines to be attested in the ancient sources. Steinmann's reconstruction team (Steinmann 2021: 406) refers to the production of sheep intestine.

[123] von Jan 1882: 17.

[124] von Jan 1882: 18.

[125] von Jan 1882: 18.

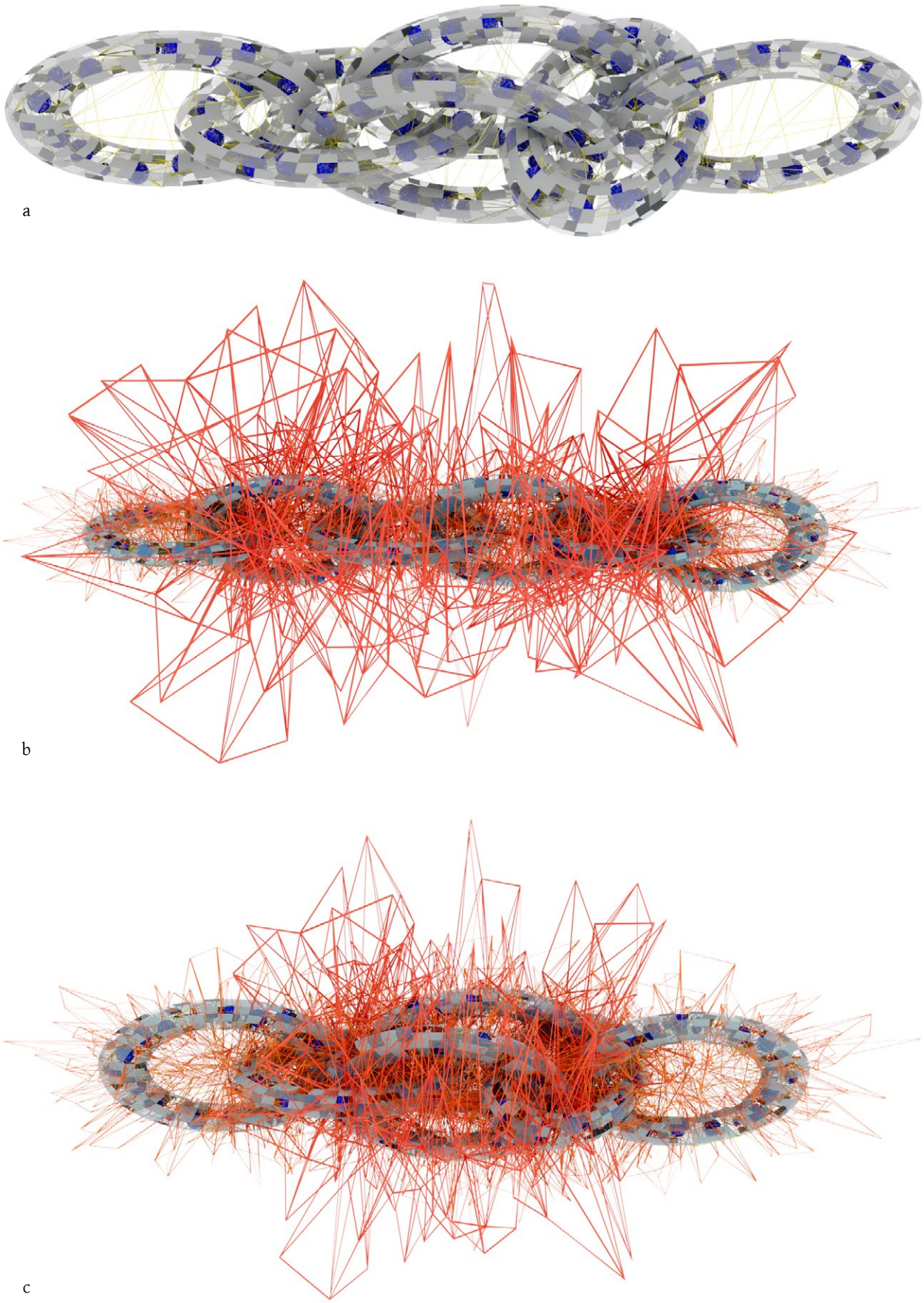


Figure 8: Visualisation of three ramified forms of a chaîne opératoire with ramifications realised by the contact points of the chain-links (a), by extension factors/external web (b), and both the above (c) (illustrations by the author).

attested in the ancient written sources.[126] Since (possible) tuning elements of the Elgin Lyre are not preserved,[127] there are no grounds for refuting Birch's hypothesis on actual evidence. Nevertheless, the discovery of an alternative mechanism may raise scepticism. This occurs with Pöhlmann, who investigated this problem in 1987. In his letter quoted by von Jan, Birch speaks of 'two lyres'. Pöhlmann can identify one of these two 'lyres' as the hinge of a small box. This discovery entails that all thoughts and arguments based on these elements should be removed from the discussion.[128] The presence and form of the tuning mechanism, strings and a possible tail-piece on the Elgin Lyre can only be reconstructed hypothetically. Thus, all sound events produced today on the basis of replicas are also based on the sound of these hypothetical elements. Accordingly, the supposedly 'new' tuning mechanism is no longer addressed in later publications; instead, the usual mechanisms known from the ancient sources are used for the reconstruction. Dumoulin speaks of 'notches that should hold the strings in their intended position'.[129] Bélis adds the remark that no holes for fastening the strings can be found in the yoke.[130] According to her, the yoke of the Elgin Lyre should have carried eight *kollopes*, which were attached in such a way that the strings did not touch the wood. There are no notches that could have been caused by direct contact between the string and the wood. The marks should run around the entire round circumference of the yoke. Perhaps this is a system similar to that shown on a bowl from Delphi or on a crater fragment in Amsterdam.[131]

Our information about these *kollopes* is based exclusively on an interpretation of ancient written and pictorial sources, partly including modern instruments. Von Jan had reconstructed the tuning mechanism based on an etymological derivation of the term by Eusthathios in combination with a reference to the African Kissar as a string fastening by means of a sticky coil wrapped around the crossbar, which held the string in position. This view was taken up by many later authors and has been *communis opinio* for a long time.[132] Pöhlmann and Eva Tichy object to this interpretation after a critical examination of the sources.[133] Without more detailed studies and analyses, the exact reconstruction of the (possibly existing) tuning mechanism of the Elgin Lyre should remain open due to the interpretative uncertainties in some cases also noted by Pöhlmann and Tichy and the general argumentative limitations.[134] The remains of a lyre found in a grave at Locri could provide some help. Some of the parts are interpreted by Stefan Hagel as tuning pegs and used as a basis for the reconstruction of a yoke that would fit the dimensions of the yoke of the Elgin Lyre.[135] Without more detailed studies, I would rather not take a position on this proposal or make any further statements about the attachment of the strings and (possible) tunability.

With this limiting comment, let us turn back to our theoretical considerations regarding the chaîne opératoire. Although the core elements for sound production are not precisely known, their inclusion in the chaîne opératoire has massive implications for our argumentation line. Due to structural similarities, some basic elements of those points might be projected onto many other aspects regarding the functional or even symbolic understanding of the Elgin Lyre. As expressed by Sellet, for example, a chaîne opératoire often starts with the procurement of raw materials and ends with the completion or discard of the artefact.[136] In our relativism of a schematic separation of the individual stages of our chaîne opératoire, we have so far omitted discussing the connection between the first and the final stage, or, in other words, the start and the end of the chaîne opératoire. If we adhere to the schematic separation of (if only) those two stages, the only connection between the start and the end would be the chaîne opératoire itself (cf. **Figures 3 and 5**). Re-applying the argumentation line used above, the raw materials in this case had to be selected without reference to the intended function and design of the artefact and without taking into account the knowledge, tools and processing methods available; the same applied to the choice of all elements of the extension(s) of the individual stages, the planning of the shape and conception of the components, etc. All elements of the chaîne opératoire – all raw materials, tools, workstations, planning concepts, manufacturing processes, etc. – would be selected completely without context-bound decision criteria. The result would be a

[126] Pöhlmann 1987: 319-321 with bibliography.
[127] See also Bélis 1985: 216; Steinmann 2021: 373.
[128] Pöhlmann 1987: 319-321.
[129] Dumoulin 1992a: 101: 'Kerben, die die Saiten in der für sie bestimmten Position halten sollten'.
[130] Bélis 1985: 217.
[131] Bélis 1985: 219.
[132] Pöhlmann and Tichy 1982: 287-289 with further literature, in particular 288 note 16 with the later receptions of von Jan's interpretation. See also Roberts 1981: 305-307 in the context of the presentation of its reconstruction.
[133] Pöhlmann and Tichy 1982: 299: 'Sieht man von jenem letzten Zeugnis ab, so kann man feststellen, daß überall, wo die Stimmvorrichtung gemeint ist, entweder eindeutig als 'Pflock, Wirbel' oder Verwandtes zu verstehen ist oder jedenfalls ohne weiteres so verstanden werden kann. Jans Theorie, die sich auf eine antike Fehletymologie — κόλλοψ von κόλλα und ἔψω — sowie auf jene suggestive Analogie zu der afrikanischen Kissar stützte, findet also auch in den literarischen Belegen keine Bestätigung.'
[134] For some considerations on possible tuning devices see also Dumoulin 1992b: 240-243.
[135] Hagel 2016. Hagel (2016: 161) interprets this as an indication of an 'organological optimisation mediation between conflicting demands: on the one hand, the need for a stable yoke that would not bend significantly during tuning; on the other, for an amount of friction that ensured that the strings would hold tight enough to maintain their grip on the yoke, while not becoming so tight that they would rather snap than allow re-adjustment.' If his reconstruction is correct, this would probably have circumvented some of the difficulties that Roberts encountered in her reconstruction.
[136] Sellet 1993: 106.

random conglomerate of individual components and influences, of which the form and design, conception, usability and sound behaviour were only influenced by chance, which from this perspective determined the choices of the actors involved. As was the case with the interconnections between the other stages discussed above, our daily observations speak against the applicability of such an assumption.

In addition to the argumentative weak 'daily observations', we can also counterargue for such an assumption while discussing (a) possible chaîne(s) opératoire(s) of the Elgin Lyre. Let us briefly mention some exemplary points. Regarding craft activities, the nature of the materials has a direct impact upon the choice of tools, the processing methods used and the knowledge required.[137] Maple and cedar wood (the two types of wood discussed for the Elgin Lyre) have partly similar, but also different properties. Their processing thus might pose different challenges.[138] At the same time, the sound behaviour of the stringed instrument directly depends on the wood the instrument is made of. Modern instrument-making and physical acoustics teach us that properties such as the vibrational behaviour of the materials used in an instrument can contribute to the character of its sound.[139] Due to a lack of sources, we do not know whether aspects such as the sound behaviour were taken into account during the planning of the Elgin Lyre. However, an observation by Steinmann suggests that this is at least possible. According to him, 'the forward-facing annual rings [of the stone arm] should allow a hugest strength possible'.[140] Unfortunately, there are no further details that explain or justify this statement. Of course, we do not know whether the ancient instrument-maker deliberately chose this aspect or whether the observed image was created by chance. If the processing qualities and perhaps even the tonal properties of the wood were incorporated into the design of the instrument, the instrument-maker had to consider the desired behaviour of the instrument before selecting the raw materials and base the choice of raw materials and further processing on this.

Depending on the quantity and quality of the aspects involved in the planning process, it might require knowledge far beyond pure craftsmanship skills. Even if many details of the possible tuning(s) of antique stringed instruments are unknown to us,[141] it seems rather unlikely that all the strings of the Elgin Lyre produced arbitrary pitches or even the same tone. Rather, they were tuned to different pitches (either once while fastening the strings or time and again by means of a tuning mechanism). From a physical point of view, different pitches can be generated by several approaches. The pitch of a string is the result of its vibration intensity. It can be changed by varying the string's thickness, length or the tension applied to it, provided that the string's material is constant. If the strings are made of different materials, we not only experience different timbres, but are also confronted with different physical features of the strings.[142] The overall design of an instrument plays an important role in the adaptation of those points. The length of the strings is determined by its dimensions. Different string lengths are only possible if the instrument was built accordingly. This solution seems rather unlikely in the case of the Elgin Lyre due to the at least approximate symmetry of the wooden arms and the position of the fastening elements on the yoke. However, since we lack the fastening mechanism of the strings at the lower end of the resonance body has not been preserved, we can only conjecture on this point. Still, an overly large difference between the string lengths seems very unlikely.

Assuming that all strings were made of the same material and that they were tunable, different pitches of the strings of the Elgin Lyre were probably realised by means of thickness and/or tension applied. If this is true, the tuning and, by extension, also the making and fastening of the strings can be separated from the production of the instrument body (wooden arms, yoke, resonance box) – at least at first glance and to a certain extent. Taking a closer look, such a separation can only be maintained if the sound behaviour of the body was not taken into account when the instrument was built. In stringed instruments with a resonance box, 'the strings and body form mechanically coupled resonators [...]. Energy is cyclically exchanged between them, resulting in a beat.'[143] To reach an instrument's

[137] A causal connection between the nature of the materials, and the working techniques and the finished products has been an integral part of chaîne opératoire since the beginning of its research. See, for example, Lemonnier 1976: 108-109.

[138] Wagenführ and Wagenführ 2022: 57-61 (maple), 892-893 (cedar).

[139] See e.g. Bakarezos *et al.* 2012; Egry 2023; Hutchins 1998. For specific statements on the Elgin Lyre or generally on the use of different materials in *chelys*-like instruments, further analyses are necessary.

[140] Steinmann 2021: 374: 'die nach vorne gerichteten Jahresringe [des Steinarms] eine grösstmögliche Festigkeit erlauben'.

[141] For a summary, see Hagel 2015: esp. 76-92, 103-134 with bibliography.

[142] For the physical principles, see for example Egry 2023: 70-73. For a reference to ancient stringed instruments, see also Hagel 2015: 76-92.

[143] Hutchins 1998: 71: 'Saiten und Korpus [bilden] mechanisch gekoppelte Resonatoren [...]. Zwischen ihnen wird zyklisch Energie ausgetauscht, wodurch eine Schwebung entsteht.' Bakarezos and his team (Bakarezos *et al.* 2012: 481) describe the interaction between the components of their reconstructed *chelys* during sound production in the following terms: 'The emitted *Chelys* sound is generated as follows: the strings are plucked by the plectrum and the resulting vibration, known as Helmholtz vibration, which consists of many frequencies is transferred to the bridge (magas). The bridge in turn, starts to vibrate and the energy is transferred to the front part of the sound box (leather). The lower side of the bridge is in full contact with the front side of the *Chelys* sound box. This is also the case for the lute-type musical instruments, such as the guitar, one of the most widely studied plucked string musical instruments. This category is of great interest due to its long history, since it includes

full potential, the vibrational behaviour of the strings, the tortoise shell, the sound-board, the air and wooden construction inside the resonance box and their interactions had to be taken into account in the course of planning and building the instrument. Furthermore, the vibrational characteristics were not only important during the planning and construction phase, but also while using the already completed instrument. Environmental conditions and the tensions applied to the instrument can lead to later deformation of the materials.[144] We have no sources telling us whether the tonal potential and the later behaviour of the materials were taken into account in the construction process of the Elgin Lyre or other ancient stringed instruments. If this was the case, knowledge of wood- and horn-working would not be sufficient for the production of a stringed instrument such as the Elgin Lyre. The people involved in the planning and production process would either have to be qualified with theoretical and/or practical musical knowledge themselves and/or collaborate with musicians.[145]

A rigorous linearity of the chaîne opératoire in the sense of a kind of 'transformation' of an initial state to a final state through a sequence of work-steps without overlaps, interactions and spiral steps does no justice to the complexity of an artefact production. It can only be applied if the representation of the process – for example by means of a chaîne opératoire of the overall artefact – is limited to and focused on the 'transformation(s)' of one (or, under certain circumstances, a few) parameters while neglecting the rest. This point will lead us back to the central concern of von Rüden and my objection to it.

Learning by …? And learning what?

We have abandoned the idea of isolated chain links and the notion of a linearity of the chain between an initial and a final state. Due to the interlocking of the initial state and the intended final state, as well as all other intermediate and later states of the chaîne opératoire,[146] our chain takes on a ramified form including, among others, connections between the first and the final state. **Figure 8** gives an impression of the crowded and branched character our descriptive model of a chaîne opératoire has assumed while adding more and more aspects and relations between them. The clear-cut stages we started with (the 'chain-links') are blurred by a tight network of relations within and between the stages. Their boundaries fade or even vanish, if we are willing to accept them as created by our own definition. If we include case differentiations necessary due to lack of information and/or a spectrum of possibilities (which unfortunately cannot be properly visualised in a 3D-graphics focusing on the structure of one given chaîne) the number of potentially relevant elements and relations further increases significantly. Leaving aside (artificial) preconditions and hypotheses – as necessary for research as limiting for the object under investigation – we are free to include any aspect we can think of in a content-related application of our theoretical model.

Turning back to considerations on the 'real-life level' including humans, objects, artefacts, concepts etc. however, we might wish to employ at least one basic premiss that certainly limits the extent of our content-related model of (a) certain chaîne(s) opératoire(s) – but also values some argumentative tension regarding the accessibility of human perception. For an exemplary discussion of this point (related to one of the deepest problems of philosophy) we might look back at the starting and end point of a chaîne opératoire and focus on the character of the 'transformations' of the former while reaching the latter.

The notion that a chaîne opératoire does not necessarily have to be linear should not be credited to us, since it can already be found in some of the earliest publications dealing with the theoretical concept. A short passage of Pierre Lemonnier, for example, illustrates the decomposition of a chaîne opératoire into several smaller, separable chaînes opératoires,[147] which we have dealt with in our previous explanations.[148] Those 'smaller' chaînes opératoires can

the necked chordophones, of which the *Chelys* is an example that was used in ancient cultures Furthermore, there is also no direct connection between the bridge and the back side of the sound box. The initial excitation of the instrument is modulated by the bridge due to its geometry and elastic properties which make some of the initial frequency components be transferred to the sound box more efficiently than others. This excitation is further dispersed to the remaining sound box, where the frequency components are further modulated depending on the sound box geometry and its elastic properties.'

[144] Such observations were also made, for example, by the team led by Bakarezos (Bakarezos *et al.* 2012: 479) when dealing with the acoustic properties of an antique *chelys*: 'Small deviations were observed from the desired tuning frequencies, and these were attributed to the instrument sensitivity to different string tension and ambient conditions, suchas temperature and humidity.' Cf. the observations by Roberts 1981: 305. 309-311.

[145] In the absence of explicit indications, we cannot answer whether the strings were produced, stretched and perhaps even tuned by the craftsmen who made the remaining parts of the instrument body. Following the Homeric Hymn of Hermes, Steinmann (2021: 262) assumes that several crafts were involved in the construction of a *chelys*.

[146] Basically, the raw materials and their properties affected the artefact even after the last step of its production.

[147] Lemonnier 1976: 106: 'Une chaîne opératoire 'série d'opérations qui transforment une matière première en un produit' (Cresswell 1976), est constituée d'actions sur la matière de phases de préparation, matérielle ou non, de ces actions, et de temps morts, n´nécessaires ou non à l'obtention du résultat technique visé. Ces éléments ont une dimension temporelle: ils se succèdent, se d´déroulent simultanément ou se chevauchent; si une chaîne opératoire possède un début et une fin, elle n'est pas n´nécessairement linéaire.'

[148] In another passage, Lemonnier (1976: 107) mentions 'parties de chaînes opératoires'. For the 'staggering' see also Lemonnier 1976: 112.

be arranged in sequence one after the other, but they can also take place simultaneously or overlap (**Figure 7a-c**).[149] Yet, there is one important difference between our approach and the one formulated by Lemonnier. The chaîne opératoire in his elaborations does not represent the 'highest level' of his theoretical concept, but is integrated into a kind of 'superordinate' concept: the 'Processus Technique'.[150]

The terminological separation between a single chaîne opératoire (for the production of an artefact as the 'final state' of an organised manufacturing process) and the Processus Technique (as an organisational concept for more complex technological processes) renders more relative, if not abandons, the idea that all 'sequence concepts' lead up to a single artefact. Rather, it is combined with an additional focus on the relationship between productions of several artefacts (as 'independent production results' or parts of a 'superordinate production'). The investigation of an individual artefact production, however, is not abandoned. During the last sections we have taken up a similar core idea by distinguishing between a chaîne opératoire of a (construction) part of an artefact and a chaîne opératoire of an entire artefact. However, we have not followed the (at least terminological) shift of considerations towards technology research, which in my opinion is evident in Lemonnier's explanations.

The differentiation between chaîne opératoire and technical activity/process or technology leads us to the words of von Rüden, who deals with Lemonnier's approach in the course of her essay.[151] One of her central objections to Lemonnier's approach is his definition of technology as 'physical renderings of mental schemas', since, according to her, it is based on 'a somehow Aristotelian perspective which conceives the mental schema as the primacy which is then physically rendered or executed in a bodily or material practice'. 'Hence, despite his wish to integrate the material and the mental world, he carries forward a Cartesian division and marginalises the integrative aspect of the bodily gesture and embodiment'.[152] Von Rüden expresses a similar objection to Leroi-Gourhan's approach:

> 'Beyond this more general methodological approach, his aim was to understand the development of the human mental abilities in accordance with rhythm, movement and technique. The human subject was therefore always at the center of Leroi-Gourhan's considerations, but maybe surprisingly one can nonetheless trace a certain neglect of the human's sensual involvement in his description of technical processes. In his book 'Le Geste et la Parole' of 1964 he described the 'progress' of techniques from an evolutionist perspective: techniques conducted by the human body, techniques with tools moved by a human 'motor', and the externalization of technologies to machines. Certainly driven by a fascination for technologies and machines, he draws parallels between machines and humans, culminating in a description of habitualized human operations as 'automatic' or 'machine-like' (Leroi-Gourhan 1988: 289-293). Such a labelling of these often highly complex technical practices puts them closer to mechanics and technological functioning, and draws them away from the human sensual involvement in techniques. Whether intentionally or not, his choice of words reduces the motion within these techniques to a mechanical one, marginalizes the specific human character of the sensually guided body movement, and therefore dehumanizes techniques (von Rüden 2015: 36-37)'.[153]

I have a great deal of understanding for the fact that the quoted formulations by Leroi-Gourhan can evoke the associations that von Rüden expresses. However, considering my own perception and some other formulations that Leroi-Gourhan uses, for example, in his (admittedly brief) explanations of the concept of chaîne opératoire, the question arises as to whether the tension between the approaches of Leroi-Gourhan and Lemonnier on the one hand and von Rüden on the other could not be summarised in an alternative way. If my view of the explanations is correct, it is not so much different research interests or perspectives on the significance of the cognitive aspects of the people involved in a production process that come together in them, but rather different ways of how cognitive processes can support and enrich current theoretical research on ancient craft activities.

In order to explain the concept, we need to take a brief excursion into some of the early trends in the history

[149] Pelegrin, Karlin and Bodu (Pelegrin *et al.* 1988: 60) summarise Lemonnier's considerations: 'De plus la description d'une chaîne opératoire n'est pas une simple organisation linéaire de données. C'est aussi l'articulation et l'interaction de tout un ensemble d'éléments qui permettent de pondérer chaque moment de valeurs différentes.' See also Balfet 1991: esp. 17.

[150] Lemonnier 1976: 106-107: 'Aussi en employant l'expression processus technique voulons-nous définir un ensemble de faits plus large que celui que représente une Chaîne opératoire. Une activité technique peut demander l'organisation relative et la combinaison de plusieurs Chaînes opératoires; cette organisation et son d´déroulement dans le temps forment un processus technique.' Cf. Lemonnier 1976: 105: 'Sous ce terme [processus technique] nous regroupons l'ensemble des opérations enchainement d'actions sur la matière, attentes etc. qui interviennent lors d'une activité technique.' Cf. Lemonnier 1976: 128. The concept is repeated by Pelegrin, Karlin and Bodu (Pelegrin *et al.* 1988: 58): 'Des *suites de gestes ou d'opérations*, qui sont les *processus techniques*, eux-mêmes décomposables en *chaînes opératoires* regroupant des *séquences gestuelles*.'

[151] For the connection between chaîne opératoire and technology, see also Bar-Yosef and Van Peer 2009: 105.

[152] von Rüden 2017: 73-74 with reference to the (translated) passages by Lemonnier.

[153] von Rüden 2017: 72.

of research also addressed by von Rüden. We may start with the work of Leroi-Gourhan, which Lemonnier (among others) cites as a direct reference in several key passages. Leroi-Gourhan defines the chaîne opératoire in brief words in a passage in his work 'Le Geste et la Parole':

> 'La notion de Chaîne Opératoire sera reprise aux chapitres VII et VIII mais il est nécessaire de l'évoque içi pour comprendre le lien entre technique et langage. La technique est à la fois geste et outil, organisés en chaîne par une véritable syntaxe qui donne aux séries opératoires à la fois leur fixité et leur souplesse.'[154]

In this short passage, Leroi-Gourhan distinguishes between three aspects: the 'chaîne opératoire', the 'séries opératoires', and the 'syntaxe (opératoire)'. The latter establishes the connection between these three aspects and has two 'tasks': it organises movements/ gestures (geste) and tools (outil) in a chain (I), and it offers the séries opératoires (depending on the need or situation) independence and flexibility (II). The 'starting point' of the syntaxe opératoire for Leroi-Gourhan is situated in the memory, where (according to my interpretation of the passage) it is 'stored' after its emergence through an interaction between the brain as the centre of the human cognitive apparatus and the material world that surrounds man and can be perceived by him. As 'stored information' it can be 'retrieved' (and also modified) as required:

> 'La syntaxe opératoire est proposée par la mémoire et naît entre le cerveau et le milieu matériel.'[155]

In my understanding of this passage, Leroi-Gourhan describes human learning through interaction with the (physical-material) environment. Sensory experiences necessarily play just as central a role in this learning as the cognitive processes in the human cognitive apparatus that are based on them. For Leroi-Gourhan, a tool is a kind of 'secretion' ('sécrétion') of body and brain, which should be treated as an 'artificial organ' ('organe artificiel') according to the rules that also apply to 'natural' organs. For this reason, 'il doit répondre à des formes constantes, a un véritable stéréotype'.[156] With the caution required for hasty connections or even for drawing parallels in complex situations, I would at least like to point out similar considerations from the context of today's cognitive sciences.[157] Even if this point requires much more comprehensive analyses than can be accommodated in the scope of this paper, in my understanding, the previously quoted and paraphrased passages at least tend to take into account the body-bound level of perception or sensation in the conception of human cognition (which is admittedly strongly focused on the human brain). However, I am alarmed by the connection between human cognitive processes and a 'stereotype', which is at least hinted at in one of the passages. We will come back to this point later and in a different context.

The interplay between tool and action is taken up by Lemonnier.[158] He distinguishes between the three levels of work equipment ('moyens de travail'), chaînes opératoires and technical knowledge ('connaissances techniques') when dealing with a technique. In the summarised presentation of these three levels, Lemonnier emphasises (very clearly in my opinion) different research possibilities for these three levels. The means of labour would be by far the most frequently investigated by technologists, since 'the only material traces of human activity can be related to this category of technical facts' ('sans doute parce que les seules traces matérielles de l'activité humaine se rapportent à cette catégorie des faites techniques').[159] Technical knowledge, on the other hand, was mostly ignored in technological studies, as were also the definitions, since it left few material traces.

Despite these methodological limitations, Lemonnier ascribes essential importance to knowledge in the study of technical phenomena.[160] He presents cognitive concepts such as technical skills as a kind of complementary level to the chaîne opératoire and

[154] Leroi-Gourhan 1964: 164. The chapters referred to cannot be found in the publication.

[155] Leroi-Gourhan 1964: 164.

[156] Leroi-Gourhan 1964: 132.

[157] See, for example, some considerations from the field of embodied cognition. For an overview: Shapiro and Spaulding 2021 with bibliography. The exact relationship between the concepts needs to be examined in more detail. For such an interpretation of Leroi-Gourhan, see also, for example, Audouze and Karlin 2017: 2-3: '«Pour Leroi-Gourhan qui la nomme, la chaîne opératoire est dans le prolongement de sa vision biologique» (Schlanger 1991: 2004). On est loin de la méthode analytique sophistiquée que va devenir la chaîne opératoire au cours des années.' For some considerations on the relationship between 'body' and 'mind' in Leroi-Gourhan see, for example, Leroi-Gourhan 1964: 87. In my view, this passage also shows a differentiation between the 'constitution' of man and his 'acquisition', in the context of which 'body' and 'mind' 'depuis toujours' are regarded as separate.

[158] See, for example, Lemonnier 1976: 107: 'On a souvent insisté sur le caractère indissociable du couple geste-outil (Haudricourt, 1940: 760 ; 1948 : 54 : 1955 : 32 ; 1964 : 31 ; Leroi-Gourhan 1965 : 35 sq); l'action sur la matière ne peut être comprise qu'en complétant la connaissance de l'outil par la connaissance du geste qui le met en œuvre, il est inutile d'y revenir. L'étude d'une pratique technique doit donc comporter, a` côté de la description des moyens de travail et des connaissances techniques mobilisés, la description des différentes actions sur la matière mises en œuvre, de leur succession (chaînes opératoires), de leurs agencements relatifs, etc.'; cf. Pelegrin *et al.* 1988: 60.

[159] Lemonnier 1976: 103-104.

[160] Lemonnier 1976: 104: 'Elles sont généralement ignorées dans les études technologiques (sans dout parce que laissant peu de traces matérielles), voire même omises dans les définitions du domaine technique; elle en sont pourtant un élément essentiel, ne serait-ce que parce qu'elles forment un préamble nécessaire à tout pratique technique. La difficulté de leur raisir ne doit pas faire oublier la complexité des choix et des élaborations intellectuels non exprimés et souvent non exprimables qui accompagnent tout processus technique.'

does not explicitly integrate them into it. Instead, these flow into the Processus Technique together with the traces of work. Such a (admittedly rather schematic) differentiation can justifiably give the impression that the material and mental levels appear and are treated as clearly separate in Lemonnier's theoretical conception. However, in my opinion, this differentiation results – at least to a certain extent – from the different accessibility of these areas, as emphasised by Lemonnier.

As Lemonnier emphasises at various points of his explanations, his approach to the study of technology is focused on the interaction between humans and matter.[161] In line with this, cognitive aspects play an essential role in Lemonnier's search for technological issues; however, limitations are posed by methodological problems, since these aspects – unlike, for example, certain work processes that leave tool marks – leave no material traces and thus cannot be 'read' on the artefacts.[162]

In my opinion, this methodological problem plays a central role in the fact that cognitive aspects tend to recede into the background in some of the later works dealing with the concepts of Leroi-Gourhan and Lemonnier. Sellet, for example, describes the chaîne opératoire in the following words: 'It is a chronological segmentation of the actions and mental processes required in the manufacture of an artifact and in its maintenance into the technical system of a prehistoric group.'[163] His summary of the development of the concept in the history of research reveals a rather schematic conception of the integration of actions, objects/tools and cognitive concepts such as technical/technological knowledge:

> 'Subsequently, a chaîne opératoire study was seen as integrating three levels of analysis, which would reveal the technical decisions made in the process of tool manufacture. The most basic level is represented by the objects themselves (tools and by-products of the manufacture process); then comes a series of gestures or technical sequences (the methods by which the tools are produced); and finally, at the most abstract level, is the specific technical knowledge shared by all group members.'[164]

Sellet traces the composition of this sentence back to a passage in Jacques Pelegrin, Claudine Karlin and Pierre Bodu, who in turn summarise Lemonnier's explanations. In the course of this 'chain of reception', the network of interaction between humans and 'material' seems to recede further and further into the background, at least in the formulations used. Pelegrin, Karlin and Bodu discuss the 'connaissances spécifiques' as one of the three levels on which technical activities can be grasped, and mention in this context that they could not always be expressed by the actors and that their analysis could be underpinned by 'well thought-out reproductions'.[165] However – and at this point we reach the associations that von Rüden also sees – the three authors also bring in at least one formulation an (apparent or actual) 'primacy' of the mental[166] over the following physical realisation:

> 'L'analyse de cette démarche, aidée de reproductions raisonnées, a néanmoins permis d'aborder le registre délicat du *schéma conceptuel préexistant à tout projet dans l'esprit du tailleur* et, parallèlement, l'espace des possibles et des choix dont il disposait selon ses connaissances, ses habitudes culturelles, ses ressources et les limites d'un matériau contraignant.'[167]

The italicised passage is close to a parallelism of one of the two most precise definitions (explicitly naming the materialising aspect implicitly present in the former passage) of the background to von Rüden's approach to her wish 'to bridge the Cartesian way of analysing technique in anthropological and archaeological research:[168]

> 'Archaeological research often tends to consider ancient techniques as a *mechanical process, which simply materializes mental representations*. This Cartesian perspective draws the attention away from the human sensual involvement and reduces techniques and in general crafts to externalized knowledge or bare information of mechanical functioning and hence clearly distorts our ideas of ancient crafts.'[169]

Let us now return to our theoretical model of the chaîne(s) opératoire(s) as presented at the beginning of this chapter, and think about the difference between the first and the final state of the chain. Von Rüden criticises that this difference 'would be measured' exclusively in the material (or better: materialising)[170] dimension, for example in the previously quoted passage by Pelegrin,

[161] See, for example, Lemonnier 1976: 103: 'En limitant le domaine technique aux phénomènes relatifs à l'action de l'homme sur la matière [...].'
[162] Lemonnier 1976: 104: 'Il est certain que notre analyse ne peut pas appréhender de manière exhaustive des processus mentaux largement inexprimables tels que ceux qui permettent à un acteur de suivre la piste d'un animal [...].'
[163] Sellet 1993: 106.
[164] Sellet 1993: 107.
[165] Pelegrin *et al.* 1988: 58.
[166] Cf. a formulation by von Rüden 2017: 73 (emphasis by the author): 'Therefore, despite his careful analysis a certain Cartesian separation of his layers is still maintained as well as the idea of *a primacy of higher mental processes.*'
[167] Pelegrin *et al.* 1988: 58 (emphasis by the author).
[168] von Rüden 2017: 74.
[169] von Rüden 2017: 71 (emphasis by the author).
[170] For terminology and a complete research approach based on it, see Lucas 2012, discussed in Bosche 2023.

Karlin and Bodu. Sensory experiences, on the other hand, would fade into the background.

I am not in a position to make statements about the majority of archaeological and anthropological research approaches, as I do not want to claim to have complete knowledge of published work in these two research areas or at least to have carried out a systematic examination of this aspect on a random basis. I can only state that, based on my personal, subjective impression, I would not be surprised if this were the case, and that the reception of the passages by Leroi-Gourhan and Lemonnier may be understood as an indication in this direction.[171] However – and this is where my view partly differs from von Rüden's words – I do not see that the topic addressed by von Rüden is completely absent from the theoretical work on the concept chaîne opératoire.[172] I merely see that it is shifted out of focus – in line with an observation by von Rüden in the introductory abstract ('This Cartesian perspective draws the attention away from the human sensual involvement.').[173] In order not to break with my own argument, I am not able to judge at this point whether the reason for this 'focusing' is any kind of 'Cartesian perspective'. However, there might be an alternative justification: the inclusion of individual/personal sensory experiences in scientific investigations in the sense of a science oriented towards any kind of 'discourse of validity' can present us with even greater problems than the beyond infinite number of possible case differentiations in the inclusion of as many details as possible in the reconstruction of a chaîne opératoire. This holds even in the case of an (in my opinion impossible) ideal reproduction of all and every planning and production contexts, if the attempt is made to uncritically transfer one's own sensual experiences to other people (for example, the ancient producers of the Elgin Lyre), the inclusion of individual/personal sensory experiences in scientific investigations in the sense of a science oriented towards any kind of 'discourse of validity' can present us with even greater problems than the beyond infinite number of possible case differentiations in the inclusion of as many details as possible in the reconstruction of a chaîne opératoire.

So far, we have focused on the integration of artefact components and physical-material entities in our theoretical model of the chaîne opératoire – speaking of the Elgin Lyre, for example raw materials, tools, etc. possibly used for its manufacture. Thus, we have, at least at the beginning, taken up the perspective of focusing on the (physical) material remains, as advocated by Lemonnier, for example. When we spoke of human interactions with these 'non-human actors', we described them verbally in a comparable form and attempted to reconstruct them in the form of hypothetical representations. We did not undertake any manual activities of our own. I completely agree with von Rüden that the sensory experience and understanding of production processes provides us with essential knowledge that allows us to view research interests like production processes of the past from different perspectives. Even from my personal experience alone, I also hold the view that certain things can only be learnt by incorporating one's own observations and experiences in such a way that a satisfactory result is achieved. A musician must adjust to his instrument and harmonise the feedback from his body with the instrument in the literal sense in order to improve his sound quality – and I can report from my own experience that, at least for me subjectively, an examination of my own body perception is very conducive to this process.[174] Even though my own manual skills are rather limited, especially in specialised areas such as the processing of natural materials, it is very natural for me to assume something similar in an area that depends on the interaction between material, tool and body. However, this topic raises a central problem in the scientific discourse, which von Rüden deals with in detail in her essay and explicitly expresses in her concluding remarks:

> 'This might be related to the fact that these aspects of craft are difficult to approach with the help of so-called rational and objective methods of archaeological research, the way we are categorizing our archaeological evidences, and our still very Cartesian way of thinking, no matter if we contrast mental processes or representations with bodily experiences and the material world. Furthermore, *to articulate all these largely nonverbal, embodied experiences in a theoretical, and therefore necessarily a verbal, discursive paper seems to be a paradox in itself (von Rüden, 2015). One can even postulate that a theoretical, and therefore necessarily a verbal, discursive paper about embodied knowledge and skill is not an appropriate way of approaching these aspects.*'[175]

[171] For some critical considerations on the inclusion of mental concepts in chaîne opératoire research up to 2009, partly with similar implications as in my following remarks, see Bar-Yosef and Van Peer 2009: 113-115. For the consideration of cognitive factors in chaîne opératoire research, see also Soressi and Geneste 2011: 344-345.

[172] See also some formulations in Lemonnier 1976: 118.

[173] von Rüden 2017: 71.

[174] At this point, in the course of self-reflection and in anticipation of a quite possible and in part certainly justified objection, I would like to allow myself a brief self-positioning: I am writing these explanations not only as a theoretical researcher, but also from the perspective of an (ambitious) amateur musician with many years of (classical) training on various (modern) instruments, including several years of lessons in stringed instruments (classical concert guitar and violin) in addition to my current focus on woodwind instruments. I therefore have some practical knowledge of stringed instruments – even if not on an antique *chelys* – and of the craftsmanship of musical instruments, as I maintain and repair most of my instruments myself as long as my knowledge and skills allow me to do so without the help of an expert, even though I am not a trained instrument maker.

[175] von Rüden 2017: 77 (emphasis by the author).

I fully agree with von Rüden on this point as well: the 'necessity of representation' is a massive problem for sensory comprehension. However, it is also inevitable if communication (scientific or not) is to be possible over greater distances. Von Rüden and I share the view, that communication is essential for scientific discourse. From this perspective, I see no fundamental contradiction between the representation-based forms of representation of cognitive aspects (partly supplemented by experimental procedures) within the framework of the chaîne opératoire in the older works (even if these can sometimes fade into the background) and von Rüden's concern, even if I can only agree that the emphasis on the great importance of sensory experiences is essential with regard to some of the works I am familiar with.

Despite – or perhaps just because of – the essential importance of this point, I cannot avoid advising a high degree of caution and delicacy in its realisation for ethical reasons. If we want to integrate mental aspects or even sensory experiences in research questions like chaîne(s) opératoire(s), we have to find a way of grasping mental aspects and/or sensory experiences of other people, perhaps having lived centuries and miles apart. With this, we encounter a basic methodological problem that we have dealt with extensively in the previous section. However, now, we do not limit it to physical-material aspect, but extend it to sensory and mental phenomena. Such an extension is highly problematic, since the applicability of the method depends on the adaption of a fundamental premiss/precondition considered axiomatic as concerns certain aspects of the physical-material world, but at least partially refuted for mental and/or sensory phenomena. Let us take a closer look at this area of tension starting with the physical-material. If we deal with a projection and/or extrapolation of aspects (in the broader sense) or even conclusions across topographical and chronological (or, by extension, social and/or cultural) distances – be it by incorporating insights from modern crafts or by theoretical considerations – we presuppose a constancy of these projected aspects at least across the distances spanned. If these aspects are physical, chemical and/or other 'scientific' characteristics of entities, our laws of nature provide us with a millennia-long tradition and very plausible reasons for accepting this assumption. We assume – in my opinion in all plausibility – that wood of a certain type behaves in the same physical, chemical and biological way today, in Sparta in the third century BC and in Athens in the fifth century BC, and that on this basis we can at least calculate back (or transfer) individual aspects of our chaîne opératoire. Thus, in all areas that are based exclusively on natural laws and the aspects they can describe, we can perform 'back-calculations' from documented observations and conclusions – for example, from many parts of the construction processes of the components, the nature of the raw materials, tools and components, and their reactions to each other under certain conditions, like the effect of a hammer blow on a piece of wood – provided that the elements and movements involved are exactly identical. If we include a tolerance range and/or other probability parameters in our considerations, we can significantly extend the applicability of these methods, even if this comes at the price of obtaining a spectrum of possible results rather than a certain result. If we stay within the limits of scientific laws, this spectrum can even be classified by probability values. This allows the individual options to be weighed against each other and, on this basis, their weighing within the spectrum.

The line of reasoning becomes much more problematic when we wish to include factors that lie beyond the boundaries of the natural sciences (in the classical sense) and/or whose scientific prerequisites cannot be measured in the preserved remains.[176] If we look at the fundamental approach to artefacts in archaeological theory, we can grasp a certain consensus towards the assumption that an artefact is embedded in a superordinate (according to 'traditional' language, cultural and/or social) 'fabric' or 'web' (e.g. network, entanglement, network, entanglement) (**Figure 9**)[177] that is structured quite differently depending on the approach, and which, in addition to non-human physical-material entities, might also include humans and immaterial entities.[178] In research projects with a similar orientation, the extension of the overall artefact and its components (the artefacts of the individual chain links) cannot be limited to aspects that can be reconstructed by applying the laws of natural science. The scientific aspects relevant to those studies among others also include the sensory experiences of the individual human being. Even if we know from scientific disciplines such as biology, medicine and the cognitive sciences (and ultimately also from our everyday experience) that large areas of the basic structure of the human anatomy represent a connecting factor for large parts of living (and deceased) people,[179] there are also

[176] Although Schiffer's approach differs from mine in many respects, there is a hint in his explanations that at least points in a similar direction. The aim of his approach is not to formulate universally applicable generalisations to explain human behaviour, but to codify our assumptions and our provisional knowledge about behaviour in specific circumstances. LaMotta 2012: 65-66; Schiffer 2010: 11-12.

[177] The differentiations of **Figure 8** can be visualised accordingly.

[178] The bibliography on this topic is extremely extensive and cannot be compiled in full at this point. For example, see Fowler 2013 (assemblage); Hodder 2012; Hodder 2014 (entanglement); Lucas 2012 (assemblage and interdisciplinary, with theoretical considerations). For a discussion see Bosche 2023: 175-223, with bibliography. The refusal to reduce the behaviour of non-human physical-material entities to their scientifically ascertainable characteristics has been an integral part of archaeological research from the very beginning, and was never abandoned even during the methodological controversy in the second half of the twentieth century. The social and cultural dimension also plays a central role in Lemonnier's explanations. See, for example, Lemonnier 1976: 57-58, 105, 111-112, 118, 137-138.

[179] This formulation is chosen very carefully for ethical reasons – I hope carefully enough.

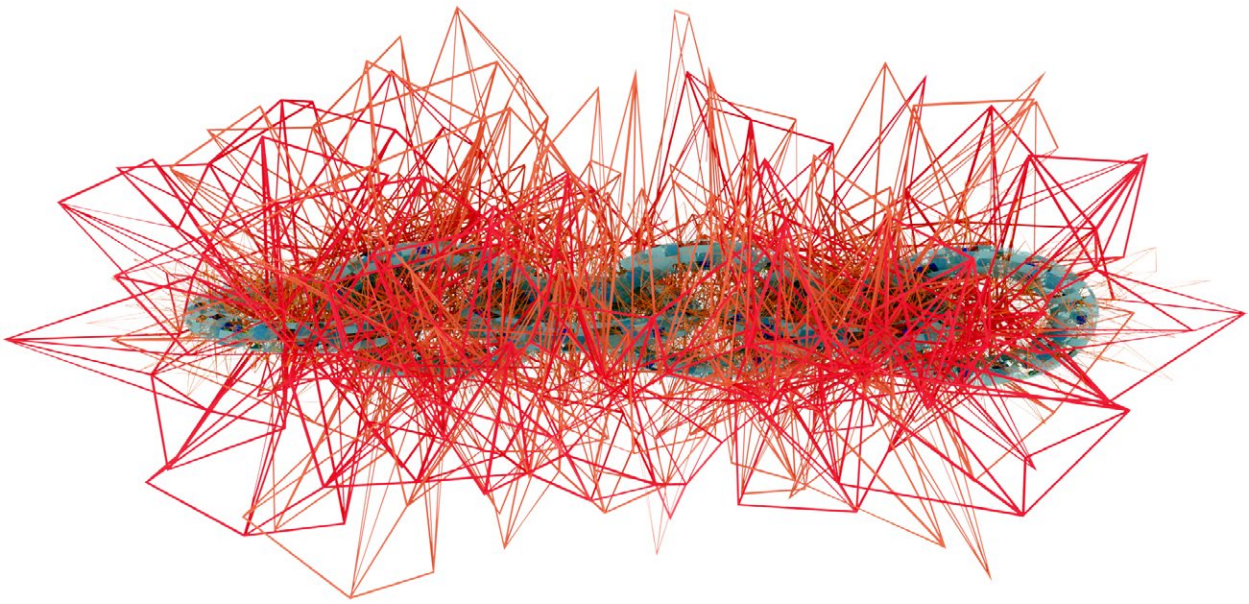


Figure 9: Visualisation of a chaîne opératoire as a simple 'chain' with extensional webs around the single chain-links (orange), several chain-links tying them together (dark orange) and the whole chain (red) (illustrations by the author).

many smaller or even larger deviations in all areas. The sharpness of vision and hearing varies from person to person (a central factor for the chaîne opératoire of our Elgin Lyre, as we have seen), the tertiary sulci (troughs of the folds in the human brain anatomy developing comparatively late during fetal development) of our brains differ, and so forth.[180] Certainly, the similarities between us offer us the opportunity not only to communicate with each other, but also to transfer certain aspects (empathically and/or rationally) between us. Nevertheless, we should be careful about which aspects we apply these generalisations to (because that is what they are essentially), as for to run the risk of making statements about one type of person and (explicitly or implicitly) assigning our own perceptions and sensory experiences a primacy over the individual perceptions and experiences of another, equally individual people. The desire to learn something about the sensory experiences and perceptions of other human individuals (for example the producers of the Elgin Lyre) from our own sensory experiences and perceptions is, in my opinion, associated with a very high level of ethical responsibility and respect for the individual human being. After all, everything we learn today through our sensory experiences is first and foremost our perception[181] – and we must look with great respect and even greater caution for the possibilities and limits, but also the risks and dangers, when we attempt to transfer them to people of antiquity. In other words, we should always ask ourselves: do we learn something about (the production of) an artefact, or do we learn something about the (or a) person who produces a (certain) artefact – and in the second case: who is this person?

Conclusion

The concept of chaîne opératoire was formulated and further developed as a methodological tool[182] and, at a time when debates on scientific theory and epistemology revolved strongly around method-critical aspects, it fulfilled important needs and offered the possibility of capturing, documenting and presenting complex work processes through organising principles. Despite the sometimes strong further developments in the theoretical field, these basic needs are still present in scientific questions, and so it is hardly surprising that the chaîne opératoire as a term continues to be an important model in craft and technology research in the broader sense. At the beginning of the paper, we have started our thoughts with one (it not the) core ideas of the concept: the transformation of raw materials to a product, an artefact, with a certain form and function. This 'transformation', obviously,

[180] For the (neuro-)anatomical foundations of human cognition, see for example Trepel 2015.

[181] A comparable objection can be found in Bar-Yosef and Van Peer 2009: 113-114. Cf. Grüner 2019: 188, with a reference to the explanations of Immanuel Kant. In my opinion, it is already expressed Lemonnier 1976: 111 (with an additional reference to practical realisability): 'Mais les processus techniques se présentent comme un continuum d'opérations', de séquences gestuelles et de gestes, eux-mêmes décomposables et analysables en termes anatomiques ou physiologiques. La question se pose alors de savoir où porter notre regard. Nous voudrions ici insister sur le fait qu'il n'y a pas a priori de niveau d'analyse plus pertinent qu'un autre, déterminé par un quelconque 'bon sens'. Il faut par contre reconnaître que notre champ d'analyse est limité par des facteur matériels. Nous ne savons pas étudier le détail d'un geste ('prendre une pomme'), et nous n'en avons pas les moyens en hommes, en temps et en matériel.'

[182] Cf. also Audouze and Karlin 2017: 3.

includes the 'help' from other materials, instruments, tools, persons etc. Thus, the extent of a single stage of the chaîne opératoire cannot be limited to the raw materials and components, but has to include those elements as well (or at least relations to them). The extension of a single chain-link reaches beyond the element that defines it at the beginning. Thinking of everyday practicability and observations on preserved artefacts like the Elgin Lyre both the extension and the 'core' of the chain-links might (and often do) entail interconnections, since, for example, one tool is used in the manufacture of several components or the latter ones had to be planned together to ensure their later combination. Depending on the perspective taken on the descriptive model, the boundaries between the chain-links and their extensions are crossed, blurred or even transcended (in other words: not visible from the actual perspective). In addition, including self-reflection and epistemological concerns in our discussion we have to label many of the elements we wish to include in our content-filled application of the theoretical background model of a chaîne opératoire hypothetical/only potentially relevant. Formulation of case differentiations might help us describe a spectrum of possible models for a certain case, yet the uncertainties remain. The formulation of a single chaîne opératoire is only possible on an abstract background level without any 'real-life' content apart from the theoretical concepts used to describe the abstract elements. In this paper, we have explored some facets of such a model and visualised them in several graphics. Yet, as usual in archaeological science, we have developed most of our thoughts with reference to a historical artefact and/or topics necessary for its discussion. And it is this content-charging that leads us to a further and further increase of the number of elements and relations in our (now content-charged) model of a (still theoretical) chaîne opératoire.

This way parallels the development of the initial notion of the concept chaîne opératoire in archaeological and anthropological research. The parameters of the approach(es) to the investigation of past technologies and craft activities have developed in many respects in the recent decades and have also changed in some cases. The number of factors to be taken into account during a production step has increased enormously. The focus is not only on the interaction between the (more or less stereotypical) tools used, raw materials, thought and trading processes, forms of organisation and possible cooperation; the physical, natural and social and/or cultural environment in which a production process takes place has also become an integral part of the discussions. Due to the complex interdependencies observed and/or assumed there between a large number of (potential and actual) 'actors' in the sense of entities that have or can have an influence on other entities in their environment,[183] a decomposition of a chaîne opératoire into several, clearly distinguishable and only one-dimensionally connected stages ('chain-links') can only be maintained if the analysed work process is only described from a single perspective. If – for example by choosing alternative definition points of the individual chain links or by including or reconstructing different extensions of these definition points – several perspectives are integrated into a discussion, not only the one-dimensional development, but also the linear sequence is placed in relation to the perspective adopted. Thus, even the last visualisation of the theoretical model of a chaîne opératoire (**Figure 8**) only gives one possible appearance of the theoretical model, changing its appearance with every turn of perspective.

However, if the spectrum of aspects described by (or integrated into) a chaîne opératoire is extended to such an extent that potentially all conceivable factors that can be perceived during a contemporary production process are to be transferred to historical production processes, one exposes oneself to what I consider to be a great risk of generalising human perception and cognition. My intention in making this point is not to argue in favour of abandoning this approach – quite the opposite: in my opinion, we can learn a great deal from today's experiences, which is of great importance for the investigation of a historical chaîne opératoire. However, we should always bear in mind that these experiences only provide us with insights into what can be relevant during the production process – and not how exactly it was during the production process. At least as far as the perception of the historical actors is concerned, I believe that we always remain within a hypothetical framework if we recognise people as individuals. Even with an ideal information situation about all actors and their nature in the extension of a completely observable chaîne opératoire, our maximum result thus always remains, in my opinion, a chaîne opératoire of an 'artefact like...', and not a chaîne opératoire of the concrete historical artefact that is before our eyes and of which the historical production process we are trying to investigate. If we integrate this theoretical discrepancy into the further handling of our statements, we have created a valuable and promising starting point for further work, despite these theoretical limitations.

Bibliography

For the works cited in this article, please refer to the bibliography compiled at the end of the volume.

[183] For some basic considerations on this problem, see Bosche 2023: 175-223.

Academic apparatus

Abbreviations

Epigraphical Corpora and Editions

CIL = *Corpus Inscriptionum Latinarum*. Berlin: Berlin-Brandenburgische Akademie der Wissenschaften, viewed 19 February 2024, <https://cil.bbaw.de/hauptnavigation/das-cil/baende>.

FHG = *Fragmenta Historicorum Graecorum*, viewed 19 February 2024, <https://www.dfhg-project.org/>.

I.Labraunda = Crampa, J. 1969–1972. *Labraunda. Swedish Excavations and Researches 3. Vol. 1 and 2: The Greek Inscriptions*. Lund: Gleerup and Stockholm: Swedish Research Institute in Istanbul.

I.Mus. Burdur = Horsley, G.H.R. 2007. *The Greek and Latin Inscriptions in the Burdur Archaeological Museum.* London: The British Institute of Archaeology at Ankara.

ID = *Inscriptions de Délos*. 7 vols, 1926-1972. Plassart, A. (ed.) 1950 *Vol. 6 [1]: nos 1-88*; Coupry, J. (ed.) 1972 *Vol. 7 [2]: nos 89-10433*; Durrbach, F. (ed.) 1926 *Vol. 1 [3], nos 290-371*; Durrbach, F. (ed.) 1929 *Vol. 2 [4], nos 372-509*; Durrbach, F. and P. Roussel (eds) 1935 *Vol. 3 [5], nos 1400-1496*; Roussel, P. and M. Launey (eds) 1937 *Vol. 4 [6], nos 1497-2219*; Roussel, P. and M. Launey (eds) 1937 *Vol. 5 [7], nos 2220-2879*. Paris: Académie des Inscriptions et Belles-Lettres.

IG = *Inscriptiones Graecae*. Berlin: Berlin-Brandenburgische Akademie der Wissenschaften, viewed 19 February 2024, <http://telota.bbaw.de/ig/>.

Lindos II = Blinkenberg, C. 1941. *Lindos. Fouilles et Recherches, 1902-1914. Vol. II: Inscriptions 1-2*. Berlin: De Gruyter.

OGIS = W. Dittenberger (ed.) 1903-1905. *Orientis Graeci Inscriptiones Selectae.* Leipzig: Hirzel.

Paton, W.R. (ed.) 1915. *The Greek Anthology* (with an English translation). London: William Heinemann.

P. = *Papyrus*, viewed 19 February 2024, <https://papyri.info/>.

SEG = *Supplementum Epigraphicum Graecum*, viewed 19 February 2024, <https://scholarlyeditions.brill.com/sego/>.

SIG = W. Dittenberger (ed.) 1915-1924. *Sylloge Inscriptionum Graecarum.* Leipzig: Hirzel.

TL = Kalinka, E. (ed.) 1901. *Tituli Lyciae, lingua lycia conscripti* (Tituli Asiae Minoris I). Vienna: Österreichische Akademie der Wissenschaften.

TM = *Trismegistos*, viewed 24 February 2024, <https://www.trismegistos.org/tm/detail.php?quick=5876>.

Lexica

DNO = Kansteiner, S., K. Hallof, L. Lehmann, B. Seidensticker and K. Stemmer (eds) 2014. *Der neue Overbeck. Die antiken Schriftquellen zu den bildenden Kunsten der Griechen*, vols I-V, Berlin: De Gruyter, online edition, viewed 26 October 2023: <doi:https://www.degruyter.com/database/overbeck/html>.

DNP = Cancik, H., H. Schneider and M. Landfester (eds) *Der Neue Pauly*, online edition, viewed 26 October 2023, <https://referenceworks.brillonline.com/browse/der-neue-pauly>.

LGPN = *Lexicon of Greek Personal Names Database*, viewed 26 October 2023, <https://www.lgpn.ox.ac.uk/>.

LIMC = *Lexicon Iconographicum Mythologiae Classicae*, online edition, viewed 26 October 2023, <https://weblimc.org/>.

RE = *Paulys Realencyclopädie der classischen Altertumswissenschaft,* online edition, viewed 26 October 2023, <http://de.wikisource.org/wiki/RE>.

Großes Lexikon der Bestattungs- und Friedhofskultur = Zentralinstitut für Sepulkralkultur Kassel (ed.). Großes Lexikon der Bestattungs- und Friedhofskultur. Wörterbuch zur Sepulkralkultur. 2002. *Volume 1: Volkskundlich-kulturgeschichtlicher Teil: Von Abdankung bis Zweitbestattung*, 2005. *Volume 2: Archäologisch-kunstgeschichtlicher Teil: Von Abfallgrube bis Zwölftafelgesetz*, 2010. *Volume 3: Praktisch-aktueller Teil: Von Abfallbeseitigung bis Zwei-Felder-Wirtschaft*, 2020. *Volume 4: Medienkultureller Teil: Von Absurdes Theater bis Zombie*, 2016. *Biographischer Teil: von Abraham a Sancta Clara bis Johannes Zwingli.* Frankfurt am Main: Fachhochschulverlag. Der Verlag für angewandte Wissenschaft.

Varia

A.D.R.A. = Association pour la Diffusion de la Recherche sur l'Antiquité

APC = Association des Publications Chauvinoises

ARC = Archaeological Review from Cambridge

ASCSA = American School of Classical Studies at Athens

ASMOSIA = Association for the Study of Marble and Other Stones in Antiquity

BAR = British Archaeological Reports

BIAMA = Bibliothèque d'Archéologie Méditerranéenne et Africaine

CISAM = Centro italiano di Studi sull'alto medioevo di Spoleto

CNRS = Centre national de la recherche scientifique

CSIC = Consejo Superior de Investigaciones Científicas

CTHS = Comité des travaux historiques et scientifiques

CUEM = Cooperativa Universitaria Editrice Milanese S.C.R.L.

DAPCAD = Direction d'Archéologie Préventive de la Communauté d'Agglomération du Douaisis

ERIAC = European Roma Institute for Arts and Culture

IFPO = Institut français du Proche-Orient

Inrap = Institut national de recherches archéologiques préventives
MOM = Maison de l'Orient et de la Méditerranée
PUL = Presses universitaires de Louvain
PULIM = Presses Universitaires de Limoges
PUN-Édulor = Presses universitaires de Nancy-Éditions universitaires de Lorraine
PUR = Presses universitaires de Rennes
SFECAG = Société Française d'Étude de la Céramique Antique en Gaule
UPMC = Université Pierre et Marie Curie (Paris VI)

Archival Data

Hausbuch der Mendelschen Zwölfbrüderstiftung, Band 1. Nürnberg 1426–1549. Stadtbibliothek Nürnberg, Amb. 317, Mendel-1, fol. 36v, viewed 27 October 2023, <https://www.nuernberger-hausbuecher.de/75-Amb-2-317-36-v/data>.

Notebook 1948 (Labraunda Notebook 1). S. Brunnsåker. Uppsala University Library, alvin-record:294187, viewed 19 August 2022, <https://www.alvin-portal.org/alvin/view.jsf?dswid=-1531&searchType=EXTENDED&query=labraunda+notebook+1948&aq=%5B%5B%7B%22A_FQ%22%3A%22labraunda+notebook+1948%22%7D%5D%5D&aqe=%5B%5D&af=%5B%5D&pid=alvin-record%3A294187&c=4#alvin-record%3A294187>.

Notebook Oikoi I, 1950–1951 (Labraunda Notebook 29). I. Dahlén and L. Käll. Uppsala University Library, alvin-record:294166, viewed 19 August 2022, <https://www.alvin-portal.org/alvin/view.jsf?dswid=5632&aq=%5B%5B%7B%22A_FQ%22%3A%22labraunda+oikoi%22%7D%5D%5D&c=4&aqe=%5B%5D&af=%5B%5D&searchType=EXTENDED&pid=alvin-record%3A294166&dspwid=5632>.

Notebook Oikoi II, 1951–1953 (Labraunda Notebook 40). I. Dahlén. Uppsala University Library, alvin-record:294147, viewed 19 August 2022, <https://www.alvin-portal.org/alvin/view.jsf?dswid=-1531&searchType=EXTENDED&query=labraunda+notebook+oikoi&aq=%5B%5B%7B%22A_FQ%22%3A%22labraunda+notebook+oikoi%22%7D%5D%5D&aqe=%5B%5D&af=%5B%5D&pid=alvin-record%3A294147&c=3#alvin-record%3A294147>.

Bibliography

Abbe, M. 2008. Polychromy and gilding on marble statuary at Aphrodisias, in R.R.R. Smith and J. Lenaghan (eds) *Roman Portraits from Aphrodisias*: 136–151. Istanbul: Yapı Kredi Cultural Activities, Arts and Publishing.

Abbe, M. 2015. Polychromy, in E.A. Friedland, M.G. Sobocinski and E.K. Gazda (eds) *The Oxford Handbook of Roman Sculpture*: 173–188. Oxford: Oxford University Press.

Abbe, M. 2020. Politura and polychromy on ancient marble sculpture, in K. Kollandsrud and B. Kiilerich (eds) *Classical Art and Archaeology* 5. *Special Issue Perceiving Matter. Visual, Material and Sensual Communication from Antiquity to the Middle Ages and Beyond*: 1–21.

Abramitis, D.H. and M.B. Abbe 2019. A group of painted funerary monuments from Hellenistic Alexandria in the Metropolitan Museum of Art, in B. Bourgeois, V. Jeammet and F. Prost (eds) *Technè* 48. *Special Issue Les Couleurs de l'Antique. Actes de la 8e table ronde sur la polychromie de la sculpture et de l'architecture antique*: 60–71.

Adam, J.P. 1984. *La Construction Romaine, Matériaux et Techniques*. Paris: A. et J. Picard.

Adamesteanu, D. 1973a. Le suddivisioni di terra nel Metapontino, in M.I. Finley (ed.) *Problèmes de la terre en Grèce ancienne*: 49–61. Paris-La Haye: Mouton & Co.

Adamesteanu, D. 1973b. L'attività archeologica in Basilicata, in P. Romanelli (ed.) *Metaponto. Atti del tredicesimo convegno di studi sulla Magna Grecia (Taranto, 14-19 ottobre 1973)*: 441–456. Naples: Arte tipografica.

Adiego, I. 2015. Standardization and variation in the Lycian alphabet, in E. Dupraz and W. Sowa (eds) *Genres Épigraphiques et Langues d'Attestation Fragmentaire dans l'Espace Méditerranéen* (Cahiers de l'ERIAC 9): 13–29. Rennes: PUR.

Adiego, I. 2018. Local adaptations of the alphabet among the non-Greek peoples of Anatolia, in S. Ferrara and M. Valerio (eds) *Paths into Script Formation in the Ancient Mediterranean* (Studi Micenei ed Egeo-Anatolici – Nuova Serie, Supplemento 1): 145–162. Rome: Edizioni Quasar.

Agelarakis, A.P. 2002. Investigations of physical anthropology and palaeopathology at the ancient necropolis of Thasos. Appendix of M. Sgourou, Excavating houses and graves: exploring aspects of everyday life and afterlife in ancient Thasos, in M. Stamatopoulou and M. Yeroulanou (eds) *Excavating Classical Culture* (BAR International Series 1031. Studies in Classical Archaeology I): 12–19. Oxford: Archaeopress.

Agelarakis, A.P. 2004. The Clazomenian colonization endeavor at Abdera in retrospect: Evidence from the anthropological record, in A. Moustaka, E. Skarlatidou, M.-C. Tzannes and Y. Ersoy (eds) *Klazomenai, Teos and Abdera: Metropoleis and Colony. Proceedings of the International Symposium held at the Archaeological Museum of Abdera, 20-21 October 2001:* 327–349. Thessaloniki: University Studio Press.

Agresti, A. and M. Zannoni 2014. Querciola 3: un nuovo sito etrusco nella piana di Sesto Fiorentino, in G. Poggesi and L. Sarti (eds) *Passaggio a Nord-Ovest: Interventi di archeologia preventiva nell'area fiorentina (Mezzana-Perfetti Ricasoli)* (Millenni. Studi di archeologia preistorica 10): 201–232. Siena: ARA Edizioni.

Agresti, A., P. Giroldini and P. Pallecchi 2022. I manufatti ceramici: tecniche di realizzazione, in P. Giroldini (ed.) *Plasmati dal Fuoco: Storie di ceramiche nella Figline etrusca*: 44–48. Figline Valdarno: Comune di Figline e Incisa Valdarno.

Agus, M., S. Cara, L. Lazzarini and A.M. Corda 2007. I marmi colorati di Uthina, in A.M. Corda, G. Sotgiu and H. Ben Hassen (eds) *Scavi archeologici ad Uthina (2001-2007): Rapporto preliminare dell'attività di ricerca dell'Institut national du patrimoine di Tunisi e dell'Università di Cagliari, Italia*: 375–394. Cagliari-Tunis: Askòs.

Akrigg, B. 2019. *Population and Economy in Classical Athens.* Cambridge: Cambridge University Press.

Alchermes, J. 1994. Spolia in Roman Cities of the Late Empire: Legislative rationales and architectural reuse. *Dumbarton Oaks Papers* 48: 167–178.

Alexandrescu, P. 1978. *Histria IV: La Céramique d'Époque Archaïque et Classique (VIIe – IVe s.)* Bucharest: Ed. Academiei române.

Alexandri, O. 1975. Οδός Κυκλώπων 23. *Αρχαιολογικόν Δελτίον* 30.Β΄1: 23

Alexandri, O. 1976. Οδός Κυκλώπων 27. *Αρχαιολογικόν Δελτίον* 31.Β΄1: 35.

Alexandridou, A. 2016. Funerary variability in late eighth-century B.C.E. Attica (Late Geometric II). *American Journal of Archaeology* 120.3, viewed 23 January 2024, <https://doi.org/10.3764/aja.120.3.0333>.

Alexopoulou, G. 2021. Συμβολή στην Αρχαιολογία και Τοπογραφία της Αζανίας (Βόρειας Αρκαδίας) Επαρχία Καλαβρύτων. Unpublished PhD dissertation, National and Kapodistrian University of Athens, viewed 23 January 2024, < http://hdl.handle.net/10442/hedi/27848>.

Alfonso, G., P. Arnaud and F. Baucheron (eds) 2013. *Lezoux gallo-romain cinq années d'archéologie préventive, 2008 –*

2012. Clermont Ferrand: Conseil général du Puy-de-Dôme.

Allgaier, B., K. Bolle, N. Jaspert, K. Knauber, L. Lieb, E. Roels, R. Sauer, N. Schneidereit and K. Wallenwein 2019. Gedächtnis – Materialität – Schrift: Ein erinnerungskulturelles Modell zur Analyse schrifttragender Artefakte. *Saeculum* 69.II: 181–244.

Alston, R. 2002. *The City in Roman and Byzantine Egypt*. London and New York: Routledge.

Altripp, I. 2010. *Athenastatuen der Spätklassik und des Hellenismus*. Köln: Böhlau Verlag.

Amandry, P. and E. Hansen 2010. *Fouilles de Delphes II, Topographie et Architecture 14: Le Temple d'Apollon du IVe Siècle*. Paris: Éditions de Boccard.

Ammerman, R. 2002. *The Sanctuary of Santa Venera at Paestum II: The Votive Terracottas*. Ann Arbor: University of Michigan Press.

Ammirati, A. 1990. La prima età del Ferro, in D. Vitali (ed.) *Monterenzio e la valle dell'Idice. Archeologia e storia di un territorio*: 75–82. Bologna: Bologna University Press.

Anderson, W.D. 1995. *Music and Musicians in Ancient Greece*. Ithaca, London: Cornell University Press.

Ansieau, C., C. Frébutte and C. Urbain 1995. Enghien/Petit-Enghien : «Grand-Champ», four, fosses et fossés gallo-romains. *Chronique de l'Archéologie wallonne* 3: 41.

Arafat, K. 1996. *Pausanias' Greece: Ancient Artists and Roman Rulers*. Cambridge: Cambridge University Press.

Aravantinos, V. 1994. Ανασκαφικές εργασίες (Τάχι Θηβών – αρχ. Ποτνιαί), εργατικές κατοικίες οικισμού Θήβα ΙΙ. *Αρχαιολογικόν Δελτίον* 49.Β'1: 269–271.

Arfaras, M. 2002. *Νίσυρος: Η Πορφυρίς των Αρχαίων*. Athens: Kameiros.

Argiropoulos, V. 2017. Νέα δεδομένα για την οργάνωση του χώρου στη Δυτική Αχαΐα στους Κλασικούς και Ελληνιστικούς χρόνους, in V. Argiropoulos, H. Simoni and K. Papagiannopoulos (eds) *Αρχαιολογικοί Χώροι και Μνημεία του Δήμου Δυτικής Αχαΐας. Workshop Proceedings 19.9.2016. Ephorate of Antiquities of Achaea and Municipality of Western Achaea*: 52–60. Δήμος Δυτικής Αχαΐας.

Argiropoulos, V. 2021. Social changes from the fifth to the third century BC in the light of new archaeological discoveries in the countryside of Dymaia Chora. *Pelargòs* 2: 225–249.

Arias, P.E. 1976. L'arte locrese nelle sue manifestazioni artigianali: Terrecotte, bronzi, vasi, arti minori, in G. Pugliese Carratelli (ed.) *Locri Epizefirii. Atti del sedicesimo convegno di studi sulla Magna Grecia (Taranto, 3-8 ottobre 1976)*: 479–579. Naples: Arte tipografica.

Arias Maldonado, M. 2015. *Environment and Society: Socionatural relations in the Anthropocene*. Heidelberg/New York: Springer.

Aristodemou, G. 2020-21. Μια ποτάμια μορφή από τη Θάσο – και μια συζήτηση για τις ποτάμιες θεότητες της Μακεδονίας και της Θράκης. *Θασιακά* 21: 44–69.

Aristodemou, G. and Th. Tassios (eds) 2018. *Great Waterworks in Roman Greece: Aqueducts and Monumental Fountains. Function in Context* (Archaeopress Roman Archaeology 35). Oxford: Archaeopress.

Arnold, D.E. 1985. *Ceramic Theory and Cultural Process* (New Studies in Archaeology). Cambridge: Cambridge University Press.

Antweiler, Ch. 1998. Local knowledge and local knowing: An anthropological analysis of contested 'cultural products' in the context of development. *Anthropos* 9: 468–494.

Arribàs, A. 1987. Los Molinos, in A. Arribàs, M.G. Trias, D. Cerda and J. De Hoz (eds) *El Barco de El Sec (Calvia, Mallorca): Estudio de los materiales, Ayuntamiento de Calvia (Mallorca)*: 563–588. Palma de Mallorca: Ajuntament de Calvia.

Attanasio, D. 2003. *Ancient White Marbles: Analysis and Identification by Paramagnetic Resonance Spectroscopy*. Rome: L'Erma di Bretschneider.

Attanasio, D., M. Bruno, A.B. Yavyz and H. Elci 2008. Aphrodisias and the newly discovered quarries at Göktepe, in R.R.R. Smith and J. Lenaghan (eds) *Roman Portraits from Aphrodisias*: 216–227. Istanbul: Yapı Kredi Cultural Activities, Arts and Publishing.

Attanasio, D., M. Bruno and W. Prochaska 2019. The marbles of Roman portraits: New data on the marble provenance of 261 imperial and private urban portraits dating from the mid 1st century B.C. to the early 6th century A.D. *Jahrbuch des Deutschen Archäologischen Instituts* 134: 167–277.

Audouze, F. and C. Karlin 2017. La chaîne opératoire a 70 Ans: Qu'en ont fait les préhistoriens français. *Journal of Lithic Studies* 4: 5–73.

Avagliano, G. 1992. Nuovi contributi alla conoscenza della chora meridionale di Poseidonia, in G. Greco and L. Vecchio (eds) *Archeologia e territorio: Ricognizioni, scavi e ricerche nel Cilento*: 139–151. Laureana Cilento: Edizioni dell'Alento.

Baatz, D. 1994. Die Handmühlen, in G. Hellenkemper Salies, H.-H. von Prittwitz und Gaffron and G. Bauchhenß (eds) *Das Wrack I: Der Schiffsfund von Mahdia*: 97–103. Köln: Rheinland-Verlag.

Babbi, A. 2008. *La piccola plastica fittile antropomorfa dell'Italia antica dal Bronzo Finale all'Orientalizzante* (Mediterranea. Quaderni Annuali dell'Istituto di Studi sulle Civiltà Italiche e del Mediterraneo Antico del Consiglio Nazionale delle Ricerche, Supplemento I). Pisa and Rome: Fabrizio Serra Editore.

Badiali, F. 2013. Il lago Bracciano di Montese: studio interdisciplinare di un'area sacra nell'Appennino modenese, in A.M. Stagno (ed.) *Montagne incise. Pietre incise: Archeologia delle Risorse nella Montagna Mediterranea / Craved Mountains. Engraved Stones: Environmental Resources Archaeology in the Mediterranean Mountains* (Archeologia Postmedievale. Società Ambiente Produzione 17): 323–332. Sesto Fiorentino: All'Insegna del Giglio.

Bagnasco Gianni, G. 2007. Aristonothos: Il vaso, in *strumenti, suono, musica in Etruria e in Grecia: letture tra archeologia e fonti letterarie* (Aristhonotos 1): V–XVI. Milan: CUEM.

Bak, V. and J.-H. Yvinec 2013. *Canal Seine-Nord Europe, fouille 38, Picardie, Somme, Béthencourt-sur-Somme : les traces d'un atelier de glutinarius à Béthencourt-sur-Somme.* Croix-Moligneau: Inrap NP.

Bakarezos, E., V. Vathis, S. Brezas, Y. Orphanos and N.A. Papadogiannis 2012. Acoustics of the chelys – An ancient Greek tortoise-shell lyre. *Applied Acoustics* 73.5: 478–483.

Bakirtzis, C. 1989. *Βυζαντινά Τσουκαλολάγηνα: Συμβολή στη μελέτη ονομασιών, σχημάτων και χρήσεων πυρίμαχων μαγειρικών σκευών, μεταφορικών και αποθηκευτικών δοχείων* (Δημοσιεύματα Αρχαιολογικού Δελτίου 39). Athens: Ταμείο Αρχαιολογικών Πόρων.

Balfet, H. 1991. Des chaînes opératoires, pour quoi faire?, in H. Balfet (ed.) *Observer l'Action Technique: Des Chaînes Opératoires, Pour Quoi Faire?* (Matières et Manières): 11–19. Paris: Éditions du CNRS.

Ballet, P., P. Cordier and N. Dieudonné-Glad (eds) 2003. *La Ville et ses Déchets dans le Monde Romain: Rebuts et Recyclages. Actes du colloque de Poitiers, 19-20 Septembre 2002.* Montagnac: Éditions Monique Mergoil.

Ballet, P., N. Dieudonné-Glad and C. Saliou (eds) 2008. *La Rue dans l'Antiquité : Définition, Aménagement, Devenir*. Rennes: PUR.

Bankel, H. 1984. Griechische Bleistifte. *Archäologischer Anzeiger* 1984: 409–411.

Banou, E. 2013. Οι ανασκαφές της Γ' ΕΠΚΑ κατά την τελευταία πενταετία, in S. Oikonomou and M. Doga-Toli (eds) *Αρχαιολογικές Συμβολές Β: Αττική, Α' και Γ' Εφορείες Προϊστορικών και Κλασικών Αρχαιοτήτων*: 281–303. Athens: Μουσείο Κυκλαδικής Τέχνης.

Banou, E. and L. Bournias 2014. *Κεραμεικός*. Athens: Κοινωφελές Ίδρυμα Ιωάννη Σ. Λάτση.

Barbet, A. 2008. *La Peinture Murale en Gaule Romain.* Paris: A. and J. Picard.

Barberis, V. 2004. *Rappresentazioni di Divinità e di Devoti dell'Area Sacra Urbana di Metaponto: La coroplastica dalla fine del VII all'inizio del V sec. a.C.* Florence: Olschki.

Bar-Yosef, O. and P. Van Peer 2009. The chaîne opératoire approach in Middle Paleolithic archaeology. *Current Anthropology* 50.1: 103–131.

Baldini Lippolis, I. 2007. Private space in Late Antique cities: Laws and building, in L. Lavan, L. Özgenel and A. Sarantis (eds) *Housing in Late Antiquity: From Palaces to Shops*: 197–237. Leiden: Brill.

Barker, S.J. 2010. Roman builders – pillagers or salvagers? The economics of destruction and reuse, in S. Camporeale, H. Dessales and A. Pizzo (eds) *Arqueología de la Construcción II: Los Procesos Constructivos en el Mundo Romano. Italia y provincias orientales. Congreso, Certosa di Pontignano, Siena, 13-15 de noviembre de 2008* (Anejos de Archivo Español de Arqueología 57): 127–142. Madrid-Mérida: CSIC, Instituto de Arqueología de Mérida.

Barker, S.J. 2018. The demolition, salvage, and recycling industry in Imperial Rome. *Aedificare* 2.4: 37–88.

Barker, S.J. 2020. Reuse of statuary and the recycling habit of Late Antiquity: An economic perspective, in C. Duckworth and A. Wilson (eds) *Recycling and Reuse in the Roman Economy*: 105–190. Oxford: Oxford University Press.

Barker, S.J. and B. Russell 2012. Labour figures for Roman stone-working: pitfalls and potential, in S. Camporeale, H. Dessales and A. Pizzo (eds) *Arqueología de la Construcción III: los Procesos Constructivos en el Mundo Romano. La economía de las obras. École Normale Supérieure, Paris, 10-11 de dieciembre de 2009* (Anejos de Archivo Español de Arqueología 64): 83–94. Madrid-Mérida: CSIC, Instituto de Arqueología de Mérida.

Barker, S.J. and B. Russell 2020. Historical sources, labour figures and ancient stone working costs, in M. Heinzelmann and C. Recko (eds) *Quantifying Ancient Building Economy: Panel 3.24. Archaeology and Economy in the Ancient World. Proceedings of the 19th International Congress of Classical Archaeology, Cologne/Bonn 2018* (Quantifying Ancient Building Economy 23): 1–3. Heidelberg: Propylaeum.

Barker, S.J. and S. Perna 2018. Alabaster: Quarrying and trade in the Roman world. Evidence from Pompeii and Herculaneum, in D. Matetić Poljak and K. Marasović (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 11th international conference of Association for the Study of Marble and Other Stones in Antiquity, Split, Croatia, May 18–22, 2015* (ASMOSIA XI): 45–64. Split: Arts Academy in Split, University of Split.

Barker, S.J. and Y. Marano 2017. Demolition laws in an archaeological context: Legislation and architectural re-use in the Roman building industry, in P. Pensabene, M. Milella and F. Caprioli (eds) *Décor: Decorazione e Architettura nel Mondo Romano*: 833–850. Rome: Edizioni Quasar.

Barker, S.J., S. Perna, J.C. Fant, L. Lazzarini and I.M. Villa 2018. Archaeometric analyses of the alabaster thresholds of Villa A, Oplontis (Torre Annunziata, Italy) and new SR and PB isotopic data for alabastro Ghiaccione del Circeo, in D. Matetić Poljak and K. Marasović (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 11th international conference of Association for the Study of Marble and Other Stones in Antiquity, Split, Croatia, May 18–22, 2015* (ASMOSIA XI): 215–229. Split: Arts Academy in Split, University of Split.

Barles, S. 2011. Les villes transformées par la santé, XVIIIe-XXe siècles. *Les tribunes de la santé* 33.2011/4: 31–37.

Barra Bagnasco, M. 1986. *Protomi in Terracotta da Locri Epizefiri: Contributo allo studio della scultura arcaica in Magna Grecia*. Turin: Il Quadrante.

Barral, P., C. Fruchart and C. Laplaige (in press). L'artisanat dans la ville : le cas de Mandeure, in G. Pagès and R. Clotuche (eds) *Le Rôle de l'Artisanat dans la Genèse et la Structuration des Agglomérations. Actes des trois tables rondes organisées à Nanterre (2 octobre 2014, 12 mars 2015 et 4 novembre 2015, dans le cadre du projet partagé de l'UMR 7041 ArScAn «Construire l'espace – Analyse chrono-spatiale des logiques territoriales»* (Humanités 1). Nanterre: Presses universitaires Paris Nanterre.

Barresi, P. 2014. Calculating the cost of columns: The case of the temple of Apollo at Didyma, in P. Pensabene and E. Gasparini (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 10th international conference of the Association for the Study of Marble and Other Stones in Antiquity, Rome, Italy, May 21-26, 2012* (ASMOSIA X): 933–939. Rome: L'Erma di Bretschneider.

Barry, F. 2020. *Painting in Stone: Architecture and the Poetics of Marble from Antiquity to the Enlightenment.* New Haven, CT: Yale University Press.

Bartelheim, M., R. Hardenberg and T. Scholten 2021. Ressourcen – RessourcenKomplexe – RessourcenGefüge – RessourcenKulturen, in T. Schade, B. Schweizer, S. Teuber, R. Da Vela, W. Frauen, M. Karami, D.K. Ojha, K. Schmidt, R. Sieler and M.S. Toplak (eds) *Exploring Resources: On Cultural, Spatial and Temporal Dimensions of ResourceCultures* (RessourcenKulturen 13): 9–21. Tübingen: Tübingen University Press.

Batchelor, D. 2000. *Chromophobia*. London: Reaktion.

Bauchhenß, G. 1986. Hercules Saxanus, ein Gott der niedergermanischen Armee, in *Studien zu den Militärgrenzen Roms III: 13. Internationaler Limeskongreß. Aalen 1983. Vorträge* (Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg 20): 90–95. Stuttgart: Konrad Theiß Verlag.

Baudoux, J., A. Bocquet, R. Brulet, F. Laubenheimer, E. Marlière and F. Vilvorder 1998. La production des amphores dans le Nord et l'Est des Gaules: Typologie et caractérisation physico-chimique, in F. Laubenheimer (ed.) *Les Amphores en Gaule II: Production et circulation* (Amphores): 11–48. Paris: Presses Universitaires Franc-Comtoises.

Baumer, L.E. 2001a. Klassische Bildwerke für tote Philosophen? Zu zwei spätklassischen Votivskulpturen aus Athen und ihrer Wiederverwendung in der späten Kaiserzeit. *Antike Kunst* 44: 55–69.

Baumer, L.E. 2001b. Praeterea typos tibi mando. Klassische Weihreliefs in römischem Kontext, in Chr. Reusser (ed.) *Griechenland in Kaiserzeit: Neue Funde und Forschungen zu Skulptur, Architektur und Topographie. Kolloquium zum 60. Geburtstag von Prof. Dietrich Willers, Bern, 12.-13. Juni 1998*: 85–94. Bern: Institut für Klassische Archäologie der Universität Bern.

Bayliss, R. 2004. *Provincial Cilicia and the Archaeology of Temple Conversion.* Oxford: Archaeopress.

Baziotopoulou-Valavani, E. 1994. Ανασκαφές σε αθηναϊκά κεραμικά εργαστήρια αρχαϊκών και κλασικών χρόνων, in W. Coulson, O. Palagia and T.L. Shear (eds) *The Archaeology of Athens and Attica under the Democracy. Proceedings of an International conference celebrating 2500 years since the birth of democracy in Greece, held at the American School of Classical Studies at Athens, December 4-6, 1992*: 45–54. Oxford: Oxbow Books.

Bean, G.E. and J.M. Cook 1957. The Carian coast III. *Annual of the British School at Athens* 52: 118–119.

Beaussart, P. 1976a. Les vases à bustes de Famars. *Revue du Nord* 58.228/Janvier-Mars 1976: 14–24.

Beaussart, P. 1976b. L'exploration archéologique de Famars: Les données du Haut-Empire. *Revue du Nord* 58.231/Octobre-Décembre 1976: 621–671.

Beaussart, P. 1984. Famars: les fouilles de la parcelle AC69 premier bilan. *Revue du Nord* 66.260/Janvier-Mars 1984: 103–114.

Bechtel, F., O. Kern, K. Praechter, C. Robert, E. von Stern, U. Wilcken and G. Wissowa 1913. *Dikaiomata: Auszüge aus alexandrinischen Gesetzen und Verordnungen, in einem Papyrus des Philologischen Seminars der Universität Halle (Pap. Hal. 1)*. Berlin: Weidmannsche Buchhandlung.

Bechi, E. 2022. L'arte del modellare a mano: testimonianze di ceramica d'impasto non tornita dal sito etrusco di Monte Giovi (Pontassieve, Firenze), in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 421–432. Rome: L'Erma di Bretschneider.

Bedon, R. 1984. *Les carrières et les carriers de la Gaule romaine*. Paris: A. and J. Picard.

Belavilas, N. 2009. Το Αιγαίο των ορυχείων: Γεωγραφία των νησιωτικών μεταλλευτικών εγκαταστάσεων, in N. Belavilas and L. Papastefanaki (eds) *Ορυχεία στο Αιγαίο: Βιομηχανική Αρχαιολογία στην Ελλάδα*: 18–33. Athens: Melissa.

Bélis, A. 1985. À propos de la construction de la lyre. *Bulletin du Correspondence Héllenique* 109.1: 201–220.

Belot, E. 1984. A propos d'un poncif pictural provincial. *Revue du Nord* 66.260/Janvier-Mars 1984: 231–251.

Belot, E. 1985. Architectures fictives de Famars. Mise en évidence d'une «vogue» picturale archaïsante antonino-sévérienne. *Revue du Nord* 67.264/Janvier-Mars 1985: 21–62.

Bencze, Á. 2013. *Physionomies d'une cité grecque: Développements stylistiques de la coroplathie votive archaïque de Tarente*. Naples: Centre Jean Bérard.

Bentz, M. and T. Helms (eds) 2018. *Craft Production in a Cross-Cultural Perspective*. Bonn: Habelt Verlag.

Bentz, M., L. Adorno, J. Albers, A. Benz, A. Miss, J.M. Müller 2016. Das Handwerkerviertel von Selinunt: Vorbericht zu den Kampagnen 2010-2016. *Kölner und Bonner Archaeologica* 6: 59–74.

Bentz, M., L. Adorno, J. Albers, J.M. Müller and G. Zuchtriegel 2013. Das Handwerkerviertel von

Selinunt: Die Töpferwerkstatt in der Insula S 16/17-E. Vorbericht zu den Kampagnen 2010-2012. *Mitteilungen des Deutschen Archäologischen Instituts, Römische Abteilung* 119: 69–98.

Bentz, M., W. Geominy and J.M. Müller 2010. *TonArt: Virtuosität antiker Töpfertechnik*. Petersberg: Michael Imhof Verlag.

Berger, E., H. Beck and P.C. Bol 1993. *Polykletforschungen*. Berlin: Gebr. Mann.

Bergemann, J. 2022. Attische Gräber zwischen Lebenswirklichkeit, gesellschaftlichen Konstruktionen und moderner Eschatologie, in L. Balandat and K. Opitz (eds) *Grab·Denk·Mal: Workshop am Institut für Klassische Archäologie der Universität Tübingen, 17.-19. November 2017*: 53–65. Rahden, Westf.: VML Verlag Marie Leidorf.

Bergquist, B. 1967. *The Archaic Greek Temenos: A study of structure and function*. Lund: Gleerup.

Berhouma, M.-A. 2017. Les imaginaires de l'atelier ou l'expérience de la matière ouvrée. *Socio-anthropologie* 35, viewed 3 Februar 2022 <https://doi.org/10.4000/socio-anthropologie.2530>.

Berkes, F. 2018. *Sacred Ecology*. New York: Routledge.

Bernal-Casasola, D., J.J. Díaz Rodríguez, J.Á. Expósito Álvarez and V.M. Palacios Macías (eds) 2020. *Baelo Claudia y los Secretos del Garum: Atunes, ballenas, ostras, sardinas y otros recursos marinos en la cadena operativa haliéutica romana*. Cádiz: Universidad de Cádiz, Servicio de Publicaciones.

Bernard, S.G. 2013. The transport of heavy loads in antiquity: Lifting, moving, and building in ancient Rome, in S. Altekamp, C. Marcks-Jacobs and P. Seiler (eds) *Perspektiven der Spolienforschung 1: Spoliierung und Transposition* (Topoi. Berlin Studies of the Ancient World 15): 99–122. Berlin and Boston: De Gruyter.

Berranger, D. 1983. Le relief inscrit en l'honneur des Nymphes dans les carrières de Paros. *Revue des Études Anciennes* 85.3-4: 235–259.

Bessac, J.-C. 1986. *L'Outillage Traditionnel du Tailleur de Pierre de l'Antiquité à nos Jours* (Revue archéologique de Narbonnaise 14). Paris: Éditions du CNRS.

Bessac, J.-C. 1988. Analyse des procédés de construction des remparts de pierre de Doura-Europos: Questions de méthodologie. *Syria. Archéologie, Art et Histoire* 65.3-4: 297–313.

Bessac, J.-C. 1997. La Construction des Fortifications Hellénistiques en Pierre de Doura-Europos (Syrie). Unpublished PhD dissertation, University of Rennes.

Bessac, J.-C. 2004. Restitution en pierre du mur nord du socle du Strategion de Doura-Europos et archéologie expérimentale, in P. Leriche, M.-F. Billot and A. Dandrau (eds) *Doura-Europos: Études V, 1993–1997*: 79–89. Paris: P. Geuthner.

Bessac, J.-C. 2016. Techniques et économie de la construction des fortifications en pierre: méthodes et perspectives, in R. Frederiksen, S. Müth, P.I. Schneider and M. Schnelle (eds) *Focus on Fortifications: New Research on Fortifications in the Ancient Mediterranean and the Near East* (Fokus Fortifikation Studies 2): 129–141. Oxford: Oxbow Books.

Bessac, J.-C., J. Abdul-Massih and Z. Vallat 1997. De Doura-Europos à Aramel: Enquête Ethno-Archéologique dans les carrières traditionnelles de Syrie, in P. Leriche and M. Gelin (eds) *Doura-Europos: Études IV, 1991-1993* (Bibliothèque archéologique et historique 149): 159–197. Beirut: IFPO.

Bessac, J.-C. and S. Müth 2020. Economic challenges of building a Geländemauer in the middle of the 4th century BC: Quantifying the city wall of Messene, in M. Heinzelmann and C. Recko (eds) *Quantifying Ancient Building Economy: Panel 3.24. Archaeology and Economy in the Ancient World. Proceedings of the 19th International Congress of Classical Archaeology, Cologne/Bonn 2018* (Quantifying Ancient Building Economy 23): 23–37. Heidelberg: Propylaeum.

Biermann, V. 2013. Ortswechsel: Überlegungen zur Bedeutung der Bewegung schwerer Lasten für die Wirkung und Rezeption monumentaler Architektur am Beispiel des Vatikanischen Obelisken, in S. Altekamp, C. Marcks-Jacobs and P. Seiler (eds) *Perspektiven der Spolienforschung 1: Spoliierung und Transposition* (Topoi. Berlin Studies of the Ancient World 15): 123–156. Berlin and Boston: De Gruyter.

Bilbao Zubiri, E. 2017. Nuove prospettive di ricerca sulla coroplastica arcaica di San Biagio alla Venella (Metaponto), in A. Pontrandolfo and M. Scafuro (eds) *Dialoghi sull'Archeologia della Magna Grecia e del Mediterraneo. Atti del 1° Convegno internazionale di studi. Paestum, 7-9 settembre 2016:* 997–1008. Paestum: Pandemos.

Bilbao Zubiri, E. 2019. Le "style achéen" dans les terres cuites votives de Métaponte: critères de définition et filiations, in O. de Cazanove and A. Duplouy (eds) *La Lucanie entre deux Mers: Archéologie et Patrimoine. Actes du Colloque international. Paris, 5-7 novembre 2015* (Collection du Centre Jean Bérard 50): 865–876. Naples: Centre Jean Bérard.

Bilbao Zubiri, E. 2020. Évolutions de la coroplathie archaïque en Grande Grèce, de l'étude de cas à l'analyse régionale. *Quaderni ticinesi – Numismatica e Antichità Classiche* 49: 11–25.

Bilbao Zubiri, E. 2022. Le modelage dans les pratiques artisanales de Métaponte à l'époque archaïque, in H. Aurigny and L. Rohaut (eds) *«Quand on a la Terre sous l'Ongle»: Le Modelage dans le Monde Grec Antique. Actes du Colloque international. Aix-en-Provence, 4-5 avril 2019* (BIAMA 32): 269–280. Aix-en-Provence: Presses universitaires de Provence, Centre Camille Jullian.

Billi, A. 2005. Τα ελαιοτριβεία της Νισύρου. *Νισυριακά* 16: 374–378.

Billot, M.-Fr. 1992. Le Cynosarges, Antiochos et les tanneurs: Questions de topographie. *Bulletin de Correspondance Hellénique* 116: 119–156.

Binford, L.R. 1981. Behavioral archaeology and the 'Pompeii premise'. *Journal of Anthropological Research* 373: 195–208.

Bintliff, J. 2012. *The Complete Archaeology of Greece: From Hunter-Gatherers to the 20th Century.* Oxford-New York: Wiley-Blackwell.

Biris, K. 2006. *Αι τοπωνυμίαι της πόλεως και των περιχώρων των Αθηνών*. Athens: Ταμείο Αρχαιολογικών Πόρων.

Birk, S. 2013. *Depicting the Dead: Self-Representation and Commemoration on Roman Sarcophagi with Portraits.* Aarhus: Aarhus University Press.

Blanco-Pérez, A. 2016. Nomenclature and dating in Roman Asia Minor: (M.) Aurelius/a and the 3rd Century AD. *Zeitschrift für Papyrologie und Epigraphik* 199: 271–293.

Blid, J. 2016. *Labraunda. Swedish Excavations and Researches 4: Remains of Late Antiquity.* Stockholm: Swedish Research Institute in Istanbul.

Blondé, F., J.Y. Perreault and C. Péristéri 1992. Un atelier de potier archaïque à Phari (Thasos), in F. Blondé and J.Y. Perreault (eds) *Les Ateliers de Potiers dans le Monde Grec aux Époques Géométrique, Archaïque et Classique. Actes de la Table Ronde organisée à l'École française d'Athènes. 2 et 3 octobre 1987* (Bulletin de Correspondance Hellénique Supplément 23): 10–40. Wilsele: Peeters.

Blume, C. 2015. *Polychromie hellenistischer Skulptur: Ausführung, Instandhaltung und Botschaften.* Petersberg: Michael Imhof Verlag.

Blümel, C. 1941. *Griechische Bildhauer an der Arbeit*. Berlin: De Gruyter.

Boardman, J. 1998. *Early Greek Vase Painting: 11th-6th Centuries BC.* London: Thames & Hudson.

Boardman, J. 2006. Sources and models, in O. Palagia (ed.) *Greek Sculpture: Function, Materials and Techniques in the Archaic and Classical Periods.* 1–31. Cambridge: Cambridge University Press.

Boëda, E., J.-M. Geneste and L. Meignen 1990. Identification de chaînes opératoires lithiques du Paléolithique Ancien et Moyen. *Paléo* 2: 43–80.

Boggess, E.T. 1989. The Development of the Attic pithos. PhD dissertation, Bryn Mawr College. Ann Arbor, MI: University Microfilms.

Bol, P.C. (ed.) 1989. *Forschungen zur Villa Albani. Katalog der Bildwerke I: Bildwerke im Treppenaufgang und im Piano nobile des Casino.* Berlin: Gebr. Mann.

Bol, P.C. (ed.) 2004. *Die Geschichte der antiken Bildhauerkunst 2: Klassische Plastik* (Schriften des Liebieghauses). Mainz: Philipp von Zabern.

Bol, P.C., M. Bückling and H. Beck (eds) 1990. *Polyklet: Der Bildhauer der griechischen Klassik. Ausstellung im Liebieghaus, Museum Alter Plastik, Frankfurt am Main*. Mainz: Philipp von Zabern.

Bollen, E. 2011. Pottery, lamps and miniatures from the central acropolis, in S. Dietz and M. Stavropoulou-Gatsi (eds) *Kalydon in Aitolia I. Reports and Studies: Danish/Greek fieldwork 2001-2005*: 455–518. Aarhus: Aarhus University Press.

Bommelaer, J.-F. 1996. Sur quelques nouveautés de l'architecture du IVe siècle, in P. Carlier (ed.) *Le IVe siècle av. J.-C.: Approches Historiographiques* (Collection d'Études anciennes 15): 141–156. Nancy: A.D.R.A.

Bommelaer, J.-F. 2014. Delphica 5: Une niche étolienne en bas du sanctuaire d'Apollon? *Bulletin de Correspondance Hellénique* 138: 131–157.

Bommelaer, J.-F. and D. Laroche 1991. *Guide de Delphes: Le Site*. Paris: Éditions de Boccard.

Bommelaer, J.-F. and J. des Courtils 1994. *La Salle Hypostyle d'Argos* (Études Péloponnésiennes X). Paris: Éditions de Boccard.

Bondarenko, D.V. and D.E. Chistov 2021. "Kvartal Goncharov" (Uchastok "GSH") v systeme zastroiki i v ekonomike archaicheskogo Borisfena. *Stratum plus* 3: 235–259.

Bonetto, J. and C. Previato 2018. The construction process of the Republican city walls of Aquileia (northeastern Italy). A case study of the quantitative analysis on ancient buildings, in A. Brysbaert, V. Klinkenberg, A. Gutiérrez Garcia-M. and I. Vikatou (eds) *Constructing Monuments, Perceiving Monumentality and the Economics of Building: Theoretical and Methodological Approaches to the Built Environment*: 309–330. Leiden: Sidestone Press.

Bonnie, R. 2016. Thrown into limekilns: The reuse of statuary and architecture in Galilee from Late Antiquity onwards, in J. Day, R. Hakola, M. Kahlos and U. Tervahauta (eds) *Spaces in Late Antiquity: Cultural, Theological and Archaeological Perspectives*: 190–211. London and New York: Routledge.

Bonsangue, M.L. 2015. Un aspect de la forme de la ville dans l'Occident romain : la topographie des lieux de l'artisanat sous la République et le Haut-Empire, in S. Bourdin, M. Paoli and A. Reltgen-Tallon (eds) *La Forme de la Ville de l'Antiquité à la Renaissance*: 385–404. Rennes: PUR.

Borbein, A.H. and C. Boehringer 1995. *Das Alte Griechenland: Geschichte und Kultur der Hellenen.* Munich: C. Bertelsmann.

Borbein, A.H. 2002. Polyklet, in W.-D. Heilmeyer and M. Maischberger (eds) *Die griechische Klassik: Idee oder Wirklichkeit; eine Ausstellung im Martin-Gropius-Bau, Berlin 1. März – 2. Juni 2002 und in der Kunst- und Ausstellungshalle der Bundesrepublik Deutschland, Bonn 5. Juli – 6. Oktober 2002 [12. Juli – 13. Oktober]*: 354–363. Mainz: Philipp von Zabern.

Borbein, A.H. 2005. Sinn und Unsinn der Meisterforschung, in V.M. Strocka (ed.) *Meisterwerke: Internationales Symposion anlässlich des 150. Geburtstages von Adolf Furtwängler, Freiburg in Breisgau 30.Juni – 3.Juli 2003*: 223–234. Munich: Hirmer.

Borchhardt, J. 1975. *Die Bauskulptur des Heroons von Limyra: Das Grabmal des lykischen Königs Perikles* (Istanbuler Forschungen 32). Berlin: Gebr. Mann.

Borchhardt, J. 1993. *Die Steine von Zemuri: Archäologische Forschungen an den verborgenen Wassern von Limyra.* Vienna: Phoibos.

Borchi, S. (ed.) 2007. *Gli Scavi e le Indagini Ambientali nel Sito Archeologico del Lago degli Idoli*. Stia: Comunità Montana del Casentino.

Borgers, B., C. Ionescu, S. Willems, L. Barbu-Tudoran, M. Bernroider and R. Clotuche 2020. Continuity and diversity of Roman pottery production at Famars (northern France) in the 2nd-4th centuries AD: Insights from the pottery waste. *Archaeological and Anthropological Sciences* 12: 1–27.

Bosche, S. 2023. *Distanzen: Über die Beobachtung von Übermittlungen im republikanischen Italien*. Heidelberg: Universitätsbibliothek Heidelberg, viewed 12 February 2024, <DOI:10.11588/heidok.00033937>.

Bosche, S. (forthcoming). Romanisierung ohne Rom? Überlegungen zum Charakter eines Phänomens, in *Proceedings of the congress 'Romanisation – Romanization ?!?', Heidelberg, 15-17. Dezember 2017*. Heidelberg.

Bosche, S. (in preparation) Das „Gedächtnis" der Gemma Augustea: Über Biographien, Vergleiche und Interpretationen.

Bosio, L. and G. Rosada 2020. Le fonti della fonte: L'Italia fisica nella descrizione della Tabula Peutingerana, in D. Usai, S. Tuzzato and M. Vidale (eds) *Tales of Three Worlds: Archaeology and Byond – Asia, Italy, Africa. A tribute to Sandro Salvatori*: 119–134. Oxford: Archaeopress.

Botte, E. 2020. Les tanneurs ont-ils toujours été des voisins gênants?. *Mélanges de l'École française de Rome. Antiquité* 132.2: 289–296.

Bouaziz, S., M. Ghanmi and M. Zarbout 1989. La serie a dominante continentale (Oxfordien à Cenomanien) de la falaise du Dahar (Sud-tunisien); Son evolution du Tebaga de Medenine à la frontier tripolitaine. *Géologie Méditérraneenne* 16: 67–76.

Boulanger, K. and C. Moulis (eds) 2018. *La Pierre dans l'Antiquité et au Moyen Âge en Lorraine*. Nancy: PUN-Édulor.

Bourgeoise, B. (ed.) 2014. *Technè* 40. *Special Issue Thérapéia. Polychromie et restauration de la sculpture dans l'Antiquité.*

Bourguet, E. 1903. ΘΥΑΙ – ΘΥΣΤΙΟΝ, in *Mélanges Georges Perrot: Recueil de mémoires concernant l'archéologie classique, la littérature et l'histoire anciennes*: 25–29. Paris: Fontemoing.

Bourguet, E. 1914. *Les Ruines de Delphes*. Paris: Fontemoing.

Bousquet, J. 1975. Arbinas, fils de Gergis, dynaste de Xanthos. *Comptes rendus des séances de l'Académie des Inscriptions et Belles-Lettres* 119.1: 138–150.

Bousquet, J. 1984. L'atelier de la Tholos de Delphes. *Bulletin de Correspondance Hellénique* 108: 199–206.

Bousquet, J. 1985. L'hoplothèque de Delphes. *Bulletin de Correspondance Hellénique* 109: 717–726.

Bousquet, J. 1988. *Études sur les Comptes de Delphes*. Paris: Éditions de Boccard.

Bousquet, J. 1989. *Corpus des Inscriptions de Delphes II* : *Les Comptes.* Paris: Éditions de Boccard.

Bousquet, J. and Ph. Gautier 1994. Inscriptions du Letôon de Xanthos. *Revue des Études Grecques* 107: 319–361.

Boussen, S., F. Chaabani and M. Jouirou 2016. Characterization and evaluation of the potential limestone Jebels Bent Saidane, Bou Garnine, Raous and Bridge of Fahs (North East Tunisia). *Industrial Engineering and Management* 5.2: 1–9.

Boutsikas, E. 2017. The role of darkness in ancient Greek religion and religious practice, in C. Papadopoulos and H. Moyes (eds) *The Oxford Handbook of Light in Archaeology*: 43–63. Oxford: Oxford University Press, <https://doi.org/10.1093/oxfordhb/9780198788218.013.2>.

Bouvier, M. 2000. Les goûts des vins antiques. *Pallas* 53: 125–138.

Bowkett, L.C. 1995. *Well Built Mycenae: The Hellenistic Dye-works*. Oxford: Oxbow Books.

Bowyer, E. 2018. The presumption of white, in L. Syson, S. Wagstaff, E. Bowyer and B. Kumar (eds) *Like Life: Sculpture, Color and the Body*: 76–81. New York: The Metropolitan Museum of Art.

Bracci, S., G. Giachi, P. Liverani, P. Pallecchi and F. Paolucci 2018. *Polychromy in Ancient Sculpture and Architecture*. Livorno: Sillabe.

Brann, E. 1962. *Agora VIII: Late Geometric and Protoattic Pottery, Mid 8th to Late 7th Century B.C.* Princeton, NJ: ASCSA.

Brandenburg, H. 1996. Die Verwendung von Spolien und originalen Werkstücken in der spätantiken Architektur, in J. Poeschke (ed.) *Antike Spolien in der Architektur des Mittelalters und der Renaissance*: 11–48. Munich: Hirmer.

Brenk, B. 1987. Spolia from Constantine to Charlemagne: Aesthetics versus ideology. *Dumbarton Oaks Papers* 41: 103–109.

Brenk, B. 1996. Spolien und ihre Wirkung auf die Ästhetik der varietas: Zum Problem alternierender Kapitelltypen, in J. Poeschke (ed.) *Antike Spolien in der Architektur des Mittelalters und der Renaissance*: 49–92. Munich: Hirmer.

Brilliant, R. and D. Kinney (eds) 2011. *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*. Burlington, VT: Ashgate.

Brinkmann, V. 2016. *Athen: Triumph der Bilder. Eine Ausstellung der Liebieghaus Skulpturensammlung, Frankfurt am Main, 4. Mai bis 4. September 2016.* Petersberg: Michael Imhof Verlag.

Brinkmann, V., O. Primavesi and M. Hollein (eds) 2010. *Circumlitio: The Polychromy of Antique and Medieval Sculpture* (Schriftenreihe der Liebighaus-Skulpturensammlung). Munich: Hirmer.

Brinkmann, V., R. Dreyfuss and U. Koch-Brinkmann (eds) 2017. *Gods in Colour: Polychromy in the Ancient World*. New York: Fine Arts Museums of San Francisco, Legion of Honor DelMonico Books, Prestel.

Broneer, O. 1971. *Isthmia I: The Temple of Poseidon.* Princeton, NJ: ASCSA.

Brouskari, M.S. 1974. *The Acropolis Museum: A Descriptive Catalogue.* Athens: Εμπορική Τράπεζα Ελλάδος.

Brouskari, M.S. 1979. *Από τον Αθηναϊκό Κεραμεικό του 8ου αι. π.Χ. αιώνα*. Athens: Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων.

Brown, A.R. 2016. Crosses, noses, walls, and wells: Christianity and the fate of sculpture in Late Antique Corinth, in T.M. Kristensen and L. Stirling (eds) *The Afterlife of Greek and Roman Sculpture: Late Antique Responses and Practices*: 150–176. Ann Arbor: University of Michigan Press.

Brueckner, A. 1909. *Der Friedhof am Eridanos bei der Hagia Triada zu Athen*. Berlin: G. Reimer.

Brulet, R., J.-P. Dewert, F. Vilvorder 2001. *Liberchies IV: Vicus Gallo-Romain. Travail de Rivière. Fouilles du Musée de Nivelles (1986/87 et 1991/97)* (Publication d'histoire de l'art et d'archéologie, série générale). Louvain-la-Neuve: UCL. Département d'archéologie et d'histoire de l'art.

Brun, J.P. 2004. *Archéologie du Vin et de l'Huile: De la Préhistoire à l'Époque Hellénistique.* Paris: Errance.

Brun, P., L. Cavalier, K. Konuk and F. Prost (eds) 2013. *Euploia: La Lycie et la Carie Antiques – Dynamiques des Territoires, Échanges et Identités*. Pessac: Ausonius.

Bruneau, Ph. 1969. Documents sur l'industrie délienne de la pourpre. *Bulletin de Correspondance Hellénique* 93: 759–791.

Bruneau, Ph. 1970. *Recherches sur les Cultes de Délos à l'Époque Hellénistique et à l'Époque Impériale* (Bibliothèque des Écoles françaises d'Athènes et de Rome 217). Paris: Éditions de Boccard.

Bruneau, Ph. and J. Ducat 1983. *Guide de Délos*. Paris: Éditions de Boccard.

Bruneau, Ph. and J. Ducat 2005. *Guide de Délos*. Athens: École française d'Athènes.

Bruni, S. 2013. Attorno a Praxias, in G.M. Della Fina (ed.) *Mobilità Geografica e Mercenariato nell'Italia Preromana* (Annali della Fondazione per il Museo Claudio Faina di Orvieto 20): 257–337. Rome: Edizioni Quasar.

Bruno, M., L. Lazzarini, M. Soligo, B. Turi and V. Matarangas 2000. The ancient quarry at Karavos (Paros) and the characterization of its marble, in D. Schilardi and D. Katsonopoulou (eds) *Παρία Λίθος: Λατομεία, Μάρμαρο και Εργαστήρια Γλυπτικής της Πάρου: Πρακτικά Α' διεθνούς συνεδρίου αρχαιολογίας Πάρου και Κυκλάδων, Παροικιά 2-5 Οκτωβρίου 1997*: 94–103. Athens: The Institute for Archaeology of Paros and the Cyclades.

Bruno, M. 2002. Alabaster quarries near Hierapolis (Turkey), in L. Lazzarini (ed.) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 6th international conference of the Association for the Study of Marble and Other Stones in Antiquity, Venice, June 15-18, 2000* (ASMOSIA VI): 19–24. Padua: Bottega d'Erasmo Aldo Ausilio Editore.

Buikstra, J. and A. Lagia 2009. Bioarchaeological approaches to Aegean archaeology, in L.A. Schepartz, S.C. Fox and C. Bourbou (eds) *New Directions in the Skeletal Biology of Greece* (Hesperia Supplements 43): 7–30. Princeton, NJ: ASCSA.

Buiskikh, A.V. 2021. City plan of Olbia Pontica. *Vestnik drevnei istorii* 81.3: 673–698.

Buiskikh, A.V. and J. Fornasier 2022. The city versus its suburb: The spatial development of Pontic Olbia. *Ancient Civilizations from Scythia to Siberia* 28: 195–230.

Bujskikh, A.V. 2015. The southern temenos in Pontic Olbia (Preliminary Results of the Investigation). *Ancient Civilizations from Scythia to Siberia* 21: 222–250.

Bujskikh, A.V. 2017. From dugouts to houses: Urban development in Late Archaic Olbia Pontica. *Arhitectură. Restaurare. Arheologie Reports* 8: 5–16.

Bujskikh, A.V. 2022. Aphrodite in Olbia: Sacred gifts in cult practice, in C. Colombi, V. Parisi, O. Dally, M.A. Guggisberg and G. Piras (eds) *Comparing Greek Colonies: Mobility and Settlement Consolidation from Southern Italy to the Black Sea (8th – 6th Century BC). Proceedings of the International Conference (Rome, 7.-9.11.2018)*: 494–507. Berlin and Boston: De Gruyter.

Bulić, F. 1891. Starinska iznašašća na otoku Braču (Brattia). *Bulletino di archeologia e storia Dalmata* 14: 117–120.

Buoite, C. 2013a. «Necessario è avere poi dei vasi per ogni bisogno» (Geoponica II, 49), in D. Locatelli, L. Malnati and D.F. Maras (eds) *Storie della Prima Parma: Etruschi, Galli, Romani. Le origini della città alla luce delle nuove scoperte archeologiche*: 23–26. Rome: L'Erma di Bretschneider.

Buoite, C. 2013b. Culture in movimento, in D. Locatelli, L. Malnati and D.F. Maras (eds) *Storie della Prima Parma: Etruschi, Galli, Romani. Le origini della città alla luce delle nuove scoperte archeologiche*: 53–56. Rome: L'Erma di Bretschneider.

Buoite, C. and L. Zamboni (eds) 2008. *Gli scavi di Castelfranco Emilia presso il Forte Urbano: Un abitato etrusco alla vigilia delle invasioni celtiche* (Quaderni di Archeologia dell'Emilia Romagna 21). Sesto Fiorentino: All'Insegna del Giglio.

Buoite, C. and L. Zamboni 2017. Le officine mutevoli: Analisi spaziale e riesame delle evidenze produttive nel porto adriatico di Spina (VI-III sec. a.C.), in M.C. Biella, R. Cascino, A.F. Ferrandes and M. Revello Lami (eds) *Scienze dell'Antichità* 23.2. *Special Issue Gli Artigiani e la città: Officine e aree produttive tra VIII e III sec. a.C. nell'Italia centrale tirrenica:* 377–385.

Burford, A. 1965. The economics of Greek temple building. *Proceedings of the Cambridge Philological Society* 191: 21–34.

Burford, A. 1969. *The Greek Temple Builders at Epidauros: A Social and Economic Study of the Building in the Asklepian Sanctuary, during the Fourth and Early Third Centuries BC* (Liverpool Monographs in Archaeology and Oriental Studies). Liverpool: Liverpool University Press.

Burford, A. 1972. *Craftsmen in Greek and Roman Society* (Aspects of Greek and Roman Life). London: Thames & Hudson.

Burford, A. 1993. *Land and Labor in the Greek World* (Ancient Society and History). Baltimore, MD: Johns Hopkins University Press.

Burkert, W. 1997. Impact and Limits of the Idea of Progress in Antiquity, in A. Burgen, P. McLaughlin and J. Mittelstraß (eds) *The Idea of Progress*: 19–46. Berlin and New York: De Gruyter.

Cabouret, B. 2020. Le sanctuaire d'Apollon à Daphné. *Syria. Archéologie, art et histoire* 97: 143–164.

Cahill, N.D. 2002. *Household and City Organization at Olynthus*. New Haven, CT: Yale University Press.

Cain, H. 2012. *Lust auf Farbe: Die neue bunte Antike. Begleitheft zur Sonderausstellung. Antikenmuseum der Universität Leipzig, 7. Juli bis 25. November 2012*. Leipzig: Antikenmuseum der Universität Leipzig.

Cambi, N. 2004. Kiparstvo na Braču u antičko doba. *Bračk zbornik* 21: 239–272.

Cambi, N. 2005. *Kiparstvo rimske Dalmacije: The Sculpture of the Roman Province of Dalmatia* (Biblioteka Knjiga Mediterana 38). Split: Književni Krug.

Cambi, N. 2013. Herkul na Braču. *Klesarstvo i graditeljstvo* 24.1-2: 4–19.

Cammas, C. 2017. Géoarchéologie des villes: Premiers résultats des analyses menées sur le site du Technopôle à Famars, in R. Clotuche, J. Clerget, G. Teysseire and A. Tixador (eds) *Un Quartier Antique de Fanum Martis: Résultats de la Fouille du Technopôle Transalley, Phase 1, 3 et 4 a, Campagnes 2011 à 2014, Tome 4, Vol. 2, Les études thématiques*: 5–84. Glisy: Inrap NP.

Camp, J. McK II 1990. *The Athenian Agora: Site Guide.* Athens: ASCSA.

Camporeale, G. 2015. Gli Etruschi di Firenze, in V. d'Aquino, G. Guarducci, S. Nencetti and S. Valentini (eds) *Archeologia a Firenze: Città e Territorio*: 39–54. Oxford: Archaeopress.

Cannon, A. 1995. Two faces of power: Communal and individual modes of mortuary expression. *Arx* 1: 3–8.

Capozzoli, V. 2024. The so-called "urban demes" of Athens during the Archaic period: Challenging multidimensional spaces beyond a binary logic, in N. Arvantis and A. Duplouy (eds) *Athens and Attica from the Late Bronze Age to the End of the Archaic Period: The Spatial Roots of Politics and Society*: 309–340. Athens: Scuola Archeologica Italiana di Atene.

Cappuccini, L. (ed.) 2017. *Monte Giovi. "Fulmini e saette": Da luogo di culto a fortezza di altura* (Insediamenti di altura 2). Sesto Fiorentino: All'Insegna del Giglio.

Cappuccini, L. 2022. Su alcune ceramiche orientalizzanti del Medio Valdarno: influenze e interazioni, in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 325–342. Rome: L'Erma di Bretschneider.

Cappuccini, L. and A. Gaucci (eds) 2022. *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66). Rome: L'Erma di Bretschneider.

Carbon, J.-M. 2022. Funerals and foreigners, founders and functionaries: On the boundary stones of associations from Kos, in A. Cazemier and S. Skaltsa (eds) *Associations and Religion in Context: The Hellenistic and Roman Eastern Mediterranean* (Kernos Supplément 39): 169–206. Liège: Presses Universitaires de Liège.

Cardarelli, A. and L. Malnati (eds) 2003. *Atlante dei Beni Archeologici della Provincia di Modena I: Pianura*. Sesto Fiorentino: All'Insegna del Giglio.

Cardarelli, A. and L. Malnati (eds) 2006. *Atlante dei Beni Archeologici della Provincia di Modena II: Montagna.* Sesto Fiorentino: All'Insegna del Giglio.

Cardarelli, A. and L. Malnati (eds) 2009. *Atlante dei Beni Archeologici della Provincia di Modena III: Collina e Alta Pianura.* Sesto Fiorentino: All'Insegna del Giglio.

Carless-Unwin, N. and O. Henry 2016. A new Olympichos inscription from Labraunda: I.Labraunda 137. *Epigraphica Anatolica* 49: 27–45.

Carlson, D.N. and W. Aylward 2010. The Kızılburun shipwreck and the temple of Apollo at Claros. *American Journal of Archaeology* 114.1: 145–159.

Carpenter, J. and D. Boyd 1977. Dragon houses: Euboia, Attica, Karia. *American Journal of Archaeology* 81.2: 179–215.

Carpenter, R. 1968. The unfinished colossus on Mt. Pendeli. *American Journal of Archaeology* 72.3: 279–280.

Carusi, C. 2021. The recruitment and remuneration of construction workers in Classical Athens, in K. Harter-Uibopuu and W. Riess (eds) *SYMPOSION 2019: Vorträge zur griechischen und hellenistischen Rechtsgeschichte, Hamburg, 26-28 August 2019*: 131–154. Vienna: Österreichische Akademie der Wissenschaften.

Caruso, A. 1997. Materiale Coroplastico Inedito dall' Heraion Extraurbano di Metaponto: Contributo alla Definizione Cronologica. Unpublished Bachelor's dissertation in Archeologia della Magna Grecia, Università della Tuscia, Facoltà di Conservazione dei Beni culturali, Istituto di Scienze dell'Antichità.

Casini, S. 2007. La ceramica di produzione locale: Impasto, bucchero, etrusco-padana, in R. De Marinis and M. Rapi (eds) *L'Abitato Etrusco del Forcello di Bagnolo San Vito (Mantova)*: 247–266. Florence: Tipografia Latini.

Catarsi, M. 2013. Il villaggio con fornaci di Baganzola, in D. Locatelli, L. Malnati and D.F. Maras (eds) *Storie della Prima Parma: Etruschi, Galli, Romani. Le origini della città alla luce delle nuove scoperte archeologiche*: 30. Rome: L'Erma di Bretschneider.

Catling, H.W. 1980-81. Archaeology in Greece, 1980-81. *Archaeological Reports* 27: 3–48.

Cavalier, L. 2012. Deux nouveaux temples à Limyra?, in M. Seyer (ed.) *40 Jahre Grabung Limyra. Akten des internationalen Symposions Wien, 3.-5. Dezember*

2009: 133–141. Vienna: Verlag der Österreichischen Akademie der Wissenschaften.

Cavalier, L. 2020. Influence, imitation, copy: From Athens to Lycia, in M. Grawehr, C. Leypold, M. Mohr and E. Thiermann (eds) *Klassik – Kunst der Könige: Kings and Greek Art in the 4th Century B.C., Tagung an der Universität Zürich vom 18.-20. Januar 2018* (Zürcher Archäologische Forschungen 7): 55–63. Rahden, Westf.: VML Verlag Marie Leidorf.

Cavanagh, W., J. Crouwel, R.W.V. Catling and G. Shipley 1996. *Continuity and Change in a Greek Rural Landscape: The Laconia Survey. Archaeological Data II* (British School at Athens – Supplementary Volumes 27). London: British School at Athens.

Caylus, A.C.Ph. de P. de L. de T.-G. de. 1759. *Recueil d'antiquités égyptiennes, étrusques, grecques romaines et gauloises 3*: 436–439, pl. XXXVIII. Paris: Desaint & Saillant.

Censier, D., A. Dananaï and G. Fronteau 2023. *Douchy-les-Mines Z.A.C des Prouettes: Rapport de fouilles*. Douai: DAPCAD.

Cevizoğlu, H. and Y. Ersoy 2016. Zur Rolle der handwerklichen Betriebe in Bezug auf die wirtschaftliche Entwicklung von Klazomenai, in K. Piesker (ed.) *Wirtschaft als Machtbasis: Beiträge zur Rekonstruktion vormoderner Wirtschaftssysteme in Anatolien* (Byzas 22): 105–131. Istanbul: Phoibos.

Chahine, C. 2005. L'utilisation de l'alun dans la transformation de la peau en cuir, in P. Borgard, J.-P. Brun and M. Picon (eds) *L'Alun de Méditérannée*: 299–309. Naples: Centre Jean Bérard.

Champlin, E. 2003. *Nero*. Cambridge/London: The Belknap Press of Harvard University Press.

Chankowski, V. 2014. Réparer les idoles, entretenir les lieux de culte. L'économie de la restauration dans les sanctuaires du monde grec, in B. Bourgeois (ed.) *Technè* 40. *Special Issue Thérapéia. Polychromie et restauration de la sculpture dans l'Antiquité:* 42–45.

Chapman, W.P. 1993. *Karystos: City-State and Country Town*. Baltimore: Uptown Press.

Charitos, N.K. 2005. Αρχαιολογικά ενδιαφέροντα Νισύρου. *Νισυριακά* 16: 320–351.

Charneux, P. 1953. Inscriptions d'Argos. *Bulletin de Correspondance Hellénique* 77: 387–403.

Charneux, P. 1956. Inscriptions d'Argos. *Bulletin de Correspondance Hellénique* 80: 596–618.

Charneux, P. 1958. Inscriptions d'Argos. *Bulletin de Correspondance Hellénique* 82: 1–15.

Charneux, P. 1990. En relisant des décrets argiens. *Bulletin de Correspondance Hellénique* 114: 395–415.

Chartofyllis, G.M. 1990. Οι Μαχαλάδες της Νισύρου. *Νισυριακά* 11: 229–270.

Chatzidimitriou, A. 2005. *Παραστάσεις εργαστηρίων και εμπορίου στην εικονογραφία των Αρχαϊκών και Κλασικών χρόνων*. Athens: Ταμείο Αρχαιολογικών Πόρων.

Chatzidimitriou, A. 2018. Ο Αρχαίος Δήμος του Ικαρίου στον σύγχρονο δήμο του Διονύσου Αττικής, in *Αρχαία Θέατρα της Αττικής: Τα Θέατρα των Δήμων 14*: 139–157. Athens: Περιφερειακή Ένωση Δήμων Αττικής and ΔΙΑΖΩΜΑ.

Chatzilias, Ch. 2009. Η Λέσβος και ο Πολιτισμός της Πέτρας (1850-1950): Η Περίπτωση του Σκαλοχωρίου και της Ανεμότιας. Unpublished PhD dissertation, University of the Aegean.

Chatzipouliou, E. 1988a. Οδός Βαλαβάνη 6 και Παμφίλης. *Αρχαιολογικόν Δελτίον* 43.Β΄1: 31.

Chatzipouliou, E. 1988b. Οδός Βαλαβάνη 4. *Αρχαιολογικόν Δελτίον* 43.Β΄1: 30–31.

Chatzipouliou, E. 1988c. Οδός Καλλισθένους 36. *Αρχαιολογικόν Δελτίον* 43.Β΄1: 31.

Chauwin, L. and M. Tuffreau-Libre 1973. Le site gallo-romain du Pont-Rouge à Bourlon. *Bulletin de la commission départementale des monuments historiques du Pas-de-Calais* 9: 200–207.

Chidiroglou, M. 2012. Η Αρχαία Καρυστία: Συμβολή στην Ιστορία και Αρχαιολογία της Περιοχής από τη Γεωμετρική έως και την Αυτοκρατορική Εποχή. Unpublished PhD dissertation, National and Kapodistrian University of Athens, viewed 18.10.2023, <http://hdl.handle.net/10442/hedi/29516>.

Chidiroglou, M. 2017. Karystos revisited: Interaction networks of an Aegean island polity (sources and finds), in Ž. Tankosić, F. Mavridis and M. Kosma (eds) *An Island between two Worlds: The Archaeology of Euboea from Prehistoric to Byzantine Times* (Papers and Monographs from the Norwegian Institute at Athens 6): 321–344. Athens: The Norwegian Institute at Athens.

Cherstich, L., O. Menozzi, S. Antonelli, I. Cherstich, M.C. Mancini, M.G. Di Antonio, A. Abdalrahim Sheriff Saad and S. Farag Abdel Hati 2018. A 'living' necropolis: Change and reuse in the cemeteries of Cyrene. *Libyan Studies* 49: 121–152.

Christakopoulou, G. 2023. A mortuary testimony as a guide for a society's economic evaluation. Case study: The establishment of Protogeometric Stamna, Aetolia, Greece, in M. Bentz and M. Heinzelmann (eds) *Sessions 11–12, Single Contributions – Poster Sessions: Archaeology and Economy in the Ancient World. Proceedings of the 19th International Congress of Classical Archaeology, Cologne/Bonn 2018* (Archaeology and Economy in the Ancient World 56): 251–257. Heidelberg: Propylaeum.

Christakopoulou, G. 2016. The Protogeometric settlement at Stamna, Aetolia: Some thoughts on the settlers' origin based on the typology of the graves, in E. Papadopoulou, V. Chrysikopoulos and G. Christakopoulou (eds) *ACHAIOS: Studies Presented to Professor Thanasis I. Papadopoulos*: 59–76. Oxford: Archaeopress.

Christakopoulou-Somakou, G. (forthcoming). *Excavation Results of the Ancient Cemetery in Stamna Aetolia, Greece*

(1994, 1998-2000): The collapse of a myth. Athens: Athens University Review of Archaeology – AURA.

Christakopoulou-Somakou, G. 2009. Το Νεκροταφείο στην Σταμνά και η Πρωτογεωμετρική Περίοδος στην Αιτωλία/Ακαρνανία. Unpublished Phd dissertation, National and Kapodistrian University of Athens, viewed 12 February 2024, <http://hdl.handle.net/10442/hedi/18271>.

Christien, J. 2018. Roads and quarries in Laconia, in A. Powell (ed.) *A Companion to Sparta 2* (Blackwell Companions to the Ancient World. Ancient History 2392): 615–642. Chichester: John Wiley & Sons.

Christien, J. and M. De La Santa 2001-2002. Pausanias et Strabon: La route du Taygète et les carrières de marbre laconien, in *Πρακτικά του Στ' Διεθνούς Συνεδρίου Πελοποννησιακών Σπουδών. Τρίπολις 24-29 Σεπτεμβρίου 2000. Τόμος Β': Αρχαιότης και Βυζάντιο* (Πελοποννησιακά, Παράρτημα 24): 203–216. Athens: Εταιρεία Πελοποννησιακών Σπουδών.

Christopoulou, V. 2004. *Αρχαία Αγορά της Αθήνας- Άρειος Πάγος: Σύντομο Ιστορικό και Περιήγηση* (Αρχαιολογικοί περίπατοι γύρω από την Ακρόπολη, Υπουργείο Πολιτισμού, Ά Εφορεία Προϊστορικών και Κλασικών Αρχαιοτήτων). Athens: Έκδοση Ένωσης Φίλων Ακροπόλεως.

Christof, E. 2022. Zur antiken Umarbeitung und Wiederverwendung von Grabstelen in Kleinasien und in den griechischen Inseln. *Gephyra* 23: 1-78, https://doi.org/10.37095/gephyra. 1005665.

Chryssoulaki, S. 2022. Κραυγές και ψίθυροι: Οι αποκλίνουσες ταφές του Φαληρικού νεκροταφείου, in I. Pappas and I. Lourentzatou (eds) *ΦΑΛΗΡΟΘΕΝ Ανάμεσα σε Δύο Κόσμους*: 26–34. Athens: Υπουργείο Πολιτισμού και Αθλητισμού.

Choisy, A. 1884. *Études Épigraphiques sur l'Architecture Grecque*. Paris: Librairie de la Société anonyme de publications périodiques.

Cianferoni, G.C. and R. Da Vela 2015. Fornaci di età etrusca sotto l'ex Cinema Apollo in via Nazionale a Firenze, in V. d'Aquino, G. Guarducci, S. Nencetti and S. Valentini (eds) *Archeologia a Firenze: Città e Territorio*: 125–134. Oxford: Archaeopress.

Cipriani, M. 2008. Il santuario settentrionale di Poseidonia: La documentazione archeologica dei culti dalla fondazione della città al tramonto dell'egemonia lucana, in G. Greco and B. Ferrara (eds) *Doni agli Dei: Il Sistema dei Doni Votivi nei Santuari*: 113–139. Pozzuoli: Naus.

Cirucci, G. 2020. Too ugly to be collected? Unexpected Greek "originals" in Roman contexts, in G. Adornato, G. Cirucci, and W. Cupperi (eds) *Beyond "Art Collections": Owning and Accumulating Objects from Greek Antiquity to the Early Modern Period*: 55–75. Berlin and Boston: De Gruyter.

Clairmont, C.W. 1993. *Classical Attic Tombstones*. Kilchberg: Akanthus.

Clerget, J. and R. Clotuche 2017. La production, in R. Clotuche, J. Clerget, G. Teysseire and A. Tixador (eds) *Un Quartier Antique de Fanum Martis: Résultats de la Fouille du Technopôle Transalley, Phase 1, 3 et 4 a, Campagnes 2011 à 2014, Tome 4, Vol. 2, Les études thématiques*: 69–292. Glisy: Inrap NP.

Clinton, K. 2023a. Agora I 7538: A banquet for the 'majority'. *ΓΡΑΜΜΑΤΕΙΟΝ* 12: 85–104.

Clinton, K. 2023b. On the sanctuaries of Kalliste and Ariste, Artemis Soteira, and Agathe Theos at Athens. *Zeitschrift für Papyrologie und Epigraphik* 227: 69–80.

Clop, X., M.R. Estrada and L. Salanova 2014. Raw material management in the first pottery production of the Mediterranean basin: A developing project. *The Old Potters' Almanack*: 26–31.

Clotuche, R. 2016. Fanum Martis: Agglomération sans faubourg au cœur d'un espace de production et d'échanges, in C. Besson, O. Blin and B. Triboulot (eds) *Actes du colloque international (Versailles, 29 février-3 mars 2012): Franges Urbaines, Confins Territoriaux, la Gaule dans l'Empire:* 151–162. Pessac: Ausonius.

Clotuche, R. 2019. Fanum Martis (Famars): Démantèlement d'une ville pour la construction d'un castellum au IVe s., in D. Bayard and J.-P. Fourdrin (eds) *Actes du colloque Villes et Fortifications de l'Antiquité Tardive dans le Nord de la Gaule, Lille III et Forum Antique de Bavay, 25-27 mars 2015* (Revue du Nord. Hors série, Collection Art et archéologie 26): 277–292. Lille: Université de Lille.

Clotuche, R. 2022. L'agglomération de Fanum Martis (Famars) et son territoire. *Revue du Nord* 104.446/2022 Archéologie: 53–67.

Clotuche, R., B. Fort, J. Donnadieu and N. Tisserand 2017a. L'agglomération secondaire de Famars/Fanum Martis (Nord) durant l'Antiquité tardive: D'un pôle commercial au centre militaire. *Gallia – Archéologie de la France antique* 74.1: 223–234.

Clotuche, R., M. Derreumaux, F. Pigière, G. Jouanin, S. Preiss and J.-H. Yvinec 2017b. Les campagnes en territoire nervien: Approche croisée, in M. Reddé (ed.) *Gallia Rustica 1: Projet européen Rurland. Les campagnes du nord-est de la Gaule de la fin de l'âge du Fer à l'Antiquité tardive*: 179–210. Pessac: Ausonius.

Clotuche, R., M. Derreumaux, J. Clerget, G. Teysseire, J.-H. Yvinec, G. Jouanin, N. Tisserand and C. Hoët-Vancauwenberghe 2018. Fanum Martis (Famars). Un exemple de gestion des productions agricoles dans une agglomération, in M. Reddé (ed.) *Gallia Rustica 2: Projet européen Rurland. Les campagnes du nord-est de la Gaule de la fin de l'âge du Fer à l'Antiquité tardive*: 568–584. Pessac: Ausonius.

Clotuche, R., M. Derreumaux, S. Willems, J.-H. Yvinec (in press). The management of a territory for surplus production: The example of Fanum Martis (north, northern France), *Brittania*.

Coldstream, J.N. 2008. *Greek Geometric Pottery: A survey of ten local styles and their chronology. Updated second edition.* Exeter: Bristol Phoenix Press.

Coleman, J.E. 1977. *Keos I: Kephala. A Late Neolithic Settlement and Cemetery.* Princeton, NJ: ASCSA.

Conwell, D.H. 2008. *Connecting a City to the Sea: The History of the Athenian Long Walls* (Mnemosyne Supplements 293). Leiden: Brill.

Conze, A. 1893. *Die attischen Grabreliefs I*. Berlin: W. Spemann.

Conze, A. 1900. *Die attischen Grabreliefs II*. Berlin: W. Spemann.

Conze, A. 1906. *Die attischen Grabreliefs III*. Berlin: Georg Reimer.

Conze, A. 1911-1922. *Die attischen Grabreliefs IV*. Berlin: Walter de Gruyter & Co.

Cook, R.M. 1961. The double stocking tunnel of Greek kilns. *Annual of the British School at Athens* 56: 64–67.

Cornet, J. 1919. Le Turonien entre Mons et l'Escaut. *Annales de la Société Géologique de Belgique* 42: 126–168.

Corso, A. 2016. Sugli agoni di artisti della Grecia classica. *Rendiconti della Accademia Nazionale dei Lincei: Classe di Scienze Morali, Storiche e Filologiche* 27: 115–127.

Costaki, L. 2006. *The Intra Muros Road System of Ancient Athens*. Toronto: University of Toronto.

Coulson, W., O. Palagia and T.L. Shear (eds) 1994. *The Archaeology of Athens and Attica under the Democracy. Proceedings of an International Conference celebrating 2500 years since the Birth of Democracy in Greece, held at the American School of Classical Studies at Athens, December 4-6, 1992*. Oxford: Oxbow Books.

Coulton, J.J. 1974. Lifting in early Greek architecture. *Journal of Hellenic Studies* 94: 1–19.

Coupel, P. and P. Demargne 1969. *Fouilles de Xanthos III: Le Monument des Néréides. L'Architecture.* Paris: Klincksieck.

Childs, W.A.P. and P. Demargne 1989. *Fouilles de Xanthos VIII: Le Monument des Néréides. Le Décor Sculpté. Relevés et études d'architecture par Pierre Coupel et Anca Lemaire avec la collaboration de S. Flatko, D. Bylund, N. Laos.* Paris: Klincksieck.

Courbin, P. 1980. Lyres d'Argos. *Bulletin du Correspondence Héllenique Supplément 6: Special Issue Études argiennes*. 93–114.

Courby, F. 1912. *Exploration Archéologique de Délos V: Le Portique d'Antigone ou du Nord-Est*. Paris: Éditions de Boccard.

Courby, F. 1931. *Exploration Archéologique de Délos XII: Les temples d'Apollon*. Paris: Éditions de Boccard.

Cracolici, V. 2003. *I Sostegni di Fornace dal Kerameikos di Metaponto.* Bari: Edipuglia.

Crampa, J. 1969. *Labraunda. Swedish Excavations and Researches 3. Vol. 1: The Greek Inscriptions.* Lund: Gleerup.

Crampa, J. 1972. *Labraunda. Swedish Excavations and Researches 3. Vol. 2: The Greek Inscriptions.* Stockholm: Swedish Research Institute in Istanbul.

Croissant, F. 1992. Sybaris: La production artistique, in G. Pugliese Carratelli (ed.) *Sibari e la Sibaritide. Atti del trentaduesimo Convegno internazionale di studi sulla Magna Grecia. Taranto, 7-12 ottobre 1992*: 538–559. Taranto: Istituto per la storia e l'archeologia della Magna Grecia.

Culasso Gastaldi, E. 2010. Lemnos e il V secolo. *Annuario della Scuola Archeologica di Atene e delle Missioni Italiane in Oriente* 88 NS 3.10: 135–147.

Cullen, J. and D. Keller 1990. The Greek pithos through time: Multiple functions and diverse imagery, in W.D. Kingery (ed.) *The Changing Roles of Ceramics in Society: 26000 B.P. to the Present* (Ceramics and Civilisation V): 183–209. Westerville, OH: The American Ceramic Society.

Cuomo Di Caprio, N. 1992. Les ateliers de potiers en Grande Grèce: Quelques aspects techniques, in F. Blondé and J.Y. Perreault (eds) *Les Ateliers de Potiers dans le Monde Grec aux Époques Géométrique, Archaïque et Classique. Actes de la Table Ronde organisée à l'École française d'Athènes. 2 et 3 octobre 1987* (Bulletin de Correspondance Hellénique Supplément 23): 69–85. Wilsele: Peeters.

Cuomo Di Caprio, N. 2007. *La Ceramica in Archeologia 2: Antiche Tecniche di Lavorazione e Moderni Metodi di Indagine* (Studia archeologica 144). Rome: L'Erma di Bretschneider.

Dagmar, L. 2002. Carrières et extraction romaines dans le nord-est de la Gaule et en Rhénanie. *Gallia – Archéologie de la France antique* 59: 155–174.

D'Agostino, B. 1995. La "stipe dei cavalli" di Pitecusa. *Atti e Memorie della Società Magna Grecia, Serie III* 1994-1995: 9–108.

Dahlén, I. 1955. Fragments of a kline from Labraunda. *Opuscula Atheniensia* 2: 37–46.

Dakoura-Vogiatzoglou, O. 2004. *Λόφοι Φιλοπάππου-Πνύκας-Νυμφών: Σύντομο Ιστορικό και Περιήγηση* (Αρχαιολογικοί περίπατοι γύρω από την Ακρόπολη, Υπουργείο Πολιτισμού, Α' Εφορεία Προϊστορικών και Κλασικών Αρχαιοτήτων). Athens: Έκδοση Ένωσης Φίλων Ακροπόλεως.

Dakoura-Vogiatzoglou, O. 2009. Η «δια Κοίλης» οδός, in M. Korres (ed.) *Αττικής Οδοί: Αρχαίοι Δρόμοι της Αττικής:* 220–235. Athens: Melissa.

Dakoura-Vogiatzoglou, O. 2013. Αναδιφώντας την ιστορία των δυτικών λόφων, in S. Oikonomou and M. Doga-Toli (eds) *Αρχαιολογικές Συμβολές Β: Αττική, Α' και Γ' Εφορείες Προϊστορικών και Κλασικών Αρχαιοτήτων*: 193–212. Athens: Μουσείο Κυκλαδικής Τέχνης.

Dakoura-Vogiatzoglou, O. 2017. The water supply network on the western hills of Athens, in K. Wellbrock (ed.) *Cura Aquarum in Greece. Proceedings of the 16th International Conference on the History of Water Management and Hydraulic Engineering in the Mediterranean Region. Athens, Greece. 28-30 March 2015* (Schriften der Deutschen Wasserhistorischen

Gesellschaft 27): 89–132. Siegburg: Deutsche Wasserhistorische Gesellschaft.

D'Andria, F. 1975. Scavi nella zona del kerameikos, in D. Adamesteanu, D. Mertens and F. D'Andria (eds) *Metaponto I* (Atti della Accademia Nazionale dei Lincei. Notizie degli scavi di Antichità 29 suppl.): 355–452. Rome: Accademia Nazionale dei Lincei.

D'Andria, F. 2003. *Hierapolis di Frigia (Pamukkale): Guida Archeologica.* Istanbul: Ege.

Darcque, P., R. Étienne and A.-M. Guimier-Sorbets (eds) 2013. *PROASTEION: Recherches sur le Périurbain dans le Monde Grec* (Travaux de la MAE René Ginouvès 17). Paris: Éditions de Boccard.

Daux, G. 1968. Chronique des fouilles: Corinthe – péribole d'Apollon. *Bulletin de Correspondance Hellénique* 92: 787–788.

Daux, G. and E. Hansen 1987. *Fouilles de Delphes II: Le Trésor de Siphnos*. Paris: Éditions de Boccard.

Da Vela, R. 2019. L'officina ceramica etrusca nel centro di Firenze: Strutture e pratiche di obliterazione, in M. Denti and M. Villette (eds) *Archéologie des Espaces Artisanaux : Fouiller et Comprendre les Gestes des Potiers. Actes du colloque international de Rennes, 27-28 novembre 2014:* 33–41. Lattes: Éditions ADAL.

Da Vela, R. 2022a. For the pottery and for the potters: An ergonomic approach to pottery production in Italy (8th to 1st century BC), in N. Burkhardt and R.P. Krämer (eds) *Organizations of Production and Craft in Pre-Roman Italy* (Archaeology and Economy in the Ancient World 11): 31–45. Heidelberg: Propylaeum.

Da Vela, R. 2022b. Le ceramiche miniaturistiche casentinesi a altovaltiberine di età arcaica e classica: Produzioni, scambi, contatti culturali e pratiche sociali, in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 281–299. Rome: L'Erma di Bretschneider.

Da Vela, R. 2022c. The Memory of Little Things: Mobility and Encounters as Constitutive Elements of Memoryscapes in the Iron Age Apennines. *Ocnus* 30: 183–195.

Da Vela, R. and R.P. Krämer 2022. Eine etruskische Residenz bei Cortona? Neue deutsch-italienische Forschungen zu einem etruskischen Hofgebäude des 7. /6. Jhs. v. Chr. im Herzen der Toskana. *Antike Welt* 4: 69–75.

Davies, J. 2021. Soldiers, peasants, industry and towns: The Roman army in Britain. A Welsh perspective, in P. Erdkamp (ed.) *The Roman Army and the Economy*: 169–203. Leiden: Brill.

Dawkins, R.M. and A.J.B. Wace 1905. Notes from the Dodecanese: Astypalea, Telos, Nisyros, Leros. *Annual of the British School at Athens* 12: 165–171.

Debord, P. 1999. *L'Asie Mineure au IVe siècle (412-323 a.C.). Pouvoirs et Jeux Politiques (Ausonius – Publications. Études 3).* Pessac: Ausonius.

De Cazanove, O., A. Esposito, N. Monteix and A. Pollini 2023a. Activités de production et lieux de culte dans le monde antique: Quelques remarques, in O. de Cazanove, A. Esposito, N. Monteix and A. Pollini (eds) *Travailler à l'Ombre du temple: Activités de Production et Lieux de Culte dans le Monde Antique* (Collection du Centre Jean Bérard 57. Archéologie de l'artisanat antique 11): 5–14. Naples: Centre Jean Bérard.

De Cazanove, O., A. Esposito, N. Monteix and A. Pollini (eds) 2023b. *Travailler à l'Ombre du Temple: Activités de Production et Lieux de Culte dans le Monde Antique* (Collection du Centre Jean Bérard 57. Archéologie de l'artisanat antique 11). Naples: Centre Jean Bérard.

Dekoulakou, I. 1971. Πλευρών. *Αρχαιολογικόν Δελτίον* 26.B'2: 326–327.

Dekoulakou, I. 1973. Γεωμετρικοί ταφικοί πίθοι εξ Αχαΐας. *Αρχαιολογική Εφημερίς* 112: 15–29.

Dekoulakou, I. 1982. Κεραμική 8ου και 7ου αιώνα π.Χ. από τάφους της Αχαΐας και της Αιτωλίας. *Annuario della Scuola archeologica di Atene e delle missioni italiane in Oriente* 60: 219–236.

DeLaine, J. 1997. *The Baths of Caracalla. A Study in the Design, Construction, and Economics of Large-Scale Building Projects in Imperial Rome* (Journal of Roman Archaeology Supplementary Series 25). Portsmouth, RI: Journal of Roman Archaeology.

DeLaine, J. 2006. The cost of creation: Technology at the service of construction, in E. Lo Cascio (ed.) *Innovazione Tecnica e Progresso Economico nel Mondo Romano. Atti degli incontri capresi di storia dell'economia antica, Capri, 13-16 aprile 2003* (Pragmateiai 10): 237–252. Bari: Edipuglia.

DeLaine, J. 2017. Quantifying manpower and the cost of construction in Roman building projects: Research perspectives, in G.P. Brogiolo, St. Camporeale, and Al. Chavarría Arnau Costi (eds) *Tempi e Metri Cubi. Quantificare in Architettura. Giornata Di Studi. Padova, 28 Ottobre 2016* (Archeologia dell'Architettura 22): 13–19. Sesto Fiorentino: All'Insegna del Giglio.

Delattre, L. 1992. Autel d'Apollon, le sondage 1a, in J. de La Genière (ed.) *Cahiers de Claros I*: 19–50. Paris: Éditions Recherche sur les civilisations.

Delivorrias, A., in collaboration with G. Berger-Doer and A. Kossatz-Deissmann 1984. s.v. Aphrodite, in *LIMC* II: 2-151.

Dell'Aglio, A. 1996. Taranto, in E. Lippolis (ed.) *Greci in Occidente: Arte e Artigianato in Magna Grecia*: 51–79. Naples: Electa.

Dell'Aglio, A. 2001. La forma della città: aree e strutture di produzione artigianale, in *Taranto e il Mediterraneo. Atti del quarantunesimo Convegno internazionale di studi sulla Magna Grecia, Taranto, 12-16 ottobre 2001*: 171–193. Taranto: Istituto per la storia e l'archeologia della Magna Grecia.

Demangel, R. and G. Daux 1923. *Fouilles de Delphes II: Le Sanctuaire d'Athéna Pronaia. Les Temples de Tuf. Les Deux Trésors*. Paris: Éditions de Boccard.

Demargne, P. 1958. *Fouilles de Xanthos I: Les Piliers Funéraires*. Paris: Klincksieck.

Demargne, P. 1974. *Fouilles de Xanthos V: Tombes-Maisons, Tombes Rupestres et Sarcophages*. Paris: Klincksieck.

Demargne, P. 1981. Le fronton oriental du monument des Néréides à Xanthos: Archaïsmes et provincialismes. *Comptes rendus des séances de l'Académie des Inscriptions et Belles-Lettres* 125.4: 584–592.

De Marinis, R. and M. Rapi (eds) 2007. *L'Abitato Etrusco del Forcello di Bagnolo San Vito (Mantova)*. Florence: Tipografia Latini.

Demarolle, J.M. 2010. Recherches sur le travail du lapicide à partir d'une nouvelle dédicace à Hercule Saxsetanus, in P. Chardron-Picault (ed.) *Aspects de l'Artisanat en Milieu Urbain: Gaule et Occident Romain. Actes du colloque international d'Autun, 20-22 sept. 2007* (Revue archéologique de l'Est Supplément 28): 269–279. Dijon: Revue Archéologique de l'Est.

Denti, M. 2014. Rites d'abandon et opérations d'obliteration 'conservative' à l'Age du Fer. *Revue de l'histoire des religions* 4, viewed 03.09.2021, <https://doi.org/10.4000/rhr.8328>.

Denti, M. and M. Villette 2013. Ceramisti greci dell'Egeo in un atelier indigeno d'Occidente: Scavi e ricerche sullo spazio artigianale dell'Incoronata nella valle del Basento (VIII-VII secolo a.C.). *BArte* 17: 1–36.

Denti, M. and M. Vilette (eds) 2019. *Archéologie des Espaces Artisanaux : Fouiller et Comprendre les Gestes des Potiers. Actes du colloque international de Rennes, 27-28 novembre 2014*. Lattes: Éditions ADAL.

De Polignac, F. 1998. Cité et territoire à l'époque géométrique: un modèle argien?, in A. Pariente and Ph. Touchais (eds) *Argos et l'Argolide: Topographie et Urbanisme. Actes de la table ronde internationale 28.4-1.5.1990. Athènes-Argos* (Recherches franco-helléniques III): 145–162. Paris: Éditions de Boccard.

Déroche, V., V. Mandi, Y. Maniatis and A. Nikolaou 1989. Identification de marbres antiques à Delphes. *Bulletin de Correspondance Hellénique* 113: 403–416.

Desantis, P., L. Manzoli and P. Poli 2022. L'insediamento de La Quercia e la sua ceramica di produzione locale, in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 179–191. Rome: L'Erma di Bretschneider.

Des Courtils, J. 1983. Ionisme en Péloponnèse? À propos d'un anthémion archaïque de Thasos. *Bulletin de Correspondance Hellénique* 107: 133–148.

Des Courtils, J. 1992. L'architecture et l'histoire d'Argos dans la première moitié du Ve s. av. J.-C., in M. Piérart (ed.) *Polydipsion Argos: Argos de la Fin des Palais Mycéniens à la Constitution de l'État Classique. Actes de la table ronde de Fribourg 1987* (Bulletin de Correspondance Hellénique Supplément 22): 241–251. Athens, Fribourg: École française d'Athènes, Éd. universitaires.

Des Courtils, J. 1997. Moulures architecturales en marbre de l'île de Thasos. *Bulletin de Correspondance Hellénique* 121: 489–552.

Des Courtils, J. 2007. La Lycie dans l'histoire, in S. Lemaître (ed.) *Céramiques Antiques en Lycie (VIIe s. a.C. – VIIe s. p.C.): Les Produits et les Marches*: 11–23. Pessac: Ausonius.

Des Courtils, J. 2020. Le temple inachevé d'Athéna à Thasos. *Bulletin de Correspondance Hellénique* 144: 477–530.

Desoignies, J. 1967. *Carte Géologique de la France à 1/50 000. Feuille n°28 with 22 pages key to the maps, Valenciennes*. Paris: Ministère de l'Industrie, Service de la carte géologique de la France, Édition de BRGM.

Desrosiers, S. 1991. Sur le concept de chaîne opératoire, in H. Balfet (ed.) *Observer l'Action Technique: Des Chaînes Opératoires, Pour Quoi Faire?* (Matières et Manières): 21–25. Paris: Éditions du CNRS.

De Staebler, P.D. 2008. The city wall and the making of a Late-Antique provincial capital, in C. Ratté and R.R.R. Smith (eds) *Aphrodisias Papers 4: New Research on the City and Its Monument*s (Journal of Roman Archaeology Supplementary Series 70): 284–318. Portsmouth, RI: Journal of Roman Archaeology.

De Staebler, P.D. 2016. The building experience, in S. Müth, P.I. Schneider, M. Schnelle and P.D. De Staebler (eds) *Ancient Fortifications: A Compendium of Theory and Practice* (Fokus Fortifikation Studies 1): 61–74. Oxford: Oxbow Books.

Detoratou, S. 2013. Παριανή Γλυπτική της Ελληνιστικής και Ρωμαϊκής Περιόδου: Η περίπτωση ενός Εργαστηρίου Γλυπτικής στην Πάρο. Unpublished PhD dissertation, National and Kapodistrian University of Athens, viewed 18 October 2023, <http://hdl.handle.net/10442/hedi/28675>.

Dey, H.W. 2015. *The Afterlife of the Roman City: Architecture and Ceremony in Late Antiquity and the Early Middle Ages.* Cambridge: Cambridge University Press.

Dietrich, N. 2016. Exposed bedrock in Miletus and Priene: An overlooked aspect of Hellenistic and Imperial-era urbanism. *Revue Archéologique* 62: 303–328.

Dietrich, V.J. 2018. Geography, nature and habitation of Nisyros volcano, in V.J. Dietrich and E. Lagios (eds) *Nisyros Volcano: The Kos – Yali – Nisyros Volcanic Field*: 1–12. Cham: Springer.

Dietz, S. 2019. Town and sanctuary in Aetolia – Calydon in context, in E.C. Partida and B. Schmidt-Dounas (eds) *Listening to the Stones: Essays on Architecture and Function in Ancient Greek Sanctuaries, in Honour of Richard Alan Tomlinson:* 81–92. Oxford: Archaeopress.

Dillon, S. and E. Palmer Baltes 2013. Honorific practices and the politics of space on Hellenistic Delos: portrait statue monuments along the dromos. *American Journal of Archaeology* 117: 207–246.

Dinsmoor, W.B. 1934. The repair of the Athena Parthenos: A story of five dowels. *American Journal of Archaeology* 38: 93–106.

Dirksmeier, L. and F. Fechner 2021. Indigenous knowledge as a resource: Transmission, reception, and interaction of knowledge between the Americas and Europe, 1492–1800. Truthmakers and contexts of indigenous knowledge transmission, in L. Dirksmeier, F. Fechner and K. Takeda (eds) *Indigenous Knowledge as a Resource: Transmission, Reception and Interaction of Knowledge between the Americas and Europe, 1492–1800* (RessourcenKulturen 14): 15–25. Tübingen: Tübingen University Press.

Di Tuccio, A. 2021. Coroplastica votiva e sistemi rituali. Il caso metapontino delle terrecotte con Ninfa e Pan o Sileno. *Polygraphya* 3: 37–62.

Djindjian, F. 2013. Us et abus du concept de 'chaîne opératoire' en archéologie, in S. Krausz, A. Colin, K. Gruel, I. Ralston and T. Dechezleprêtre (eds) *L' Âge du Fer en Europe: Mélanges Offerts à Olivier Buchenschutz* (Mémoirs): 93–107. Pessac: Ausonius.

D'Onofrio, A.-M. 2008. L'apporto cicladico nella piu' antica plastica monumentale in Attica, in Y. Kourayos and F. Prost (eds) *La Sculpture des Cyclades à l'Époque Archaïque: Histoire des Ateliers, Rayonnement des Styles. Actes du colloque international organisé par l'Ephorie des Antiquités préhistoriques et classiques des Cyclades et l'École française d'Athènes (7-9 Septembre 1998)* (Bulletin de Correspondance Hellénique Supplément 48): 201–262. Wilsele: Peeters.

D'Onofrio, A.-M. 2020. The beautiful monument: The aristocracy of images in Athenian funerary sculpture (c. 530–480 BCE), in M. Meyer and G. Adornato (eds) *Innovations and Inventions in Athens c. 530 to 470 BCE – Two Crucial Generations* (Wiener Forschungen zur Archäologie 18): 167–186. Vienna: Phoibos.

Doulfis, G. 2019. Η Εικόνα της Σπάρτης και της Λακωνίας από τη Ρωμαϊκή Κατάκτηση έως την Ύστερη Αρχαιότητα μέσω των Κιονοκράνων: Τυπολογία – Μορφολογία – Τοπογραφικά Συμφραζόμενα. Unpublished PhD dissertation, National and Kapodistrian University of Athens, accessed 18 October 2023, <http://hdl.handle.net/10442/hedi/45512>.

Doulfis, G. 2020. Building for the mos Romanus in the Peloponnese: The columbaria monuments, in N. Dimakis and T. Dijkstra (eds) *Mortuary Variability and Social Diversity in Ancient Greece: Studies on Ancient Greek Death and Burial. Netherlands Institute at Athens, 1-2 December 2016*: 126–141. Oxford: Archaeopress.

Drachmann, A.G. 1963. *The Mechanical Technology of Greek and Roman Antiquity: A Study of the Literary Sources.* Copenhagen: Munksgaard.

Drine, A. 2000. Les fouilles de Meninx: Résultats des campagnes de 1997 et 1998. *Africa Romana* 13.1: 87–94.

Drine, A. 2007. Les entrepôts de Meninx. *Antiquités Africaines* 43: 239–251.

Drine, A., E. Fentress and R. Holod 2009. *Jerba Studies I: An Island Through Time. The Punic and Roman Periods* (Journal of Roman Archaeology Supplementary Series 71). Portsmouth, RI: Journal of Roman Archaeology.

Drougou, S. (ed.) 2020. Ι' Διεθνής Επιστημονική Συνάντηση για την Ελληνιστική Κεραμική / *10th International Scientific Meeting on Hellenistic Pottery.* Κεραμεία, Τεχνίτες και Εργαστήρια / *Pottery Workshops, Craftsmen and Workshops.* Athens: Ταμείο Αρχαιολογικών Πόρων.

Dubois, C. 1908. *Étude sur l'Administration et l'Exploitation des Carrières Marbres, Porphyre, Granit, etc. dans le Monde Romain.* Paris: Fontemoing.

Ducat, J. 1966. *Les Vases Plastiques Rhodiens Archaïques en Terre Cuite*. Paris: Éditions de Boccard.

Ducci, C., L. Paoli and S. Sarti (eds) 2015. *Museo Archeologico Comprensoriale del Mugello e della Val di Sieve a Dicomano: Revisione inventariale del materiale esposto nei locali del museo ottobre 2015*. Florence: Soprintendenza Archeologia della Toscana.

Duchêne, H. 1992. *Études Thasiennes XIV: La Stèle du Port. Fouilles du Port 1. Recherches sur une nouvelle inscription thasienne*. Athens: École française d'Athènes.

Duckworth, C. and A. Wilson (eds) 2020. *Recycling and Reuse in the Roman Economy*. Oxford: Oxford University Press.

Dumoulin, D. 1992a. Die Chelys. Ein altgriechisches Saiteninstrument, Teil I. *Archiv für Musikwissenschaft* 49.2: 85–109.

Dumoulin, D. 1992b. Die Chelys. Ein altgriechisches Saiteninstrument, Teil II. *Archiv für Musikwissenschaft* 49.3: 225–257.

Dumser, E.A. 2018. Visual literacy and reuse in the architecture of Late Imperial Rome, in D.Y. Ng and M. Swetnam-Burland (eds) *Reuse and Renovation in Roman Material Culture: Functions, Aesthetics, Interpretations*: 140–159. Cambridge: Cambridge University Press.

Dupré Raventos, X. and J.-A. Remola (eds) 2000. *Sordes Urbis: La Eliminación de Residuos en la Ciudad Romana. Actas de la reunión de Roma, 15-16 de novembre de 1996.* Rome: L'Erma di Bretschneider.

Durm, J. 1910. *Die Baukunst der Griechen*. Leipzig: A. Krömer.

Durugönül, S. 1989. *Die Felsreliefs im Rauhen Kilikien* (BAR International Series 511). Oxford: BAR Publishing.

Dworakowska, A. 1975. *Quarries in Ancient Greece*. Breslau: Ossolineum.

Dworakowska, A. 1983. *Quarries in Roman Provinces*. Breslau: Ossolineum.

Dyer, J. (ed.) 2023-2024 (in press). *Heritage. Special Issue Polychromy in Ancient Sculpture and Architecture.* <https://www.mdpi.com/journal/heritage/special_issues/polychromy_sculpture_architecture>, last accessed 20 March 2024.

Egry, I. 2023. *Die Physik der Musik und ihrer Instrumente: Von Schallschnellen, Wolfstönen und Liebesfüßen*. Weinheim: WILEY-VCH.

Eichner, I. 2011. *Frühbyzantinische Wohnhäuser in Kilikien: Baugeschichtliche Untersuchung zu den Wohnformen*

in der Region um Seleukeia am Kalykadnos. Tübingen: Wasmuth.

Eichner, H. 2017. Ein philologisch-sprachwissenschaftlicher Blick auf den Fortgang der lykischen Studien seit Emmanuel Laroche, in A. Mouton (ed.) *L'Hittitologie aujourd'hui: Études sur l'Anatolie Hittite et néo-hittite à l'occasion du centenaire de la naissance d'Emmanuel Laroche. 5e Rencontres d'archéologie de l'IFEA, Istanbul 21-22 novembre 2014*: 277–293. Istanbul: Institut français d'Études Anatoliennes.

Eleftheratou, S. 2005. Στοιχεία πολεοδομικής και οικιστικής οργάνωσης από το νότιο τμήμα της αρχαίας Αθήνας, in S. Vlizos (ed.) *Athens during the Roman Period: Recent Discoveries, New Evidence* (4ο Παράρτημα): 185–205. Athens: Μουσείο Μπενάκη.

Elsner, J. 2000. From the culture of spolia to the cult of relics: The Arch of Constantine and the genesis of Late Antique forms. *Papers of the British School at Rome* 68: 149–184.

Engelmann, I. and P. Niewöhner 2010. Bauen nach der Krise: Die Spoliengalerie an der Apsis der Apostelkirche von Anazarbos, in D. Kreikenbom, K.-U. Mahler, P. Schollmeyer and Th. Weber (eds) *Krise und Kult: Vorderer Orient und Nordafrika von Aurelian bis Justinian*: 109–137. Berlin: De Gruyter.

Engels, J. 1998. *Funerum Sepulcrorumque Magnificentia: Begräbnis- und Grabluxusgesetze in der griechisch-römischen Welt. Mit einigen Ausblicken auf Einschränkungen des funeralen und sepulkralen Luxus im Mittelalter und in der Neuzeit*. Stuttgart: Franz Steiner Verlag.

Esposito, A. 2013. Ateliers de potiers et choix du lieu d'implantation en Grande Grèce et en Sicile: Bilan de la recherche, in P. Darcque, R. Étienne and A.-M. Guimier-Sorbets (eds) *PROASTEION: Recherches sur le Périurbain dans le Monde Grec* (Travaux de la MAE René Ginouvès 17): 201–221. Paris: Éditions de Boccard.

Esposito, A. and G.M. Sanidas (eds) 2012a. *«Quartiers» Artisanaux en Grèce Ancienne, une Perspective Méditerranéenne.* Villeneuve d'Ascq: Presses universitaires du Septentrion.

Esposito, A. and G.M. Sanidas 2012b. La question des regroupements des activtiés économiques et le concept de «quartier d'artisans»: Quelle approche?, in A. Esposito and G.M. Sanidas (eds) *«Quartiers» Artisanaux en Grèce Ancienne, une Perspective Méditerranéenne*: 11–21. Villeneuve d'Ascq: Presses universitaires du Septentrion.

Estrin, S. 2023. *Grief Made Marble: Funerary Sculpture in Classical Athens*. New Haven, CT: Yale University Press.

Étienne, R. 2013. La notion de proasteion dans les textes grecs, in P. Darcque, R. Étienne and A.-M. Guimier-Sorbets (eds) *PROASTEION: Recherches sur le Périurbain dans le Monde Grec* (Travaux de la MAE René Ginouvès 17): 13–30. Paris: Éditions de Boccard.

Fachard, S., S.C. Murray, A.R. Knodell and K. Papangeli 2020. The fortress of Eleutherai: New insights from survey, architecture, and epigraphy. *Hesperia* 89.3: 475–549.

Faklaris, P. 1977. Χέλυς. *Αρχαιολογικόν Δελτίον* 32.Α': 218–233.

Fant, J.C. 2001. Rome's marble yards. *Journal of Roman Archaeology* 14: 167–198.

Farnsworth, M. and I. Simmons 1963. Coloring agents for Greek glazes. *American Journal of Archaeology* 67: 389–396.

Fauvel, L.F.S. 1807. Extrait d'une Lettre de M. Fauvel, Sous-Commissaire des Relations Commerciales de France à Athènes, et Correspondant de la Classe d'Histoire et de Littérature Anciennes de l'Institut, Adressée à M. Barbie du Bocage, Membre de ladite Classe, Athènes, le 30 Septembre 1806. *Magasin Encyclopédique* 2: 358–359.

Favennec, B., S. Willems, R. Clotuche and B. Borgers 2019. Nouvelles mises en perspectives, interprétations et particularités de l'officine de Famars (Nord), in *Actes du Congrès de Maubeuge-Bavay, SFECAG, 30 mai – 2 juin 2019*: 65–86. Marseille: SFECAG.

Fayder-Faitmans, G. 1952. Les limites de la cité des Nerviens. *L'antiquité classique* 21: 338–358.

Fedeli, L. and G. Warden 2005. Vicchio (FI): Recenti scavi a Poggio Colla. *Notiziario della Soprintendenza per i Beni Archeologici della Toscana* 1: 366–369.

Fedeli, L., F. Guidelli, G. Gori and A. Salvi 2007. Cortona (AR), Fossa del Lupo: Intervento di scavo 2006-2007. *Notiziario della Soprintendenza per i Beni Archeologici della Toscana* 3: 255–259.

Fedeli, L., P. Giroldini and G. Baldini 2013. Figline Valdarno (FI), Località La Rotta: Campagna di scavo 2013. *Notiziario della Soprintendenza per i beni Archeologici della Toscana* 9: 317–321.

Feld, O. and H. Weber 1967. Tempel und Kirche über der Korykischen Grotte (Cennet Cehennem) in Kilikien. *Istanbuler Mitteilungen* 17: 254–78.

Ferdière, A. 2006-2007. La place de l'artisanat en Gaule romaine du Centre, Nord-Ouest et Centre-Ouest (province de Lyonnaise et cités d'Aquitaine septentrionale). *Revue archéologique du Centre de la France* 45-46, viewed 12 October 2023, <http://journals.openedition.org/racf/758>.

Ferrandini Troisi, F. and M. Chelotti 1992. Artigianato epigrafico, in L. Todisco and M. Catucci (eds) *Introduzione all'Artigianato della Puglia Antica: Dall'Età Coloniale all'Età Romana*: 207–226. Bari: Edipuglia.

Ferrandini Troisi, F., B. Buccoliero and D. Ventrelli 2012. *Coroplastica Tarantina: Le Matrici Iscritte.* Bari: Edipuglia.

Ferrari, A., G. Steffè, F. Fontana and P. Mazzieri 2006. Il comprensorio montano tra paleolitico superiore ed età del rame: Il caso modenese, in A. Caradelli and L. Malnati (eds) *Atlante dei Beni Archeologici della Provincia di Modena II: Montagna*: 17–39. Sesto Fiorentino: All'Insegna del Giglio.

Feyel, C. 1998. La structure d'un groupe socio-économique: Les artisans dans les grands sanctuaires grecs du IVe siècle. *Topoi* 8.2: 561–579.

Feyel, C. 2006. *Les Artisans dans les Sanctuaires Grecs aux Époques Classique et Hellénistique à Travers la Documentation Financière en Grèce* (Bibliothèque des Écoles françaises d'Athènes et de Rome 318). Athens: École française d'Athènes.

Ficuciello, L. 2008. *Le Strade di Atene* (Studi di Archeologia e di Topografia di Atene e dell'Attica 4). Athens, Paestum: Scuola Archeologica Italiana di Atene, Pandemos.

Filimonos, M. 1993. Ανασκαφικές έρευνες στη Νίσυρο. *Νισυριακά* 12: 139–146.

Filimonos-Tsopotou, M. 2004. Ρόδος *I: Η Ελληνιστική Οχύρωση της Πόλης της Ρόδου* (Δημοσιεύματα του Αρχαιολογικού Δελτίου 86). Athens: Υπουργείο Πολιτισμού.

Filimonos-Tsopotou, M. 2013a. Το Παλαιόκαστρο της Νισύρου. *Νισυριακά* 20: 149–172.

Filimonos-Tsopotou, M. 2013b. Πρώρα πολεμικού πλοίου από τη Νίσυρο, in A. Giannikouri (ed.) *Ρόδος IV: Ὅλβιος Ἀνερ. Μελέτες στη μνήμη του Γρηγόρη Κωνσταντινόπουλου*: 265–285. Athens: Υπουργείο Πολιτισμού και Αθλητισμού/Αρχαιολογικό Ινστιτούτο Αιγαιακών Σπουδών.

Finley, M. 1973. *The Ancient Economy* (Sather Classical Lectures 43). Berkeley, Los Angeles and London: University of California Press.

Flahaut, J., S. Willems and B. Borgers 2014. Les vases à visage et à bustes dans le nord de la Gaule : Nouvelles données à Fanum Martis, in *Actes du Congrès de Chartres, SFECAG, 29 mai – 1er juin 2014*: 703–718. Marseille: SFECAG.

Floren, J. 1987. Die geometrische und archaische Plastik, in W. Fuchs and J. Floren (eds) *Die griechische Plastik I* (Handbuch der Archäologie). Munich: C.H. Beck.

Florescu, G. 1936. Cariera romana de la Cernavoda. *Analele Dobrogei* 17: 33–46.

Florescu, G. 1937. Römischer Steinbruch bei Cernavoda, Rumänien. *Germania* 21: 108–113.

Fol, V. 2017. Culte héroïque dans la Thrace – images littéraires grecques ou images réelles du chevalier-héros thrace, in P. Delev, T. Stoyanov, S. Yanakieva, H. Popov, A. Bozkova, M. Vassileva, J. Tzvetkova, M. Damyanov, P. Ilieva and J. Emilov (eds) *Ancient Thrace: Myth and Reality II. The Proceedings of the Thirteenth International Congress of Thracology Kazanlak, September 3 – 7, 2017*: 95–98. Sofia: St. Kliment Ohridski University Press.

Forbes, R.J. 1955. *Studies in Ancient Technology 3*. Leiden: Brill.

Forbes, R.J. 1964. *Studies in Ancient Technology 4: The Fibres and Fabrics of Antiquity*. Leiden: Brill.

Formigli, E. 1984. La tecnica di costruzione delle statue di Riace, in *Due Bronzi da Riace: Rinvenimento, Restauro, Analisi ed Ipotesi di Interpretazione* (Bollettino d'arte. Serie speciale 3): 107–142. Rome: Istituto poligrafico e zecca dello Stato.

Fornasier, J., A.V. Bujskich, A.G. Kuz'miščev, A. Patzelt, M. Helfert and N. Kratzsch 2017. Vor den Toren der Stadt: Deutsch-ukrainische Forschungen in der Vorstadt von Olbia Pontike. *Archäologischer Anzeiger* 2017: 19–61.

Fornasier, J., A. Buiskykh and O.H. Kuzmishchev 2022. Urban planning with divine protection? On the location of (sub-)urban sanctuaries in Olbia Pontica in the Archaic-Classical period. *Arheologia* 2: 67–95.

Forster, E. and A. Woodward 1906-07. Laconia: II: Topography. *Annual of the British School at Athens* 13: 219–267.

Fort, B. and N. Tisserand 2011. Découverte d'une cymbale à Famars Fanum Martis (F, Nord). *Instrumentum* 34: 11.

Fort, B. and N. Tisserand 2017. Étude du mobilier métallique et d'instrumentum, in R. Clotuche, J. Clerget, G. Teysseire and A. Tixador (eds) *Un Quartier Antique de Fanum Martis: Résultats de la Fouille du Technopôle Transalley, Phase 1, 3 et 4 a, Campagnes 2011 à 2014, Tome 4, Vol. 2, Les études thématiques*: 7–282. Glisy: Inrap NP.

Fossey, J.M. (ed.) 1981. *Khostia 1980: A Preliminary Report on the First Season of Canadian Excavations at Khostia, Boiotia, Central Greece* (McGill University Monographs in Classical Archaeology and History 1). Montreal: McGill University Press.

Fossey, J.M. and J. Morin (eds) 1986. *Khostia 1983: Preliminary Report of the Second Season of Canadian Excavations at Khostia, Boioia, Central Greece* (McGill University Monographs in Classical Archaeology and History 3). Amsterdam: J.C. Gieben.

Fouquet, J. 2019. *Bauen zwischen Polis und Imperium: Stadtentwicklung und urbane Lebensformen auf der kaiserzeitlichen Peloponnes*. Berlin: De Gruyter.

Fournier, P. and D. Massounie 2001. *Eau et Salubrité dans le Midi de la France à l'Époque Moderne. Siècles* 14, viewed 24 October 2023, <https://journals.openedition.org/siecles/3220>.

Fowler, C. 2013. Dynamic assemblages, or the past is what endures: Change and the duration of relation, in B. Alberti, A.M. Jones and J. Pollard (eds) *Archaeology after Interpretation: Returning Materials to Archaeological Theory*: 235–256. Walnut Creek: Left Coast Press.

Fox, M. 1996. Greek and Roman Hercules: Moments in pre-historical imperialism. *Kunapipi* 18.1: 9–21.

Foxhall, L. 1998. The Greek countryside, in B.A. Sparkes (ed.) *Greek Civilization: An Introduction*: 99–114. Oxford: Blackwell.

Foxhall, L. and K. Stears 2000. Redressing the balance: Dedications of clothing to Artemis and the order of life stages, in M. Donald and L. Hurcombe (eds) *Gender and Material Culture in Historical Perspective*: 3–16. London: Macmillan.

Fraser, P.M. 1977. *Rhodian Funerary Monuments*. Oxford: Clarendon Press.

Frébutte, C. 1996. Enghien/Petit-Enghien (Ht), "Warelles" et "Grand Champ", vestiges gallo-romains, in K. Bausier, R. Borremans, D. Bosquet, H. Remy and M. Soumoy (eds) *Sur la Voie de l'Histoire, Archéologie et TGV : Études et Documents, Fouilles* 2: 151–154. Namur: Service public de Wallonie, Département du patrimoine.

Freccero, A. 2015. Marble trade in antiquity: Looking at Labraunda. *Anatolia Antiqua* 23: 11–54.

Frey, J.M. 2015a. *Spolia in Fortifications and the Common Builder in Late Antiquity.* Leiden: Brill.

Frey, J.M. 2015b. The Archaic colonnade at ancient Corinth: A case of early Roman spolia. *American Journal of Archaeology* 119.2: 147–175.

Freyer-Schauenburg, B. 1974. *Samos XI: Bildwerke der Archaischen Zeit und des Strengen Stils.* Bonn: Habelt Verlag.

Frödin, O. and A.W. Persson 1938. *Asine: Results of the Swedish Excavations 1922–1930.* Stockholm: Generalstabens Litografiska Anstalts Förlag i Distribution.

Fuchs, W. 2008. Das Reiterrelief Albani. *Thetis* 15: 19–44.

Gabelmann, H. 1965. *Studien zum frühgriechischen Löwenbild*. Berlin: Gebr. Mann.

Gadolou, A. 2008. *Η Αχαΐα στους Πρώιμους Ιστορικούς Χρόνους: Κεραμική Παραγωγή και Έθιμα Ταφής*. Athens: Ταμείο Αρχαιολογικών Πόρων.

Gaillard, J. 2011. *L'Exploitation Antique de la Pierre de Taille dans le Bassin de la Charente* (coll. Mémoire 11). Chauvigny: APC.

Gambash, G., B. Pestarino and D. Friesem 2022. From murex to fabric: The Mediterranean purple. *Technai* 13: 85–113.

Gardner, W.A. 1908. *In Greece with the Classics*. Boston: Little, Brown, and Co.

Gatsi, M. 2010. Θέση "Ρηγαίικα" Μεσολογγίου Χ.Θ. 27+200 – Χ.Θ. 27+530-550, 1057-1058. Έργο: Παραϊόνια Οδός. Οδικές συνδέσεις σήραγγας Αγ. Ηλία, Χ.Θ. 27+682 έως 27+787, 1052-1055, θέση "Χονδρέικα" Χ.Θ. 23+550 – Χ.Θ. 23+750, Είσοδος Σήραγγας Καλυδώνας Ιόνιας Οδού. *Αρχαιολογικόν Δελτίον* 65.Β΄1.2: 1059–1062.

Gasparini, D. 2016, in D. Gasparini and Rossi T., 1.1.2 Periodo II. L'Età del Ferro, in M. Miari and C. Negrelli (eds) *Ritmi di Transizione 2: Dal Garampo al Foro Annonario. Ricerche Archeologiche 2009–2013* (Università Ca' Foscari di Venezia Monografie): 43–44. Sesto Fiorentino: All'Insegna del Giglio.

Gatto, F. and F. Van Haeperen (eds) 2023. *Cultes et Divinités dans les Carrières et les Mines de l'Empire Romain* (Fervet Opus). Louvain: PUL.

Gaucci, A. 2016. Nuovi studi sull'isolato Mansuelli di Marzabotto (Regio IV, Insula I), in G.M. Della Fina (ed.) *Dalla Capanna al Palazzo: Edilizia Abitativa nell'Italia Preromana* (Annali della Fondazione per il Museo Claudio Faina di Orvieto 23): 243–299. Rome: Edizioni Quasar.

Gaucci, A. 2010. I Graffiti, in E. Govi and G. Sassatelli (eds) *Marzabotto. La Casa 1 della Regio IV, Insula 2. I Materiali*: 350–395. Bologna: Ante Quem.

Gaucci, A. 2021. *Iscrizioni della città etrusca di Adria: Testi e contesti tra Arcaismo ed Ellenismo* (Università di Bologna Dipartimento di Storia Culture Civiltà 28). Bologna: Bologna University Press.

Geertz, C. 1993. *Local Knowledge: Further Essays in Interpretive Anthropology*. London: Fontana Press.

Gelichi, S. and C. Negrelli (eds) 2008. *A Misura d'Uomo: Archeologia del territorio cesenate e valutazione dei depositi* (Università Ca'Foscari di Venezia Monografie). Sesto Fiorentino: All'Insegna del Giglio.

Georgiadis, M. 2012. *Kos in the Neolithic and Early Bronze Age: The Halasarna Finds and the Aegean Settlement Pattern*. Philadelphia, PA: INSTAP Academic Press.

Georgiadis, M. 2020. The Prehistoric period, in G. Kokkorou-Alevras (ed.) *ΑΛΑΣΑΡΝΑ V*: 9–120. Athens: National and Kapodistrian University of Athens.

Gerster, B. 1896. *L'Isthme de Corinthe et son Percement*. Paris: Márkus.

Gevaert, F.A. 1881. *Histoire et Théorie de la Musique de l'Antiquité II.* Gent: Typographie C. Annoot-Braeckmann.

Geyer, A. 1993. Ne ruinis urbs deformetur... Ästhetische Kriterien in der spätantiken Baugesetzgebung. *Boreas. Münstersche Beiträge zur Archäologie* 16: 63–77.

Giannakakis, *I*. 2015. Ελλαδικοί Προϊστορικοί Πίθοι. Αποθηκευτικά Αγγεία στη Νότια Ηπειρωτική Ελλάδα. Unpublished PhD dissertation, University of Ioannina, <http://hdl.handle.net/10442/hedi/37422>.

Giannakopoulos, P.E. 1906. *Το Γύθειον: Αρχαιολογική και Ιστορική Άποψις από της Προϊστορικής Εποχής μέχρι του Μεγάλου Κωνσταντίνου*. Athens.

Giannopoulou, D. 2002. Η Τεχνολογία των Χειροποίητων Αποθηκευτικών Αγγείων στον Ελλαδικό Χώρο. Διαχρονική έρευνα της τεχνολογίας αυτής με βάση τα χειροποίητα αποθηκευτικά αγγεία στα νεότερα εργαστήρια του Μεσσηνιακού Κόλπου. Unpublished PhD dissertation, Aristotle University of Thessaloniki.

Giannopoulou, M. 2010. Περί κατασκευής πίθων, in D. Papanikola-Bakirtzi and D. Kousoulakou (eds) *Κεραμική της Ύστερης Αρχαιότητας από τον Ελλαδικό Χώρο (3ος- 7ος αιώνας μ.Χ.). Επιστημονική Συνάντηση Θεσσαλονίκη 12-16 Νοεμβρίου 2006* (Δημοσιεύματα Αρχαιολογικού Ινστιτούτου Μακεδονικών και Θρακικών Σπουδών 8): 65–80. Thessaloniki: Αρχαιολογικό Ινστιτούτο Μακεδονικών και Θρακικών Σπουδών.

Giannicchedda, E. and J.A. Quirós Castillo 1997. La ceramica vacuolata nell'Appennino ligure e toscano, in *1. Congresso nazionale di archeologia medievale*: 379–383. Sesto Fiorentino: All'Insegna del Giglio.

Giannidis, L.I. 1987. Ludwig Ross: Ταξιδιωτικές εντυπώσεις από τη Νίσυρο. *Νισυριακά* 10: 109–122.

Gillet, E. 2017. *Douchy-les-Mines Z.A.C des Prouettes: Rapport de diagnostic*. Villeneuve d'Ascq: Publications Nord – Pas-de-Calais du Service régional de l'archéologie.

Ginouvès, R. 1970. *Le Théatron à Gradins Droits et l'Odéon d'Argos* (Études Péloponnésiennes II). Paris: Éditions de Boccard.

Ginouvès, R. and R. Martin 1985. *Dictionnaire Méthodique de l'Architecture Grecque et Romaine I: Matériaux, techniques de construction, techniques et formes du décor* (Publications de l'École française de Rome 84). Rome: École française de Rome.

Giroldini, P. (ed.) 2022. *Plasmati dal Fuoco: Storie di ceramiche nella Figline etrusca*. Figline Valdarno: Comune di Figline e Incisa Valdarno.

Giroldini, P. and G. Baldini 2020. Il sito Archeologico in località La Rotta a Figline e Incisa Valdarno (FI): Le Campagne 2013 e 2014. *Tutela e Restauro* 2020. *Notiziario della Soprintendenza Archeologica Belle Arti e Paesaggio per la Città Metropolitana di Firenze e le Province di Pistoia e Prato*: 209–216.

Giuliani, L. 2019: Unser, Unser Winckelmann: Zwischen Kanonisierung und Verdrängung. *Zeitschrift für Ideengeschichte* 13.1: 114–124.

Gliozzo, E., A. Comini, A. Cherubini, A. Ciacci, A. Moroni and I. Turbanti Memmi 2011. Ceramic production and metal working at the Trebbio archaeological site (Sansepolcro, Arezzo, Italy), in I. Turbanti Memmi (ed.) *Proceedings of the 37th International Symposium on Archaeometry*: 61–69. Berlin/Heidelberg: Springer.

Gnoli, R. 1988. *Marmora Romana*. Rome: Edizioni dell'Elefante.

Goette, H.R. 1991. Die Steinbrüche von Sounion im Agrileza-Tal. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 106: 201–229.

Goette, H.R. 1994. Der sogenannte römische Tempel von Karystos. Ein Mausoleum der Kaiserzeit. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 109: 259–300.

Golvin, J.C. 1993. Quelques grands principes de la construction pharaonique à la lumière de l'étude des échafaudages antiques égyptiens. *Bulletin de la Société Nationale des Antiquaires de France* 1991: 116–135.

Govi, E. 2010. Il settore III: L'atelier ceramico, in G. Sassatelli and E. Govi (eds) *Marzabotto: La Casa I della Regio IV, Insula 2* (Studi e Scavi nuova serie 26, Kainua 2): 189–191. Bologna: Ante Quem.

Graml, C. 2020. *The Sanctuary of Artemis Soteira in the Kerameikos of Athens* (Philippika 136). Wiesbaden: Harrassowitz.

Grandjean, Y. 1988. *Études Thasiennes XII: Recherches sur l'Habitat Thasien à l'Époque Grecque*. Paris: Éditions de Boccard.

Grandjean, Y. and F. Salviat 2006. Règlement du Délion de Thasos. *Bulletin de Correspondance Hellénique* 130: 293–327.

Grandjean, Y. and F. Salviat 2012. *Οδηγός της Θάσου, transl. G.M. Sanidas* (Sites et Monuments 3). Athens: École française d'Athènes.

Gras, M., H. Tréziny and H. Boise 2004. *Mégara Hyblaea 5: La Ville Archaïque – l'Espace Urbain d'une Cité Grecque de Sicile Orientale*. Rome: École française de Rome.

Greco, G. 1998. Da Hera Argiva ad Hera Paestana, in C. Delplace (ed.) *I Culti della Campania Antica. Atti del Convegno internazionale di studi in ricordo di Nazarena Valenza Mele. Napoli, 15-17 maggio 1995*: 46–62. Rome: Giorgio Bretschneider.

Greco, G. 2010. Il culto, il rito, i doni votivi: La fenomenologia religiosa dell'universo olimpico a quello ctonio, in J. de La Genière and G. Greco (eds) *Il Santuario di Hera alla Foce del Sele: Indagini e studi 1987-2006. Atti e Memorie della Società Magna Grecia, Serie IV (2008-2010)*: 556–589. Rome: Società Magna Grecia.

Greco, E. and L. Ficuciello 2010. Cesure e continuità: Lamno, dai 'Tireni' agli Ateniesi. *Annuario della Scuola Archeologica di Atene e delle Missioni Italiane in Oriente* 88 NS 3.10:149–168.

Greenberg, C. 1995. David Smith's new sculpture, in J. O'Brian (ed.) *The Collected Essays and Criticism 4: Modernism with a Vengeance: 1957-1969*: 188–192. Chicago: University Press of Chicago.

Greenhalgh, M. 1999. Spolia in fortifications: Turkey, Syria, and North Africa, in *Ideologie e Pratiche del Reimpiego nell'alto Medioevo. 16-21 aprile 1998*: 785–935. Spoleto: CISAM.

Greenhalgh, M. 2009. *Marble Past, Monumental Present: Building with Antiquities in the Medieval Mediterranean.* Leiden: Brill.

Greenhalgh, M. 2011. Spolia: A definition in ruins, in R. Brilliant and D. Kinney (eds) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*: 75–95. Burlington, VT: Ashgate.

Grira, K. 2013. Caractérisation des Lipides Contenus dans des Échantillons Archéologiques. Mémoire de stage de licence de chimie 3e année, effectué au laboratoire de biogéochimie et écologie des milieux continentaux de Jussieu, sous la direction T. Nguyen Tu, Paris : Université Pierre et Marie Curie.

Grmek, M.D. 1989. *Diseases in the Ancient Greek World.* Baltimore, MD: Johns Hopkins University Press.

Groessens, E. 2002. Les matériaux de construction de Belgique et du Nord de la France. *Géologues – Revue officielle de l'Union Française des géologues* 133-134: 84–92.

Grossmann, J.B. 2013. *The Athenian Agora XXXV: Funerary Sculpture.* Princeton, NJ: ASCSA.

Grüner, A. 2019. Meta Sudans, oder: Akustik und Geruch im antiken Rom: Kritische Bemerkungen zu einer archäologischen Urbanistik der Sinne, in C. Illies (ed.) *Bauen mit Sinn: Schritte zu einer Philosophie der Architektur*: 175–208. Wiesbaden: Springer Fachmedien.

Guidorzi, G. 2013. Non solo abitazioni: Il complesso produttivo di San Pancrazio, in D. Locatelli, L.

Malnati and D.F. Maras (eds) *Storie della Prima Parma: Etruschi, Galli, Romani. Le origini della città alla luce delle nuove scoperte archeologiche*: 27–29. Rome: L'Erma di Bretschneider.

Guyon, J., M. Bouiron and J. Lucan 2009. «Débat» : les faubourgs ou l'ambiguïté urbaine. *Archéopages, Quartiers et faubourgs* 24: 56–63.

Guzzo, P.G., A. Bedini, R. Spadea and L. Rota 1970. Campagna di scavo 1970: Stombi, in *Sibari II* (Atti della Accademia Nazionale dei Lincei. Notizie degli scavi di Antichità 24 suppl. 3): 216–366. Rome: Accademia Nazionale dei Lincei.

Guzzo, P.G. 1972. Relazione preliminare della terza campagna di scavo a Sibari, in P.G. Guzzo, M.N. Pagliardi, U. Spigo, L. Rota, A. Pennacchi, P. Quiri and D. Mertens (eds) *Sibari III: Rapporto preliminare della campagna di scavo: Stombi, Casa Bianca, Parco del Cavallo, San Mauro 1971* (Atti della Accademia Nazionale dei Lincei. Notizie degli scavi di Antichità 26): 19–48. Rome: Accademia Nazionale dei Lincei.

Guzzo, P.G., M.N. Pagliardi, U. Spigo and L. Rota 1972. Descrizione dei materiali, in P.G. Guzzo, M.N. Pagliardi, U. Spigo, L. Rota, A. Pennacchi, P. Quiri and D. Mertens (eds) *Sibari III: Rapporto preliminare della campagna di scavo: Stombi, Casa Bianca, Parco del Cavallo, San Mauro 1971* (Atti della Accademia Nazionale dei Lincei. Notizie degli scavi di Antichità 26): 48–146. Rome: Accademia Nazionale dei Lincei.

Gygax, M.D and W. Tietz 2005. 'He who of all mankind set up the most numerous trophies to Zeus': The inscribed pillar of Xanthos reconsidered. *Anatolian Studies* 55: 89–98.

Hafner, G. 1997. *Polyklet Doryphoros: Revision eines Kunsturteils*. Frankfurt am Main: Arbeitskreis Frankfurt und die Antike.

Hagel, S. 2015. *Ancient Greek Music. A New Technical History.* Cambridge: Cambridge University Press.

Hagel, S. 2016. An invention worth fifty cows: Evidence for supra-regionality in tortoise shell lyre construction, in L. Bravi, L. Lomiento, A. Meriani and G. Pace (eds) *Tra Lyra e Aulos: Tradizioni Musicali e Generi Poetici* (Rivista di Cultura Classica e Medioevale. Quaderni 14): 157–166. Rome: Fabrizio Serra Editore.

Hägg, R. 1974. *Die Gräber der Argolis in Submykenischer, Protogeometrischer und Geometrischer Zeit 1: Lage und Form der Gräber* (Boreas 7.1). Uppsala: Uppsala University Press.

Hallof, K. and S. Kansteiner 2014. s.v. Archedamos (Ἀρχέδαμος) von Thera, in *DNO* 2: 662–664.

Hallof, K., S. Kansteiner and S. Prignitz 2014. s.v. Pythokritos (Πυθόκριτος) von Rhodos, in *DNO* 4: 521–545.

Hamilakis, Y. and A. Meirion Jones 2017. Archaeology and assemblage. *Cambridge Archaeological Journal* 27.1: 77–84, viewed 27 November 2023, <https://doi.org/10.1017/S0959774316000688>.

Hanoune, R. 2002. Amoenitas urbium? Quelques textes en réaction, in R. Bedon (ed.) *Amoenitas Urbium: Les Agréments de la Vie Urbaine en Gaule Romaine et dans les Régions Voisines. Hommage à Pierre Pouthier* (Caesarodunum XXXV-XXXVI): 287–293. Limoges: PULIM.

Hansen, E. 1991. Versetzen von Baugliedern am griechischen Tempel, in A. Hoffmann, E.L. Schwandner, W. Hoepfner and G. Brands (eds) *Bautechnik der Antike. Internationales Kolloquium in Berlin vom 15.-17. Februar 1990 veranstaltet vom Architecturreferat des DAI in Zusammenarbeit mit dem Seminar für Klassische Archäologie der Freien Universität Berlin*: 72–79. Mainz: Philipp von Zabern.

Hansen, E. 2010. Une pierre à Delphes, in E. Hallager and D. Mulliez (eds) *The French Connection – 100 Years with Danish Architects at L'École française d'Athènes* (Monographs of the Danish Institute at Athens 13): 33–40. Athens: École française d'Athènes.

Hansen, E. and G. Algreen-Ussing 1975. *Fouilles de Delphes II: Atlas*. Paris: Éditions de Boccard.

Hansen, E., G. Algreen-Ussing and R. Frederiksen 2016. A short-cut to Delphi: Indications of a vehicle track from a stone quarry to the sanctuary of Apollo at Delphi. *Proceedings of the Danish Institute at Athens* 8: 208–263.

Hansen, M.F. 2003. *The Eloquence of Appropriation: Prolegomena to an Understanding of Spolia in Early Christian Rome.* Rome: L'Erma di Bretschneider.

Harari, M. 2010. Gli Etruschi nella valle del Po, in G. Bonini, A. Brusa and R. Cervi (eds) *Quaderni dell'Istituto Alcide Cervi* 6. *Storia e Didattica: Special Issue Il paesaggio agrario italiano protostorico e antico*: 51–57.

Hardenberg, R., M. Bartelheim and J. Staecker 2017. The 'Resource Turn': A sociocultural perspective on resources, in A.K. Scholz, M. Bartelheim, R. Hardenberg, and J. Staecker (eds) *ResourceCultures: Sociocultural Dynamics and the Use of Resources – Theories, Methods, Perspectives* (RessourcenKulturen 5): 13–23. Tübingen: Tübingen University Press.

Hardenberg, R. 2021. The rise of a new millet assemblage in India, in T. Schade, B. Schweizer, S. Teuber, R. Da Vela, W. Frauen, M. Karami, D.K. Ojha, K. Schmidt, R. Sieler and M.S. Toplak (eds) *Exploring Resources: On Cultural, Spatial and Temporal Dimensions of ResourceCultures* (RessourcenKulturen 13): 141–156. Tübingen: Tübingen University Press.

Hardenne, L. 2015. *Le Décor Architectonique en Pierre en Cités des Tongres, Nerviens et Ménapiens. Mémoire de Master en histoire de l'art et archéologie*. Université de Louvain-la-Neuve.

Harris E.M. 2006. *Law and Society in Ancient Athens*. Cambridge: Cambridge University Press.

Harrison, E.B. 1965. *The Athenian Agora XI: Archaic and Archaistic Sculpture*. Princeton, NJ: ASCSA.

Harter-Uibopuu, K. 2012. Öffentliches und privates Eigentum an Grabstätten im kaiserzeitlichen Athen und Kleinasien. Antwort auf M. Faraguna, in B.

Legras and G. Thür (eds) *Symposion 2011. Vorträge zur griechischen und hellenistischen Rechtsgeschichte (Paris, 7.–10. September 2011)*: 187–198. Vienna: Verlag der Österreichischen Akademie der Wissenschaften.

Harter-Uibopuu, K. 2014. Tote soll man ruhen lassen ... Verbote und Strafen zur Sicherung von Gräbern am Beispiel der Inschriften von Ephesos, in J. Fischer (ed.) *Der Beitrag Kleinasiens zur Kultur- und Geistesgeschichte der Griechisch-Römischen Antike. Akten des internationalen Kolloquiums, Wien, 3.-5. November 2010:* 157–180. Vienna: Verlag der Österreichischen Akademie der Wissenschaften.

Harter-Uibopuu, K. and K. Wiedergut (eds) (forthcoming) „Vorsorge, Verbote und Sanktionen. Grabschutz in der griechisch-römischen Antike nach den epigraphischen Quellen", viewed 26 October 2023, <https://www.academia.edu/87729041/Tagungsprogramm_Vorsorge_Verbote_und_Sanktionen_Grabschutz_in_der_griechisch_r%C3%B6mischen_Antike_nach_den_epigraphischen_Quellen_>.

Hasaki, E. 2002. Ceramic Kilns in Ancient Greece: Technology and Organization of Ceramic Workshops. Unpublished PhD dissertation, University of Cincinnati, <http://rave.ohiolink.edu/etdc/view?acc_num=ucin1023219003>.

Hasaki, E. 2011. Crafting spaces: Archaeological, ethnographic and ethnoarchaeological studies of spatial organization in pottery workshops in Greece and Tunisia, in M. Lawall and J. Lund (eds) *Pottery in the Archaeological Record – Greece and Beyond. Acts of the international colloquium held at the Danish and Canadian Institutes in Athens, June 20-22 2008*: 11–28. Aarhus: Aarhus University Press.

Hasaki, E. 2012. Craft apprenticeship in ancient Greece: Reaching beyond the masters, in W. Wendrich (ed.) *Archaeology and Apprenticeship: Body Knowledge, Identity and Comunities of Practice:* 171–202. Tucson: Arizona University Press.

Hasaki, E. 2020. Ο διαδικτυακός Άτλας των κεραμικών κλιβάνων της αρχαίας Ελλάδας, in S. Drougou (ed.) *Ι' Διεθνής Επιστημονική Συνάντηση για την Ελληνιστική Κεραμική / 10th International Scientific Meeting on Hellenistic Pottery. Κεραμεία, Τεχνίτες και Εργαστήρια / Pottery Workshops, Craftsmen and Workshops*: 280–312. Athens: Ταμείο Αρχαιολογικών Πόρων.

Hasaki, E. and D. Pont 2019. Potters and their wheels in ancient Greece: Skills and secrets in communities of practice, in M. Denti and M. Villette (eds) *Archéologie des Espaces Artisanaux: Fouiller et Comprendre les Gestes des Potiers. Actes du colloque international de Rennes, 27-28 novembre 2014:* 293–314. Lattes: Éditions ADAL.

Haug, F. 1913. s.v. Hercules, in *RE* 8.1: 550–612.

Haussoullier, B. 1919. Inscriptions de Didymes: Classement chronologique de comptes de la construction du Didymeion. *Revue de Philologie, de Littérature et d'histoire Anciennes* 43: 175–226.

Hayson, M. and J. Wallensten 2011 (eds) *Current Approaches to Religion in Ancient Greece. Papers presented at a symposium at the Swedish Institute at Athens. 17-19 April 2008* (Skrifter utgivna av Svenska institutet i Athen. 8o = Acta Instituti Atheniensis Regni Sueciae). Stockholm: Swedish Institute at Athens.

Heilmeyer, W.-D. and H. Born 1996. *Der Jüngling von Salamis: Technische Untersuchungen zu Römischen Großbronzen*. Mainz: Philipp von Zabern.

Heilmeyer, W.-D., G. Zimmer and G. Schneider 1987. Die Bronzegießerei unter der Werkstatt des Phidias in Olympia. *Archäologischer Anzeiger* 1987: 239–299.

Hellmann, M.-C. 1980. Un problème d'architecture et d'épigraphie déliennes. *Bulletin de Correspondance Hellénique* 104: 151–159.

Hellmann, M.-C. 1999. *Choix d'Inscriptions Architecturales Grecques, Traduites et Commentées* (Travaux de la Maison de l'Orient et de la Méditerranée 30). Lyon: MOM éditions.

Hellner, N. 2018. Überlegungen zum Gebrauch von singulären Werkzeugfunden unter dem archaischen Tempelbau von Kalapodi, in M. Korres, S. Mamaloukos, F. Mallouchou-Tufano and K. Zampas (eds) *ΗΡΩΣ ΚΤΙΣΤΗΣ. Μνήμη Χαράλαμπου Μπούρα*: 293–300. Athens: Melissa.

Hellström, P. 1965. *Labraunda. Swedish Excavations and Researches 2. Vol. 1: Pottery of Classical and Later Date, Terracotta Lamps and Glass.* Lund: Gleerup.

Hellström, P. 2007. *Labraunda: A Guide to the Karian Sanctuary of Zeus Labraundos.* Istanbul: Ege.

Hellström, P. and J. Blid 2019. *Labraunda. Swedish Excavations and Researches 5: The Andrones*. Stockholm: Swedish Research Institute in Istanbul.

Hellström, P. and T. Thieme 1982. *Labraunda. Swedish Excavations and Researches 1. Vol. 3: The Temple of Zeus*. Stockholm: Swedish Research Institute in Istanbul.

Hennig, D. 1999. Rechtliche und wirtschaftliche Aspekte, in W. Hoepfner (ed.) *Geschichte des Wohnens 1: 5000 v. Chr. – 500 n. Chr., Vorgeschichte, Frühgeschichte, Antike*: 587–600. Stuttgart: Deutsche Verlags-Anstalt.

Henry, O. and D. Aubriet 2015. Le territoire de Mylasa et le serment d'Olympichos: Autour d'une nouvelle inscription découverte au sanctuaire de Zeus Labraundos en Carie. *Comptes rendus des séances de l'Académie des Inscriptions et Belles-Lettres* 159.2: 673–702.

Henry, O., E. Andersson, C. Bost, Ö. D. Çakmaklı, A. Commito, M. Cormier-Huguet, P. de Staebler, P. Dupont, D. Ergenc, A. Frejman, B. Kepenek, P. Lebouteiller, H. Nilsson, F. Rojas and B. Vergnaud 2015. Labraunda 2014. *Anatolia Antiqua* 23: 301–394.

Henry, O., E. Andersson, C. Bost, Ö. Çakmaklı, F. Cederling, A. Commito, M. Cormier-Huguet, A. Coutelas, A. Dolea, D. Ergenc, A. Freccero, A. Frejman, P. Lebouteiller, F. Lesguer, D. Löwenborg, V. Lungu, F. Marchand-Baulieu, A. Sitz, P. de Staebler and B.

Vergnaud 2016. Labraunda 2015. *Anatolia Antiqua* 24: 339–457.

Herbin, P., D. Roger and E. Calonne 2005. Une production de céramique commune à pâte claire à Famars (Nord), in M. Polfer (ed.) *Artisanat et Économie Romaine : Italie et Provinces Occidentales de l'Empire. Actes du 3e colloque international d'Erpeldange (Luxembourg) sur l'artisanat romain*: 147–168. Dremil Lafage: Edition Mergoil.

Herdt, G., A. Erkal, D. D'Ayala and M. Wilson Jones 2014. The structural assessment of ancient building components: The temple of Artemis at Corfu, in G. Earl, T. Sly, A. Chrysanthi, P. Murrieta-Flores, C. Papadopoulos, I. Romanowska, D. Wheatley and Ph. Verhagen (eds) *Archaeology in the Digital Era. Proceedings of the 40th Annual Conference on Computer Applications and Quantitative Methods in Archaeology* (Southampton, 26-30.3.2012): 130–137. Amsterdam: Amsterdam University Press.

Hermann, J., A. van den Hoek and R.H. Tykot 2012. Alabastro a Pecorella, Aïn Tekballet, and Bou Hanifa, Algeria: A preliminary report, in A. Gutiérrez Garcia-M., P. Lapuente and I. Rodà (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 9th international conference of Association for the Study of Marble and Other Stones in Antiquity, Tarragona, Spain, June 8-13, 2009* (ASMOSIA IX. Documenta 23): 463–470. Tarragona: Institut Català d'Arqueologia Clàssica.

Hermitage State Museum (ed.) 2005. *Borysthenes-Berezan: The 120th Anniversary of Archaeological Investigations of the Ancient Settlement on Berezan Island*. St. Petersburg: St. Petersburg Hermitage Publishing House.

Herrmann, K. 2014/2015. Miniaturbauteile aus Olympia: Paradeigmata oder Anathemata? mit einem Beitrag von Wolf Koenigs. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 129/130: 147–162.

Hildebrandt, F. 2006. *Die attischen Namenstelen: Untersuchungen zu Stelen des 5. und 4. Jahrhunderts v. Chr.* Berlin: Frank & Timme.

Hill, A.F. 1952. *Economic Botany: A Textbook of Useful Plants and Plant Products*. London: McGraw-Hill Book Company Inc.

Hiller, F. 1971. *Formgeschichtliche Untersuchungen zur griechischen Statue des späten 5. Jahrhunderts v. Chr*. Mainz: Philipp von Zabern.

Hirt, A.M. 2010. *Imperial Mines and Quarries in the Roman World: Organizational Aspects 27 BC – AD 235*. Oxford: Oxford University Press.

Hirt, A.M. 2015. Centurions, quarries, and the emperor, in P. Erdkamp, K. Verboven and A. Zuiderhoek (eds) *Ownership and Exploitation of Land and Natural Resources in the Roman World*: 289–316. Oxford: Oxford University Press.

Heuzey, L. 1860. *Le Mont Olympe et l'Akarnanie*. Paris: Éditions Firmin-Didot.

Hochscheid, H. 2015. *Networks of Stone: Sculpture and Society in Archaic and Classical Athens.* Oxford: Peter Lang.

Hochscheid, H. 2020. Review of Van Voorhis, J. 2018. Aphrodisias 10: The Sculptor's Workshop. Wiesbaden: Reichert Verlag. *Bryn Mawr Classical Review* 2020.06.2023, viewed 24 October 2023, <https://bmcr.brynmawr.edu/2020/2020.06.23/>.

Hochscheid, H. and B. Russell (eds) 2021. *The Value of Making: Theory and Practice in Ancient Craft Production* (Studies in Classical Archaeology 13). Turnhout: Brepols.

Höcker, Chr. 2006a. s.v. Straßen- und Brückenbau, in *DNP Online*, viewed 26 October 2023, <http://dx.doi.org/10.1163/1574-9347_dnp_e1123690>.

Höcker, Chr. 2006b. s.v. Städtebau. Städtebau IV. Klassische Antike B. Griechenland, in *DNP Online*, viewed 26 October 2023, <http://dx.doi.org/10.1163/1574-9347_dnp_e1120730>.

Hodder, I. 2012. *Entangled: An Archaeology of the Relationships between Humans and Things.* Chichester: Wiley-Blackwell.

Hodder, I. 2014. The entaglement of humans and things: A long-term view. *New Literary History* 45: 19–36.

Hoët-Van Cauwenberghe, C. 2015. Les Nerviens dans et hors de leur cité: Une population active, in *Rome en Pays Nervien: Retour sur Notre Passé Antique. Catalogue de l'exposition présentée au Forum antique de Bavay, Musée archéologique du Département du Nord et à l'Espace gallo-romain de Ath, du 5 février au 25 août 2015*. 108–115: Bavay: Forum antique de Bavay – Ath, Espace gallo-romain.

Holtzmann, B. 1994. *Études Thasiennes XV: La Sculpture de Thasos. Corpus des Reliefs I. Reliefs à thème divin*. Paris: Éditions de Boccard.

Holzman, S. 2016. Tortoise-shell lyres from Phrygian Gordion. *American Journal of Archeology* 120.4: 537–564.

Homolle, Th. 1909. *Fouilles de Delphes IV, 1: Art Primitif. Art Archaïque du Péloponnèse et des Îles.* Paris: Éditions de Boccard.

Hornblower, S. 1982: *Mausolus*. Oxford: Clarendon Press.

Houser, C. 1998. The 'Alexander Sarcophagus' of Abdalonymos, in O. Palagia and W. Coulson (eds) *Regional Schools in Hellenistic Sculpture. Proceedings of an international conference held at the American School of Classical Studies at Athens, March 15-17, 1996* (Oxbow Monograph 90): 281–292. Oxford: Oxbow Books.

Howard, H. 2001. Analyses of the painted plaster, in J. Mitchell and I. Hanson (eds) *San Vincenzo al Volturno 3: The Finds from 1980-86 Excavations*: 288–295. Spoleto: CISAM.

Howard, H. 2003. *Pigments of English Medieval Wall Painting*. London: Archetype Publications.

Huguenot, C. 2012. Production et commerce dans la cité hellénistique d'Érétrie, in A. Esposito and G.M. Sanidas (eds) *«Quartiers» Artisanaux en Grèce Ancienne,*

une Perspective Méditerranéenne: 175–200. Villeneuve d'Ascq: Presses universitaires du Septentrion.

Hutchins, C.M. 1998. Violinen, in *Die Physik der Musikinstrumente* (Verständliche Forschung): 64–77. Heidelberg: Spektrum Akademischer Verlag.

Iaculli, G. 1986. Note di coroplastica crotoniate. *Annali della Scuola Normale Superiore di Pisa. Classe di Lettere e Filosofia* 16.2: 411–426.

Iaia, C. and A. Moroni Lanfredini (eds) 2009. *L'Età del Ferro a Sansepolcro, Attività Produttive e Ambiente nel Sito del Trebbio*. Sansepolcro: Aboca.

Intagliata, E.E., C. Courault and S.J. Barker (eds) 2020. *City Walls in Late Antiquity*. Oxford: Oxbow Books.

Ismaelli, T. 2013. Ancient architectural restoration in Asia Minor: Typology, techniques and meanings discussed with reference to examples of large-scale public buildings in Hierapolis of Phrygia, a seismic city in Western Turkey. *Istanbuler Mitteilungen* 63: 267–324.

Ismaelli, T. 2016. Architecture and decoration in context – a cross-analysis of the ancient building site in five steps: The case study of the Severan Temple A in the Sanctuary of Apollo at Hierapolis, Phrygia, in T. Ismaelli and G. Scardozzi (eds) *Ancient Quarries and Building Sites in Asia Minor: Research on Hierapolis in Phrygia and Other Cities in South-Western Anatolia – Archaeology, Archaeometry, Conservation* (Bibliotheca Archaeologica 45): 339–364. Bari: Edipuglia.

Ismaelli, T. 2017. Architettura, decorazione e spazio sacro a Hierapolis di Frigia: Il tempio severiano del Santuario di Apollo, in: P. Pensabene, M. Milella and F. Caprioli (eds) *Décor: Decorazione e Architettura nel Mondo Romano. Atti del Convegno Roma 21-24 maggio 2014* (Thiasos Monografie 9): 683–698. Rome: Edizioni Quasar.

Ismaelli, T. and S. Bozza 2016. Ancient construction sites in Hierapolis: New data on strategies, materials and techniques, in T. Ismaelli and G. Scardozzi (eds) *Ancient Quarries and Building Sites in Asia Minor: Research on Hierapolis in Phrygia and Other Cities in South-Western Anatolia – Archaeology, Archaeometry, Conservation* (Bibliotheca Archaeologica 45): 437–458. Bari: Edipuglia.

Jacobs, I. 2010. Production to destruction? Pagan and mythological statuary in Asia Minor. *American Journal of Archaeology* 114.2: 267–303.

Jacobs, I. 2013. *Aesthetic Maintenance of Civic Space: The 'Classical' City from the 4th to the 7th c. AD.* Leuven: Peeters.

Jacquemin, A. 1992. Thyia et Castalie, in J.-F. Bommelaer (ed.) *Delphes: Centenaire de la Grande Fouille réalisée par l'Ecole française d'Athènes (1892-1903). Actes du Colloque Paul Perdrizet, Strasbourg, 6-9 novembre 1991:* 167–175. Leiden: Brill.

Jacquemin, A. 1993. Répercussions de l'entrée de Delphes dans l'Amphictionie sur la construction à Delphes à l'époque archaïque in J. des Courtils and J.-C. Moretti (eds) *Les Grands Ateliers d'Architecture dans le Monde Égéen du VIe s. av. J.-C. Actes du colloque d'Istanbul, 23-25 mai 1991* (Varia Anatolica III): 217–225. Istanbul : Institut français d'Études Anatoliennes.

Jacquemin, A. and D. Laroche 2001. Le monument de Daochos ou le trésor des Thessaliens. *Bulletin de Correspondance Hellénique* 125: 305–332.

Jacquemin, A. and D. Laroche 2012. Regards nouveaux sur deux quadriges delphiques, in M. Denoyelle, S. Descamps-Lequime, B. Mille and S. Verger (eds) *Bronzes Grecs et Romains: Recherches Récentes. Hommage à Claude Rolley*. Paris: Publications de l'Institut national d'histoire de l'art, viewed 1 November 2023, <https://books.openedition.org/inha/7243>.

Jacquemin, A. and D. Laroche 2014. Un espace politique au coeur du sanctuaire de Delphes. *Comptes rendus des séances de l'Académie des Inscriptions et Belles-Lettres* 158.2: 727–753.

Jacquemin, A., D. Mulliez and G. Rougement 2012. *Choix d'Inscriptions de Delphes Traduites et Commentées* (Études Épigraphiques 5). Athens: École française d'Athènes.

Jaczynowska, M. 1981. s.v. Le culte de l'Hercule romain au temps du Haut-Empire, in *Aufstieg und Niedergang der römischen Welt* 2.17.2: 631–661.

Jeammet, V. (ed.) 2010. *Tanagra: Figurines for Life and Eternity. The Musée du Louvre's Collection of Greek Figurines.* Valencia: Fundación Banjaca.

Jenkins, I. 2006. *Greek Architecture and its Sculpture*. Cambridge, MA: Harvard University Press.

Jewell, V. 2024. Haptic colour: Experiential viewing in Graeco-Roman sacred spaces, in B. Misic and A. Graham (eds) *Senses, Cognition, and Ritual Experience in the Roman World* (Ancient Religion and Cognition): 89–117. Cambridge: Cambridge University Press.

Johnson, M. 2010. *Archaeological Theory: An Introduction*. Oxford: Wiley-Blackwell.

Judeich, W. 1931. *Topographie von Athen.* Munich: C.H. Beck.

Jürke, F., J. Montes-Landa and A. Ceccarelli 2021. Knowledge-scapes in Archaeology: An Introduction, in F. Jürke, J. Montes-Landa and A. Ceccarelli (eds) *Archaeological Review from Cambridge* 35.2. *Special Issue Knowledge-scapes*, <https://doi.org/10.17863/CAM.71846>.

Kahrstedt, U. 1954. *Das wirtschaftliche Gesicht Griechenlands in der Kaiserzeit.* Bern: Bernae Aedibus A. Francke.

Kairofilas, G. 1995. *Τοπωνύμια της Αθήνας, του Πειραιά και των περιχώρων.* Athens: Εκδόσεις Φιλιππότη.

Kakavoyannis, E. 1984. Παραγωγή μολύβδου από λιθαργύρους στην ελληνιστική Ρόδο. *Αρχαιολογικά Ανάλεκτα εξ Αθηνών* 17: 124–140.

Kalligas, P. 2000. Acropolis Station/Σταθμός Ακρόπολις, in L. Parlama and N.Chr. Stampolidis (eds) *Η Πόλη κάτω από την Πόλη: Ευρήματα από τις Ανασκαφές του Μητροπολιτικού Σιδηροδρόμου των Αθηνών*: 28–39. Athens: Υπουργείο Πολιτισμού, Ίδρυμα Ν.Π. Γουλανδρή, Μουσείο Κυκλαδικής Τέχνης.

Kalpaxis, A.E. 1980. Die Pfostenlöcher unter dem Naxieroikos auf Delos: Spuren eines Vorgängerbaues oder eines Baugerüstes?, in F. Krinzinger, B. Otto and E. Walde-Psenner (eds) *Forschungen und Funde. Festschrift Bernhard Neutsch*: 237–242. Innsbruck: Institut für Sprachwissenschaft der Universität Innsbruck.

Kalpaxis A.E. 1990. Naxier-Oikos I und andere Baugerüste. *Archäologischer Anzeiger* 1990: 149–153.

Kanellopoulos, C. and E. Kolia 2011. Ancient Keryneia, Aigialeia: Excavations and architecture in the sanctuary of Profitis Elias. *Mitteilungen* des *Deutschen Archäologischen Instituts*, *Athenische Abteilung* 126: 137–176.

Kanellopoulos, C. and E. Zavvou 2014. The Agora of Gytheion. *Annual of the British School at Athens* 109: 357–378.

Kansteiner, S., L. Lehmann and B. Seidensticker 2014. s.v. Theodoros (Θεόδωρος) von Samos, in: *DNO online*, viewed 14 November 2023, <https://www.degruyter.com/database/OVERBECK/entry/ov.0040.b1/html>.

Kantirea, M. 2023. Building inscriptions from Roman Lydia, in E. Laflı and G. Labarre (eds) *Archaeology and History of Lydia from the Early Lydian Period to Late Antiquity* (Collection de l'Institut des Sciences et Techniques de l'Antiquité): 379–386. Besançon: Presses Universitaires de Franche-Comté.

Karagiorga-Stathakopoulou, Th. 1971. Κεραμεικός κλίβανος εν Ήλιδι. *Αρχαιολογικά Ανάλεκτα εξ Αθηνών* 4.1: 27–31.

Karagiorga-Stathakopoulou, Th. 1979. Οδός Βαλαβάνη 10. *Αρχαιολογικόν Δελτίον* 34.Β'1: 18.

Karagiorga-Stathakopoulou, Th. 1988. Δημόσια έργα και ανασκαφές στην Αθήνα τα τελευταία 5 χρόνια. *Hόρος* 6: 87–108.

Karakasi, K. 2003. *Archaic Korai.* Los Angeles: Getty Publications.

Karasev, A.N. 1964. Monumentalnye pamyatniki Olviiskogo temenosa, in V.F. Gaidukevich (ed.) *Olviya: Temenos i Agora*: 27–130. Moscow and Leningrad: Nauka.

Kardara, C.P. 1961. Dyeing and weaving works at Isthmia. *American Journal of Archaeology* 65: 261–266.

Katakis, S. 1997. s.v. Die Sphinx in der römischen Welt, in *LIMC* VIII: 1169–1170, figs. 268, 272.

Katakis, S. 2002. *Επίδαυρος: Τα Γλυπτά των Ρωμαϊκών Χρόνων από το Ιερό του Απόλλωνος Μαλεάτα και του Ασκληπιού.* Athens: Η εν Αθήναις Αρχαιολογική Εταιρεία.

Katerinopoulos, A., G. Kokkorou-Alevras, K. Mavrogonatos and E. Poupaki 2016. Volcanic millstones from ancient Halasarna, Kos island. Mineralogy, geochemistry and comparison of archaeological samples to rock samples from ancient quarries on Kos and Nisyros, Dodecanese, Greece. *HEROM* 5.2: 161–197.

Katerinopoulos, A., G. Kokkorou-Alevras, K. Mavrogonatos and E. Poupaki 2017. Ανάλυση ηφαιστειογενών λίθων, in G. Kokkorou-Alevras (ed.) *ΑΛΑΣΑΡΝΑ VI: Το Ιερό του Απόλλωνα Πυθαίου/Πυθαέως και ο Οικισμός Πρώιμων Βυζαντινών Χρόνων στην Αρχαία Αλάσαρνα της Κω. Γλυπτική, Λιθοτεχνία, Επιγραφές*: 251–323. Athens: National and Kapodistrian University of Athens.

Katsonopoulou, D. 1991. Αρχαία Ελίκη: Ιστορία και σύγχρονη έρευνα, in A.D. Rizakis (ed.) *Achaia und Elis in der Antike* (Μελετήματα 13): 227–234. Athens. Εθνικό Ίδρυμα Ερευνών.

Katsonopoulou, D. 1995. Ελίκη. *Αρχαιολογία* 54: 35–40.

Katsonopoulou, D. 1998. Η πρώτη ανασκαφή στην Ελίκη: Κτήμα Κλωνή. Μια εισαγωγική παρουσίαση, in D. Katsonopoulou, S. Soter and D. Schilardi (eds) *Helike II: Ancient Helike and Aigialeia*: 125–145. Athens: The Helike Society.

Katsonopoulou, D. 2002. Helike and her territory in the light of new discoveries, in E. Greco (ed.) *Gli Achei e l'Identità Etnica degli Achei d'Occidente. International conference* (Tekmeria 3): 205–216. Paestum: Pandemos.

Katsonopoulou, D. 2005a. The earthquake of 373 BC. Literary and archaeological evidence, in D. Katsonopoulou, S. Soter and I. Koukouvelas (eds) *HELIKE III: Archaeological Sites in Geologically Active Regions*: 15–32. Athens: The Helike Society.

Katsonopoulou, D. 2005b. Test excavations in the Helike Delta in 2000, in D. Katsonopoulou, S. Soter and I. Koukouvelas (eds) *HELIKE III: Archaeological Sites in Geologically Active Regions*: 33–66. Athens: The Helike Society.

Katsonopoulou, D. 2011a. A proto-urban Early Helladic settlement found on the Helike Delta, in D. Katsonopoulou (ed.) *HELIKE IV: PROTOHELLADIKA – The Southern and Central Greek Mainland*: 63–88. Athens: The Helike Society.

Katsonopoulou, D. 2011b. The Hellenistic dye-works at Helike, Achaea, Greece, in C. Alfaro, J.P. Brun, Ph. Borgard and R. Pierobon Benoit (eds) *Purpureae Vestes III*: *Textiles y Tintes en la Ciudad Antigua*: 237–242. València-Naples: Universitat de València, Centre Jean Bérard.

Katsonopoulou, D. 2016. Natural catastrophes in the Gulf of Corinth, northwestern Peloponnese, from Prehistory to Late Antiquity: The example of Helike, in J. Borsch and L. Carrara (eds) *Erdbeben in der Antike*: 137–152. Tübingen: Mohr Siebeck.

Katsonopoulou, D. 2018. Recent evidence of sculptures in Parian marble, in D. Katsonopoulou (ed.) *Η Πάρος και οι Αποικίες της / Paros and its Colonies. Proceedings of the fourth international conference on the archaeology of Paros and the Cyclades, Paroikia 11-14.6.2015* (PAROS IV): 101–113. Athens: The Institute for Archaeology of Paros and the Cyclades.

Katsonopoulou, D. and S. Katsarou 2017. Mainland cosmopolitanism and the rise of personal prestige:

New evidence from the coastal Early Helladic town of Helike, northwest Peloponnese. *Annual of the British School at Athens* 112: 1–32.

Katsonopoulou, D. and I. Koukouvelas 2019. Η άγνωστη Γεωμετρική Ελίκη – νέα αρχαιολογικά και παλαιοσεισμικά ευρήματα. *Αρχαιολογία* 129: 66–77.

Katsonopoulou, D. and E. Partida 2023. Filling a gap in the history of an Achaean leader city: Post-373 BC Helike. *Numismatica e Antichità Classiche* 52: 169-199.

Katsonopoulou, D. and E. Partida 2024. Η αναγέννηση της Ελίκης μετά το 373 π.Χ., in D. Katsonopoulou (ed.) *HELIKE VI: Helike after 373 BC – An Interdisciplinary Approach*: 33–60. Athens: The Helike Society.

Keen, A. 1998. *Dynastic Lycia: A Political History of the Lycians and their Relationship with Foreign Powers.* Leiden: Brill.

Keune, J. 1921. s.v. Saxanus, in *RE* 2A.1: 266–268.

Khalil, L.A.H., J. Seigne and Th. Weber 2013. *Metal Casting in Roman Gerasa: Preliminary reports on the Jordanian-European cultural heritage conservation program at Jerash in 2012 funded by the Hashemite Kingdom of Jordan, the Republic of France, and the Federal Republic of Germany* (Guides archéologiques de l'Institut français d'Archéologie du Proche-Orient 10). Amman: IFPO.

Kilikoglou, V., G. Vekinis, Y. Maniatis and P.M. Day 1998. Mechanical performance of quartz-tempered ceramics, Part I: Strength and toughness. *Archaeometry* 40.2: 261–279.

King, L.W. 1915. *The Code of Hammurabi* (with commentary from Ch. F. Horne). Yale Law School, Avalon Project, viewed 25 October 2023, <https://avalon.law.yale.edu/subject_menus/hammenu.asp>.

Kinney, D. 1997. Spolia: Damnatio and renovatio memoriae. *Memoirs of the American Academy in Rome* 42: 117–148.

Kinney, D. 2001. Roman architectural spolia. *Proceedings of the American Philosophical Society* 145.2: 138–161.

Kinney, D. 2006. The concept of spolia, in C. Rudolph (ed.) *A Companion to Medieval Art: Romanesque and Gothic in Northern Europe*: 233–252. Malden, MA: Blackwell.

Kinney, D. 2013. Spoliation in Medieval Rome, in S. Altekamp, C. Marcks-Jacobs and P. Seiler (eds) *Perspektiven der Spolienforschung 1: Spoliierung und Transposition* (Topoi. Berlin Studies of the Ancient World 15): 261–285. Berlin and Boston: De Gruyter.

Kissas, K. 2008. *Archaische Architektur der Athener Akropolis* (Archäologische Forschungen 24). Wiesbaden: Reichert Verlag.

Kissel, T. 2021. Road-building as a munus publicum, in P. Erdkamp (ed.) *The Roman Army and the Economy*: 127–160. Leiden: Brill.

Kleemann, I. 1984. *Frühe Bewegung: Untersuchung zur Archaischen Form bis zum Aufkommen der Ponderation in der Griechischen Kunst. Einführung und Überblick*. Mainz: Mainz: Philipp von Zabern.

Kleiss, W. 1970. Zur Topographie des „Partherhanges" in Bisutun. *Archäologische Mitteilungen aus Iran, N.F.* 3: 133–168.

Klocke-Daffa, S. 2017. ResourceKomplexes, networks, and frames: The Sambrata in Madagascar, in A.K. Scholz, M. Bartelheim, R. Hardenberg, J. Staecker (eds) *ResourceCultures: Sociocultural Dynamics and the Use of Resources – Theories, Methods, Perspectives* (RessourcenKulturen 5): 253–270. Tübingen: Tübingen University Press.

Knappett, C. 2011. *An Archaelogy of Interaction: Network Perspectives on Material Culture and Society*. Oxford: Oxford University Press.

Koch, N. 1999. Fügung zur Einheit: Zu Polyklet Frg. B 1 D./K. (with Th. Schirren). *Hermes* 127: 263–273.

Kokkoliou, A. 2000a. Οδός Δημοφώντος 111-113 (οικόπεδο Κ. Πούλιου). *Αρχαιολογικόν Δελτίον* 55.Β'1: 80.

Kokkoliou, A. 2000b. Οδός Δρυόπων 38 και Τρώων (οικόπεδο Δ. και Β. Καποπούλου). *Αρχαιολογικόν Δελτίον* 55.Β'1: 81.

Kokkoliou, A. 2001-04. Συμβολή των οδών Δωριέων και Τρώων. *Αρχαιολογικόν Δελτίον* 56-59.Β'1: 227.

Kokkorou-Alevras, G. 1992. Τα αρχαία λατομεία μαρμάρου της Νάξου. *Αρχαιολογική Εφημερίς* 131: 101–128.

Kokkorou-Alevras, G. 1993. Τμήμα κούρου από τον Τουρκολέκα Αρκαδίας, in O. Palagia and W. Coulson (eds) *Sculpture from Arcadia and Laconia* (Oxbow Monograph 30): 13–24. Oxford: Oxbow Books.

Kokkorou-Alevras, G. 2014. I.1.176: Ημίεργο άγαλμα κούρου από τη Νάξο, in G. Despinis and N. Kaltsas (eds) *Εθνικό Αρχαιολογικό Μουσείο: Γλυπτά των Αρχαϊκών Χρόνων από τον 7ο αιώνα έως το 480 π.Χ.*: 188–190. Athens: Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων.

Kokkorou-Alevras, G. 2015. Η σημασία του καθορισμού της προέλευσης του μαρμάρου των αρχαίων ελληνικών γλυπτών, in L. Karali and G. Pherentinos (eds) *Τετράδια Γεωαρχαιολογίας*: 37–46. Athens: OLKOS.

Kokkorou-Alevras, G. 2020. A new Hellenistic grave relief stele from the sanctuary of Apollo Pythaios-Pythaeus at ancient Halasarna on the island of Kos, in A. Delivorrias, E. Vikela, A. Zarkadas, N. Kaltsas and I. Trianti (eds) *Σπονδή. Αφιέρωμα στη Μνήμη του Γιώργου Δεσπίνη* (Παράρτημα 12): 721–732. Athens: Μουσείο Μπενάκη.

Kokkorou-Alevras, G., A. Efstathopoulos, K. Kopanias, E. Poupaki and A. Chatziconstantinou 2006. Αρχαία λατομεία στη «Γυναίκα» και στο Πλατυβούνι Ταϋγέτου, in *Πρακτικά Β' Τοπικού Συνεδρίου Λακωνικών Σπουδών: Ξηροκάμπι Λακωνίας, 28 Οκτωβρίου – 1 Νοεμβρίου 2004* (Λακωνικαί Σπουδαί 13-14): 109–121. Athens: Εταιρεία Λακωνικών Σπουδών.

Kokkorou-Alevras, G., A. Chatziconstantinou, A. Efstathopoulos, E. Zavvou, N. Themos, K. Kopanias and E. Poupaki 2009a. Ancient quarries in Laconia,

in W.G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta and Laconia: From Prehistory to Pre-Modern. Proceedings of the Conference held in Sparta, organised by the British School Athens, the University of Nottingham, the 5th Ephorate of Prehistoric and Classical Antiquities and the 5th Ephorate of Byzantine Antiquities, 17-20 March 2005:* 169–179. London: British School at Athens.

Kokkorou-Alevras, G., A. Chatziconstantinou, A. Efstathopoulos and E. Poupaki 2009b. Ancient Quarries of Kythera, in Ph. Jockey (ed.) *Λευκός Λίθος: Marbres et Autres Roches de la Méditerranée Antique – Études Interdisciplinaires. Actes du 8ème colloque international de l'Association for the Study of Marble and Other Stones Used in Antiquity, Aix-en-Provance, June 12-18, 2006* (ASMOSIA VIII): 177–188. Paris: Éd. Karthala, Maison méditerranéenne des sciences de l'homme.

Kokkorou-Alevras, G., E. Poupaki and A. Efstathopoulos 2010. *Αρχαία Ελληνικά Λατομεία: Οργάνωση Χώρου και Εργασίας, Τεχνικές Λατόμησης και Λάξευσης, Τρόποι Μεταφοράς, Κόστος, Διασπορά και Χρήση Λίθων.* Athens: Πολιτιστικό Ίδρυμα Ομίλου Πειραιώς.

Kokkorou-Alevras, G., E. Poupaki and A. Efstathopoulos 2013. Αρχαίο λατομείο μαρμάρου στον Απόλλωνα της Νάξου, in I. Probonas and E.S. Psarras (eds) *Πρακτικά Δ΄ Πανελληνίου Συνεδρίου με θέμα 'Η Νάξος διά μέσου των Αιώνων' (Κωμιακή, 4-7 Σεπτεμβρίου 2008)*: 109–126. Athens: Δήμος Νάξου και Μικρών Κυκλάδων.

Kokkorou-Alevras, G., E. Poupaki, A. Efstathopoulos, E. Rigatou and A. Chatziconstantinou 2014. *Corpus Αρχαίων Λατομείων. Λατομεία του Ελλαδικού Χώρου από τους Προϊστορικούς έως και τους Μεσαιωνικούς Χρόνους.* Athens: National and Kapodistrian University of Athens.

Kokkorou-Alevras, G., E. Poupaki, A. Efstathopoulos, E. Rigatou and A. Chatziconstantinou 2019. An overview on ancient quarries of southeastern Attica: The ancient quarries of Hymettus revisited. *Aura* 2: 117–136.

Kokkorou-Alewras, G. 1993. Die Entstehungszeit der naxischen Delos-Löwen und anderer Tierskulpturen der Archaik. *Antike Kunst* 36: 91–126.

Kokkorou-Alewras, G. 1995. Die archaische naxische Bildhauerei. *Antike Plastik* 24: 37–138.

Kokkorou-Alewras, G. 2008. Les Cavaliers archaïques de Délos, in Y. Kourayos and F. Prost (eds) *La Sculpture des Cyclades à l'Époque Archaïque: Histoire des Ateliers, Rayonnement des Styles. Actes du colloque international organisé par l'Ephorie des Antiquités préhistoriques et classiques des Cyclades et l'École française d'Athènes (7-9 Septembre 1998)* (Bulletin de Correspondance Hellénique Supplément 48): 417–435. Wilsele: Peeters.

Kolonas, L. 1981. Οδός Παλληναίων 37 (οικόπεδο Σερεφόγλου). *Αρχαιολογικόν Δελτίον* 36.Β'1: 23.

Kolonas, L. 1997. Τα μνημεία της Αιτωλοακαρνανίας κατά την υλοποίηση της προγραμματικής σύμβασης Αμβρακικού. *Πυρφόρος* 27: 49–83.

Kolonas, L. 2018. Χάλκινοι ταφικοί λέβητες από τη θέση 'Σταθμός – Κεφαλόβρυσο' του Πρωτογεωμετρικού νεκροταφείου της Σταμνάς Αιτωλοακαρνανίας, in *2ο Διεθνές Αρχαιολογικό-Ιστορικό Συνέδριο Αιτωλοακαρνανίας και Λευκάδας, 6-8 Δεκεμβρίου 2013, Μεσολόγγι*: 71–98. Messolonghi: Υπουργείο Πολιτισμού.

Kolonas, L. and G. Christakopoulou 1994 Σταμνά. *Αρχαιολογικόν Δελτίον* 49.Β'1: 242–243.

Kolonas, L. and G. Christakopoulou 1998 Επαρχιακή οδός Σταμνάς-Αγγελοκάστρου. *Αρχαιολογικόν Δελτίον* 53.Β'1: 281.

Kolonas, L. and G. Christakopoulou 1999. Σταμνά. *Αρχαιολογικόν Δελτίον* 54.Β'1: 271–272.

Kolonas, L. and G. Christakopoulou 2000. Σταμνά. *Αρχαιολογικόν Δελτίον* 55.Β'1: 330.

Kolonas, L. and G. Christakopoulou 2001-04. Σταμνά. *Αρχαιολογικόν Δελτίον* 56-59.Β'2: 72.

Kontoleon, N. 1960. Ανασκαφαί Νάξου. *Πρακτικά της εν Αθήναις Αρχαιολογικής Εταιρείας* 1960: 258–262.

Kontopanagou, M. 2009. Οδός Τέλλου 6. *Αρχαιολογικόν Δελτίον* 64.Β'1: 105.

Kontopanagou, M. 2010a. Άνω Πετράλωνα – Οδός Δημοφώντος 132 και Δωριέων 17 (Ο.Τ. 59014). *Αρχαιολογικόν Δελτίον* 65.Β'1: 52.

Kontopanagou, M. 2010b. Άνω Πετράλωνα – Οδός Τριών Ιεραρχών 159 (Ο.Τ. 59024, οικόπεδο Σ. Λουμάκου). *Αρχαιολογικόν Δελτίον* 65.Β'1: 105–107.

Kontopanagou, M. and A. Stamoudi 2013. Ο αρχαιολογικός χαρακτήρας των Άνω Πετραλώνων κατά τους κλασικούς και πρώιμους ελληνιστικούς χρόνους, in S. Oikonomou and M. Doga-Toli (eds) *Αρχαιολογικές Συμβολές Β: Αττική, Α'και Γ' Εφορείες Προϊστορικών και Κλασικών Αρχαιοτήτων*: 305–322. Athens: Μουσείο Κυκλαδικής Τέχνης.

Kormann, M. and D. Katsonopoulou 2024. Exploring the use of GNSS survey of the Helike Delta with point cloud data visualisation and analysis of dyeworks structures in Late Classical-Hellenistic Helike, in D. Katsonopoulou (ed.) *HELIKE VI: Helike after 373 BC – An Interdisciplinary Approach*: 71–91. Athens: The Helike Society.

Korres, M. 1994. *Από την Πεντέλη στον Παρθενώνα: Τα Αρχαία Λατομεία και η Ιστορία ενός Ημιτελούς Δωρικού Κιονοκράνου του Πρώτου Μαρμάρινου Παρθενώνος*. Athens: Melissa.

Korres, M. 1995. *Από την Πεντέλη στον Παρθενώνα. Κατάλογος της Έκθεσης: Τα Αρχαία Λατομεία και η Ιστορία ενός Ημιτελούς Δωρικού Κιονοκράνου του Πρώτου Μαρμάρινου Παρθενώνος*. Athens. Melissa.

Korres, M. (ed.) 2009. *Αττικής Οδοί: Αρχαίοι Δρόμοι της Αττικής*. Athens: Melissa.

Korres, M. 2021. Αρχαία Λατομεία Μελάνων Νάξου και Κολοσσικά Αγάλματα, in V. Lambrinoudakis, L.G. Mendoni, M. Koutsoubou, T. Panagou, A. Sfyroera

and X. Charalambidou (eds) *Έξοχος Άλλων. Τιμητικός Τόμος για την Καθηγήτρια Εύα Σημαντώνη-Μπουρνιά*: 315–344. Athens: Υπουργείο Πολιτισμού.

Korver, J. 1950. Néron et Musonius: À propos du dialogue du Pseudo-Lucian 'Néron, ou sur le percement de l'isthme de Corinthe'. *Mnemosyne* 3: 319–329.

Koumartzis, N., D. Tzetzis, P. Kyratsis and R.G. Kotsakis 2015. A new music instrument from ancient times: Modern reconstruction of the Greek lyre of Hermes using 3D laser scanning, advanced computer aided design and audio analysis. *Journal of New Music Research* 44.4: 324–346.

Koumentos, N.I. 1994. Το Μοναστήρι Σταυρός στο Άργος Νισύρου. *Νισυριακά* 13: 31–122.

Kourayos, Y. 2008. Γλυπτά από το ιερό του Απόλλωνα στη θέση Μάντρα της νησίδας Δεσποτικού και νέα γλυπτά από την Πάρο, in G. Kokkorou-Alevras and W.-D. Niemeier (eds) *Neue Funde Archaischer Plastik aus Griechischen Heiligtümern und Nekropolen. Internationales Symposion, Athen, 2-3. November 2007* (Athenaia 3): 102–132. Munich: Hirmer.

Kourayos, Y. 2012. *Δεσποτικό: Το ιερό του Απόλλωνα*. Athens: Ίδρυμα Παύλου και Αλεξάνδρας Κανελλοπούλου.

Kourou, N. 2023. Τήνος – Ξώμπουργο 2021-2022: Η βιοτεχνική περιοχή στα όρια του νεκροταφείου, in *Ανασκαφή και Έρευνα XIV: Από το ερευνητικό έργο του Τομέα Αρχαιολογίας και Ιστορίας Τέχνης του Εθνικού και Καποδιστριακού Πανεπιστημίου Αθηνών. 14ο Επιστημονικό Συμπόσιο, Αθήνα 1-2.6.2023*, viewed 30 January 2024, <https://hub.uoa.gr/excavation-and-research-xiv/>.

Kourou, N. 2024. Αρχαιομεταλλουργικοί κλίβανοι στο Ξώμπουργο της Τήνου, in Π. Μ. Φώσκολος, Μ. Σικ-Φωσκόλου and Μανώλης Σκαρής (eds) *Navigare necesse est. Τιμή στον Κώστα Δανούση*: 75–100. Athens: Αδελφότης των εν Αθήναις Τηνίων.

Koutelakis, Ch. 1993. Τα Νικιά της Νισύρου 1760-1948: Μέσα από το αρχείο του Σταύρου Χαρτοφύλλη. *Νισυριακά* 12: 147–192.

Koželj, T. 1988a. Les carrières des époques Grecque, Romaine et Byzantine: Techniques et organisation, in J.C. Fant (ed.) *Ancient Marble, Quarrying and Trade. Papers from a Colloquium held at the Annual Meeting of the Archaeological Institute of America, San Antonio, Texas, December 1986* (BAR International Series 453): 3–79. Oxford: BAR Publishing.

Koželj, T. 1988b. Extraction of blocks in antiquity: Special methods of analysis, in N. Herz and M. Waelkens (eds) *Classical Marble: Geochemistry, Technology, Trade*: 31–39. Dordrecht-Boston: Kluwer Academic Publishers.

Koželj, T. and M. Wurch-Koželj 1992. The military protection of the quarries of the Aliki Area during the Byzantine period, in M. Waelkens, N. Herz and L. Moens (eds) *Ancient Stones: Quarrying, Trade and Provenance. Interdisciplinary Studies on Stones and Stone Technology in Europe and Near East from the Prehistoric to the Early Christian Period* (Acta Archaeologica Lovaniensia 4): 43–57. Leuven: Leuven University Press.

Koželj, T. and M. Koželj-Wurch 1995. Dragon-houses of southern Euboea: Military guard-places of the quarries, in Y. Maniatis, N. Herz and Y. Bassiakos (eds) *The Study of Marble and Other Stones in Antiquity. Proceedings of the 3rd international conference of the Association for the Study of Marble and Other Stones in Antiquity, Athens, Greece, May 17-19, 1993* (ASMOSIA III): 17–31. London: Archetype Publications.

Koželj, T., A. Muller and J.-P. Sodini 1981. Thasos: Carrières de marbre de la région de Saliari. *Bulletin de Correspondance Hellénique* 105: 961–963.

Koželj, T., A. Muller and J.-P. Sodini 1982. Thasos: Les carrières de marbre. *Bulletin de Correspondance Hellénique* 106: 676–677.

Kozlovskaya, V. 2008. The harbour of Olbia. *Ancient Civilizations from Scythia to Siberia* 14: 25–65.

Krämer, R.P. 2022. *Etruskische Heiligtümer des 8.–5. Jhs. v. Chr. als Wirtschaftsräume und Konsumptionsorte von Keramik* (Italiká 8). Wiesbaden: Reichert Verlag.

Kremer, G., S. Insulander, E. Draganits, M. Kronberger, B. Moshammer, M. Mosser and A. Rohatsch 2021. Stone supply for Carnuntum and Vindobona: Provenance analysis in a historico-economical context, in D. van Limbergen and D. Taelman (eds) *The Exploitation of Raw Materials in the Roman World: A Closer Look at Producer-Resource Dynamics: Panel 4.4* (Archaeology and Economy in the Ancient World 27): 47–62. Heidelberg: Propylaeum.

Kritzas, Ch. and S. Prignitz 2016. A building inscription from Epidauros: IG IV2.1, 114, SEG XLI 298, IG IV2.1, 110. *Αρχαιολογική Εφημερίς* 155: 1–41.

Kruta Poppi, L. 2015. Casalecchio su Reno (BO), via Isonzo: la tomba 1. Una famiglia di maggiorenti di epoca orientalizzante, in L. Kruta Poppi and D. Neri (eds) *Donne dell'Etruria Padana dall'VIII al VII Secolo a.C.: Tra gestione domestica e produzione artigianale*: 103–117. Florence: All'Insegna del Giglio.

Krutilov, V.V. 2006. Liteinye formy, in V.N. Zin'ko (ed.) *Drevneishyi temenos Olvii Pontiiskoi* (Materials in Archaeology, History and Ethnography of Tauria. Suppl. 2): 213–220. Simferopol': Krymskoe otdelenie Instituta vostokovedeniya im. A.E. Krymskogo, Tsentr arkheologicheskikh issledovanii Blagotvoritelniy fond "Demetra".

Krutilov, V.V. 2007. Zhelezodelatelnaya masterskaya s syrtzovymi stenami na territorii temenosa Berezanskogo poseleniya, in V.N. Zin'ko and V.V. Krapivina (eds) *Drevnosti Severnogo Prichernomorya v antichnoe vremya* (Materials in Archaeology, History and Ethnography of Tauria. Suppl. 4): 117–126. Simferopol': Krymskoe otdelenie Instituta vostokovedeniya im. A.E. Krymskogo, Tsentr arkheologicheskikh issledovanii Blagotvoritelniy fond "Demetra".

Krutilov, V.V. and D.V. Bondarenko 2015. Keramicheskie obzhygatelnye pechi Borisfena serediny VI v. do n.e. (po materialam raskopok 2011-2013 gg.). *Archeologiya i davnya istoriya Ukrainy* 1.15: 205–216.

Krutilov, V.V., H. Mommsen and J. Fornasier 2021. Neue Perspektiven zur Herkunftsbestimmung griechischer Keramik im nordwestlichen Schwarzmeerraum, in J. Fornasier and A.V. Bujskich (eds) *An den Ufern des Bug: Deutsch-Ukrainische Ausgrabungen in Olbia Pontike im Kontext internationaler Forschungen zu antiken Migrationsprozessen* (Frankfurter Archäologische Schriften 42): 253–276. Bonn: Habelt Verlag.

Kuhn, G. 2017. *Kerameikos 19: Das Heilige Tor*. Wiesbaden: Reichert Verlag.

Kuntz, U.S. 1994. Griechische Reliefs aus Rom und Umgebung, in G. Bauchhenß, H. v. Prittwitz und Gaffron and G. Hellenkemper Salies (eds) *Das Wrack II: Der antike Schiffsfund von Mahdia*: 889–899. Köln: Rheinland-Verlag.

Kurtz, D.C. and J. Boardman 1994. *Έθιμα Ταφής στον Αρχαίο Ελληνικό Κόσμο.* Athens: Kardamitsa Publications.

Labarre, D. and S. Willems 2019. Une officine de potiers à Bavay entre la période augustéenne et la période flavienne, in *Actes du Congrès de Maubeuge-Bavay, SFECAG, 30 mai – 2 juin 2019*: 13–23. Marseille: SFECAG.

Labate, D. 2006. *Castelvetro: Archeologia e Ricerche Topografiche* (Quaderni di Archeologia dell'Emilia Romagna 17). Sesto Fiorentino: All'Insegna del Giglio.

La Buff, J. 2016. *Polis Expansion and Elite Power in Hellenistic Karia*. Lanham, Boulder, New York and London: Lexington Books.

Lacroix, L. 1853. *Les Îles de la Grèce*. Paris: Éditions Firmin-Didot.

Ladstätter, S. 2019. The so-called imperial cult temple for Domitian in Ephesos, in D. Schowalter, S. Ladstätter and S. Friesen (eds) *Religion in Ephesos Reconsidered: Archaeology of Spaces, Structures, and Objects*: 11–40. Leiden: Brill.

Lahusen, G. and E. Formigli 2001. *Römische Bildnisse aus Bronze: Kunst und Technik*. Munich: Hirmer.

Lalonde, G.V. 2006. IG I3 1005 B and the boundary of Melite and Kolytos. *Hesperia* 75: 83–119.

La Marciada, I., M. Maguregiu, H. Morillas and N. Prieto-Taboada 2018. In situ non-invasive characterization of the composition of Pompeian pigments preserved in their local bowls. *Microchemical Journal* 139: 458–466.

Lambrinoudakis, V.K. 1980. Ανασκαφή Νάξου. *Πρακτικά της εν Αθήναις Αρχαιολογικής Εταιρείας* 1980: 259–262.

Lambrinoudakis, V.K. 1991. Ανασκαφή Νάξου. *Έργον της εν Αθήναις Αρχαιολογικής Εταιρείας* 94-96: 84–96.

Lambrinoudakis, V.K. 2005. A new archaic building on Naxos: Some thoughts on the Oikos of the Naxians on Delos, in M. Geroulanou and M. Stamatopoulou (eds) *Architecture and Archaeology in the Cyclades. Papers in Honour of J.J. Coulton* (BAR International Series 1455): 79–86. Oxford: BAR Publishing.

Lambrinoudakis, V.K. 2013. Η βορειοανατολική Νάξος κατά την κλασική αρχαιότητα, in I. Probonas and E.S. Psarras (eds) *Πρακτικά Δ΄ Πανελληνίου Συνεδρίου με θέμα 'Η Νάξος διά μέσου των Αιώνων' (Κωμιακή, 4-7 Σεπτεμβρίου 2008)*: 99–108. Athens: Δήμος Νάξου και Μικρών Κυκλάδων.

Lambrinoudakis, V.K., A. Sfyroera and Th. Bilis 2010. *Συντήρηση και Ανάδειξη του Αρχαίου Υδραγωγείου Μελάνων Νάξου, Αρχαίου Ιερού στις Πηγές των Μελάνων και Αγαλμάτων στα Αρχαία Λατομεία της Περιοχής*. Athens: National and Kapodistrian University of Athens.

Lambrinoudakis, V.K. 2021. Ναξιακές σφίγγες, in V.K. Lambrinoudakis, L.G. Mendoni, M. Koutsoubou, T. Panagou, A. Sfyroera and X. Charalambidou (eds) *΄Εξοχος Άλλων. Τιμητικός Τόμος για την Καθηγήτρια Εύα Σημαντώνη-Μπουρνιά*: 375–391. Athens: Υπουργείο Πολιτισμού.

LaMotta, V.M. 2012. Behavioral archaeology, in I. Hodder (ed.) *Archaeological Theory Today*: 62–92. Cambridge: Polity Press.

Lamy, P.-A. and M. Ribolet 2020. Dismantling, re-carving, and re-using: Some observations about the Late Antique city wall of Agedincum, in E.E. Intagliata, C. Courault, and S.J. Barker (eds) *City Walls in Late Antiquity*: 101–108. Oxford: Oxbow Books.

Lancaster, L. 2010. Parthian influence on vaulting in Roman Greece? An inquiry into technological exchange under Hadrian. *American Journal of Archaeology* 114: 447–472.

Laroche, D. 2018. Considérations sur les transformations, les dégradations et la ruine des édifices antiques, in O. Zunal, Y. Polat, Yasemin, H. Cevizoğlu and G.R. Gürtekin-Demir (eds) *EPIPHANEIA. A Festschrift for Prof. Dr. Nuran Şahin from her colleagues, friends and former students* (Ege Üniversitesi Edebiyat Fakültesi yayınları 198): 245–256. Izmir: Ege Üniversitesi Basımevi.

Laroche, D. and A. Jacquemin 2016. L'offrande des Messéniens et Naupactiens à Delphes, in O. Palagia (ed.) *Ναύπακτος: Η Αρχαία Πόλη και η Σημασία της κατά τον Πελοποννησιακό Πόλεμο και τα Ελληνιστικά Χρόνια*: 85–103. Naupaktos: Ίδρυμα Μπότσαρη.

Laroche, D. and A. Jacquemin 2017. Observations sur le temple d'Apollon à Delphes au IVe siècle. *Bulletin de la Société Française d'Archéologie Classique* 47/2015-2016: 130–139.

Lave, J. and E. Wenger 1991. *Situated Learning: legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lazari, K., G. Riginos, Ch. Spanodimos and A. Tzortzatou 2018. Ανασκαφικές έρευνες στα οικόπεδα του Δικαστικού μεγάρου και του Λυρικού θεάτρου στη βόρεια νεκρόπολη της Αρχαίας Κέρκυρας (2000-2007), in *Το Αρχαιολογικό Έργο στη Βορειοδυτική Ελλάδα και τα Νησιά του Ιονίου. Ιωάννινα, 10-13 Δεκεμβρίου 2014 –*

Πρακτικά: 705–716. Athens: Υπουργείο Πολιτισμού και Αθλητισμού.

Lazaridis, P. 1953. Συμβολή εις την μελέτη των παλαιοχριστιανικών μνημείων της Δωδεκανήσου, in S. Kyriakidou, A. Xuggopoulou and P. Zepou (eds) *Πεπραγμένα του Θ΄ Διεθνούς Βυζαντινολογικού Συνεδρίου*: 227–248. Thessaloniki: Εταιρεία Μακεδονικών Σπουδών.

Lazaridou, K. 2004. *Hills of Philopappou-Pnyx-Nymphs: Brief History and Tour* (Archaeological promenades around the Acropolis 7, Published on the occasion of Olympic Games, Athens, 2004). Athens: Ministry of Culture, First Ephorate of Prehistoric and Classical Antiquities.

Lazzarini, L. 2004. *Pietre e Marmi Antichi: Natura, Carratterizzazione, Origine, Storia d'uso, Diffusione, Collezionismo.* Padova: Cedam.

Lazzarini, L. 2007. *Poikiloi Lithoi, Versiculores Maculae: I marmi colorati della Grecia antica – storia, uso, diffusione, cave, geologia, caratterizzazione scientifica, archeometria, deterioramento.* Pisa and Rome: Fabrizio Serra Editore.

Lazzarini, L. 2009. The distribution and re-use of the most important coloured marbles in the provinces of the Roman empire, in Y. Maniatis (ed.) *Actes du 7ème colloque international de l'Association for the Study of Marble and Other Stones in Antiquity, Thassos 15-20 September, 2003* (ASMOSIA VII. Bulletin de Correspondance Hellénique Supplément 51): 459–484. Athens: École française d'Athènes.

Lazzarini, L. 2019. Ancient mediterranean polychrome stones. *EMU Notes in Mineralogy* 20: 367–392.

Lazzarini, L. and C. Marconi 2014. A new analysis of major Greek sculptures in the Metropolitan Museum: Petrological and stylistic. *Metropolitan Museum Journal* 49: 117–140.

Lazzarini, L., D. Visonà, M. Giamello and I. Villa 2012. Archaeometric characterization of one Tunisian and two Italian calcareous alabasters used in antiquity, in A. Gutiérrez Garcia-M., P. Lapuente and I. Rodà (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 9th international conference of Association for the Study of Marble and Other Stones in Antiquity, Tarragona, Spain, June 8-13, 2009.* (ASMOSIA IX. Documenta 23): 436–444. Tarragona: Institut Català d'Arqueologia Clàssica.

Lefèvre, F. 2019. Privilèges honorifiques ou avantages contractuels? Observations sur quelques documents épigraphiques ambigus. *Chiron* 49: 187–213.

Lefert, S. and K. Bausier 2011. Villas gallo-romaines en Condroz namurois: Situations contrastées. *Signa Romana :* 81–99, viewed 22 January 2024, <https://signaromana.files.wordpress.com/2012/05/jar-2011.pdf>.

Leidwanger, J., E.S. Greene, and A. Donnelly 2021. The sixth-century CE shipwreck at Marzamemi. *American Journal of Archaeology* 125.2: 283–317.

Leka, E. 2012. Unfinished kouros in the Mytilene archaeological museum: Marble sculpture in Lesbos in the Archaic period, in A. Gutiérrez Garcia-M., P. Lapuente and I. Rodà (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 9th international conference of Association for the Study of Marble and Other Stones in Antiquity, Tarragona, Spain, June 8-13, 2009.* (ASMOSIA IX. Documenta 23): 75–81. Tarragona: Institut Català d'Arqueologia Clàssica.

Lemaître, S. 2007. Contribution à l'étude du mobilier céramique des époques archaïque et classique du Létôon de Xanthos, in S. Lemaître (ed.) *Céramiques Antiques en Lycie (VIIe s. a.C. – VIIe s. p.C.): Les Produits et les Marches*: 115–126. Pessac: Ausonius.

Lemonnier, P. 1976. La description des chaînes opératoires: Contribution à l'analyse des systèmes techniques. *Techniques and Culture* 1: 100–151.

Lentini, M.C. 2012. Fours et quartier de potiers à Naxos de Sicile (VIIe-Ve siècle av. J.-C.), in A. Esposito and G.M. Sanidas (eds) *«Quartiers» Artisanaux en Grèce Ancienne, une Perspective Méditerranéenne*: 281–300. Villeneuve d'Ascq: Presses universitaires du Septentrion.

Lenzi, S. 2016. *La Policromia dei Monochromata: La Ricerca del Colore su Dipinti su Lastre di Marmo di Età Romana.* Florence: Firenze University Press.

Leone, A. 2013. *The End of the Pagan City: Religion, Economy, and Urbanism in Late Antique North Africa.* Oxford: Oxford University Press.

Lepetz, S. 2008. Boucherie, sacrifice et marché à la viande en Gaule romaine septentrionale: L'apport de l'archéozoologie, in W. Van Andringa (ed.) *Food and History* 5.1/2007. *Special Issue Sacrifices, marché de la viande et pratiques alimentaires dans les cités du monde romain*: 73–105.

Lernould, A. 2000. Plutarque, E de Delphes 387 d2-9: Une interprétation philosophique de l'épisode de l'enlèvement du trépied par Héraclès – une erreur de jeunesse. *Revue des Études Grecques* 113: 147–171.

Leroi-Gourhan, A. 1964. *Le Geste et la Parole: Technique et Langage* (Sciences d'Aujourd'hui). Paris: Éditions Albin Michel.

Leroux, J. 2008. *Building New Brunswick: An Architectural History.* Fredericton: Goose Lane.

Letta, C. 1971. *Piccola Coroplastica Metapontina nel Museo Archeologico Provinciale di Potenza.* Naples: Libreria scientifica.

Leveau, P. 1983. La ville antique et l'organisation de l'espace rural: Villa, ville, village. *Annales: Économies, Sociétés, Civilisations* 4: 920–942.

Leveau, P. 2007. Les moulins de Barbegal 1986-2006, in J. Brun and J. Fiches (eds) *Énergie Hydraulique et Machines Élévatrices d´Eau dans l´Antiqué. Actes du colloque international organisé par l´établissement public de coopération culturelle Pont du Gard, l›UMR 5140 du CNRS «Archéologie des sociétés méditerranéennes» et le Centre Jean Bérard (UMS 1797 du CNRS/EFR) à Vers-Pont-du-Gard 20 – 22 septembre 2006* : 185–199. Naples: Centre Jean Bérard.

Leventi, I. and C. Mitsopoulou (eds) 2010. *Ιερά και Λατρείες της Δήμητρας στον Αρχαίο Ελληνικό Κόσμο. Πρακτικά Επιστημονικού Συμποσίου, Πανεπιστήμιο Θεσσαλίας, Τμήμα Ιστορίας, Αρχαιολογίας και Κοινωνικής Ανθρωπολογίας. Βόλος, 4-5 Ιουνίου 2005*. Volos: Εργαστήριο Αρχαιολογίας Πανεπιστημίου Θεσσαλίας, Τμήμα ΙΑΚΑ.

Levi, E.I. 1985. *Olviya: Gorod Epokhi Ellinizma*. Leningrad: Nauka.

Lézine, A. 1968. *Carthage-Utique: Études d'Architecture et d'Urbanisme*. Paris: Éditions du CNRS.

Liangouras, A. 1973-74. Οδός Κυκλώπων 16-18. *Αρχαιολογικόν Δελτίον* 29.Β'1: 41–43.

Lichtenberger, A. 2011. *Severus Pius Augustus: Studien zur sakralen Repräsentation und Rezeption der Herrschaft des Septimius Severus und seiner Familie (193–211 n. Chr.)*. Leiden: Brill.

Lindenlauf, A. 2000. Waste Management in Ancient Greece from the Homeric to the Classical period: Concepts and Practices of Waste, Dirt, Recycling and Disposal. Unpublished Doctoral Thesis, University of London, viewed 26 October 2023, <https://discovery.ucl.ac.uk/id/eprint/1317693/>.

Lindenlauf, A. 2001. Thrown away like rubbish – disposal of the dead in ancient Greece. *Papers from the Institute of Archaeology* 12: 86–99.

Lindenlauf, A. 2006. Recycling of votive offerings in Greek sanctuaries: Epigraphical and archaeological evidence, in C.C. Mattusch, A.A. Donohue and A. Brauer (eds) *Common Ground: Archaeology, Art, Science and Humanities. Proceedings of the XVIth International Congress of Classical Archaeology, Boston, August 23-26, 2003:* 30–32. Oxford: Oxbow Books.

Liseno, M.G. 2004. *Metaponto: Il Deposito Favale*. Rome: L'Erma di Bretschneider.

Lister, F.C. and R.H. Lister 1976. *A Descriptive Dictionary for 500 Years of Spanish-Tradition Ceramics (13th through 18th centuries)* (The Society of Historical Archeology special publication series 1). Glassboro, NJ: The Society of Historical Archeology.

Liverani, P. 2004. Reimpiego senza ideologia: La lettura antica degli *spolia* dall'arco di Costantino all'età di Teodorico. *Mitteilungen des Deutschen Archäologischen Instituts, Römische Abteilung* 111: 383–436.

Liverani, P. 2013. Il museo come 'Spolienraum', in S. Altekamp, C. Marcks-Jacobs and P. Seiler (eds) *Perspektiven der Spolienforschung 1: Spoliierung und Transposition* (Topoi. Berlin Studies of the Ancient World 15): 351–365. Berlin and Boston: De Gruyter.

Liverani, P. and U. Santamaria (eds) 2014. *Diversamente Bianco: La Policromia della Scultura Romana*. Rome: Edizioni Quasar.

Locatelli, D. 2005. La 'fonderia' della Regio V, insula 5: elementi per una definizione dell'attività produttiva, in G. Sassatelli and E. Govi (eds) *Culti, Forma Urbana e Artigianato a Marzabotto: Nuove Prospettive di Ricerca*: 213–237. Bologna: Università di Bologna.

Locatelli, D. 2013a. Agricoltori, ma anche mercanti: Distribuzioni e carattere dell'insediamento, in D. Locatelli, L. Malnati and D.F. Maras (eds) *Storie della Prima Parma: Etruschi, Galli, Romani. Le origini della città alla luce delle nuove scoperte archeologiche*: 10–12. Rome: L'Erma di Bretschneider.

Locatelli, D. 2013b. Una produzione di buccheri monumentali, in D. Locatelli, L. Malnati and D.F. Maras (eds) *Storie della Prima Parma: Etruschi, Galli, Romani. Le origini della città alla luce delle nuove scoperte archeologiche*: 38. Rome: L'Erma di Bretschneider.

Loewy, E. 1885. *Inschriften griechischer Bildhauer*. Leipzig: B.G. Teubner.

Logothetis, M. 2017. Τα θειοχώματα του ηφαιστείου της Νισύρου: Διαχρονική προσέγγιση της εκμετάλλευσής τους. *Δωδεκανησιακά Χρονικά* ΚΖ΄: 547–556.

Lolos, Y. 1997. The Hadrianic aquadect of Corinth (with an appendix on the Roman aqueducts in Greece). *Hesperia* 66.2: 271–314.

Loney, H.L. 2000. Society and technological control: A critical review of models of technological change in ceramic studies. *American Antiquity* 65: 646–668.

Loney, H.L. 2007. Prehistoric Italian pottery production: Motor memory, motor development and technological transfer. *Journal of Mediterranean Archaeology* 20.2: 183–207.

Lo Porto, F.G. 1964. Satyrion (Taranto): Scavi e ricerche nel luogo del più antico insediamento laconico in Puglia. *Atti della Accademia Nazionale dei Lincei. Notizie degli scavi di Antichità* 18: 177–279.

Lo Porto, F.G. 1966. Metaponto – Scavi e ricerche archeologiche. *Atti della Accademia Nazionale dei Lincei. Notizie degli scavi di Antichità* 20: 136–231.

Luberto, M.R. 2021. Spazi sacri e aree di produzione a Caulonia e Sibari tra periodo arcaico e classico. *Hesperìa. Studi sulla grecità d'Occidente* 39: 105–128.

Lucas, G. 2012. *Understanding the Archaeological Record*. Cambridge: Cambridge University Press.

Łukaszewicz, A. 1975. Some remarks on P. Lond. III 755 and the problem of building materials in the fourth century AD. *Archeologia* 30: 115–118.

Lupu, E. 2005. *Greek Sacred Law: A Collection of New Documents* (Religions in the Graeco-Roman World 152). Leiden: Brill.

Lynch, T.A.C. and E. Rocconi (eds) 2020. *A Companion to Ancient Greek and Roman Music* (Blackwell Companions to the Ancient World). Hoboken: John Wiley & Sons.

Lyngouri-Tolia, E. 1985a. Αιολέων και Ψαμάθης. *Αρχαιολογικόν Δελτίον* 40.Β': 16–18.

Lyngouri-Tolia, E. 1985b. Ανασκαφική έρευνα παρά την Πειραϊκή πύλη: Νέα στοιχεία για την οχύρωση των Αθηνών. *Αρχαιολογικά Ανάλεκτα εξ Αθηνών* 18: 137–142.

Lyngouri-Tolia, E. 2000. Evangelismos Station, in L. Parlama and N.Chr. Stampolidis (eds) *Η Πόλη κάτω από την Πόλη: Ευρήματα από τις Ανασκαφές του Μητροπολιτικού Σιδηροδρόμου των Αθηνών*: 208–

214. Athens: Υπουργείο Πολιτισμού, Ίδρυμα Ν.Π. Γουλανδρή, Μουσείο Κυκλαδικής Τέχνης.

Maas, M. and J.M. Snyder 1989. *Stringed Instruments of Ancient Greece.* New Haven, CT: Yale University Press.

Macridy, T. 1905. Altertümer von Notion. *Jahreshefte des Österreichischen Archäologischen Institutes in Wien* 8: 155–173.

Macridy, T. 1912. Antiquités de Notion II. *Jahreshefte des Österreichischen Archäologischen Institutes in Wien* 16: 36–67.

Magdelaine, C. 2002. Ville et campagne: Réflexions sur la salubrité chez les médecins grecs. *Ktéma* 27: 325–342.

Magdelaine, C. 2003. Ville, déchets et pollution urbaine chez les médecins grecs, in P. Ballet, P. Cordier and N. Dieudonné-Glad (eds) *La Ville et ses Déchets dans le Monde Romain: Rebuts et Recyclages. Actes du colloque de Poitiers, 19-20 Septembre 2002*: 27–36. Montagnac: Éditions Monique Mergoil.

Maier, F.G. 1959. *Griechische Mauerbauinschriften 1: Text und Kommentare* (Vestigia 1). Heidelberg: Quelle & Meyer.

Maier, F.G. 1961. *Griechische Mauerbauinschriften 2: Untersuchungen* (Vestigia 2). Heidelberg: Quelle & Meyer.

Maillot S. 2020. Synoikia: Remarques sur l'habitat locatif et collectif dans le monde égéen classique et hellénistique, in L. Lopez-Rabatel, V. Mathé and J.-Ch. Moretti (eds) *Dire la Ville en Grec aux Époque Antique et Byzantine. Actes du colloque de Créteil, 10-11 juin 2016*: 77–96. Lyon: MOM éditions.

Maischberger, M. 2009. Das Nymphäum, in O. Dally, M. Maischberger, P.I. Schneider and A. Scholl (eds) *ZeitRäume – Milet in Kaiserzeit und Spätantike. Ausstellung der Antikensammlung und des Deutschen Archäologischen Instituts im Pergamonmuseum auf der Berliner Museumsinsel, 6. Mai 2009 – 10. Januar 2010*: 97–107. Regensburg: Schnell & Steiner.

Malnati, L. 2015. Emilia, in A. Naso (ed.) *Etruscology*: 1437–1452. Boston and Berlin: De Gruyter.

Maniaki, A. 2009. Δρέπανο, θέση Αλώνια (οικόπεδα Ε. Χαλκίδη και Ε. Καρέλα). *Αρχαιολογικόν Δελτίον* 64.Β': 419–422.

Maniaki, A. 2013. Δρέπανο, οικόπεδο Η. Ηλιόπουλου. *Αρχαιολογικόν Δελτίον* 68.Β': 341–343.

Maniaki, A. 2014. Αρχαίο νεκροταφείο στο Δρέπανο Αχαΐας. *Αρχαιολογική Εφημερίς* 153: 141–183.

Maniaki, A. 2019a. New research in the cemetery of Drepanon in Achaea: Preliminary results, in E. Greco and A. Rizakis (eds) *Gli Achei in Grecia e in Magna Grecia: Nuove scoperte e nuove prospettive. Atti del convegno di Aighion (12-13.12.2016)* (Annuario della Scuola archeologica di Atene e delle missioni italiane in Oriente, Supplemento 3): 241–259. Rome: Scuola Archeologica Italiana di Atene.

Maniaki, A. 2019b. Το αρχαίο νεκροταφείο του Δρεπάνου Αχαΐας. Η παρουσίαση των δεδομένων από τις πρώτες έρευνες της Αρχαιολογικής Υπηρεσίας έως σήμερα, in E. Kountouri and A. Gadolou (eds) *Σωστικές ανασκαφές της Αρχαιολογικής Υπηρεσίας I: Τα νεκροταφεία. Χωροταξική οργάνωση – ταφικά έθιμα – τελετουργίες*: 95–124. Athens: Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων.

Maniaki, A. and I. Moutafi 2019. The latest Geometric finds of the cemetery in Drepanon Achaea, Greece: The rescue excavation at the Iliopoulos plot. *Jahreshefte des Österreichischen Archäologischen Institutes in Wien* 88: 281–344.

Maniatis, Y., Y. Facorellis, S. Soter, D. Katsonopoulou and B. Kromer 1995. Locating archaeological horizons with 14C sediment dating: The case of the lost city of Helike. *Radiocarbon* 37.3: 931–941.

Mann, M.I. (1962) 1978. *Méthodes Artisanales de Tannage* (Organisation des Nations Unies pour l'alimentation et l'agriculture). Rome: F.A.O.

Marano, Y. 2016. The circulation of marble in the Adriatic Sea at the time of Justinian, in J. Herrin and J. Nelson (eds) *Ravenna: Its Role in Earlier Medieval Change and Exchange*: 111–132. London: University of London Press.

Marano, Y. 2020. Teoria e pratica del reimpiego in età romana: Fonti scritte ed evidenza archeologica, in E. Culasso-Gastaldi (ed.) *La Seconda Vita delle Iscrizioni: E Molte Altre Ancora*: 107–132. Alessandria: Edizioni dell'Orso.

Marc, J.-Y. 1995. Who owned the marble quarries of Thasos during the Imperial Period?, in Y. Maniatis, N. Herz and Y. Bassiakos (eds) *The Study of Marble and Other Stones in Antiquity. Proceedings of the 3rd international conference of the Association for the Study of Marble and Other Stones in Antiquity, Athens, Greece, May 17-19, 1993* (ASMOSIA III): 33–37. London: Archetype Publications.

Marcadé, J., A. Hermary, Ph. Jockey and Fr. Queyrel (eds) 1996. *Sculptures Déliennes* (Sites et Monuments 17). Paris: Éditions de Boccard.

Marchiandi, D. and L. Mercuri 2011. s.v. Il Santuario di Pan presso la chiesa di Hag. Fotini, in E. Greco (ed.) *Topografia di Atene: Sviluppo urbano e monumenti dalle origini al III secolo d.C. Colline sud-occidentali – Valle dell'Ilisso* (Studi di Archeologia e di Topografia di Atene e dell'Attica 1.2): 485–486. Athens, Paestum: Scuola Archeologica Italiana di Atene, Pandemos.

Marginesu, G. 2010. *Gli Epistati dell'Acropoli: Edilizia Sacra nella Città di Pericle 447/6–433/2 a.C.* (Studi di Archeologia e di Topografia di Atene e dell'Attica 5). Athens, Paestum: Scuola Archeologica Italiana di Atene, Pandemos.

Marinatos, S. 1960. Helice: A sumberged town of classical Greece. *Archaeology* 13.3: 186–193.

Mark, I.S. 1993. *The Sanctuary of Athena Nike in Athens: Architectural Stages and Chronology* (Hesperia Supplements 26). Princeton, NJ: ASCSA.

Marksteiner, Th. 1997. *Die befestigte Siedlung von Limyra: Studien zur vorrömischen Wehrarchitektur und Siedlungsentwicklung in Lykien unter besonderer*

Berücksichtigung der klassischen Periode (Forschungen in Limyra). Vienna: Phoibos.

Maršić, D. 2007. Novi Heraklov žrtvenik iz Trogira. *Archaeologia Adriatica* 1.1: 111–128.

Martens, M. and S. Willems 2002. La production et la diffusion de céramiques locales: Les exemples de Tirlemont et Tongres, in *Actes du Congrès de Bayeux, SFECAG, 9-12 mai 2002*: 331–344. Marseille: SFECAG.

Martin, R. 1965. *Manuel d'Architecture Grecque I: Matériaux et Techniques*. Paris: A. and J. Picard.

Martin, R. 1971. Le monument des Néréides et l'architecture funéraire. *Revue Archéologique* 1971 N.S. 2: 327–337.

Maschek, D. 2016. The marble stoa at Hierapolis: Materials, labour force and building costs, in T. Ismaelli and G. Scardozzi (eds) *Ancient Quarries and Building Sites in Asia Minor: Research on Hierapolis in Phrygia and Other Cities in South-Western Anatolia – Archaeology, Archaeometry, Conservation* (Bibliotheca Archaeologica 45): 393–402. Bari: Edipuglia.

Masi von Eles, P. 1982. 78 Imola, via di Montericco: Insediamento, in P. Masi von Eles (ed.) *La Romagna tra VI e V sec. a.C.: La Necropoli di Montericco e la Protostoria Romagnola*: 142. Bologna: University Press.

Mastrokostas, E. 1961-62. Αρχαιότητες και μνημεία Αιτωλοακαρνανίας. *Αρχαιολογικόν Δελτίον* 17.Β': 182–185.

Mastrokostas, E. 1963. Ανασκαφή Αγίου Ηλία Ιθωρίας. *Πρακτικά της εν Αθήναις Αρχαιολογικής Εταιρείας* 1963: 203–217.

Mastrokostas, E. 1965. Αρχαιότητες και μνημεία Αχαΐας. *Αρχαιολογικόν Δελτίον* 20.Β'2: 220–227.

Mastrokostas, E. 1967. Αρχαιότητες και μνημεία Αιτωλοακαρνανίας. *Αρχαιολογικόν Δελτίον* 22.Β'2: 318–324.

Mastrokostas, E. 1985. Αποθραύσματα υστεροαρχαϊκών εναετίων γλυπτών εκ Κερυνείας Αχαΐας, in H. Kyrileis (ed.) *Archaische und Klassische griechische Plastik. Akten des internationalen Kolloquiums vom 22.-25. April 1985 in Athen*: 139–141. Mainz: Philipp von Zabern.

Matijević, K. 2010. *Römische und Frühchristliche Zeugnisse im Norden Obergermaniens: Epigraphische Studien zu unterer Mosel und östlicher Eifel* (Pharos 27). Rahden, Westf.: VML Verlag Marie Leidorf.

Matijević, K. 2016. Hercules Saxanus: Germanisch, keltisch oder römisch?, in K. Matijević (ed.) *Kelto-Römische Gottheiten und ihre Verehrer. Akten des 14. F.E.R.C.AN.-Workshops, Trier, 12.–14. Oktober 2015* (Pharos 39): 41–73. Rahden, Westf.: VML Verlag Marie Leidorf.

Mattern, M. 2005. *Römische Steindenkmäler aus Hessen südlich des Mains sowie vom bayerischen Teil des Mainlimes* (Corpus Signorum Imperii Romani, Deutschland II.13). Mainz: Verlag des Römisch-Germanischen Zentralmuseums.

Matthiesen, U. 2005. *KnowledgeScapes: Pleading for a Knowledge Turn in Socio-Spatial Research* (Working Paper, No. 31). Erkner: Leibniz-Institut für Regionalentwicklung und Strukturplanung (IRS).

Mattusch, C.C. 1977. Bronze- and ironworking in the area of the Athenian Agora. *Hesperia* 46.4: 340–379.

Mattusch, C.C. 1988. *Greek Bronze Statuary: From the Beginning Through the Fifth Century B.C.* Ithaca, London: Cornell University Press.

Mattusch, C.C. and H. Lie 2005. *The Villa dei Papiri at Herculaneum: Life and Afterlife of a Sculpture Collection*. Los Angeles: Getty Publications.

Mauné, S., N. Monteix and M. Poux (eds) 2013. *Cuisines et Boulangeries en Gaule Romaine* (coll. Gallia 70.1). Paris: Éditions du CNRS.

McDonald, W.A., W.D.E. Coulson and J. Rosser 1983. *Excavations at Nichoria in Southwest Greece III: Dark Age and Byzantine Occupation.* Minneapolis: University of Minnesota Press.

Mégnien, C. (ed.)1980. *Synthèse Géologique du Bassin de Paris III: Lexique des Noms de Formations* (Mémoire BRGM 104). Paris: Édition de BRGM.

Meirano, V. 2012. Productions et espaces artisanaux à Locres Epizéphyrienne, in A. Esposito and G. Sanidas (eds) *«Quartiers» Artisanaux en Grèce Ancienne, une Perspective Méditerranéenne*: 255–279. Villeneuve d'Ascq: Presses universitaires du Septentrion.

Meneghini, R. and R. Santangeli Valenzani 2007. *I Fori Imperiali: Gli Scavi del Comune di Roma (1991-2007)*. Rome: Viviani.

Metzger, H. 1963. *Fouilles de Xanthos II: L'Acropole Lycienne*. Paris: Klincksieck.

Metzger, H. 1972. *Fouilles de Xanthos IV: Les Céramiques Archaïques et Classiques de l'Acropole Lycienne*. Paris: Klincksieck.

Meylan-Krause, M.-F. (in press). Aventicum (Avenches, Suisse), capitale de la cité des Helvètes: Les artisanats urbains/suburbains et leur interaction avec les agglomérations et des domaines ruraux de l'arrière-pays, in G. Pagès and R. Clotuche (eds) *L'Influence des Activités Économiques dans l'Occupation du Territoire de l'Antiquité au Moyen Âge*. Nanterre: Presses universitaires Paris Nanterre.

Miari, M. 2003. Un impianto produttivo per ceramica a Savignano sul Rubicone (FO), in *Atti del XXXV Convegno di Studi dell'Istituto Italiano di Preistoria e Protostoria*: 499–514. Florence: Istituto Italiano di Preistoria e Protostoria.

Miari, M. 2016. Il Garampo nell'età del Ferro, in M. Miari and C. Negrelli (eds) *Ritmi di Transizione 2: Dal Garampo al Foro Annonario: Ricerche Archeologiche 2009–2013* (Ca' Foscari di Venezia Monografie): 149–150: Sesto Fiorentino: All'Insegna del Giglio.

Miari, M. 2022. Il materiale ceramico nella Romagna più interna, in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 205–215. Rome: L'Erma di Bretschneider.

Miari, M., C. Mazzoni, C. Gentile and T. Rossi 2008. San Zaccaria-Maiano (RA): Indagine archeologica su un

complesso produttivo della seconda età del Ferro, in M. Ficara and V. Manzelli (eds) *Orme nei Campi: Archeologia a Sud di Ravenna* (Quaderni di Archeologia dell'Emilia Romagna 20): 13–36. Sesto Fiorentino: All'Insegna del Giglio.

Michel, C. and M.-L. Nosch (eds) 2010. *Textile Terminologies in the Ancient Near East and Mediterranean from the Third to the First Millennia BC* (Ancient Textiles Series 8). Oxford and Oakville: Oxbow Books.

Mielsch, H. 1982. Review of Fraser, P.M. 1977. Rhodian funerary monuments. Oxford: Clarendon Press. *Gnomon* 54: 574–577.

Miliadis, I. 1956. Ανασκαφαί νοτίως της Ακροπόλεως. *Πρακτικά της εν Αθήναις Αρχαιολογικής Εταιρείας* 1956: 262–265.

Miliadis, I. 1957. Ανασκαφή νοτίως της Ακροπόλεως. *Πρακτικά της εν Αθήναις Αρχαιολογικής Εταιρείας* 1957: 23–26.

Miller Ammerman, R. 1991. The naked standing goddess: A group of Archaic terracotta figurines from Paestum. *American Journal of Archaeology* 95: 203–230.

Mirković, M. 1971. Sirmium: Its history from the 1st century AD to 582 AD, in Đ. Bošković (ed.) *Sirmium I: Archaeological Investigations in Syrmian Pannonia*: 5–90. Belgrade: National Archaeological Institute.

Misailidou-Despotidou, V. 2020. Τα κεραμικά εργαστήρια της Μακεδονίας στους υστεροκλασικούς και ελληνιστικούς χρόνους. Τυπολογία και διάδοση, in S. Drougou (ed.) *Κεραμεία, Τεχνίτες και Εργαστήρια. Ι' Διεθνής Επιστημονική Συνάντηση για την Ελληνιστική Κεραμική / Pottery Workshops, Craftsmen and Workshops. 10th International Scientific Meeting on Hellenistic Pottery*: 14–48. Athens: Ταμείο Αρχαιολογικών Πόρων.

Mitchell, W.J.T. 2005. *What do Pictures Want? The Lives and Loves of Images*. Chicago: University Press of Chicago.

Mitford, T.B. 1950. Kafizin and the Cypriot syllabary. *The Classical Quarterly* 44.3-4: 97–106.

Mitford, T.B. 1980. *The Nymphaeum of Kafizin: The Inscribed Pottery* (Kadmos Supplement 2). Berlin and New York: De Gruyter.

Mitsopoulou, C. 2010. Το ιερό της Δήμητρας στην Κύθνο και η μίσθωση του Ελευσινιακού τεμένους, in I. Leventi and C. Mitsopoulou (eds) *Ιερά και λατρείες της Δήμητρας στον αρχαίο ελληνικό κόσμο. Πρακτικά Επιστημονικού Συμποσίου, Πανεπιστήμιο Θεσσαλίας, Τμήμα Ιστορίας, Αρχαιολογίας και Κοινωνικής Ανθρωπολογίας. Βόλος, 4-5 Ιουνίου 2005*: 43–90. Volos: Εργαστήριο Αρχαιολογίας Πανεπιστημίου Θεσσαλίας, Τμήμα ΙΑΚΑ.

Mitsopoulou, C. 2011. The Eleusinian processional cult vessel. Iconographic evidence and Interpretation, in M. Hayson and J. Wallensten 2011 (eds) *Current Approaches to Religion in Ancient Greece. Papers presented at a symposium at the Swedish Institute at Athens. 17-19 April 2008* (Skrifter utgivna av Svenska institutet i Athen. 8o = Acta Instituti Atheniensis Regni Sueciae): 189–226 Stockholm: Swedish Institute at Athens.

Mitsopoulou, C. 2014. Το αττικό σκεύος των Ελευσινίων Μυστηρίων: Πρόταση χρονολόγησης, in *Η' Επιστημονική Συνάντηση για την Ελληνιστική Κεραμική. Ιωάννινα, 5-9 Μαΐου 2009*: 441–467. Athens: Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων.

Mittica, G. and N. Perrone 2019. Espressioni votive e rituali nel Santuario arcaico di Timpone della Motta: Le novità dagli scavi DIR 2017*. *Analecta Romana Instituti Danici* 43: 237–263.

Moeinipour, K., R. Ellerbrok, A.R. Bührig-Polaczek, P.R. Ellerbrok, G. Sahm, G. Zimmer and A. Dostert 1995. Bestimmung historischer Gießtechnik mittels numerischer Simulation am Beispiel etruskischer Handspiegel. *Berliner Beiträge zur Archäometrie* 13: 5–86.

Monaco, M.C. 2000. *Ergasteria: Impianti Artigianali Ceramici ad Atene ed in Attica dal Protogeometrico alle Soglie dell'Ellenismo*. Rome: L'Erma di Bretschneider.

Monaghan, M.D. 2013. Coats of Many Colours: Dyeing and Dyeworks in Classical and Hellenistic Greece. Unpublished PhD dissertation, University of Leicester. Ann Arbor, MI: ProQuest.

Monteix N. 2010a. La localisation des métiers dans l'espace urbain: Quelques exemples pompéiens, in P. Chardron-Picault (ed.) *Aspects de l'Artisanat en Milieu Urbain: Gaule et Occident Romain. Actes du colloque international d'Autun, 20-22 sept. 2007* (Revue archéologique de l'Est Supplément 28): 147–160. Dijon: Revue Archéologique de l'Est.

Monteix, N. 2010b. *Les Lieux de Métier : Boutiques et Ateliers d'Herculanum* (Bibliothèque des Écoles françaises d'Athènes et de Rome 344). Rome: École française de Rome.

Monteix, N. 2016. Contextualizing the operational sequence: Pompeian bakeries as a case study, in A. Wilson and M. Flohr (eds) *Urban Craftsmen and Traders in the Roman World*: 153–180. Oxford: Oxford University Press.

Monthel, G. and M. Pinette 1977. La carrière gallo-romaine de Saint-Boil. *Revue d'archéologique de l'Est et du Centre-Est* 28: 50–51.

Moore, H. 1934. Statement for Unit One, in H. Read (ed.) *Unit One: The Modern Movement in English Architecture*: 29–30. London: Cassell and Company Ltd.

Moralee, J. 2006. The stones of St. Theodore: Disfiguring the pagan past in Christian Gerasa. *Journal of Early Christian Studies* 14.2: 183–215.

Moretti, J.-C, N. Bresch, I. Bonora, J.-J. Malmary and O. Riss 2016. Claros, le temple d'Apollon: Travaux réalisés en 2015. *Anatolia Antiqua* 24: 299–310.

Morgan, C., R.K. Pitt and T. Whitelaw 2008-09. Archaeology in Greece 2008-2009. *Archaeological Reports* 55: 1–101.

Morigi Govi, C. 1981. L'anforetta con iscrizione etrusca da Bologna. *Studi Etruschi* 49: 67–93.

Morpurgo, G. 2017. Luoghi di produzione urbani tra Bologna e Marzabotto, in M.C. Biella, R. Cascino, A. F. Ferrandes and M. Revello Lami (eds) *Scienze dell'Antichità* 23.*2. Special Issue Gli Artigiani e la Città. Officine e aree produttive tra VIII e III sec. a.C. nell'Italia centrale tirrenica*: 353–375.

Morpurgo, G., C. Pizzirani and C. Mattioli 2017. The craft settings in Kainua-Marzabotto: Places and archaeological issues. *Archeologia e Calcolatori* 28.2: 113–127.

Moschos, I. 2009. Western Achaea during the succeeding LHIII C Late period – The final Mycenaean phase and the Submycenaean period, in S. Deger-Jalkotzy and A.E. Bächle (eds) *LH IIIC Chronology and Synchronisms III: LH IIIC Late and the Transition to the Early Iron Age. Proceedings of an international workshop held at the Austrian Academy of Sciences at Vienna, 23-24 February 2007* (Mykenische Studien 30, Denkschriften der philosophisch-historischen Klasse 384): 235–288. Vienna: Österreichische Akademie der Wissenschaften.

Moschou, L., S. Raftopoulou and Th. Chatzitheodorou 1998. Λίθος ερυθρός Ταινάριος. *Αρχαιολογικόν Δελτίον* 53.Α'*:* 267–288.

Mossé, C. 1993. Les polykrateia erga à Samos: Un exemple d'architecture tyrannique?, in J. des Courtils and J.-C. Moretti (eds) *Les Grands Ateliers d'Architecture dans le Monde Égéen du VIe s. av. J.-C. Actes du colloque d'Istanbul, 23-25 mai 1991* (Varia Anatolica III): 77–81. Istanbul : Institut français d'Études Anatoliennes.

Moustaka, A. 2014. I.1.70: Ο κούρος Α του Σουνίου, in G. Despinis and N. Kaltsas (eds) *Εθνικό Αρχαιολογικό Μουσείο: Γλυπτά των Αρχαϊκών Χρόνων από τον 7ο αιώνα έως το 480 π.Χ.*: 94–100. Athens: Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων.

Moutsopoulos, N. 1982. Τα δρακόσπιτα της ΝΔ Εύβοιας: Συμβολή στην αρχιτεκτονική, την τυπολογία και τη μορφολογία τους. *Επιστημονική Επετηρίδα της Πολυτεχνικής Σχολής. Τμήμα Αρχιτεκτόνων. Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης* 8.1978-1980: 263–479.

Mühlbauer, L. 2006. Ein lykisches Fuβmaβ?, in K. Dörtlük, B. Varkıvanç, T. Kahya, J. des Courtils, M. Alparslan and R. Boyraz (eds) *The IIIrd International Symposium on Lycia, 07-10 November 2005, Antalya. Symposium Proceedings II:* 489–514. Antalya: Suna & Inan Kıraç Research Institute on Mediterranean Civilizations.

Muller, A. and E. Laflı (eds) 2016. *Figurines en Terre Cuite en Méditerranée Grecque et Romaine 1: Production, Diffusion, Étude. Actes du colloque international Colloquia Anatolica et Aegea Antiqua . Izmir, 2-6 juin 2007* (Bulletin de Correspondance Hellénique Supplément 54). Athens: École française d'Athènes.

Mulliez, D. 1998. Vestiges sans ateliers: Le lapicide. *Topoi* 8.2: 815–830.

Mulliez, D. 2016. La loi, la norme et l'usage dans les relations entre maîtres et esclaves à travers la documentation delphique (200 av. J.-C. – 100 ap. J.-C.), in M. Dondin-Payre and N. Tran (eds) *Esclaves et Maîtres dans le Monde Romain: Expressions Épigraphiques de Leurs Relations:* 13–30. Rome: École française de Rome.

Munro, B. 2011. Approaching architectural recycling in Roman and Late Roman villas, in D. Mladenović and B. Russell (eds) *TRAC 2010. Proceedings of the Twentieth Annual Theoretical Roman Archaeology Conference, Oxford 2010*: 76–88. Oxford: Oxbow Books.

Munro, B. 2016. Sculptural deposition and lime kilns at Roman villas in Italy and the western provinces in Late Antiquity, in T.M. Kristensen and L. Stirling (eds) *The Afterlife of Greek and Roman Sculpture: Late Antique Responses and Practices*: 47–67. Ann Arbor: University of Michigan Press.

Munro, B. 2020. The organized recycling of Roman villa sites, in C. Duckworth and A. Wilson (eds) *Recycling and Reuse in the Roman Economy*: 383–400. Oxford: Oxford University Press.

Murer, C. 2016. The reuse of funerary statues in Late Antique prestige buildings at Ostia, in T.M. Kristensen and L. Stirling (eds) *The Afterlife of Greek and Roman Sculpture. Late Antique Responses and Practices:* 177–197. Michigan: University of Michigan Press.

Murer, C. 2018. From the tombs into the city: Grave robbing and the reuse of funerary spolia in Late Antique Italy. *Acta ad Archaeologiam et Artium Historiam Pertinentia* 30.16 N.S.: 115–137.

Murer, C. 2022. Recycling Roman funerary sculpture in Italy and the Late Roman West, in C. Parigi (ed.) *Recycling and Reuse of Sculpture in Roman and Late Antique Times: Panel 6.8. Proceedings of the 19th International Congress of Classical Archaeology, Cologne/ Bonn 2018*: 49-57. Heidelberg: Propylaeum.

Müseler, W. and D. Schürr 2018. Zur Chronologie in den Inschriften auf dem Agora-Pfeiler von Xanthos (TL 44), den betroffenen Dynasten und ihren Münzen. *Klio* 100: 381–406.

Nazarov, V.V. 2007. A temenos of the 6th century B.C. at Berezan, in J. Cobet, V. von Graeve, W.-D. Niemeier and K. Zimmermann (eds) *Frühes Ionien: Eine Bestandsaufnahme. Panionion-Symposion Güzelçamli 26. September – 1. Oktober 1999*: 541–549. Mainz: Philipp von Zabern.

Neer, R. 2001. Framing the gift: The politics of the Siphnian treasury at Delphi. *Classical Antiquity* 20.2: 273–344.

Negrini, C. 2022. Dalla Valle del Marecchia a San Martino in Gattara: Influenze etrusche ed alto-tiberine nelle produzioni ceramiche umbro-padane di VI secolo a.C., in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 217–236. Rome: L'Erma di Bretschneider.

Neri, D. 2007. *Catalogo della Ceramica con Decorazione a Stampiglia nell'Emilia Centro-Occidentale*. Nonantola: Centro Studi Nonantolani.

Neri, D. 2012. *Gli Etruschi tra VIII e VII sec. a.C. nel Territorio di Castelfranco Emilia (MO)* (Quaderni di archeologia dell'Emilia Romagna 29). Sesto Fiorentino: All'Insegna del Giglio.

Ng, D.Y. and M. Swetnam-Burland (eds) 2018. *Reuse and Renovation in Roman Material Culture: Functions, Aesthetics, Interpretations.* Cambridge: Cambridge University Press.

Niemeier, W.-D. 2002. *Der Kuros vom Heiligen Tor: Überraschende Neufunde Archaischer Skulptur im Kerameikos in Athen*. Mainz: Philipp von Zabern.

Niewöhner, P. 2018. Varietas, spolia, and the end of antiquity in East and West, in I. Jevtić and S. Yalman (eds) *Spolia Reincarnated: Afterlives of Objects, Materials, and Spaces in Anatolia from Antiquity to the Ottoman Era*: 237–257. Istanbul: Anamed.

Niewöhner, P. 2019. Byzantine preservation of ancient monuments at Miletus in Caria: Christian antiquarianism in western Asia Minor, in J. Borsch, O. Gengler and M. Meier (eds) *Die Weltchronik des Johannes Malalas im Kontext spätantiker Memorialkultur*: 191–216. Stuttgart: Franz Steiner Verlag.

Nijboer, A.J. 1998. From Household Production to Workshops: Archaeological Evidence for Economic Transformations, Pre-Monetary Exchange and Urbanisation in Central Italy from 800 to 400 BC. Unpublished PhD dissertation, Rijksuniversiterit Groningen.

Nikolić, D. 2019. Stoneworkers' Hercules. A comment on an Upper Moesian inscription. *Studia Antiqua et Archaeologica* 25.2: 457–463.

Noble, J. 1960. The technique of Attic vase-painting. *American Journal of Archaeology* 64: 307–318.

Noethlichs, K.L. 2013. Kaiserzeitliche und spätantike staatliche Regularien zur Spoliierung – ein Kommentar, in S. Altekamp, C. Marcks-Jacobs and P. Seiler (eds) *Perspektiven der Spolienforschung 1: Spoliierung und Transposition* (Topoi. Berlin Studies of the Ancient World 15): 11–21. Berlin and Boston: De Gruyter.

Nolte, S. 2006. *Steinbruch-Werkstatt-Skulptur: Untersuchungen zu Aufbau und Organisation griechischer Bildhauerwerkstätten* (Beihefte zum Göttinger Forum für Altertumswissenschaft 18). Göttingen: Edition Ruprecht.

Nora, P. 1990. *Zwischen Geschichte und Gedächtnis. Aus dem Französischen von Wolfgang Kaiser*. Berlin: Verlag Klaus Wagenbach.

Nosch, M.-L. 2014. Linen textiles and flax in Classical Greece: Provenance and trade, in H. von Kerstin Droß-Krüpe (ed.) *Textile Trade and Distribution in Antiquity*: 17–42. Wiesbaden: Harrassowitz.

Oakley, J., W. Coulson and O. Palagia (eds) 1997. *Athenian Potters and Painters. The conference proceedings*. Oxford: Oxbow Books.

Ogden, D. 2009. *Magic, Witchcraft, and Ghosts in the Greek and Roman Worlds*. Oxford: Oxford University Press.

Oikonomou, A. and P. Triantafyllidis 2018. An archaeometric study of archaic glass from Rhodes, Greece: Technological and provenance issues. *Journal of Archaeological Science* 22: 493–505.

Olcese, G. 2012. *Atlante dei Siti di Produzione Ceramica (Toscana, Lazio, Campania e Sicilia) con le Tabelle dei Principali RELITTI del Mediterraneo Occidentale* (Immensa Aequora 2). Rome: Edizioni Quasar.

Ol'govskii, S.Ya. 2011. *Skifo-Antychna Metaloobrobka Arkhaichnogo chasu*. Kyiv: KNT.

Onasoglou, A. 1981. Οι Γεωμετρικοί τάφοι της Τραγάνας στην Ανατολική Λοκρίδα. *Αρχαιολογικόν Δελτίον* 36.Α': 1–57.

Orfanou, V. 1993. Οδός Τριών Ιεραρχών 196. *Αρχαιολογικόν Δελτίον* 48. Β'1: 38.

Orfanou, V. 1994. Οδός Δημοφώντος 115 και Κυκλώπων 31. *Αρχαιολογικόν Δελτίον* 49.Β'1: 40.

Orfanou, V. and N. Kaletzi 1994. Οδός Δωριέων 15. *Αρχαιολογικόν Δελτίον* 49.Β'1: 40–41.

Orlandi, S. 2017. Urban prefects and the epigraphic evidence of Late-Antique Rome. *Antiquité Tardive* 25: 213–222.

Orlandini, P. 1983. Le arti figurative, in G. Pugliese Carratelli, D. Adamesteanu, L. Forti, A. Frajese, M. Gigante, G. Gullini, P. Orlandini, C. Rolley, A. Stazio, Á. Szabó and L. Vagnetti (eds) *Megale Hellas: Storia e Civiltà della Magna Grecia*: 329–554. Milan: Libri Scheiwiller.

Orlandos, A. 1924-25. Ανασκαφαί εν Μολυκρείω της Αιτωλίας. *Αρχαιολογικόν Δελτίον* 9 (Παράρτημα/Appendix): 55–64.

Orlandos, A. 1947. Nouvelles observations sur la construction du temple d'Athéna Niké. *Bulletin de Correspondance Hellénique* 71-72: 1–3.

Orlandos, A. 1959-60. *Τα Υλικά Δομής των Αρχαίων Ελλήνων και οι Τρόποι Εφαρμογής αυτών κατά τους Συγγραφείς, τας Επιγραφάς και τα Μνημεία 2: Τα Μέταλλα, το Ελεφαντοστούν, τα Κονιάματα και οι Λίθοι.* Athens: Η εν Αθήναις Αρχαιολογική Εταιρεία.

Orlandos, A. 1994. *Τα Υλικά Δομής των Αρχαίων Ελλήνων και οι Τρόποι Εφαρμογής αυτών κατά τους Συγγραφείς, τας Επιγραφάς και τα Μνημεία*. Athens: Η εν Αθήναις Αρχαιολογική Εταιρεία.

Ormerod, H.A. 1909-10. Laconia II: Topography. *Annual of the British School at Athens* 16: 62–71.

Ortalli, J. 2002. La 'rivoluzione' felsinea: nuove prospettive dagli scavi di Casalecchio su Reno. *Padusa* 38: 57–90.

Ortalli, J. 2009. Modena e il suo territorio: Fisionomia e peculiarità di una colonia Romana, in A. Cardarelli and L. Malnati (eds) *Atlante dei Beni Archeologici della Provincia di Modena III: Collina e Alta Pianura*: 76–86. Sesto Fiorentino All'Insegna del Giglio.

Østby, E. 2000. Delphi and archaic Doric architecture in the Peloponnese, in A. Jacquemin (ed.) *Delphes:*

Cent Ans après la Grande Fouille – Essai de bilan. Actes du colloque international, Athène-Delphes 17-20 septembre 1992 (Bulletin de Correspondance Hellénique Supplément 36): 239–262. Athens: École française d'Athènes.

Østby, E. 2014. The sanctuary of Alea at Tegea in the pre-Classical period, in E. Østby (ed.) *Tegea I: Investigations in the Temple of Athena Alea 1991-94* (Papers and Monographs from the Norwegian Institute at Athens 3): 11–56. Athens: Norwegian Institute at Athens.

Østergaard, J.S. 2008. Emerging colors: Roman sculptural polychromy revived, in R. Panzanelli, E.D. Schmidt and K. Lapatin (eds) *The Color of Life: Polychromy in Sculpture from Antiquity to the Present*: 40–61. Los Angeles: Getty Publications.

Østergaard, J.S. and A.M. Nielsen (eds) 2014. *Transformations: Classical Sculpture in Colour*. Copenhagen: Naryana Press.

Oteros-Rozas, E., R. Ontillera-Sánchez, P. Sanosa, E. Gómez-Baggethun, V. Reyes-García, and J.A. González 2013. Traditional ecological knowledge among transhumant pastoralists in Mediterranean Spain. *Ecology and Society* 18.3, viewed 08 August 2021, <http://dx.doi.org/10.5751/ES-05597-180333>.

Ottati, A. and M.S. Vinci 2021. From the quarry to the monument: The process behind the process – design and organization of the work in ancient architecture. Introduzione, in A. Ottati and M.S. Vinci (eds) *From the Quarry to the Monument: The Process behind the Process – Design and Organization of the Work in Ancient Architecture: Panel 4.3: Archaeology and Economy in the Ancient World. Proceedings of the 19th International Congress of Classical Archaeology, Cologne/Bonn 2018* (Archaeology and Economy in the Ancient World 26): 1–3. Heidelberg: Propylaeum.

Ouaja, M., S. Ferry, G. Barale and D. Srarfi 2002. *Faciès de Dépôt du Jurassique et du Crétacé du Bassin de Tataouine (Sud de la Tunisie): Livret guide de l'excursion organisée par le Service Géologique de Tunisie et l'Association des Sédimentologistes Français*. Tunis: Office National de Mines.

Pagnini, L. 2022a. Ambienti orientali e porticato adiacente, in Donati, L., G. Millemaci, L. Pagnini and G. Poggesi (eds) *Gonfienti: L'insediamento etrusco e romano. Lo scavo*: 180–182. Florence: Edifir.

Pagnini, L. 2022b. La ceramica d'impasto, in Donati, L., G. Millemaci, L. Pagnini and G. Poggesi (eds) *Gonfienti: L'insediamento etrusco e romano. I materiali*: 171–249. Florence: Edifir.

Pakkanen, J. 2013. The economics of shipshed complexes: Zea, a case study, in D.J. Blackman, N.B. Rankov and K. Baika (eds) *Shipsheds of the Ancient Mediterranean*: 55–75. Cambridge and New York: Cambridge University Press.

Pakkanen, J. 2021. Building BIG and Greek Classical and Hellenistic houses? Estimating total costs of private housing in Attica, in J. Pakkanen and A. Brysbaert (eds) *Building BIG – Constructing Economies: From Design to Long-Term Impact of Large-Scale Building Projects: Panel 3.6: Archaeology and Economy in the Ancient World. Proceedings of the 19th International Congress of Classical Archaeology, Cologne/Bonn 2018* (Archaeology and Economy in the Ancient World 10): 59–75. Heidelberg: Propylaeum.

Palagia, O. 1986. s.v. Daphne, in *LIMC* III: 344–348.

Palagia, O. 1988. s.v. Herakles: C. Classical Greek/Roman, in *LIMC* IV: 738–790.

Palagia, O. 1990. Two statues of Hercules in the Forum Boarium in Rome. *Oxford Journal of Archaeology* 9.1: 51–70.

Palagia, O. 2006. Marble carving techniques, in O. Palagia (ed.) *Greek Sculpture: Function Materials and Techniques in the Archaic and Classical Periods*: 243–279. Cambridge: Cambridge University Press.

Palagia, O. 2011. An unfinished Mollosian hound from the Dionysos quarry on mount Pentelikon. *Marmora* 7: 3–12.

Pallecchi, P. 2011. I caratteri fisici e l'antropizzazione del territorio, in P. Perazzi and G. Poggesi (eds) *Carta Archeologica della Provincia di Prato: Dalla Preistoria all'Età Romana*: 9–16. Sesto Fiorentino: All'Insegna del Giglio.

Pallis, G. 2019. The second life of inscriptions in Late Antique and Byzantine Asia Minor: Some remarks on the reuse of the inscribed material. *Gephyra* 18: 59–76.

Pantelidou, M. 1975. Αι Προϊστορικαί Αθήναι. Unpublished PhD dissertation, National and Kapodistrian University of Athens.

Papachatzis, N. 1974. *Παυσανίου Ελλάδος Περιήγησις - Αττικά*. Athens: Εκδοτική Αθηνών.

Papachristodoulou, I.Ch. 1993. Σχέσεις Νισύρου και Ρόδου στην αρχαιότητα: Ο Δήμος Νισυρίων στα πλαίσια της ενιαίας ροδιακής πολιτείας. *Νισυριακά* 12: 39–52.

Papaconstantinou, A. 2013. A fourth-century inventory of columns and the Late Roman building industry, in R. Ast, H. Cuvigny, T. Hickey and J. Lougovaya (eds) *Papyrological Texts in Honor of Roger S. Bagnall*: 215–231. Durham, NC: American Society of Papyrologists.

Papadimitriou, A. 2018. Εργαστήρια στην αρχαία Πάρο, in D. Katsonopoulou (ed.) Η Πάρος και οι Αποικίες της / *Paros and its Colonies. Proceedings of the fourth international conference on the archaeology of Paros and the Cyclades, Paroikia 11-14.6.2015* (PAROS IV): 143–160. Athens: The Institute for Archaeology of Paros and the Cyclades.

Papadopoulos, J.K. 1992. Lasana: Tuyeres and kiln firing supports. *Hesperia* 61: 203–221.

Papadopoulos, J.K. 2001. Magna Achaea: Akhaian Late Geometric and Archaic pottery in South Italy and Sicily. *Hesperia* 70.4: 373–460.

Papadopoulos, J.K. 2003. *Ceramicus Redivivus: The Early Iron Age Potters' Field in the Area of the Classical Athenian*

Agora (Hesperia Supplements 31). Princeton, NJ: ASCSA.

Papadopoulos, J.K and L.E. Smithson 2017. *The Athenian Agora XXXVI: The Early Iron Age – The Cemeteries (with contributions by M.A. Liston, D. Ruscillo, S. Strack, and E. Dimitriadou).* Princeton, NJ: ASCSA.

Papageorgakis, I. 1964. Συμβολή εις την γνώσιν των εις την αρχαίαν Ελλάδα χρησιμοποιηθέντων μαρμάρων και των λατομείων αυτών ΙΙ: Τα αρχαία λατομεία του Καρυστίου μαρμάρου. *Πρακτικά της Ακαδημίας Αθηνών* 39: 262–278.

Papageorgakis, I. 1967. Τα εις την μαρμαρικήν τέχνην χρήσιμα πετρώματα της Ελλάδος. *Γεωλογικά Χρονικά των Ελληνικών Χωρών* 18: 193–270.

Papagrigorakis, M.J., C. Yapijakis and P.N. Synodinos 2008. Typhoid fever epidemic in ancient Athens, in D. Raoult and M. Drancourt (eds) *Paleomicrobiology: Past Human Infections*: 161–173. Heidelberg: Springer.

Papaoikomounou, Y. 1983. La stèle de Ktésikratès et le monument des Néréides. *Revue Archéologique* 2: 317–324.

Papapostolou, I.A. 1993. *Achaean Grave Stelai [with epigraphical notes by A. Rizakis]* (Βιβλιοθήκη της εν Αθήναις Αρχαιολογικής Εταιρείας 135). Athens: Η εν Αθήναις Αρχαιολογική Εταιρεία.

Papapostolou, I.A. 2008. *Θέρμος: Το Μέγαρο Β και το Πρώιμο Ιερό – Η Ανασκαφή 1992-2003* (Βιβλιοθήκη της εν Αθήναις Αρχαιολογικής Εταιρείας 261). Athens: Η εν Αθήναις Αρχαιολογική Εταιρεία.

Papapostolou, I.A. 2014. *Το Ιερό του Θέρμου στην Αιτωλία: Ιστορία – Μνημεία – Περιήγηση του Χώρου* (Βιβλιοθήκη της εν Αθήναις Αρχαιολογικής Εταιρείας 291, Αρχαίοι Τόποι και Μουσεία της Ελλάδος 31). Athens: Η εν Αθήναις Αρχαιολογική Εταιρεία.

Pappas, I. and I. Lourentzatou (eds) 2022. *ΦΑΛΗΡΟΘΕΝ Ανάμεσα σε Δύο Κόσμους*. Athens: Υπουργείο Πολιτισμού και Αθλητισμού.

Parker, R. 1983. *Miasma: Pollution and Purification in Early Greek Religion*. Oxford: Clarendon Press.

Parlama, L. 1990-91. Ο Μητροπολιτικός Σιδηρόδρομος και οι αρχαιότητες των Αθηνών. *Ηόρος* 8-9: 231–245.

Parlama, L. 1992-98. Αθήνα 1993-1995, από τις ανασκαφές του Μητροπολιτικού Σιδηροδρόμου. *Ηόρος* 10-12: 521–544.

Parlama, L. and N.Chr. Stampolidis (eds) 2000. *Η Πόλη κάτω από την Πόλη: Ευρήματα από τις Ανασκαφές του Μητροπολιτικού Σιδηροδρόμου των Αθηνών / The City beneath the City: Antiquities from the Metropolitan Railway Excavations; exhibition held at the Museum of Cycladic Art, Athens, 29 February 2000 – 31 December 2001.* Athens: Υπουργείο Πολιτισμού, Ίδρυμα Ν.Π. Γουλανδρή, Μουσείο Κυκλαδικής Τέχνης.

Partida, E. 2000a. *The Treasuries at Delphi: An Architectural Study* (Studies in Mediterranean Archaeology 160). Jonsered: P. Åström.

Partida, E. 2000b. Two Boeotian treasuries at Delphi, in V. Aravantinos (ed.) *Γ΄ Διεθνές Συνέδριο Βοιωτικών Μελετών (Θήβα 4-8 Σεπτεμβρίου 1996)* (Επετηρίς Εταιρείας Βοιωτικών Μελετών): 536–564. Athens: Εταιρεία Βοιωτικών Μελετών.

Partida, E. 2000c. Architecture in Parian marble at Delphi, in D. Schilardi and D. Katsonopoulou (eds) *Παρία Λίθος: Λατομεία, Μάρμαρο και Εργαστήρια Γλυπτικής της Πάρου. Πρακτικά Α' διεθνούς συνεδρίου αρχαιολογίας Πάρου και Κυκλάδων, Παροικιά 2-5 Οκτωβρίου 1997*: 355–363. Athens: The Institute for Archaeology of Paros and the Cyclades.

Partida, E. 2009a. From hypaethral depots to hypaethral exhibitions: Casting light on architecture and society in fourth/third-century BC Delphi. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 124: 273–324.

Partida, E. 2009b. Φυσικά και αρχιτεκτονικά μνημεία Δελφών, αρχαία μονοπάτια, νέα ευρήματα. *Αρχαιολογικόν Δελτίον* 64 Β'1: 529–536.

Partida, E. 2011. The nexus of inter-regional relations established by creators and artisans in the ancient sanctuary and the town of Delphi. *Pallas: Revue d'Études Antiques* 87: 223–242.

Partida, E. 2012. Υπαίθριες εκθέσεις στους Δελφούς: Μία προσπάθεια ανασύστασης μνημείων και κοινωνίας της αρχαιότητας. *Αρχαιολογικό Έργο Θεσσαλίας και Στερεάς Ελλάδας* 3: 1087–1097. Volos: Πανεπιστήμιο Θεσσαλίας, Υπουργείο Πολιτισμού.

Partida, E. 2013. Parian creators and a new find of the age of Skopas at Delphi, in D. Katsonopoulou and A. Stewart (eds) *Skopas of Paros and his World*: 477–498. Athens: The Institute for Archaeology of Paros and the Cyclades.

Partida E. 2015a. Architectural elements and historic circumstances that shaped the sanctuary of Delphi during the so-called 'Age of the Warriors', in J. des Courtils (ed.) *L'Architecture Monumentale Grecque au IIIe Siècle a. C.*: 29–50. Pessac: Ausonius.

Partida, E. 2015b. Η διαδοχή πολιτικών δυνάμεων στους Δελφούς και η επιρροή τους στην αρχιτεκτονική διαμόρφωση του ιερατικού τοπίου. *Αρχαιολογικό Έργο Θεσσαλίας και Στερεάς Ελλάδας* 4: 877-882.

Partida, E. 2016. Post-earthquake architecture at Olympia: The impact of natural phenomena upon the builders' attitude in the 4th century BC, in D. Katsonopoulou and E. Partida (eds) *ΦΙΛΕΛΛΗΝ. Essays presented to Stephen G. Miller*: 299–316. Athens: The Helike Society.

Partida, E. 2017a. Glorification of the Sun (Helios) at Delphi and reflections on some architectural remains on Mount Parnassos, in H. Frielinghaus and J. Stroszeck (eds) *Griechische Kulte und Heiligtümer: Neue Funde und Forschungen* (Beiträge zur Archäologie Griechenlands 4): 207–231. Möhnesee: Bibliopolis.

Partida, E. 2017b. The disaster and the experience of 373 BC followed through the architecture and topography of Delphi, in D. Katsonopoulou (ed.) *HELIKE V: Poseidon, God of Earthquakes and Waters – Cult and Sanctuaries*: 227–258. Athens: The Helike Society.

Partida, E. 2018. Οι Αιτωλοί ως παράγων διαμόρφωσης του αρχιτεκτονικού τοπίου στους Δελφούς, in *2ο Διεθνές Αρχαιολογικό-Ιστορικό Συνέδριο Αιτωλοακαρνανίας και Λευκάδας, 6-8 Δεκεμβρίου 2013, Μεσολόγγι*: 363–376. Messolonghi: Υπουργείο Πολιτισμού.

Partida, E. 2019. Politics reflected on architecture: An evaluation of the Aetolian, the Pergamene and the Roman input to the religious landscape at Delphi, in E.C. Partida and B. Schmidt-Dounas (eds) *Listening to the Stones. Essays on Architecture and Function in Ancient Greek Sanctuaries, in Honour of Richard Alan Tomlinson*: 65–79. Oxford: Archaeopress.

Partsch, J. 1913. Die alexandrinischen Dikaiomata. *Archiv für Papyrusforschung* 6: 34–76.

Patsiada, V. 1996. Grabtische und Grabaltäre in der Nekropole von Rhodos, in D. Berges (ed.) *Rundaltäre aus Kos und Rhodos*: 84–109. Berlin: Gebr. Mann.

Patsourakos, I.B. 1902. *Πραγματεία περί του αρχαίου Γυθείου*. Athens: Π.Δ. Σακελλαρίου.

Pautasso, A. 2014. Terrecotte locresi d'età arcaica da Catania : Un contributo alla storia dei rapporti tra Sicilia e Magna Grecia, in *Κατά Κορυφὴν Φάος. Studi in Onore di Graziella Fiorentini* (Sicilia Antiqua XI): 355–362. Pisa and Rome: Fabrizio Serra Editore.

Peacock, D.P.S. 1980. The Roman millstone trade: A petrological sketch. *World Archaeology* 12.1: 43–53.

Peacock, D.P.S. 1982. *Pottery in the Roman World: An Ethnoarchaeological Approach*. London: Longman.

Pedersen, P. 2013. Architectural relations between Karia and Lykia at the time of the Ionian Renaissance, in P. Brun, L. Cavalier, K. Konuk and F. Prost (eds) *Euploia: La Lycie et la Carie Antiques – Dynamiques des Territoires, Échanges et Identités*: 127–143. Pessac: Ausonius.

Pegoretti, G. 1863. *Manuale Pratico per l'Estimazione dei Lavori architettonici, Stradali, Idraulici e di Fortificazione per Uso degli Ingegneri ed Architetti* (Biblioteca Scelta dell'Ingegnere Civile 13). Milan: tip. D. Salvi.

Peinetti, A., M. Cattani and F. Debandi (eds) 2019. *Focolari, Forni e Fornaci tra Neolitico ed Età del Ferro: Comprendere le attività domestiche e artigianali attraverso lo studio delle installazioni pirotecnologiche e dei residui di combustione*. Florence: Istituto Italiano di Preistoria e Protostoria.

Pelacci, C. 2022. Produzioni artigianali tra Mugello ed Emilia-Romagna: La ceramica dipinta a motivi ornamentali, L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 433–453. Rome: L'Erma di Bretschneider.

Pelegrin J., C. Karlin and P. Bodu 1988. Chaînes opératoires: Un outil pour le préhistorien. *Technologie Prehistorique* 1988: 55–62.

Pensabene, P. 1998. Il fenomeno del marmo nella Roma tardo-repubblicana e imperiale, in A. Alvarez i Pérez (ed.) *Marmi Antichi 2: Cave e Tecnica Di Lavorazione – Provenienze e Distribuzione* (Studi Miscellanei 31): 333–391. Rome: L'Erma di Bretschneider.

Pensabene, P. 2015. *Roma su Roma: Reimpiego architettonico, recupero dell'antico e trasformazioni urbane tra il III e il XIII secolo.* Vatican City: Pontificio Istituto di Archeologia Cristiana.

Pensabene, P. 2017. Architectural spolia and urban transformation in Rome from the fourth to the thirteenth century, in S. Altekamp, C. Marcks-Jacobs and P. Seiler (eds) *Perspektiven der Spolienforschung 1: Spoliierung und Transposition* (Topoi. Berlin Studies of the Ancient World 15): 177–233. Berlin and Boston: De Gruyter.

Pensabene, P. and C. Panella 1993/94. Reimpiego e progettazione architettonica nei monumenti tardo-antica di Roma. *Rendiconti della Pontificia Accademia Romana di Archeologia* 66: 111–283.

Pensabene, P., E. Gasparini and M. Carlucci 2015. Marble quarries: Ancient imperial administration and modern scientific analysis, in E.A. Friedland, M.G. Sobocinski and E.K. Gazda (eds) *The Oxford Handbook of Roman Sculpture*: 93–106. Oxford: Oxford University Press.

Perazzi, P. and G. Poggesi (eds) 2011. *Carta Archeologica della Provincia di Prato: Dalla Preistoria all'Età Romana*: 9–16. Florence: All'Insegna del Giglio.

Perkins, P. 2021. The Etruscan pithos revolution, in M. Gleba, B. Marín-Aguileira and B. Dimova (eds) *Making Cities: Economies of Production and Urbanization in Mediterranean Europe, 1000-500 BC*: 231–258. Cambridge: McDonald Institute for Archaeological Research.

Perkins, P. 2022. The bucchero from Poggio Colla, in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 363–383. Rome: L'Erma di Bretschneider.

Perkins, P., A. Nocentini and P.G. Warden 2020. Ricerca e scavi a Albagino (2017-2019), in *Tutela e Restauro. 2016-2019. Notiziario della Soprintendenza Archeologica Belle Arti e Paesaggio per la Città Metropolitana di Firenze e le Province di Pistoia e Prato*: 414–416.

Perrier, A. 2019. La réorganisation de l'espace du sanctuaire d'Apollon à Delphes au IVe siècle av. J.-C., in S. Montel and A. Pollini (eds) *La Question de l'Espace au IVe siècle avant J.-C. dans les Mondes Grec et Étrusco-Italique: Continuités, Ruptures, Reprises* (Collection de l'Institut des Sciences et Techniques de l'Antiquité 1442): 71–91. Besançon: Presses Universitaires de Franche-Comté.

Peschlow-Bindokat, A. 1981. Die Steinbrüche von Milet und Herakleia am Latmos. *Jahrbuch des Deutschen Archäologischen Instituts* 96: 157–235.

Peschlow-Bindokat, A. 1990. *Die Steinbrüche von Selinunt: Di Cave di Cusa und di Cave di Barone [*Vicenzo Tusa zum 70. Geburtstag]. Mainz: Philipp von Zabern.

Petritaki, M. 2009. Προσπάθεια ανασύνθεσης του αρχαιολογικού τοπίου στην ευρύτερη περιοχή του Πειραιά βάσει των νέων ανασκαφικών δεδομένων, in V. Vasilopoulou and S. Katsarou-Tseveleki (eds) *Από τα Μεσόγεια στον Αργοσαρωνικό: Β΄ Εφορεία*

Προϊστορικών και Κλασικών Αρχαιοτήτων, Το έργο μίας δεκαετίας, 1994-2003. Πρακτικά Συνεδρίου Αθήνα, 18-20 Δεκεμβρίου 2003: 451–480. Athens: Δήμος Μαρκοπούλου Μεσογαίας.

Petrović, V. 2019. Some considerations about the Roman road network in Central Balkan provinces, in A. Kolb (ed.) *Roman Roads: New Evidence – New Perspectives*: 252–271. Berlin and Boston: De Gruyter.

Pettegrew, D. 2016. *The Isthmus of Corinth: Crossroads of the Mediterranean World*. Ann Arbor: University of Michigan Press.

Pfanner, M. 1989. Über das Herstellen von Porträts. *Jahrbuch des Deutschen Archäologischen Instituts* 104: 157–257.

Pfanner, M. 2008. Review of Nolte, S. 2006. Steinbruch-Werkstatt-Skulptur: Untersuchungen zu Aufbau und Organisation griechischer Bildhauerwerkstätten (Beihefte zum Göttinger Forum für Altertumswissenschaft 18). Göttingen: Edition Ruprecht. *Bonner Jahrbücher* 208: 329–332.

Pharaklas, N. 1970. The stone tripods from Plataea. *Annual of the British School at Athens* 65: 175–178.

Pharr, C. 1952. *The Theodosian Code and Novels and the Sirmondian Constitutions.* Princeton: Princeton University Press.

Philaniotou, O. 1988. Ανασκαφικές εργασίες: Απόλλωνας, οικόπεδο Ειρήνης Ρουφάνη. *Αρχαιολογικόν Δελτίον* 43.Β'2: 496–497.

Philippa-Touchais, A. 2011. Cycles of collapse in Greek prehistory: Reassessing social change at the beginning of the Middle Helladic and the Early Iron Age, in A. Mazarakis Ainian (ed.) *The 'Dark Ages' Revisited. An International Symposium in Memory of William D.E. Coulson. University of Thessaly, Volos, 14–17 June 2007*: 31–44. Volos: University of Thessaly Press.

Piérart, M. and J.-P. Thalmann 1980. Nouvelles inscriptions d'Argos (I) (Fouilles de l'agora), in G. Touchais, E. Deïlaki and J.-F. Bommelaer (eds) *Études Argiennes* (Bulletin de Correspondance Hellénique Suppléments 6): 255–278. Paris: Éditions de Boccard.

Pierattini, A. 2019. Interpreting rope channels: Lifting, setting, and the birth of Greek monumental architecture. *Annual of the British School at Athens* 114: 1–40.

Pierce-Blegen, E. 1941. News items from Athens. *American Journal of Archaeology* 45: 446–450.

Pikoulas, Y.A. 2002. Η χερσόνησος του Μαλέα: Απολογισμός και προοπτικές. Σχεδίασμα έρευνας. *Αρέσκουσα* 2: 229–246.

Pisani, M. 2012. Impianti di produzione ceramica e coroplastica in Sicilia dal periodo arcaico a quello ellenistico: Distribuzione spaziale e risvolti socio-economici, in A. Esposito and G.M. Sanidas (eds) *«Quartiers» Artisanaux en Grèce Ancienne, une Perspective Méditerranéenne*: 311–332. Villeneuve d'Ascq: Presses universitaires du Septentrion.

Pittinger, J. 1975. The mineral products of Melos in antiquity and their identification. *Annual of the British School at Athens* 70: 191–197.

Pizziolo, G. 2015. Strutture evidenti e paesaggi nascosti dell'area fiorentina nella preistoria, in V. d'Aquino, G. Guarducci, S. Nencetti and S. Valentini (eds) *Archeologia a Firenze: Città e Territorio*: 111–120. Oxford: Archaeopress.

Plage, D.L. 1953. Thucydides' description of the Great Plague. *The Classical Quarterly* 3: 97–119.

Plattner, G. 2014. Werkstatt und Muster: Zur Methode der Scheidung von Arbeitsprozessen und Stilelementen, in J. Lipps and D. Maschek (eds) *Antike Bauornamentik: Möglichkeiten und Grenzen ihrer Erforschung* (Studien zur antiken Stadt 12): 53–68. Wiesbaden: Reichert Verlag.

Plattner, G. 2017. New methods to understand tradition and transformation in Roman Imperial architectural decoration, in P. Pensabene, M. Milella and F. Caprioli (eds) *Décor: Decorazione e Architettura nel Mondo Romano. Atti del Convegno, Roma 21-24 maggio 2014* (Thiasos Monografie 9): 79–86. Rome: Edizioni Quasar.

Plessis, M. 2013. *Extraction et Caractérisation des Lipides Contenus dans des Échantillons Archéologiques*. Paris: UPMC Sorbonne.

Poggesi, G. 2011. Il popolamento del territorio in età etrusca e romana, in P. Perazzi and G. Poggesi (eds) *Carta Archeologica della Provincia di Prato: Dalla Preistoria all'Età Romana*: 31–53. Sesto Fiorentino: All'Insegna del Giglio.

Poggiali, L. 2017. La ceramica vacuolata dall'insediamento etrusco di Monte Giovi. *Florentia. Studi di Archeologia* 3: 115–134.

Poggiali, L. and M.A. Serafini 2022. La ceramica d'impasto vacuolato in Etruria settentrionale: ricerche e risultati sulle produzioni di Pietramarina e di Monte Giovi, in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 455–469. Rome: L'Erma di Bretschneider.

Pöhlmann, E. 1987. Zwei Elgin-Leiern im British Museum?, in M. von Albrecht and W. Schubert (eds) *Musik in Antike und Neuzeit* (Quellen und Studien zur Musikgeschichte von der Antike bis in die Gegenwart 1): 319–331. Frankfurt am Main: Verlag Peter Lang.

Pöhlmann, E. and E. Tichy 1982. Zur Herkunft und Bedeutung von κόλλοψ, in J. Tischler (ed.) *Serta Indogermanica. Festschrift für Günter Neumann zum 60. Geburtstag* (Innsbrucker Beiträge zur Sprachwissenschaft 40): 287–315. Innsbruck: Universität Innsbruck, Institut für Sprachen und Literaturen.

Pollitt, J.J. 1979. Kernoi from the Athenian Agora. *Hesperia* 48: 205–233.

Posamentir, R. 2008. Kulturkontakt als Impuls architektonischer Innovation: Austauch und

Inspiration in Anazarbos, einer vergessenen Grenzstadt zwischen Ost und West, in F. Pirson and U. Wulf-Rheidt (eds) *Austausch und Inspiration: Kulturkontakt als Impuls architektonischer Innovation*: 89–106. Mainz: Philipp von Zabern.

Pologiorgi, M. 1999. Παρατηρήσεις για την επανεπεξεργασία και την επαναχρησιμοποίηση αττικών επιτύμβιων στηλών. *Αρχαιολογικόν Δελτίον* 54.Α':173–214.

Poupaki, E. 2001. Πελεκητά: Το αρχαίο λατομείο του Δήμου των Ισθμιωτών, in G. Kokkorou-Alevras, A. Laimos and E. Simantoni-Bournia (eds) *Ιστορία – Τέχνη – Αρχαιολογία της Νήσου Κω. Α' Διεθνές Επιστημονικό Συνέδριο, Kos, 2-4 May 1997* (Series of Monographs of Αρχαιογνωσία Journal 1): 59–76. Athens: National and Kapodistrian University of Athens.

Poupaki, E. 2011a. *ΑΛΑΣΑΡΝΑ ΙΙ: Λίθινα Αγγεία, Χειρόμυλοι και άλλα Τέχνεργα από το Ιερό του Απόλλωνα και τον Παλαιοχριστιανικό Οικισμό*. Athens: National and Kapodistrian University of Athens.

Poupaki, E. 2011b. Κωακοί Λίθοι και Κωακή Λιθοξοϊα: Η χρήση των λίθων στην αρχιτεκτονική, γλυπτική και κατασκευή ενεπίγραφων μνημείων και τέχνεργων. Αρχαϊκή-Παλαιοχριστιανική περίοδος. Η σημασία της για την οικονομία του νησιού. Unpublished PhD dissertation. National and Kapodistrian University of Athens, viewed 18 October 2023, <http://hdl.handle.net/10442/hedi/27083>.

Poupaki, E. 2014-15. Handmills from the vicinity of the Athenian Acropolis: Finds from Athens metropolitan railway excavations. *Eulimene* 15-16: 11–53.

Poupaki, E. 2017. Λίθινα αγγεία, χειρόμυλοι και άλλα αντικείμενα από το ιερό του Απόλλωνα Πυθαίου / Πυθαέως και τον πρώιμο βυζαντινό οικισμό στην αρχαία Αλάσαρνα (σημερινή Καρδάμαινα) της Κω, in G. Kokkorou-Alevras (ed.) *ΑΛΑΣΑΡΝΑ VI: Το Ιερό του Απόλλωνα Πυθαίου/ Πυθαέως και ο Οικισμός Πρώιμων Βυζαντινών Χρόνων στην Αρχαία Αλάσαρνα της Κω. Γλυπτική, Λιθοτεχνία, Επιγραφές*: 67–118. Athens: National and Kapodistrian University of Athens.

Poupaki, E. 2020. Recent research providing clues on the Koan stone crafting during antiquity, in M. Panagiotaki, I. Tomazos and F. Papadimitrakopoulos (eds) *Cutting-Edge Technologies in Ancient Greece: Materials science applied to trace ancient technologies in the Aegean world. Proceedings of two conferences held in Rhodes, 12-14 January 2018 and 11-13 January 2019*: 173–182. Oxford: Oxbow Books.

Poupaki, E. 2021a. Stone artifacts from Agathonisi, Dodecanese, Greece: Evidence of insularity, in E. Angliker and L. De Angelo Laky (eds) *Mare Nostrum* 12.2*: Special Issue Questions of Insularity in Ancient Aegean*: 127–164.

Poupaki, E. 2021b. Imports of building stones from Hekatomnid Karia in early-synoikized Kos: Architectural remains and possible quarry-sources, in P. Pedersen, B. Poulsen and J. Lund (eds) *Karia and the Dodekanese: Cultural interrelations in the south-eastern Aegean ca. 500 BC – AD 500. Danish Institute at Athens, 24th-26th of January 2018*: 143–154. Oxford: Oxbow Books.

Poupaki, E. and A. Chatziconstantinou 2001. Νεότερες έρευνες σε λατομεία της Κω, in I. Bassiakos, E. Aloupi and G. Facorellis (eds) *Αρχαιομετρικές Μελέτες για την Ελληνική Προϊστορία και Αρχαιότητα*: 541–556. Athens: Ελληνική Αρχαιομετρική Εταιρεία.

Poupaki, E. and A. Chatziconstantinou 2002. The extraction of travertine in antiquity on the island of Cos, Dodecanese, Greece. *Mediterranean Archaeology and Archaeometry* 2.2: 59–68.

Poupaki, E. and A. Chatziconstantinou 2004. Το αρχαίο λατομείο τραβερτίνη στο Πυλί της Κω, in A. Giannikouri, E. Zervoudaki, E. Kollias and I. Papachristodoulou (eds) *Χάρις Χαίρε. Μελέτες στη μνήμη της Χάρης Κάντζια*: 111–124. Athens: Υπουργείο Πολιτισμού, Αρχαιολογικό Ινστιτούτο Αιγαιακών Σπουδών.

Poupaki, E. and M. Chidiroglou 2017. A half-carved marble vessel (tsoukali) from the ancient quarries of Myloi, Karystos in southern Euboea: A contribution to the study of the use of Karystian marble for vase carving in antiquity, in Ž. Tankosić, F. Mavridis and M. Kosma (eds) *An Island between Two Worlds: The Archaeology of Euboea from Prehistoric to Byzantine Times. Proceedings of the international conference, Eretria, 12-14 July 2013* (Papers and monographs from the Norwegian Institute at Athens 6): 441–460. Athens: The Norwegian Institute at Athens.

Pozzi, A. 2010. Le fornaci e gli apprestamenti artigianali, in G. Sassatelli and E. Govi (eds) *Marzabotto: La Casa I della Regio IV, Insula 2* (Studi e Scavi nuova serie 26, Kainua 2): 256–283. Bologna: Ante Quem.

Preka-Alexandri, K. 2016. La coroplathie de Corcyre: Ateliers et sanctuaires, in A. Muller and E. Lafli (eds) *Figurines en Terre Cuite en Méditerranée Grecque et Romaine 1: Production, Diffusion, Étude. Actes du colloque international Colloquia Anatolica et Aegea Antiqua I. Izmir, 2-6 juin 2007* (Bulletin de Correspondance Hellénique Supplément 54): 223–237. Athens: École française d'Athènes.

Prieto, A. and J.C. Carter 2011. Types of structures in the Chora, in J.C. Carter and A. Prieto (eds) *The Chora of Metaponto 3: Archaeological Survey Bradano to Basento*: 592–615. Austin: Institute of Classical Archaeology, University of Texas Press.

Proeva, N. 2017. Les représentations du «cavalier thrace» sur les monuments funéraires en Haute Macédoine, in P. Delev, T. Stoyanov, S. Yanakieva, H. Popov, A. Bozkova, M. Vassileva, J. Tzvetkova, M. Damyanov, P. Ilieva and J. Emilov (eds) *Ancient Thrace: Myth and Reality II. Proceedings of the thirteenth international congress of Thracology, Kazanlak, September 3 – 7, 2017*: 271–281. Sofia: St. Kliment Ohridski University Press.

Prost, F. 2015. La tradition de la sculpture parienne en Asie Mineure, in S. Montel (ed.) *La Sculpture Gréco-*

Romaine en Asie Mineure: Synthèses et Recherches Récentes. Colloque international de Besançon 9-10 Octobre 2014 (Collection de l'Institut des Sciences et Techniques de l'Antiquité – 1345): 209–222. Besançon : Institut des Sciences et Techniques de l'Antiquité.

Quercia, A. and L. Foxhall 2014. Temporality, materiality and women's networks: The production and manufacture of loom weights in the Greek and indigenous communities of southern Italy, in K. Rebay-Salisbury, A. Brysbaert and L. Foxhall (eds) *Knowledge Networks and Craft Traditions in the Ancient World: Material Crossovers*: 62–82. New York: Routledge.

Raeder, J. and L. Lehman 2014. s.v. Alkamenes (Ἀλκαμένης) aus Athen, in: *DNO online*, viewed 14 November 2023, <https://www.degruyter.com/database/OVERBECK/entry/ov.0008.b2/html>.

Raftopoulou, S. 1997. s.v. Sphinx Classical and Hellenistic, in *LIMC* VIII: 1156–1157; 1163–1164, figs. 102, 106.

Rangavis, A.R. 1991. *Τοπογραφικά των Αρχαίων Αθηνών*. Athens: Kardamitsa Publications.

Rapp, G.R. 2013. *Archaeomineralogy* (series *Natural Science in Archaeology*). Berlin, Heidelberg: Springer.

Rastrelli, A. 2002. Nuovi rinvenimenti in Toscana. *Etruscan Studies* 9: 122–131.

Ratka, M. and P.R. Sahm. 1997. Antike Gußtechnik in der numerischen Simulation, in G. Zimmer and N. Hackländer (eds) *Der Betende Knabe: Original und Experiment. Ausstellung der Antikensammlung der Staatlichen Museen zu Berlin, Preußischer Kulturbesitz*: 67–80. Berlin: Staatliche Museen zu Berlin, Preußischer Kulturbesitz.

Ratté, C., F. Rojas and A. Commito 2020. Notion archaeological survey 2017-2018. *Araştırma Sonuçları Toplantısı* 37.1: 333–353.

Razgallah, S., M.C. Chaouachi and A. M'Rabet 1989. Les récifs à algues du permien supérieur du Jebel Tebaga de Médenine. Sud-Est de la Tunisie, in *Genèse, Diagenèse et Intérêt Économique des Récifs. Actes du colloque tuniso-français de sédimentologie-récifs, Tunis, 26-29 mai 1988* (Géologie Méditerranéenne 16.2-3): 213–231.

Reber, K. 2010. The Dragon Houses of Styra: Topography, architecture and function. *Mediterranean Archaeology and Archaeometry* 10.3: 53–61.

Reitzenstein, D. 2020. Aurelii in Lykien: Namenslisten aus der Zeit vor und nach der Constitutio Antoniniana, in G. Frija (ed.) *Être Citoyen Romain dans le Monde Grec au IIe Siècle de Notre Ère*: 73–93. Pessac: Ausonius.

Report 1816. *Report from the Select Committee on the Earl of Elgin's Collection of Sculptures, Marbles &c*. London: J. Murray.

Rescigno, C. 2019. Produzioni architettoniche fittili e distretti territoriali: dinamiche tra città dell'arco ionico e territorio lucano, in O. de Cazanove and A. Duplouy (eds) *La Lucanie Entre Deux Mers: Archéologie et Patrimoine. Actes du colloque international, Paris, 5-7 novembre 2015* (Collection du Centre Jean Bérard 50): 883–891. Naples: Centre Jean Bérard.

Reuterswärd, P. 1960. *Studien zur Polychromie der Plastik*. Stockholm: Almqvist and Wiksell.

Revenu, M. 2009. Ressources et Utilisations de la Pierre dans le Bassin Parisien à l'Époque Romaine. Unpublished PhD dissertation, Université de Paris-Nanterre.

Révillion, S., K. Bouche and L. Wozny 1994. La partie agricole d'une grande exploitation rurale d'époque romaine: Le gisement des «Hauts de Clauwiers», Seclin (Nord). *Revue du Nord* 76.308/1994 Archéologie: 99–146.

Rhomaios, K. 1930. Το Ηρώον της Αλυζίας. *Αρχαιολογική Εφημερίς* 1930: 141–159.

Rice, P.M. 1987. *Pottery Analysis: A Sourcebook.* Chicago: University Press of Chicago.

Richter, G.M.A. 1961. *Archaic Gravestones of Attica*. London: Phaidon.

Richter, G.M.A. 1988a. *Kouroi: A Study of the Development of the Kouros Type in Greek Sculpture*. New York: Hacker Art Books.

Richter, G.M.A. 1988b. *Korai: A Study of the Development of the Kore Type in Greek Sculpture*. New York: Hacker Art Books.

Ridgway, B.S. 1993.*The Archaic Style in Greek Sculpture*. Chicago, IL: Ares Publishers.

Rinaudo, Y. 1987. Un travail en plus: Les paysans d'un métier à l'autre (vers 1830-vers 1950). *Annales: Économies, Sociétés, Civilisations* 42.2: 283–302.

Risberg, Ch. 1992. Metal-working in Greek sanctuaries, in T. Linders and B. Alroth (eds) *Economics of Cult in the Ancient Greek World. Proceedings of the Uppsala Symposium 1990* (Acta Universitatis Upsaliensis Boreas 21): 33–40. Uppsala: Uppsala University Press.

Ritter, S., S. Ben Tahar, J.E.E. Fassbinder and L. Lambers 2018. Landscape archaeology and urbanism at Meninx: Results of geophysical prospection on Jerba (2015). *Journal of Roman Archaeology* 31: 357–372.

Rizzo, M.L. 2019. *Aree e Quartieri Artigianali in Magna Grecia* (Ergasteria 9). Paestum: Pandemos.

Robert, L. 1960. Claros: Summary of archaeological research in Turkey in 1959. *Anatolian Studies* 10: 21–22.

Roberts, H. 1981. Reconstructing the Greek tortoise-shell lyre. *World Archaeology* 12.3: 303–312.

Robinson, H.S. 1963. Excavations at Corinth. *Αρχαιολογικόν Δελτίον* 18.B'1: 76–80.

Rockwell, P. 1993. *The Art of Stoneworking: A Reference Guide*. Cambridge: Cambridge University Press.

Rocco, G. 2016. The role of Cycladic workshops in Late Archaic architectural change, in K. Zambas, V. Lambrinoudakis, E. Simantoni-Bournia and A. Ohnesorg (eds) *ΑΡΧΙΤΕΚΤΩΝ. Τιμητικός Τόμος για τον Καθηγητή Μανόλη Κορρέ*: 507–515. Athens: Melissa.

Rolley, C. 2002. Le travail du bronze à Delphes. *Bulletin de Correspondance Hellénique* 126: 41–54.

Romagnoli, S. (ed.) 2014. *Il Santuario Etrusco di Villa Cassarini a Bologna* (Dipartimento di Storia Culture e Civiltà DiSci 4). Bologna: Bologna University Press.

Romualdi, A. 2004. Riflessioni sul problema della presenza dei Greci a Populonia nel quinto sec. a.C., in G. M. Della Fina (ed.) *I Greci in Etruria* (Annali della Fondazione per il Museo Claudio Faina di Orvieto 9): 181–206. Rome: Edizioni Quasar.

Rönnberg, M. 2021. *Athen und Attika vom 11. bis zum frühen 6. Jh. v. Chr.: Siedlungsgeschichte, politische Institutionalisierungs und gesellschaftliche Formierungsprozesse.* Rahden, Westf.: VML Verlag Marie Leidorf.

Rosamilia, E. 2017. Firmare matrici a Taranto: Il coroplasta Pantaleon e i suoi colleghi. *Archeologia Classica* 68: 453–473.

Rose, C.B. 2021. Reconsidering the frieze on the Arch of Constantine. *Journal of Roman Archaeology* 34: 175–210.

Ross, L. 1843. *Reisen auf den Griechischen Inseln des Ägäischen Meeres II*. Stuttgart, Tübingen: J.G. Cotta'sche Buchhandlung.

Ross, L. 1848. *Reisen des Königs Otto und der Königin Amalia in Griechenland 2*. Halle: C.A. Schwetschke [=1851. *Wanderungen in Griechenland, im Gefolge des Königs Otto und der Königin Amalia*. Halle: C.A. Schwetschke].

Rostoker, W. and E. Gebhard 1980. The sanctuary of Poseidon at Isthmia: Techniques of metal manufacture. *Hesperia* 49.4: 347–363.

Rotroff, S.I. 1982. *The Athenian Agora XXII: Hellenistic Pottery – Athenian and Imported Moldmade Bowls*. Princeton, NJ: ASCSA.

Rotroff, S.I. 2006. *The Athenian Agora XXXIII: Hellenistic Pottery – The Plain Wares*. Princeton, NJ: ASCSA.

Rougetet, J. 1992. Note en vue de la présentation et de la restauration du sanctuaire de Claros, in J. de La Genière (ed.) *Cahiers de Claros I*: 101–115. Paris: Éditions Recherche sur les civilisations.

Rous, S.A. 2019. *Reset in Stone: Memory and Reuse in Ancient Athens*. Madison: University of Wisconsin Press.

Rouvier, H. 1985. *Géologie de l'Extrême-Nord Tunisien: Tectoniques et Paléogéographies Superposées à L'extrémité Orientale de la Chaîne Nord-Maghrébine* (Annales des Mines et de la Géologie 29). Tunis: Editions du Service géologique de Tunisie.

Roux, G. 1961. *L'Architecture de l'Argolide aux IVe et IIIe s. avant J.-C.* (Bibliothèque des Écoles françaises d'Athènes et de Rome 199). Paris: Éditions de Boccard.

Roux, G. 1975. Un chef-d'œuvre d'architecture gréco-lycienne: Le monument des Néréides à Xanthos. *Revue des Études Grecques* 88: 182–189.

Roux, G. 1979. *L'Amphictionie, Delphes et le temple d'Apollon au IVe siècle*. Lyon: MOM éditions.

Roux, G. 1987. *Fouilles de Delphes II: La Terrasse d'Attale I*. Paris: Éditions de Boccard.

Roux, G. 1989. Problèmes delphiques d'architecture et d'épigraphie. *Revue Archéologique* 1: 23–64.

Roux, V. 2019. *Ceramics and Society: A Technological Approach to Archaeological Assemblages. In collaboration with Marie-Agnès Courty*. Cham: Springer Nature.

Roux, V. 2020. Chaîne opératoire, technological networks and social interpretation. *Cuadernos de Arqueología de la Universidad de Granada* 30: 15–34.

Ruffing, K. 2008. *Die berufliche Spezialisierung in Handel und Handwerk: Untersuchungen zu ihrer Entwicklung und zu ihren Bedingungen in der römischen Kaiserzeit im östlichen Mittelmeerraum auf der Grundlage griechischer Inschriften und Papyri* (Pharos 24). Rahden, Westf.: VML Verlag Marie Leidorf.

Rumscheid, F. 1994. *Untersuchungen zur Kleinasiatischen Bauornamentik des Hellenismus.* Mainz: Philipp von Zabern.

Runnels, C. 1981. A Diachronic Study and Economic Analysis of Millstones from the Argolis, Greece. PhD dissertation, Indiana University. Ann Arbor, MI: UMI University Microfilms International.

Runnels, C., D.J. Pullen and S. Langdon 1995. *Artifact and Assemblage: The Finds of a Regional Survey of the Southern Argolid, Greece 1 – The Prehistoric and Early Iron Age pottery and the lithic artifacts.* Stanford, CA: Stanford University Press.

Russell, B. 2011. Lapis transmarinus: Stone-carrying ships and the maritime distribution of stone in the Roman empire, in D. Robinson and A. Wilson (eds) *Maritime Archaeology and Ancient Trade in the Mediterranean*: 139–155. Oxford: Oxford Centre for Maritime Archaeology.

Russell, B. 2013a. Roman and Late-Antique shipwrecks with stone cargoes: A new inventory. *Journal of Roman Archaeology* 26: 331–361.

Russell, B. 2013b. *The Economics of the Roman Stone Trade* (Oxford Studies on the Roman Economy). Oxford: Oxford University Press.

Russell, B. and K. Glicksman 2015. Recent work on Roman quarries near Korčula and on Brač. *Vjesnik za arheologiju i historiju dalmatinsku* 108.1: 223–244.

Russell, B. and J. Leidwanger 2020. The energetics of lost cargoes. *Memoirs of the American Academy in Rome* 65: 194–260.

Rusyaeva, A.S. 2006. Masterskie, in V.N. Zin'ko (ed.) *Drevneishyi Temenos Olvii Pontiiskoi* (Materials in Archaeology, History and Ethnography of Tauria. Suppl. 2): 90–91. Simferopol': Krymskoe otdelenie Instituta vostokovedeniya imeni A.E. Krymskogo, Tsentr arkheologicheskikh issledovanii Blagotvoritelniy fond "Demetra".

Rusyaeva, A. S. 2015. Graffiti from the southern temenos in Pontic Olbia. *Ancient Civilizations from Scythia to Siberia* 21: 251–279.

Saba, S. 2012. *The Astynomoi Law from Pergamon: A New Commentary* (Die hellenistische Polis als Lebensform 6). Mainz: Verlag Antike.

Sabbione, C. 1970. Intorno ad una serie di statuette arcaiche locresi. *Klearchos* 47-48: 109–156.

Sabbione, C. 1996. Il santuario di Persefone in contrada Mannella, in E. Lattanzi (ed.) *I Greci in Occidente: Santuari della Magna Grecia in Calabria*: 32–39. Naples: Electa.

Şahin, H., F.A. Yüksel, and Z. Görücü 2010. Korykion Antron ve Göztepesi: Eski Problemler, Yeni Bulgular, Yeni Çözüm Önerileri. *Adalya* 13: 65–89.

Şahin, H. 2012. Korykion Antron'daki Tapınak Zeus Tapınağı Mıdır?. *Adalya* 15: 65–79.

Sakellaridis, G.M. 1993. Οδοιπορικό στις γειτονιές των Νικιών Νισύρου. *Νισυριακά* 12: 193–232.

Saliou, C. 1994. *Les Lois des Bâtiments, Voisinage et Habitat Urbain dans l'Empire Romain: Recherches sur les Rapports entre le Droit et la Construction privée du siècle d'Auguste au siècle de Justinien.* Beirut: IFPO.

Saliou, C. 1996. *Le Traité d'Urbanisme de Julien d'Ascalon: Droit et Architecture en Palestine au VIe Siècle* (Travaux et mémoires du Centre de recherches d'histoire et civilisation de Byzance – Monographies 8). Paris: Éditions de Boccard.

Saliou, C. 2003. Le nettoyage des rues dans l'Antiquité: Fragments de discours normatifs, in P. Ballet, P. Cordier and N. Dieudonné-Glad (eds) *La Ville et ses Déchets dans le Monde Romain: Rebuts et Recyclages. Actes du colloque de Poitiers, 19-20 Septembre 2002*: 37–49. Montagnac: Éditions Monique Mergoil.

Saliou, C. 2012. Artisanats et espace urbain dans le monde romain: Droit et projets urbains (Ier siècle av. J.-C. – IIe siècle ap. J.-C., in A. Esposito and G.M. Sanidas (eds) *«Quartiers» Artisanaux en Grèce Ancienne, une Perspective Méditerranéenne*: 39–53. Villeneuve d'Ascq: Presses universitaires du Septentrion.

Salowey, C.A. 1994. Herakles and the waterworks: Mycenaean dams, Classical fountains, Roman aqueducts, in K.A. Sheedy (ed.), *Archaeology in the Peloponnese* (Oxbow Monograph 48): 77–94. Oxford: Oxbow Books.

Salvini, M. 1994. L'intervento archeologico in loc. I Monti a San Piero a Sieve: Lo scavo – I materiali, in *Archeologia in Alto Mugello, Mugello, Val di Sieve e il Caso di S. Piero a Sieve*: 25–38. San Piero a Sieve: Il Torchio.

Salvini, M. 2009. L'orientalizzante in Mugello e nella Val di Sieve: Il sito etrusco I Monti a San Piero a Sieve, in L. Cappuccini, C. Ducci, S. Gori and L. Paoli (eds) *Museo Archeologico Comprensoriale del Mugello e della Val di Sieve*: 25–56. Florence: Aska.

Salvini, M. and E. Salvadori 2022. Insediamenti e produzioni etrusche in località "I Monti" a San Piero a Sieve, L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 471–494. Rome: L'Erma di Bretschneider.

Sampson, A. 1988. *Η Νεολιθική Κατοίκηση στο Γυαλί της Νισύρου*. Athens: Ευβοϊκή Αρχαιόφιλος Εταιρεία.

Sampson, A. 2001. Η Κως και η νησίδα Γυαλί στη Νεολιθική περίοδο, in G. Kokkorou-Alevras, A. Laimos, E. Simantoni-Bournia (eds) *Ιστορία-Τέχνη-Αρχαιολογία της Κω. Α΄ Διεθνές Επιστημονικό Συνέδριο, Κως 2-4 Μαΐου 1997* (Series of Monographs of Αρχαιογνωσία Journal 1): 37–48. Athens: National and Kapodistrian University of Athens.

Sanader, M. 1994. O kultu Herakla u Hrvatskoj. *Opuscula Archaeologica* 18: 87–114.

Sanders, G.D.R. 2005. Urban Corinth: An introduction, in D. Scholwalter and S. Friesen (eds) *Urban Religion in Roman Corinth: Interdisciplinary Studies* (Harvard Theological Studies 53): 11–24. Cambridge, MA: Harvard University Press.

Sanidas, G.M. 2013a. *La Production Artisanale en Grèce: Une approche spatiale et topographique à partir des exemples de l'Attique et du Péloponnèse du VIIe s. au Ier s. siècle avant J.-C.* Paris: CTHS.

Sanidas, G.M. 2013b. La question des activités «à nuisance» dans les villes grecques: Intra ou extra muros?, in P. Darcque, R. Étienne and A.-M. Guimier-Sorbets (eds) *PROASTEION: Recherches sur le Périurbain dans le Monde Grec* (Travaux de la MAE René Ginouvès 17): 173–192. Paris: Éditions de Boccard.

Sanidas, G.M 2016. La production coroplastique ἐν ἄστει: Questions et approches sur la période classique, in A. Muller and E. Laflı (eds) *Figurines en Terre Cuite en Méditerranée Grecque et Romaine 1: Production, Diffusion, Étude. Actes du colloque international Colloquia Anatolica et Aegea Antiqua I. Izmir, 2-6 juin 2007* (Bulletin de Correspondance Hellénique Supplément 54): 17–31. Athens: École française d'Athènes.

Sanidas, G.M. 2017. Activités économiques dans l'espace urbain de la cité: Quelques approches à partir du cas de Thasos (VIIe – IVe s. av. n.è.), in D. Mulliez and Z. Bonias (eds) *Thasos: Métropole et Colonies. Actes du symposion international à la mémoire de Marina Sgourou, Thasos, 21-22 septembre 2006* (Recherches franco-helléniques 5): 125–144. Athens: École française d'Athènes.

Sanidas, G.M. 2019. Comprendre le Céramique d'Athènes: À propos du modèle de «quartier des potiers», in M. Denti and M. Vilette (eds) *Archéologie des Espaces Artisanaux: Fouiller et Comprendre les Gestes des Potiers. Actes du colloque international de Rennes, 27-28 novembre 2014*: 77–88. Lattes: Éditions ADAL.

Sanidas, G.M. 2020. La ville infecte? Origines et gestion des nuisances artisanales urbaines dans l'Athènes classique: L'exemple des grandes fonderies de bronze. *Mélanges de l'École française de Rome. Antiquité* 132.2: 277–288.

Sanidas, G.M. 2022. Le feu dans les villes grecques et l'attitude de la cité: Aspects pratiques et mises au point, in G. Poccardi and G.M. Sanidas (ed.) *Le Feu dans la Ville Antique: Usages, Risques, Réglementations*: 15–30. Villeneuve d'Ascq: Presses universitaires du Septentrion.

Sanidas, G.M., A. Muller and S. Dadaki 2014. Το εργοτάξιο του τρικλινίου μίας πρωτοβυζαντινής έπαυλης στην Θάσο: Η αρχαιολογική μαρτυρία. *Αρχαιολογικό Έργο Μακεδονίας και Θράκης* 28: 675–688.

Santocchini Gerg, S. 2012. Riflessioni sui contatti fra Etruria settentrionale e padana: Motivi e tecniche decorative tra VII e V sec. a.C. *Ocnus* 20: 223–252.

Santocchini Gerg, S. 2021. L'orientalizzante nel Bolognese, in S. Bourdin, O. Dally, A. Naso and C. Smith (eds) *The Orientalizing Cultures in the Mediterranean, 8th-6th Cent. BC. Origins, Cultural Contacts and Local Developments: The Case of Italy* (Mediterranea. Studi e Ricerche sul Mediterraneo Antico Suppl. N.s. 1): 63–92. Rome: Edizioni Quasar.

Santocchini Gerg, S. 2022. Il bucchero dell'Etruria padana e le sue relazioni con l'Etruria settentrionale fra VII e VI secolo a.C., in L. Cappuccini and A. Gaucci (eds) *Officine e Artigianato Ceramico nei siti Etruschi dell'Appennino Tosco-Emiliano tra VII e IV sec. a.C.* (Biblioteca di Studi Etruschi 66): 39–74. Rome: L'Erma di Bretschneider.

Sapirstein, P. 2016. The columns of the Heraion at Olympia: Dörpfeld and early Doric architecture. *American Journal of Archaeology* 120.4: 565–601.

Saranti, F. 2008. Αιτωλία και Ακαρνανία: Από τον Εύηνο ως το Μόρνο, in A. Vlachopoulos (ed.) *Εύβοια και Στερεά Ελλάδα* (Αρχαιολογία 2): 390–397. Athens: Melissa.

Saranti, F. 2022. *Ναύπακτος: Η Εξέλιξη του Οικισμού από την Προϊστορία έως το Τέλος του Αρχαίου Κόσμου.* Athens. Kardamitsa Publications.

Sarantidis, K. 2017. Ανάλυση ενός αρχαίου συστήματος κατασκευής στεγών από το Μιλησιακό οχυρό στο Καστράκι Αγαθονησίου, in P. Triantafyllidis and K. Sarantidis (eds) *Το Αρχαιολογικό Έργο στα Νησιά του Αιγαίου. Διεθνές επιστημονικό συνέδριο, Ρόδος, 27 Νοεμβρίου 1 Δεκεμβρίου 2013, ν. Γ'*: 75–84. Mytilene: Typokykladiki.

Sarantidis, K. 2020. *Milesian Islands: The Fortified Installations in the Insular Environment of Miletus in the Aegean in Context* (Thiasos Monografie 15). Rome: Edizioni Quasar.

Sarantidis, K. 2024. «Σκάριφος: ξέσις, γραφή, μίμησις ἀκριβὴς τόπου» ή το ιχνογράφημα αρχαίου οχυρωματικού πύργου από το Καστράκι στο Αγαθονήσι, in E. Dimitriadou and N. Dimakis (eds) *ΚΑΛΛΙΝΙΚΟΣ. Honorary Volume for Professor Panos Valavanis by His Students*: 347–357. Athens: Kapon editions.

Şare, T. 2013. The sculpture of the Heroon of Perikles at Limyra: The making of a Lycian king. *Anatolian Studies* 63: 55–74.

Sargent, M.L. 2011. Recent investigation of the polychromy of a metropolitan Roman garland sarcophagus, in J.S. Østergaard (ed.) *Tracking Colour: The Polychromy of Greek and Roman Sculpture in Ny Carlsberg Glyptotek. Preliminary Report 3*: 14–34. Copenhagen: Ny Carlsberg Glyptotek.

Sarti, S. 2020. Mugello, alto Mugello e val di Sieve: Evidenze etrusche e romane, in C. Ducci, A. Nocentini and S. Sarti (eds) *Archeologia del Mugello, Centro di Documentazione di Sant'Agata: Museo e Territorio*: 223–238. Florence: Consiglio Regionale della Toscana.

Sassatelli, G. 1991. Nuovi dati epigrafici da Marzabotto e il ruolo delle comunità locali nella "fondazione" della città. *Archeologia Classica* 43: 693–715.

Sassatelli, G. 1994. *Iscrizioni e Graffiti della Città Etrusca di Marzabotto*. Bologna: Bologna University Press.

Sassatelli, G. 2008. Gli Etruschi nella valle del Po, in G.M. Della Fina (ed.) *La Colonizzazione Etrusca in Italia* (Annali della Fondazione per il Museo Claudio Faina di Orvieto 15): 71–114. Rome: Edizioni Quasar.

Sassatelli, G. 2010. Le città dell'Etruria padana, in S. Bruni (ed.) *Le Etruschi delle Città: Fonti, Ricerche e Scavi*: 204–215. Cinisello Balsamo: Silvana.

Sassatelli, G. 2011. Città etrusca di Marzabotto: Una fornace per il tempio di Tina, in D.F. Maras (ed.) *Corollari: Scritti di Antichità Etrusche e Italiche in Omaggio all'Opera di Giovanni Colonna* (Studia Erudita 14): 150–158. Pisa and Roma: Fabrizio Serra Editore.

Sassatelli, G. and R. Macellari 2009. Tuscorum Ager: Comunità etrusche tra Enza e Ongina, in D. Vera (ed.) *Storia di Parma II: Parma Romana*: 110–145. Parma: Monte Università Parma.

Sbroscia, M., M. Cestelli-Guidi, F. Colao, S. Falzone, C. Gioia, P. Gioia, C. Marconi, D. Mirabile Gattia, E.M. Loreti, M. Marinelli, M. Missori, F. Persia, L. Pronti, M. Romani, A. Sodo, G. Verona-Rinati, M.A. Ricci and R. Fantoni 2020. Multi-analytical non-destructive investigation of pictorial apparatuses of "Villa della Piscina" in Rome. *Microchemical Journal 153*: 104–450.

Scardozzi, G. 2012. Ancient marble and alabaster quarries near Hierapolis in Phrygia (Turkey): New data from archaeological surveys, in A. Gutiérrez Garcia-M., P. Lapuente and I. Rodà (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 9th international conference of Association for the Study of Marble and Other Stones in Antiquity, Tarragona, Spain, June 8-13, 2009* (ASMOSIA IX. Documenta 23): 573–583. Tarragona: Institut Català d'Arqueologia Clàssica.

Scardozzi, G., M. Brilli and F. Guistini 2018. Calcite alabaster artefacts from Hierapolis in Phrygia, Turkey: Provenance determination using carbon and oxygen stable isotopes. *Geoarchaeology* 34.2: 169–186.

Schaaff, H. 2015. *Antike Tuffbergwerke am Laacher See-Vulkan* (Monographien des RGZM 107). Mainz: Verlag des Römisch-Germanischen Zentralmuseums.

Scheibler, I. 1992. *Ελληνική Κεραμική: Παραγωγή, Εμπόριο και Χρήση των Αρχαίων Ελληνικών Αγγείων* (transl. E. Manakidou). Athens: Kardamitsa Publications.

Scheidel, W., I. Morris and R.P. Saller (eds) 2008. *The Cambridge Economic History of the Greco-Roman World*. Cambridge: Cambridge University Press.

Schenck zu Schweinsberg, J.-M. 2017. *Der Pseudo-homerische Hermes-Hymnus: Ein interpretierender Kommentar* (Wissenschaftliche Kommentare zu griechischen und lateinischen Schriftstellern). Heidelberg: Universitätsverlag Winter.

Schiffer, M.B. 1972. Archaeological context and systemic context. *American Antiquity* 37.2: 156–165.

Schiffer, M.B. 1975. Behavioral chain analysis: Activities, organization, and the use of space. *Anthropology* 65: 103–119.

Schiffer, M.B. 1976. *Behavioral Archeology* (Studies in Archeology). New York: Academic Press.

Schiffer, M.B. 1981. Some issues in the philosophy of archaeology. *American Antiquity* 46.4: 899–908.

Schiffer, M.B. 1983. Toward the identification of formation processes. *American Antiquity* 48.4: 675–706.

Schiffer, M.B. 1985. Is there a 'Pompeii premise' in archaeology?. *Journal of Anthropological Research* 41.1: 18–41.

Schiffer, M.B. 1995. *Behavioral Archaeology: First Principles* (Foundations of Archaeological Inquiry). Salt Lake City: University of Utah Press.

Schiffer, M.B. 2010. *Behavioral Archaeology: Principles and Practice* (Equinox Handbooks in Anthropological Archaeology). London: Equinox Publishing.

Schilardi, D. 1982. Ανασκαφές και επιφανειακές έρευνες στην Πάρο. *Πρακτικά της εν Αθήναις Αρχαιολογικής Εταιρείας* 1980: 263–286.

Schilardi, D. 2000. Σημειώσεις για τον ημίεργο αθλητή της Πάρου, in D. Schilardi and D. Katsonopoulou (eds) *Παρία Λίθος: Λατομεία, Μάρμαρο και Εργαστήρια Γλυπτικής της Πάρου. Πρακτικά Α' διεθνούς συνεδρίου αρχαιολογίας Πάρου και Κυκλάδων, Παροικιά 2-5 Οκτωβρίου 1997*: 163–171. Athens: The Institute for Archaeology of Paros and the Cyclades.

Schild-Xenidou, V. 2008. *Corpus der Boiotischen Grab- und Weihreliefs des 6. bis 4. Jahrhunderts v. Chr.* Mainz: Philipp von Zabern.

Schlanger, N. 2005. The Chaîne Opératoire, in C. Renfrew and P. Bahn (eds) *Archaeology: The Key Concepts*: 18–23. London and New York: Routledge.

Schliephake, C., N. Sojc and G. Weber (eds) 2020. *Nachhaltigkeit in der Antike: Diskurse, Praktiken, Perspektiven*. Stuttgart: Franz Steiner Verlag.

Schmaltz, B. 1983. *Griechische Grabreliefs*. Darmstadt: Wissenschaftliche Buchgesellschaft.

Schmaltz, B. 1998. Zur Weiter- und Wiederverwendung klassischer Grabreliefs Attikas. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 113: 165–190.

Schmaltz, B. 2001. Zur Wiederverwendung klassischer Grabreliefs, in G. Hoffmann and C.W. Clairmont (eds) *Les Pierres de l'Offrande: Autour de l'Oeuvre de Christoph W. Clairmont*: 44–51. Kilchberg: Akanthus.

Schmaltz, B. 2010a. Eine attische Frauenstele spätarchaischer Zeit. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 125: 143–171.

Schmaltz, B. 2010b. Aktualisierte Denkmäler in Paros. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 125: 173–197.

Schmaltz, B. and M. Salta 2003. Zur Weiter- und Wiederverwendung attischer Grabreliefs klassischer Zeit. *Jahrbuch des Deutschen Archäologischen Instituts* 118: 49–203.

Schmidt, S. 1991. *Hellenistische Grabreliefs: Typologische und chronologische Beobachtungen*. Köln: Böhlau Verlag.

Schmidt-Dounas, B. 1985. *Der Lykische Sarkophag aus Sidon* (Istanbuler Mitteilungen Beiheft 30). Tübingen: Wasmuth.

Scholl, A. 1993. Das „Charonrelief" im Kerameikos. *Jahrbuch des Deutschen Archäologischen Instituts* 108: 353–373.

Scholl, A., 2010. Τα αναθήματα της Ακροπόλεως από τον όγδοο έως τις αρχές του έκτου αιώνα π.Χ. και η συγκρότηση της Αθήνας σε πόλη-κράτος. *Αρχαιολογία και Τέχνες* 113: 74–85.

Scholl, A. 2020. *Der attische Grabbau: Entwicklung und Bedeutung freistehender Grabarchitektur in Athen und Attika von der archaischen Epoche bis in die römische Kaiserzeit*. Berlin: De Gruyter.

Schörner, G. and H.R. Goette 2004. *Die Pan-Grotte von Vari: Mit epigraphischen Anmerkungen von Klaus Hallof*. Mainz: Philipp von Zabern.

Schuchhardt, W.-H. 1977. *Alkamenes* (Winckelmanns-programm der Archäologischen Gesellschaft zu Berlin 126). Berlin: De Gruyter.

Schuller, M. 1985. Dorische Architektur der Kykladen. *Jahrbuch des Deutschen Archäologischen Instituts* 100: 319–398.

Schürr, D. 2007. Formen der Akkulturation in Lykien: Griechisch-lykische Sprachbeziehungen, in Ch. Schuler (ed.) *Griechische Epigraphik in Lykien: Eine Zwischenbilanz. Akten des Internationalen Kolloquiums, München 24.-26. Februar 2005* (Ergänzungsbände zu den Tituli Asiae Minoris 2, Denkschriften der philosophisch-historischen Klasse 354): 27–41. Vienna: Verlag der Österreichischen Akademie der Wissenschaften.

Schweizer, B. 2021. Knowledge-scapes as resources: An archaeological approach to the construction of cultural and social identities, in F. Jürcke, J. Montes-Landa and A. Ceccarelli (eds) *Archaeological Review from Cambridge* 35.2: *'Knowledge-scapes' in Archaeology: An Introduction*: 45–59.

Seigne, J. 2002: A sixth century water-powered sawmill at Jarash. *Annual of the Department of Antiquities of Jordan* 46: 205–213.

Selekou, M. 2014. Το Νεκροταφείο στη Θέση Τριανταφυλλιά Λιβανάτων (6ος-2ος αιώνας π.Χ.): Συμβολή στη Μελέτη της Αρχαίας Λοκρίδας. Unpublished PhD dissertation, University of Ioannina. <http://hdl.handle.net/10442/hedi/36614>.

Sellet, F. 1993. Chaîne opératoire: The concept and its applications. *Lithic Technology* 18.1/2: 106–112.

Semenova, A.A. 2021. Horn processing in western temenos of Olbia Pontica. *Eminak* 3.35: 146–153.

Sengoku-Haga, K. 2017. Polykleitos and his followers at work: How the Doryphoros was used, in J. Daehner, K.D.S. Lapatin and A. Spinelli (eds) *Artistry in Bronze: The Greeks and their Legacy. XIX International congress on ancient bronzes:* 87–93. Los Angeles: Getty Publications.

Serafini, M.A. 2019. Le ceramiche d'impasto vacuolare del sito di Pietramarina. *Florentia. Studi di Archaeologia* 4: 143–159.

Sestieri, P.C. 1940. Metaponto – campagna di scavo (marzo-aprile 1939). *Atti della Accademia Nazionale dei Lincei. Notizie degli scavi di Antichità* 19: 51–122.

Sestieri Bertarelli, M. 1990. Statuette femminili arcaiche e del primo classicismo nelle stipi votive di Poseidonia. *Rivista dell'Istituto Nazionale d'Archeologia e Storia dell'Arte* N.S. 3.12: 5–47.

Sève, M. 2014. *Philippes 1914-2014: 100 Ans de Recherches Françaises* (Patrimoine Photographique 2). Athens: École française d'Athènes, Melissa.

Shapiro, L. and S. Spaulding 2021. Embodied cognition, in E.N. Zalta (ed.) *The Stanford Encyclopedia of Philosophy* (Winter 2021 Edition), viewed 23 June 2023, <https://plato.stanford.edu/archives/win2021/entries/embodied-cognition/>.

Siddall, R. 2006. Not a day without a line drawn: Pigments and painting techniques of Roman artists. *infocus Magazine* 2: 18–31.

Sillitoe, P. 2006. Introduction: Indigenous knowledge in development. *Anthropology in Action* 13.3: 1–12.

Silvestrelli, F. 2005. Le fasi iniziale della ceramica a figure rosse nel Kerameikos di Metaponto, in M. Denoyelle (ed.) *La Céramique Apulienne: Bilan et perspectives. Actes de la table ronde organisée par l'École française de Rome en collaboration avec la Soprintendenza per i Beni culturali della Puglia et le Centre Jean Bérard (30 novembre – 2 décembre 2000)*: 113–124. Naples: Centre Jean Bérard.

Simon, Ch.G. 1986. The Archaic Votive Offerings and Cults of Ionia. Unpublished PhD dissertation, University of California, Berkeley.

Simoni, H., K. Papagiannopoulos, R. Tsiakiris and K. Stara 2021. Local resource management imprinted in the landscape: Convergent evolution in two Greek mountain plains during the last five centuries, in M. Bartelheim, L. Garcia Sanjuan and R. Hardenberg (eds) *Human-Made Environments: The Development of Landscapes as ResourceAssemblages* (RessourcenKulturen 15): 53–74. Tübingen: Tübingen University Press.

Sioumpara, E.P. 2020. Zerstörung und Wiederherstellung der Ordnung: Wiederverwendung von Baumaterialien in attischen Heiligtümern nach den Perserkriegen, in U. Wulf-Rheidt and K. Piesker (eds) *Umgebaut: Umbau-, Umnutzungs- und Umwertungsprozesses in der antiken Architektur. Internationales Kolloquium in Berlin vom 21.-24. Februar 2018, veranstaltet vom Architekturreferat des DAI*: 91–110. Regensburg: Schnell & Steiner.

Sismanidis, K. 2003. *Αρχαία Στάγειρα: Η Πατρίδα του Αριστοτέλη*. Athens: Υπουργείο Πολιτισμού.

Sitz, A. 2019a. Inscribing Caria: The perseverance of epigraphic traditions in Late Antiquity, in S. Mitchell and P. Pilhofer (eds) *Early Christianity in Asia Minor and Cyprus: From the Margins to the Mainstream*: 202–225. Leiden: Brill.

Sitz, A. 2019b. Beyond spolia: A new approach to old inscriptions in Late Antique Anatolia. *American Journal of Archaeology* 123.4: 643–674.

Sitz, A. 2019c. Hiding in plain sight: Epigraphic reuse in the temple-church at Aphrodisias. *Journal of Late Antiquity* 12.1: 136–168.

Sitz, A. 2023. *Pagan Inscriptions, Christian Viewers: The Afterlives of Temple and Their Texts in the Late Antique Eastern Mediterranean.* Oxford: Oxford University Press.

Skandalidis, M. 2015. *Λεξικό του Ιδιώματος της Νισύρου*. Athens: Εταιρεία Νισυριακών Μελετών.

Skorda, D. 1992. Recherches dans la valée du Pléistos, in J.-F. Bommelaer (ed.) *Delphes: Centenaire de la Grande Fouille réalisée par l'Ecole française d'Athènes (1892-1903). Actes du Colloque Paul Perdrizet, Strasbourg, 6-9 novembre 1991*: 39–66. Leiden: Brill.

Skorda, D. 2003. Η αρχαιολογική έρευνα στην περιοχή της Ιτέας και του Γαλαξειδίου, in P. Themelis and R. Stathaki-Koumari (eds) *Το Γαλαξείδι από την Αρχαιότητα έως Σήμερα.* Πρακτικά Α› επιστημονικού συνεδρίου, Γαλαξείδι 29-30.9.2000: 1–9. Athens: Δήμος Γαλαξειδίου.

Skovmøller, A. 2020. *Facing the Colours of Roman Portraiture* (Image & Context 19). Berlin: De Gruyter.

Skovmøller, A. 2021. The final touch: On Thorvaldsen's marble surfaces, in J. Fejfer and K.B. Johannsen (eds) *The Workshop as Concept and Space: Creating the Portrait*: 128–150. London and New York: Routledge.

Skovmøller, A. and R.H. Therkildsen 2011. On the high gloss polish of Roman sculpture, in J.S. Østergaard (ed.) *Tracking Colour: The Polychromy of Greek and Roman Sculpture in Ny Carlsberg Glyptotek. Preliminary Report 3*: 35–46. Copenhagen: Ny Carlsberg Glyptotek.

Skovmøller, A. and R.H. Therkildsen 2014. A reconstruction, in J.S. Østergaard and A.M. Nielsen (eds) *Transformations: Classical Sculpture in Colour*: 256–271. Copenhagen: Naryana Press.

Skovmøller, A. and R.H. Therkildsen 2015. The polychromy of Roman polished marble portraits, in P. Pensabene and E. Gasparini (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 10th international conference of the Association for the Study of Marble and Other Stones in Antiquity, Rome, Italy, May 21-26, 2012* (ASMOSIA X): 891–900. Rome: L'Erma di Bretschneider.

Skytte Jakobsen, L. 2019. *Metaskulptur: Skulpturbegrebet i Bevægelse*. Aarhus: Rævens Sorte Bibliotek.

Smith, A.H. 1916. Lord Elgin and his collection. *Journal of Hellenic Studies* 36: 163–372.

Smith, R.O. 2009. Architecture and Boat Building: Connecting with Spolia. Unpublished MA dissertation, Carleton University.

Sodini, J.-P. 1989. Le commerce des marbres à l'époque protobyzantine, in C. Abadie-Reynal, V. Kravari, J. Lefort and C. Morrisson (eds) *Hommes et Richesses dans l'Empire Byzantine I: IVe–VIIe Siècles*: 163–186. Paris: Lethielleux.

Sodini, J.-P., A. Lambraki and T. Koželj 1980. *Aliki I: Les Carrières de Marbre à l'Époque Paléochrétienne*. Paris: Éditions de Boccard.

Sokolowski, F. 1962. *Lois Sacrées des Cités Grecques* (Supplément. Travaux et mémoires 11). Paris: Éditions de Boccard.

Solov'yanov, N. 2016. Peculiarities of the worship of Hercules in the Roman army (in Russian). *Problemy istorii, filologii, kul'tury* 2: 121–127.

Soressi, M. and J.-M. Geneste 2011. The history and efficacy of the chaîne opératoire approach to lithic analysis: Studying techniques to reveal past societies in an evolutionary perspective. *PaleoAnthropology* 2011: 334–350.

Soter, S. and D. Katsonopoulou 1998. The search for ancient Helike, 1998–1995: Geological, sonar and bore-hole studies, in D. Katsonopoulou, S. Soter and D. Schilardi (eds) *HELIKE II*: *Ancient Helike and Aigialeia*: 67–116. Athens: The Helike Society.

Soter, S. and D. Katsonopoulou 1999. Occupation horizons found in the search for the ancient Greek city of Helike. *Geoarchaeology* 14: 531–563.

Soter, S. and D. Katsonopoulou 2005. Studies on the geoarchaeology of the Helike Delta: 1991-2000, in D. Katsonopoulou, S. Soter and I. Koukouvelas (eds) *HELIKE III: Archaeological Sites in Geologically Active Regions*: 169–182. Athens: The Helike Society.

Soter, S. and D. Katsonopoulou 2011. Submergence and uplift of settlements in the area of Helike, from the Early Bronze Age to Late Antiquity. *Geoarchaeology* 26: 584–610.

Sotgia, A. 2019. Italian pottery kilns and production areas from the Bronze Age to the Archaic period (2200–500 BC): A typological approach, in D. Gheorghiu (ed.) *Architecture of Fire: Processes, Space and Agency in Pyrotechnologies* (Access Archaeology): 48–46. Oxford: Archaeopress.

Spadea, R. 1994. Il tesoro di Hera. *Bollettino d'Arte* 88: 1–34.

Sparkes, B.A. and L. Talcott 1970. *The Athenian Agora XII: Black and Plain Pottery of the 6th, 5th and 4th Centuries B.C.* Princeton, NJ: ASCSA.

Spathari, E. 1982. Ηρακλειδών 50 (οικόπεδο Σαπέτα). *Αρχαιολογικόν Δελτίον* 37.Β'1: 23–24.

Spathatou, G. 1980. Πειραιάς, οδός Εθν. Αντίστασης – Ιπποδάμειας – Γούναρη. *Αρχαιολογικόν Δελτίον* 35.Β'1: 61–62.

Sporn, K. 2012/2013. Grab-, Weih- oder Ehrenstele? Überlegungen zu einem Relief mit Panzerfigur in Patras. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 127/128: 259–288.

Squarciapino, M.F. 1943. *La Scuola di Afrodisia.* Rome: L'Erma di Bretschneider.

Squarciapino, M. F. 1983. La Scuola di Aphrodisias (40 anni dopo). *Archeologia Classica* 35: 74–87.

Squarciapino, M. 1991. La scuola di Aphrodisias (dopo 40 anni), in R.R.R. Smith and K.T. Erim (eds) *Aphrodisias Papers 2: The Theatre, a Sculptor's Workshop, Philosophers, and Coin-Types* (Journal of Roman Archaeology Supplementary Series 2): 123–126. Portsmouth, RI: Journal of Roman Archaeology.

Stafford, E. 2012. *Herakles* (Gods and Heroes of the Ancient World). London and New York: Routledge.

Stager, J.M.S. 2022. *Seeing Color in Classical Art: Theory, Practice, and Reception, from Antiquity to the Present*. Cambridge: Cambrigde University Press, <https://doi.org/10.1017/9781009030212>.

Stanier, R.S. 1953. The cost of the Parthenon. *Journal of Hellenic Studies* 73: 68–76.

Stavropoulou-Gatsi, M. 1980. Πρωτογεωμετρικό νεκροταφείο Αιτωλίας. *Αρχαιολογικόν Δελτίον* 35.Α: 102–130.

Stavropoulou-Gatsi, M. 2008. Ακαρνανία: Ιστορικό και αρχαιολογικό περίγραμμα, in A. Vlachopoulos (ed.) *Εύβοια και Στερεά Ελλάδα* (Αρχαιολογία 2): 414–425. Athens: Melissa.

Stavropoulou-Gatsi, M. 2011. Thirty Protogeometric vases from Kalydon in Aitolia, in S. Dietz and M. Stavropoulou-Gatsi (eds) *Kalydon in Aitolia I: Reports and Studies. Danish/Greek fieldwork 2001-2005*: 279–299. Aarhus: Aarhus University Press.

Stavropoulou-Gatsi, M. 2005. Κρυονέρι, θέση Σπηλιές. *Αρχαιολογικόν Δελτίον* 60.Β'1: 473–475.

Stavropoulou-Gatsi, M. 2018. Νεότερα αρχαιολογικά δεδομένα για την Αιτωλία μέσα από το ανασκαφικό έργο της ΛΣΤ' ΕΠΚΑ κατά τα έτη 2004-2010, in *2ο Διεθνές Αρχαιολογικό-Ιστορικό Συνέδριο Αιτωλοακαρνανίας και Λευκάδας, 6-8 Δεκεμβρίου 2013, Μεσολόγγι*: 71–98. Messolonghi: Υπουργείο Πολιτισμού.

Stavropoulou-Gatsi, M. and S. Dietz 2011. Pre-Archaic finds from inside and outside the city wall, in S. Dietz and M. Stavropoulou-Gatsi (eds) *Kalydon in Aitolia I: Reports and Studies. Danish/Greek fieldwork 2001-2005*: 275–277. Aarhus: Aarhus University Press.

Steinhauer, G. 2009. Οδικό δίκτυο της Αττικής, in M. Korres (ed.) *Αττικής Οδοί: Αρχαίοι Δρόμοι της Αττικής:* 34–73. Athens: Melissa.

Steinmann, C. 2021. *Nachklänge: Instrumente der griechischen Klassik und ihre Musik – Materialien und Zeugnisse von Homer bis Heute*. Basel: Schwabe Verlag.

Stephani, E., E. Tsagkaraki and A. Arvanitaki (eds) 2019. *Από το Νότο στο Βορρά: Αποικίες των Κυκλάδων στο Βόρειο Αιγαίο. Κατάλογος περιοδικής έκθεσης στο Αρχαιολογικό Μουσείο Θεσσαλονίκης.* Thessaloniki: Αρχαιολογικό Μουσείο Θεσσαλονίκης.

Stevens, G.H., J.M. Paton, L. Caskey and H.N. Fowler 1927. *The Erechtheum*. Cambridge, MA: Harvard University Press.

Stewart, A. 2019. Patronage, compensation, and the social status of sculptors, in O. Palagia (ed.) *Handbook of Greek Sculpture I*: 50–88. Berlin, Boston: De Gruyter.

Stillwell, A.N. 1948. *Corinth XV, Part I: The Potters' Quarter*. Princeton, NJ: ASCSA.

Stoll, O. 1998. 'Silvanus im Steinbruch': Kulturtransfer durch Soldaten der legio IIII Scythica in Syrien?, in L. Schumacher (ed.) *Religion – Wirtschaft – Technik: Althistorische Beiträge zur Entstehung neuer kultureller Strukturmuster im historischen Raum Nordafrika/ Kleinasien/Syrien*: 99–145. St. Katharinen: Scripta Mercaturae Verlag.

Stoppani, C. 2013. Materiali per Parma etrusca, in D. Locatelli, L. Malnati and D.F. Maras (eds) *Storie della Prima Parma: Etruschi, Galli, Romani. Le origini della città alla luce delle nuove scoperte archeologiche*: 7–9. Rome: L'Erma di Bretschneider.

Stoppani, C. and L. Zamboni 2009. L'insediamento di Baggiovara, via Martiniana (MO), in D. Labate and D. Locatelli (eds) *L'Insediamento Etrusco e Romano di Baggiovara (MO): Le indagini archeologiche e archeometriche* (Quaderni di Archeologia dell'Emilia Romagna 27): 349–423. Sesto Fiorentino: All'Insegna del Giglio.

Stroszeck, J. 1999. Kerameikosgrabung 1998. *Archäologischer Anzeiger* 1999: 147–172.

Stroszeck, J. 2014. *Der Kerameikos in Athen: Geschichte, Bauten und Denkmäler im Archäologischen Park*. Möhnesee: Bibliopolis.

Stroszeck, J. 2017. *Ο Κεραμεικός των Αθηνών: Ιστορία και Μνημεία εντός του Αρχαιολογικού Χώρου.* Möhnesee: Bibliopolis.

Stroszeck, J. 2020. Grabrelief und Kanalbau: Zum Neufund einer Familienstele im Kerameikos, in A. Delivorrias, E. Vikela, A. Zarkadas, N. Kaltsas and I. Trianti (eds) *Σπονδή. Αφιέρωμα στη Μνήμη του Γιώργου Δεσπίνη* (Παράρτημα 12): 403–416. Athens: Μουσείο Μπενάκη.

Stroszeck, J. 2021. Review of Graml, C. 2020. The Sanctuary of Artemis Soteira in the Kerameikos of Athens (Philippika 136). Wiesbaden: Harrassowitz. *Bonner Jahrbücher* 221: 272–278.

Stroszeck, J. and G. Zimmer 2023 (in press). Werkstattfunde aus dem Kerameikos von Athen. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung.*

Stucky, R.A. 2005. *Das Eschmun-Heiligtum von Sidon: Architektur und Inschriften* (Antike Kunst Beihefte 19). Basel: Birkhäuser.

Tagliente, M. 1986. Policoro: Nuovi scavi nell'area di Siris, in A. De Siena and M. Tagliente (eds) *Siris-Polieion: Fonti letterarie e nuova documentazione archeologica. Incontro di studi. Policoro, 1984*: 129–133. Galatina: Congedo.

Taglioni, C. 1997. Le fornaci del sepolcreto San Vitale a Bologna. *Ocnus* 5: 207–224.

Talloen, P. and L. Vercauteren 2011. The fate of temples in Late Antique Anatolia, in L. Lavan and M. Mulryan (eds) *The Archaeology of Late Antique 'Paganism'*: 347–388. Leiden: Brill.

Tchekhanovets, Y. 2016. Spoils and spolia: Large marble assemblage from Givati excavations, Jerusalem. *Liber Annuus* 66: 269–300.

Tesan, H. 1998. *Thorvaldsen und seine Bildhauerschule in Rom*. Köln: Böhlau Verlag.

Teuber, S. and B. Schweizer 2020. Resources redefined: Resources and ResourceComplexes, in S. Teuber, A.K. Scholz, T. Scholten and M. Bartelheim (eds) *Waters* (RessourcenKulturen 11): 9–19. Tübingen: Tübingen University Press.

Themos, A. 1996-97. Το ρωμαϊκό υδραγωγείο του Γυθείου: Μία πρώτη επανεξέταση των στοιχείων, in T. Gritsopoulos (ed.) *Πρακτικά του Ε΄ Διεθνούς Συνεδρίου Πελοποννησιακών Σπουδών, Άργος-Ναύπλιον, 6-10 Σεπτεμβρίου 1995*: 400–409. Athens: Εταιρεία Πελοποννησιακών Σπουδών.

Themos, A. 2012. Λακωνία: Γύθειο, in A. Vlachopoulos (ed.) *Πελοπόννησος* (Αρχαιολογία 3): 548–551. Athens: Melissa.

Theocharaki, A.M. 2011. The ancient Circuit Wall of Athens: Its changing course and the phases of construction. *Hesperia* 80: 71–156.

Theocharaki, A.M. 2020. *The Ancient Circuit Walls of Athens*. Berlin and Boston: De Gruyter.

Therkildsen, R.H. 2012. A 2nd century CE colossal marble head of a women: A case study in Roman sculptural polychromy, in J.S. Østergaard (ed.) *Tracking Colour: The Polychromy of Greek and Roman Sculpture in Ny Carlsberg Glyptotek. Preliminary Report 3*: 45–63. Copenhagen: Ny Carlsberg Glyptotek.

Thomas, Y. 2004. Res Religiosae: On the categories of religion and commerce in Roman law, in A. Pottage and M. Mundy (eds) *Law, Anthropology, and the Constitution of the Social: Making Persons and Things:* 40–72. Cambridge: Cambridge University Press.

Thomas, O. 2020. *The Homeric Hymn to Hermes: Edited with Introduction, Translation, and Commentary* (Cambridge Classical Texts and Commentaries 62). Cambridge: Cambridge University Press.

Thompson, H.A 1936. Two centuries of Hellenistic pottery. *Hesperia* 3: 311–476.

Thompson, H.A. 1937. Buildings on the west side of the Agora. *Hesperia* 6: 1–226.

Thompson, H.A. 1940. *The Tholos of Athens and Its Predecessors* (Hesperia Supplement 4). Athens: ASCSA.

Thompson, H.A. and R.L. Scranton 1943. Stoas and city walls on the Pnyx. *Hesperia* 12.4: 269–383.

Threpsiadis, I. 1971. Ανασκαφαί και τυχαία ευρήματα Αττικής, Βοιωτίας και Ευβοίας. *Αρχαιολογική Εφημερίς* 1971: 32-35.

Tomas, A. 2016. *Inter Moesos et Thraces: The Rural Hinterland of Novae in Lower Moesia (1st – 6th Centuries AD)* (Archaeopress Roman Archaeology 14). Oxford: Archaeopress.

Touloupa, E. 1986. Das bronzene Reiterstandbild des Augustus aus dem nordägäischen Meer. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 101: 185–205.

Townsend, R.F. 1995. *The Athenian Agora XXVII: The East Side of the Agora – The Remains beneath the Stoa of Attalos.* Princeton, NJ: ASCSA.

Traill, J.S. 1975. *The Political Organization of Attica: A study of the Demes, Trittyes, and Phylai and their Representation in the Athenian Council* (Hesperia Supplements 14). Princeton, NJ: ASCSA.

Traina, G. 1987. L'impossibile taglio dell'Istmo (Ps. Lucian, *Nero* 1–5). *Rivista di filologia e di istruzione classica* 115: 40–49.

Travlos, I.N. 1971. *Bildlexikon zur Topographie des antiken Athen*. Tübingen: Wasmuth.

Travlos, I.N. 1993. *Πολεοδομική Εξέλιξις των Αθηνών από των Προϊστορικών Χρόνων μέχρι των Αρχών του 19ου Αιώνος*. Athens: Kapon Editions.

Trepel, M. 2015. *Neuroanatomie: Struktur und Funktion*. Munich: Urban & Fischer.

Triantafyllidis, P. 2003. Classical and Hellenistic glass workshops from Rhodes, in D. Foy and M.-D. Nenna (eds) *Échanges et Commerce du Verre dans le Monde Antique. Actes du colloque de l'Association Française pour l'Archéologie du Verre, Aix-en-Provence et Marseille, 7-9 juin 2001*: 131–138. Montagnac: Éditions Monique Mergoil.

Triantafyllidis, P. 2006. Ιστορικά και αρχαιολογικά Αγαθονησίου. *Αρχαιολογικά Ανάλεκτα εξ Αθηνών* 39: 175–192.

Triantafyllidis, P. 2010. *Agathonisi on the Frontier: The Archaeological Investigations at Kastraki (2006-2010).* Athens: Prefecture of the Dodecanese.

Triantafyllidis, P. 2015. Archaeological researches on Milesian Agathonisi in the Dodecanese, Greece, in E. Laflı, S. Patacı and G. Cankardeş-Şenol (eds) *Recent Studies on the Archaeology of Anatolia* (BAR International Series 2750): 95–104. Oxford: Archeopress.

Triantafyllos, D. 1990. Ανάγλυφο Μίθρα ταυροκτόνου στις Θέρμες του Νομού Ξάνθης. *Θρακικά Χρονικά* 44: 46–55.

Troumpouki, C., Y. Facorellis and S. Boyatzis 2024. Physicochemical study of mortars, ceramics and other findings from the Late Classical-Hellenistic dyeworks of ancient Helike, in D. Katsonopoulou (ed.) *HELIKE VI: Helike after 373 BC – An Interdisciplinary Approach*: 265-284. Athens: The Helike Society.

Tsirpanlis, Z. 1990. Το κτητορικό δίκαιο των κατοίκων του Άργους στην Ιπποτοκρατούμενη Νίσυρο. *Νισυριακά* 11: 19–36.

Tsivikis, N. 2020. Messene and the changing urban life and material culture of an Early Byzantine city in the western Peloponnese (4th-7th century), in B. Böhlendorf-Arslan and R. Schick (eds) *Transformation of City and Countryside in the Byzantine Period*: 30–53. Mainz: Verlag des Römisch-Germanischen Zentralmuseums.

Tsouklidou-Penna, D. 1981. Οδός Δρυόπων 34 (οικόπεδο Κανέλλου). *Αρχαιολογικόν Δελτίον* 36.Β'1: 19.

Tsouli, M. 2010. Εντοπισμοί αρχαιοτήτων: Έρημος-Κουτρέλα. *Αρχαιολογικόν Δελτίον* 65.Β'1: 568.

Tsouli, M. 2015. New evidence on ancient quarrying activity at the Mani Peninsula, southwestern Laconia, Greece, in P. Pensabene and E. Gasparini (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 10th international conference of the Association for the Study of Marble and Other Stones in Antiquity, Rome, Italy, May 21-26, 2012* (ASMOSIA X): 823–830. Rome: L'Erma di Bretschneider.

Tsouli, M. 2018. Το έργο της Ε΄ ΕΠΚΑ στη Λακωνική Μάνη, 2006-2009: Τα πορίσματα των ερευνών, in E. Zymi, A.-V. Karapanagiotou and M. Xanthopoulou (eds) *Το Αρχαιολογικό Έργο στην Πελοπόννησο. Πρακτικά του διεθνούς συνεδρίου, Τρίπολη, 7-11 Νοεμβρίου 2012* (ΑΕΠΕΛ 1): 353–376. Kalamata: Πανεπιστήμιο Πελοποννήσου.

Tuci, D. 2007. Calenzano (FI). Località Carraia: area con forni etruschi e strutture di età classica. *Notiziario della Sopritnendenza per I Beni Archeologici della Toscana* 3: 149–152.

Tuci, D. 2022. La fornace dell'Autostrada delle Acque, in Donati, L., G. Millemaci, L. Pagnini and G. Poggesi (eds) *Gonfienti: L'insediamento etrusco e romano. I materiali*: 302–306. Florence: Edifir.

Tuffreau-Libre, M. 1976. La céramique de l'officine gallo-romaine du Pont-Rouge à Bourlon. *Bulletin de la Commission Départementale des Monuments Historiques du Pas-De-Calais* 10: 1–20.

Tuffreau-Libre, M. and N. Vanbrugghe 1994. La céramique du IIIe siècle du site de Famars (Nord), in M. Tuffreau-Libre and A. Jacques (eds) *Actes de la table ronde La Céramique du Bas-Empire en Gaule Belgique et dans les Régions Voisines, Arras 8-10 octobre* 1991 (Revue du Nord. Hors série, Collection archéologie 4): 33–41. Villeneuve d'Ascq: Université de Lille.

Underwood, D. 2013. Reuse as archaeology: A test case for Late Antique building chronologies in Ostia, in L. Lavan and M. Mulryan (eds) *Field Methods and Post-Excavation Techniques in Late Antique Archaeology*: 383–409. Leiden: Brill.

Underwood, D. 2019. *(Re)using Ruins: Public Building in the Cities of the Late Antique West, A.D. 300–600.* Leiden: Brill.

Vaessen, R. 2014. Craftmanship at Athens in the 11th century BCE: Improvisation, networking and pottery making, in K. Rebay-Salisbury, A. Brysbaert and L. Foxhall (eds) *Knowledge Networks and Craft Traditions in the Ancient World: Material Crossovers*: 127–146. New York: Routledge.

Vallois, R. 1939. Les moulures grecques (Review of L.T. Shoe, Profiles of Greek Mouldings). *Revue des Études Anciennes* 41: 49–56.

Vallois, R. 1966. *L'Architecture Hellénique et Hellénistique à Délos jusqu'à l'Éviction des Déliens II, 1.* Paris: Éditions de Boccard.

Vallois, R. 1978. *L'Architecture Hellénique et Hellénistique à Délos jusqu'à l'Éviction des Déliens II, 2.* Paris: Éditions de Boccard.

Vanbrugghe, N. 1986. *Famars, Déviation du CD958 (Déviation d'Aulnoye-Famars), parcelles A265, A267, A270, Rapport de fouilles.* Villeneuve d'Ascq: Association pour les fouilles archéologiques nationales, Service Régional de l'Archéologie.

Vanbrugghe, N. 1989. Recherches archéologiques à Famars (1986-1988). *Revue du Nord* 71.280/Janvier-Mars 1989: 79–103.

Vanderhoeven, A. and A. Ervinck 2007. Not in my back yard? The industry of secondary animal products within the Roman civitas capital of Tongeren, Belgium, in R. Hingley and S. Willis (eds) *Roman Finds: Context and Theory. Proceedings of a conference held at the University of Durham*: 156–175. Oxford: Oxbow Books.

Vander Poppen, R.E. 2013. Evidence from flaws: Hellenistic pottery technology at Podere Funghi (Vicchio di Mugello). *Etruscan Studies* 16.2: 165–189.

Van Voorhis, J. 2008. The training of marble sculptors at Aphrodisias, in R.R.R. Smith and J. Lenaghan (eds) *Roman Portraits from Aphrodisias*: 120–135. Istanbul: Yapı Kredi Cultural Activities, Arts and Publishing.

Van Voorhis, J. 2018. *Aphrodisias 10: The Sculptor's Workshop*. Wiesbaden: Reichert Verlag.

Vanzini, R. 2019. L'abitato villanoviano di via San Donato-Caserma Battistini a Bologna. *Studi Etruschi* 82: 3–34.

Vaos, Z. and S. Nomikos 1993. *Ο Ανεμόμυλος στις Κυκλάδες*. Athens: Melissa.

Verbanck-Piérard, A. 2021. Prince Charles Alexander of Lorraine and Hercules: A political emblem between tradition and innovation, in V. Mainz and E. Stafford (eds) *The Exemplary Hercules from the Renaissance to the Enlightenment and Beyond*: 119–148. Leiden: Brill.

Verbicaro, G. 2010. Aree produttive a Crotone tra VII e III sec. a.C., in L. Lepore and P. Turi (eds) *Caulonia tra Crotone e Locri. Atti del convegno internazionale, Firenze, 30 maggio-1 giugno 2007*: 227–241. Florence: Firenze University Press.

Verčík, M. 2017. Frühe Eisentechnologie in der Ägäis: case study Ionien. *Studia Hercynia* 21.1: 25–44.

Verdelis, N. 1960. Ανασκαφή του διόλκου. *Πρακτικά της εν Αθήναις Αρχαιολογικής Εταιρείας* 1960: 136–143.

Vergados, A. 2013. *The Homeric Hymn to Hermes: Introduction, Text and Commentary* (Texte und Kommentare 41). Berlin: De Gruyter.

Verri, G., T. Opper and T. Deviese 2010. The "Treu Head": A case study in Roman sculptural polychromy. *The British Museum Technical Research Bulletin* 4: 39–53.

Veymiers, R. 2010. Dieux de l'Orient en Hainaut à l'époque romaine, in M.-C. Bruwier (ed.) *Mémoires d'Orient: Du Hainaut à Héliopolis. Catalogue d'exposition, Musée royal de Mariemont, du 7 mai au 17 octobre 2010*: 41–61. Mariemont: Musée royal de Mariemont.

Vidas, A. 2019. Religijska Slika Otoka Brača od 1. do 4. Stoljeća. Unpublished Master's thesis, Sveučilište u Zadru.

Vikatou, O. 2012a. Η Ιονία οδός (Μέρος Γ'). Η οχύρωση στις «Τρεις Εκκλησιές» Μεσολογγίου και οι νέες ανασκαφές στο πρωτογεωμετρικό νεκροταφείο Σταμνάς. <https://www.archaiologia.gr/blog/2012/09/24/%CE%B7->, accessed 24.01.2024.

Vikatou, O. 2012b. Η Ιονία οδός (Μέρος Β'). Ιερά και νεκροπόλεις στην περιοχή της αρχαίας Αλίκυρνας. <https://www.archaiologia.gr/blog/2012/09/10/%CE%B7>, accessed 24.01.2024.

Vikatou, O. 2015a. Είσοδος σήραγγας Καλυδώνας (Χ.Θ. 23+550 έως 23+800). *Αρχαιολογικόν Δελτίον* 70.Β'1: 566–568.

Vikatou, O. 2015b. Θέση Ρηγαίικα Μεσολογγίου (Χ.Θ. 27+650 έως 27+750). *Αρχαιολογικόν Δελτίον* 70.Β'1: 566–570.

Vikatou, O. 2015c. Θέση Ρηγαίικα Μεσολογγίου (Χ.Θ. 26+800 έως 26+880): Παρόδιο ταφικό μνημείο. *Αρχαιολογικόν Δελτίον* 70.Β'1: 570–571.

Vikatou, O. 2015d. Αρχαία Αλίκυρνα (Άγιος Θωμάς Μεσολογγίου) (Χ.Θ. 28+860 έως 29+360). *Αρχαιολογικόν Δελτίον* 70.Β'1: 572–576.

Vikatou, O. 2015e. Θέση Τρεις Εκκλησιές Μεσολογγίου (Χ.Θ. 38+245). *Αρχαιολογικόν Δελτίον* 70.Β'1: 577–579.

Vikatou, O. 2015f. Έργο «Παραϊόνια Οδός». Οδικές συνδέσεις σήραγγας Αγ. Ηλία (Χ.Θ. 27+682 έως 27+787). *Αρχαιολογικόν Δελτίον* 70.Β'1: 579–584.

Vikatou, O. 2016. Η Ιονία οδός: Μακύνεια – Πλευρώνα. Ένας άγνωστος αρχαίος κόσμος. *Αρχαιολογία* 121: 22–35.

Vikatou, O. 2019. Από τη ζωή στο θάνατο: Ανιχνεύοντας έθιμα ταφής και πρακτικές στην Αιτωλοακαρνανία με αφορμή την εκτέλεση μεγάλων δημόσιων έργων οδοποιίας, in E. Kountouri and A. Gadolou (eds) *Σωστικές Ανασκαφές της Αρχαιολογικής Υπηρεσίας Ι. Τα Νεκροταφεία: Χωροταξική οργάνωση – ταφικά έθιμα – τελετουργίες*: 395–435. Athens: Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων.

Vinogradov, Yu.G. and S.D. Kryžickii 1995. *Olbia: Eine altgriechische Stadt im nordwestlichen Schwarzmeerraum* (Mnemosyne, bibliotheca classica Batava. Supplementum 149). Leiden: Brill.

Vlassopoulos, K. 2007. *Unthinking the Greek Polis: Ancient Greek History beyond Eurocentrism.* Cambridge: Cambridge University Press.

Vokotopoulou, I. 1969. Πρωτογεωμετρικά αγγεία εκ της περιοχής του Αγρινίου. *Αρχαιολογικόν Δελτίον* 24.Α': 74–94.

Völling, T. and G. Zimmer 1995. Bewegliche Tiegel: Ein Neufund in Olympia. *Archäologischer Anzeiger* 1995: 661–666.

von Jan, K. 1882. *Die griechischen Saiteninstrumente*. Leipzig: B.G. Teubner.

von Rüden, C. 2017. From mechanics to embodiment: Some theoretical considerations on techniques, in P. Eisenach, T. Stöllner and A. Windler (eds) *The RITaK Conferences 2013-2014: Raw Materials, Innovation, Technology of Ancient Cultures 1* (Der Anschnitt Beiheft 34= Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum 219): 71–79. Rahden, Westf.: VML Verlag Marie Leidorf.

Vougioukalakis, G. and E. Theodosiou 2012. Γεωδιαδρομές στην Ελλάδα: Νήσος Νίσυρος. *Ελληνική Γεωσφαίρα* Απρίλιος-Αύγουστος: 18–36.

Voutira, P. 2017. Η Περίπτωση του Αρχαίου Δρόμου «Δια Κοίλης Οδού». Unpublished PG Diploma dissertation. National and Kapodistrian University of Athens.

Vrsalović, D. 1960. Pretpovijest i Stari Vijek. *Brački zbornik* 4: 33–110.

Wace, A.J.B., W.A. Heurtley, W. Lamb, L.B. Holland and C.A. Boethius 1921-1923. Excavations at Mycenae. *Annual of the British School at Athens* 25: 1–435.

Waelkens, M., P. De Paepe and L. Moens 1988. Patterns of extraction and production in the white marble quarries of the Mediterranean: History, present problems and prospects, in J.C. Fant (ed.) *Ancient Marble, Quarrying and Trade. Papers from a colloquium held at the annual meeting of the Archaeological Institute of America, San Antonio, Texas, December, 1986*: 81–116. Oxford: Archaeopress.

Wagenführ, R. and A. Wagenführ 2022. *Holzatlas.* Munich: Carl Hanser Verlag.

Walter, U. 2006. s.v. Infrastruktur, in *DNP Online*, viewed 26 October 2023, <http://dx.doi.org/10.1163/1574-9347_dnp_e524460>.

Walter-Karydi, E. 2015. *Die Athener und ihre Gräber (1000–300 v. Chr.)* (Image & Context 14). Berlin, Munich, Boston: De Gruyter.

Warden, P.G., M.L. Thomas, A. Steiner and G. Meyers 2005. Poggio Colla: A north Etruscan settlement of the 7th-2nd c. B.C. (1998-2004 excavations). *Journal of Roman Archaeology* 18: 252–266.

Ward-Perkins, B. 1984. *From Classical Antiquity to the Middle Ages: Urban Public Building in Northern and Central Italy, AD 300–850.* Oxford: Oxford University Press.

Watzinger, A. 1901. Die Ausgrabungen am Westabhang der Akropolis V: Einzelfunde. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 26: 229–232.

Weinkauf, E. (in press). Topographie des ateliers artisanaux au sein des agglomérations implantées sur les territoires des cités des Ménapiens, des Nerviens et des Tongres au Haut-Empire, in G. Pagès and R. Clotuche (eds) *Le Rôle de l'Artisanat dans la Genèse et la Structuration des Agglomérations. Actes des trois tables rondes organisées à Nanterre (2 octobre 2014, 12 mars 2015 et 4 novembre 2015, dans le cadre du projet partagé de l'UMR 7041 ArScAn «Construire l'Espace – Analyse chrono-spatiale des logiques territoriales» (Humanités 1).* Nanterre: Presses universitaires Paris Nanterre.

Weir, R. 1999. Nero and the Herakles frieze at Delphi. *Bulletin de Correspondance Hellénique* 123: 397–404.

Weir, R. 2016. Coins including Sikyonian and Corinthian issues found at the excavations of the Helike Project in Helike of Achaia, in D. Katsonopoulou and E. Partida (eds) *ΦΙΛΕΛΛΗΝ. Essays Presented to Stephen G. Miller*: 37–65. Athens: The Helike Society.

Weller, Ch. 1903. The cave at Vari: I. Description, account of excavation, and history. *American Journal of Archaeology* 7.3: 263–288.

Welzer H. 2001. Das soziale Gedächtnis, in H. Welzer (ed.) *Das soziale Gedächtnis: Geschichte, Erinnerung, Tradierung*: 9–24. Hamburg: Hamburger Edition.

Werner, W. 1997. The largest ship trackway in ancient times: The diolkos of the Isthmus of Corinth, Greece, and early attempts to build a canal. *International Journal of Nautical Archaeology* 26.2: 98–119.

Wescoat, B.D., C. Arnold-Biucchi, S. Ludi Blevins, Sh. Dillon, N.M. Dimitrova, L.M. Gadbery, J. Gaunt, K.K. Jones, A. Sowder Koch, M.L. Popkin and D.A. Stewart 2017. *Samothrace Excavations conducted by the Institute of Fine Arts of New York University 9: The Monuments of the Eastern Hill.* Princeton, NJ: ASCSA.

Westholm, A. 1963. *Labraunda. Swedish Excavations and Researches 1. Vol. 2: The Architecture of the Hieron.* Lund: Gleerup.

Whitley, J. 2001. *The Archaeology of Ancient Greece* (Cambridge World Archaeology). Cambridge: Cambridge University Press.

Willems, S. and B. Borgers 2016. Pottery workshops at Fanum Martis (Northern France): Analysis of pottery production and consumption. *Rei Cretariae Romanae Fautorum Acta* 44: 429–437.

Willems, S. and B. Borgers 2017. Les transferts de techniques potières: Les officines antiques de Bavay, Pont-sur-Sambre et Famars (Nord). *Archéopages* 45: 72–79.

Willems, S., B. Borgers, J. Clerget, R. Clotuche, G. Teysseire and A. Tixador 2019. Fanum Martis (Famars, Nord): Une officine de potiers au coeur de l'agglomération, in M. Denti and M. Villette (eds) *Archéologie des Espaces Artisanaux: Fouiller et Comprendre les Gestes des Potiers. Actes du colloque international de Rennes, 27-28 novembre 2014:* 257–270. Lattes: Éditions ADAL.

Willems, S., R. Delage, J. Donnadieu, J. Flahaut and N. Venant 2017a. Le mobilier céramique : consommation, in R. Clotuche, J. Clerget, G. Teysseire and A. Tixador (eds) *Un Quartier Antique de Fanum Martis: Résultats de la Fouille du Technopôle Transalley, Phase 1, 3 et 4 a, Campagnes 2011 à 2014, Tome 4, Vol. 2, Les études thématiques.* Glisy: Inrap NP.

Willems, S. and B. Favennec 2019. Abandon et clôture des fours de potiers: Un geste systématique?, in *Actes du congrès de Maubeuge-Bavay, SFECAG, 30 mai – 2 juin 2019*: 177–188. Marseille: SFECAG.

Willems, S., B. Favennec, B. Borgers, J. Flahaut and N. Warmé 2017b. Le mobilier céramique: La production, in R. Clotuche, J. Clerget, G. Teysseire and A. Tixador (eds) *Un Quartier Antique de Fanum Martis: Résultats de la Fouille du Technopôle Transalley, Phase 1, 3 et 4 a, Campagnes 2011 à 2014, Tome 4, Vol. 2, Les études thématiques.* Glisy: Inrap NP.

Willems, S. and A. Ledauphin 2019. Les productions précoces de Bavay (Nord), un répertoire sous influence, in *Actes du congrès de Maubeuge-Bavay, SFECAG, 30 mai – 2 juin 2019*: 267–272. Marseille: SFECAG.

Williams-Thorpe, O. 1988. Provenancing and archaeology of Roman millstones from the Mediterranean area. *Journal of Archaeological Science* 15: 253–305.

Williams-Thorpe, O. and R.S. Thorpe 1990. Millstone provenancing used in tracing the route of a 4th-century B.C. Greek merchant ship. *Archaeometry* 32.2: 115–137.

Williams-Thorpe, O. and R. Thorpe 1991. The import of millstones to Roman Mallorca. *Journal of Roman Archaeology* 4: 152–159.

Williams-Thorpe, O., R.S. Thorpe, C. Elliot and C. Xenophontos 1991. Archaeology, geochemistry and trade of igneous rock millstones in Cyprus during the Late Bronze Age to Roman periods. *Geoarchaeology* 6.1: 27–60.

Wilson, J.R. 2000. Fundamentals of ergonomics in theory and practice. *Applied Ergonomics* 31.6: 557–567.

Wilson, A. 2011. Developments in Mediterranean shipping and maritime trade from the Hellenistic period to AD 1000, in D. Robinson and A. Wilson (eds) *Maritime Archaeology and Ancient Trade in the Mediterranean* (Oxford Centre for Maritime Archaeology Monographs): 33–59. Oxford: Oxford Centre for Maritime Archaeology.

Wilson Jones, M. 2002. Tripods, triglyphs, and the origin of the Doric frieze. *American Journal of Archaeology* 106.3: 353–390.

Wilson Jones, M. 2016. Reflections on interpretation and the origins of the Doric frieze, in K. Zambas, V. Lambrinoudakis, E. Simantoni-Bournia and A. Ohnesorg (eds) *ΑΡΧΙΤΕΚΤΩΝ. Τιμητικός Τόμος για τον Καθηγητή Μανόλη Κορρέ*: 645–658. Athens: Melissa.

Wipszycka, E. 1965. *L'Industrie Textile dans l'Égypte Romaine* (Archiwum Filologiczne 9). Breslau: Ossolineum.

Wiseman, J. 1968. An unfinished colossus on Mount Penteli. *American Journal of Archaeology* 72: 75–76.

Wiseman, J. 1978. *The Land of the Ancient Corinthians*. Göteborg: P. Åström.

Wooten, W., B. Russell and P. Rockwell 2013. Stone-working tools and toolsmarks (version 1.0), in *The Art of Making in Antiquity: Stoneworking in the Roman World*, viewed 30 June 2022, <https://artofmaking.ac.uk/content/essays/2-stoneworking-tools-and-toolmarks-w-wootton-b-russell-p-rockwell/>.

Wörrle, M. 1995. Inschriftenfunden von der Hallen-straßengrabung in Aizanoi 1992. *Archäologischer Anzeiger* 1995: 719–727.

Wurch-Koželj, M. 1988. Methods of transporting blocks in antiquity, in N. Herz and M. Waelkens (eds) *Classical Marble: Geochemistry, Technology, Trade*: 55–64. Dordrecht-Boston: Kluwer Academic Publishers.

Wurch-Koželj, M. and T. Koželj 1995. Roman quarries of apse-sarcophagi in Thasos of the second and third centuries, in Y. Maniatis, N. Herz and Y. Bassiakos (eds) *The Study of Marble and Other Stones in Antiquity. Proceedings of the 3rd international conference of the Association for the Study of Marble and Other Stones in Antiquity, Athens, Greece, May 17-19, 1993* (ASMOSIA III): 39–50. London: Archetype Publications.

Wurch, M. 2017. Les Carrières de Thasos: Étude Technique et Socio-Économique. Unpublished PhD dissertation. University of Paris 1.

Wypustek, A. 2012. *Images of Eternal Beauty in Funerary Verse Inscriptions of the Hellenistic and Greco-Roman Periods*. Leiden: Brill.

Yavuz, A.B., M. Bruno and D. Attanasio 2012. A new source of bigio antico marble: The ancient quarries of Iznik (Turkey), in A. Gutiérrez Garcia-M., P. Lapuente and I. Rodà (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 9th international conference of Association for the Study of Marble and Other Stones in Antiquity, Tarragona, Spain, June 8-13, 2009.* (ASMOSIA IX. Documenta 23): 255–262. Tarragona: Institut Català d'Arqueologia Clàssica.

Younès, A. 2014a. Les pierres marbrières antiques au nord de la Dorsale Tunisienne: Etat de la question et mise au point, in M. Hassan and A. Younès (eds) *Les Ressources Naturelles au Maghreb Durant l'Antiquité et le Moyen Âge. Actes du Vème colloque international, Tunis 25-27 novembre 2010*: 161–192. Tunis: Université de Tunis.

Younès, A. 2014b. Étude Préliminaire sur le Marbre Vert Antique de la Région de Chemtou, in M. Hassan and A. Younès (eds) *Les Ressources Naturelles au Maghreb Durant l'Antiquité et le Moyen Âge. Actes du Vème colloque international, Tunis 25-27 novembre 2010*: 236–240. Tunis: Université de Tunis.

Younès, A. 2018. Geoarchaeological study of the ancient quarries of *Thugga* (north-west of Tunisia). *Marmora. An International Journal for Archaeology, History and Archaeometry of Marbles and Stones* 13/2017: 97–110.

Younès, A. and M. Ouaja 2009. The ancient underground quarries between Sullecthum and Leptiminus, in Ph. Jockey (ed.) *Λευκός Λίθος: Marbres et Autres Roches de la Méditerranée Antique – Études Interdisciplinaires. Actes du VIIIème colloque international de l'Association for the Study of Marble and Other Stones Used in Antiquity, Aix-en-Provance, June 12-18, 2006* (ASMOSIA VIII): 229–237. Paris: Éd. Karthala, Maison méditerranéenne des sciences de l'homme.

Younès, A., M. Gaied and W. Gallala 2015. The Roman Mio-Pliocene underground quarries at Ksour Essaf

(Tunisia), in P. Pensabene and E. Gasparini (eds) *Interdisciplinary Studies on Ancient Stone. Proceedings of the 10th international conference of the Association for the Study of Marble and Other Stones in Antiquity, Rome, Italy, May 21-26, 2012* (ASMOSIA X): 861–867. Rome: L'Erma di Bretschneider.

Young, R.S. 1951. An industrial district of ancient Athens. *Hesperia* 20: 135–288.

Zachariadou, O. 1994. Λεωφόρος Αμαλίας. *Αρχαιολογικόν Δελτίον* 49.B'1: 27–34.

Zachariadou, O., D. Kyriakou and E. Baziotopoulou 1985. Σωστική ανασκαφή στον ανισόπεδο κόμβο Λένορμαν-Κωνσταντινουπόλεως. *Αρχαιολογικά Ανάλεκτα εξ Αθηνών* 18: 39–50.

Zachariadou, O., D. Kyriakou and E. Baziotopoulou 1992. Ateliers de potiers à l'Angle des Rues Lenormant et de Constantinople (rapport préliminaire), in F. Blondé and J.Y. Perreault (eds) *Les Ateliers de Potiers dans le Monde Grec aux Époques Géométrique, Archaïque et Classique. Actes de la table ronde organisée à l'École française d'Athènes. 2 et 3 Octobre 1987* (Bulletin de Correspondance Hellénique Supplément 23): 53–56. Wilsele: Peeters.

Zamboni, L. 2012. Testimonianze arcaiche in Emilia occidentale: Una cultura di frontiera alla luce delle nuove indagini, in M.P. Bologna and M. Ornaghi (eds) *Novissima Studia: Dieci Anni di Antichistica Milanese* (Quaderni di Acme 129): 1–29. Milan: Cisalpino.

Zamboni, L. 2018. *Sepolture Arcaiche della Pianura Emiliana: Il Riconoscimento di una Società di Frontiera* (Reditus. Riflessioni di Archeologia 1). Rome: Edizioni Quasar.

Zapheiropoulou, Ph. 1988. *Naxos: Denkmäler und Museum*. Athens: Krene Verlag.

Zavvou, E. 2007. Νέα στοιχεία για τις λακωνικές πόλεις της δυτικής ακτής της χερσονήσου του Μαλέα, in *Πρακτικά του Ζ΄ Διεθνούς Συνεδρίου Πελοποννησιακών Σπουδών, Πύργος-Γαστούνη-Αμαλιάδα, 11-17 Σεπτεμβρίου 2005*: 413–451. Athens: Εταιρεία Πελοποννησιακών Σπουδών.

Zelnick-Abramovitz, R. 2015. Whose grave is this? The status of grave plots in ancient Greece. *Dike* 18: 51–95.

Zimmer, G. 1982. *Antike Werkstattbilder* (Bilderhefte der Staatlichen Museen Berlin, Stiftung Preussischer Kulturbesitz 42). Berlin: Gebr. Mann.

Zimmer, G. 1984. Gießereieinrichtungen im Kerameikos. *Archäologischer Anzeiger* 1984: 63–83.

Zimmer, G. 1990. *Griechische Bronzegusswerkstätten: Zur Technologieentwicklung eines antiken Kunsthandwerkes*. Mainz: Philipp von Zabern.

Zimmer, G. 1993. Werkstattbauten des fünften Jahrhunderts, in W. Hoepfner and G. Zimmer (eds) *Die Griechische Polis: Architektur und Politik:* 94–101. Tübingen: Wasmuth.

Zimmer, G. 2003. Hellenistische Bronzegußwerkstätten in Demetrias, in A.E. Furtwängler, G. Zimmer and G. Schneider (eds) *Demetrias VI: Hellenistische Bronzegußwerkstätten, Lampenproduktion und -importe, Amphorenfunde*: 9–64, pls 1–13. Würzburg: Ergon.

Zimmer, G. 2006. Die Suche nach dem Schmelztiegel: Ein deutsches Problem?. In A. Dostert, F. Lang, und W. Heilmeyer (eds) *Mittel und Wege: Zur Bedeutung von Material und Technik in der Archäologie*: 23–36. Möhnesee: Bibliopolis.

Zimmer, G. 2009. Εργαστήρια χαλκοπλαστικής στην Ελλάδα. *Εγνατία* 13: 216-223.

Zimmer, G. 2016. Searching for the goddess, in A. Giumlia-Mair and C.C. Mattusch (eds) *Proceedings of the XVIIth International Congress on Ancient Bronzes, Izmir* (Monographies Instrumentum 52): 231–236. Montagnac: Éditions Monique Mergoil.

Zimmer, G. and K. Baïrami 2008. *Ρόδος II: Ροδιακά Εργαστήρια Χαλκοπλαστικής*. Athens: Υπουργείο Πολιτισμού.

Zimmer, G. and N. Hackländer (eds) 1997. *Der Betende Knabe: Original und Experiment. Ausstellung der Antikensammlung der Staatlichen Museen zu Berlin, Preußischer Kulturbesitz*. Berlin: Staatliche Museen zu Berlin, Preußischer Kulturbesitz.

Zink, S., J. Pflug and M. Ceci 2020. How a temple survives: Resilience and architectural design at Temple A of Largo Argentina in Rome. *Mitteilungen des Deutschen Archäologischen Instituts, Römische Abteilung* 126: 387–427.

Zouari, H., K. Regaya, A. Mamou, Y. Kamoun, M. Amouri and L. Louhaïchi 1996. *Carte Géologique au 1/100 000 et Notice Explicative de Matmata*, 91. Tunis: Service Géologique de Tunisie, Office National de Mines.

Zurbach, J. 2013. The formation of the Greek city states. *Annales: Histoire, Sciences Sociales* 68: 927–968 [617–657 for English translation].

Indices

VARIA

A

acanthus 323
  acanthus-scroll 323
acculturation 233
acroterion 209, 259
aesthetic(s) 6, 9–10, 94, 167, 173, 181, 184, 189, 192, 261–262, 298, 308, 310, 324
Agora v, 3, 19, 34, 45, 47–48, 50–52, 116, 169–170, 192, 195, 218, 220, 226, 228–229, 251, 265, 267, 298, 305, 317
Amphictyony/ Amphictyons 250, 268–269, 275, 278
amphiprostyle 249, 253, 258, 260
anakalypsis (gesture) 257
anthemion (palmette) ix, 260, 299–300, 303
architect(s) 249, 254, 270, 275–276, 279
architecture ii, 5–6, 20, 60, 101, 104, 109, 112, 248–249, 251–258, 260, 262, 265, 279, 281, 285, 298, 309, 324–325, 338
  architectural landscape 261, 266, 275
  Attic/Athenian architecture 248–254, 255–260
  Cycladic architecture 248, 265
artisans 2, 5, 24, 26, 42, 45, 52, 78, 181, 200, 235, 245, 261, 263, 266, 269, 275, 279
axe v, 25, 27, 78, 310

B

Basilica 128, 156, 317, 319–320, 322–323
beam-holes/beam-sockets 308, 321–323
bichromy 265
bird-carrier 205
blueprint 3–4, 98
breccia 265
brick-yards 272
building ii, iii, iv, v, vi, 2, 4–6, 9–14, 17–23, 26–27, 32, 43, 45, 50, 52, 54–55, 59–61, 63–64, 66, 68, 71–72, 76–77, 80, 84–86, 92, 94, 101, 103–104, 106, 110, 119, 121–122, 128, 133–134, 142, 148, 155, 159, 161–162, 203, 214–215, 220–221, 228, 233, 247–251, 253–255, 257, 259–262, 264–267, 269–270, 272, 275–282, 285–287, 293–294, 298–299, 304–306, 308–314, 317–321, 323–325, 335, 346
  building accounts 266, 270, 275–277, 287
  building crews 261
  building process/procedures/programs ii, 4, 13, 261–262, 266, 278–281
  building teams 310–311, 320, 324–325
  building techniques 248
burial customs 178, 232, 297

C

carpenter(s), carpentry 118, 133–134, 276, 278, 309
cart(s) 269, 273, 275, 277–278
cart-route 269, 273, 275, 277–278
carving ii, vii, 4, 94, 99, 109–110, 112–114, 116, 118–122, 124, 129, 131–134, 141, 145, 151, 156, 159, 162–164, 167, 169–173, 197, 264, 277, 285, 310, 313, 324
caryatids 258–259, 264
casting iv, v, viii, 9–41, 48–49, 52, 77–78, 204, 221, 278
chaîne opératoire ix, x, 5–6, 9, 92, 120, 200–201, 204–206, 212, 242–243, 280, 282, 291, 293, 297, 303, 326–330, 332–337, 339–353
chalk 97, 171
  glauconious 97
  'Good-Stone of Valenciennes' (Bonne-pierre de Valenciennes) 97
chelys 326–327, 336, 341–342, 345–346, 350
chipping (stone, marble) 270, 272
  marble chipping 270
chisel vii, 81, 93, 112, 114, 116, 167, 172, 291, 313, 316, 318
  claw-chisel 93, 112, 291
  flat chisel 112, 116, 291
  gradine 93, 112
  point-chisel vii, 112, 167, 313, 318
city walls iv, 4, 13, 42, 47, 49–50, 52, 202, 216–218, 220, 306, 310
clamps ix, 248–249, 251, 253–254, 256–257, 277–279, 317–318, 321
  (double) T-clamps 248–249, 251, 253–254, 256
  dovetail 253, 256
colonisation 232–233, 245
conglomerate 20, 265, 269, 332, 345
construction i, ii, viii, 4–5, 10, 20–22, 24–25, 40, 51, 60, 66, 68, 72, 76, 80–81, 84, 88, 99, 101–103, 105–106, 122, 133, 135–136, 142–144, 146, 162, 165, 169, 175, 180–181, 194–195, 197–199, 209, 216–218, 222, 233, 235, 246–255, 257, 259, 261–263, 266–269, 272–273, 275–282, 285–288, 291–294, 298, 306, 308–311, 313, 317, 321, 323–325, 327–329, 333, 336, 340–341, 346–347, 351
contractor(s) 250, 276
coroplast, coroplath ii, 200–201, 203
crew 263, 293

crust 211–212
cult, cultic ii, 3, 6, 43, 69–71, 77–78, 85, 107, 109–110, 121–122, 141–144, 200, 206, 208, 212, 228–229, 232, 250, 252, 261, 272, 278, 286, 303
culture, cultural 1–2, 4–5, 11, 18, 24–38, 54–55, 68, 70–71, 73, 110, 115, 117, 123, 127–132, 137–140, 165, 173, 184, 194, 197, 200, 203, 208–212, 215–217, 219, 221–233, 235, 241–246, 255–256, 261–262, 264–265, 272, 276, 296–297, 301–302, 304, 316, 330, 335, 351, 353
  cultural hubs 231–232, 241, 246, 261–262

D

demolition, demolition team 71, 84, 103, 269, 310–311, 317, 324
demoulding 201, 207
deposit 201–202, 220, 229, 314
disassembly 317, 319
disjecta membra 259
dismantling 86, 101, 317, 321
divination 262
dowels 172, 249, 257, 277–278, 317
'Dragon Houses' 110, 122, 143
dump (production dump) 27, 37, 101, 106, 202
dyeing 3, 42, 47, 50, 55, 57–58, 60–63, 65–66, 68
dynamics ii, 5, 79, 200–201, 203–204, 211–212, 242, 245–246, 261–262, 266, 281, 296

E

earthquake 49, 55–57, 262–263, 266, 277, 298, 323
echinus 257, 259, 264
economy 3–4, 43, 57, 66, 68, 91, 96, 112, 263, 311
  construction economy 311
embodiment 326, 347
emic approach 231
engineering 137, 141, 264, 276, 330
entrepreneur(s) 319
erasure 300, 316–317
ergonomics 2, 4–5, 236, 243
extraction i, vii, 3, 81, 91, 95–99, 109–110, 118, 120, 122, 125, 129, 131–133, 146, 151–155, 165–166, 173, 204, 272, 286, 290

F

fasciae 259
figurine(s) viii, 60, 201, 205, 207, 210, 221
  a leggio 211
  bird-carrier 120, 205
  dedicant 205, 244
  enthroned viii, 201–202, 206–207, 209–211, 213
  potnia theron (mistress of animals) viii, 208
  protomai (busts) 211, 213
  symposiasts (participants in feasting) 209
  warlike gesture viii, 208, 210
fire, firing 14, 17–18, 20–26, 28, 35, 38, 42–43, 47–48, 50–52, 71–72, 76, 85, 110, 176, 181, 201–205, 212, 219–220, 222, 224, 233, 235–237, 241, 243–246, 266, 317
fiscal 42, 52
flakes (stone, marble) 2, 270, 272, 313
flax v, 57, 63–67, 84
foot 26, 80, 116, 183, 202, 241, 250, 259, 286, 324
  Attic foot 26, 250, 259
fortification(s) ii, ix, 12–13, 42, 80–81, 84–85, 88, 101, 104, 136, 183, 217, 279–280, 282–288, 291–294, 306, 308, 310
foundry, foundries iv, 2–3, 11–14, 16–17, 19–21, 24–27, 29–30, 34–40, 48–49, 278
frieze 103, 257, 259, 263, 314, 323–324
funerary, sepulchral ii, ix, 2–6, 13, 140, 175–176, 178–184, 190, 193–198, 215, 220, 229, 232, 238, 255–256, 258, 296–307, 310, 338

G

geological fault 263
glutinarius 81, 83
graffiti, graffito 39, 72, 89, 316–317, 324
grave marker 298–301, 304, 306
guidelines 3–4, 178, 275, 279
guilloche pattern 257, 260

H

Halos 267
hydriaphoros 303
Hydrophoros ix, 302–303
hypostyle viii, 248, 251–252

I

ideological 281, 309
  ideological appropriation 309
imbrex 209
immaterial, immaterial resources 2, 5, 230, 233, 241–246, 351
immersion v, 58, 64–65, 122
immigrant (artisans/craftsmen) 244
impression 25, 113, 204, 251, 331, 346, 349–350
Ischegaon 266–267, 276
itinerant (artisans/craftsmen) 5, 212, 260, 278

K

karstic 231, 319
kiln v, vi, viii, 3, 47, 52, 69, 72–74, 76, 83–86, 88, 90–91, 93–94, 104, 202–203, 214, 218–220, 222, 224, 226–227, 233–234, 236–237, 241, 245, 323
knowledge 1–2, 4–6, 9, 14, 22, 27, 54, 81, 164–165, 175–176, 184, 200, 205, 211, 213, 230–231, 233, 235–238, 241–246, 259, 277, 279–281, 287, 306, 328, 331–332, 334, 336, 340–342, 344–346, 348–351
  knowledge layers 235
  knowledge transfer 230, 233, 235, 242

indigenous knowledge 231
traditional ecological knowledge 230–231, 235
knowledgescape 230–247

L

labour ix, 68, 83, 85, 110, 114, 118, 120, 133, 141, 163–164, 168, 172, 181, 197, 261, 275–277, 281–282, 287, 291, 298, 337, 348
organisation of labour 281
labourmen 261, 275–276, 285
landscape 105, 243, 261–262, 265–266, 275, 278, 298, 309
architectural landscape 261, 266, 275
lapis siphnius 269
law, legislation 40, 43, 45, 50, 52, 54, 217, 298, 303, 307, 310, 316–317
lewis 249
lime v, vi, 58, 61–62, 68, 83–85, 92–94, 103–104, 311–313, 317, 323
lime kilns 92, 103, 311–312
lime production 84
limestone vi, vii, 6, 92–95, 97–98, 100–101, 114, 138, 145–146, 149–152, 155, 161, 171, 178, 189, 256–257, 262, 265, 276–277, 285, 320
literacy 230, 244–245
locus 262
logistics 4–5, 275, 281–282, 303
lyre, Elgin lyre iii, ix, 6, 92, 326–329, 331–342, 344–346, 350, 352–353

M

manpower 4, 261, 266, 275–276, 278–280, 293
marble ii, iv, vi, vii, 3–6, 10, 26, 68, 84, 92, 101, 104, 106, 109, 112–115, 118–119, 122, 133, 142–143, 145, 153, 163–173, 218, 226, 248–249, 252–254, 257, 262–266, 270, 272–273, 275–276, 285, 288, 291, 298, 303, 308–319, 323–324, 338
Docimium 166
Luna 142, 166
Parian 68, 116, 166, 257, 266
Pentelic 248–249, 254, 265, 276, 303
Proconnesian 318
Sivec 167
masonry 60, 128, 220, 258, 263–264, 266–267, 272–273, 285, 288, 313, 334
irregular 156–157, 160, 178, 258, 285–286, 288
opus vittatum mixtum 93
trapezoidal 72, 74, 258, 285, 288
memory 135, 144, 235, 261–262, 297, 306–307, 348
collective memory 261–262
lieu de mémoire 307
mnemonic 297, 303
social memory 235
merge, merging crews 261–262
metal v, ix, 7, 9, 12, 24–26, 28–29, 33, 35, 37–38, 60, 68–69, 71–72, 77–78, 84, 90, 118, 125, 146, 166, 170–171, 203, 244–245, 277–278, 311, 317–318, 321
metallurgy 26, 42
metalworker 277
metic(s) 39, 41, 302
mobility 4, 46, 230, 233, 238, 241, 244, 246, 261, 266, 275, 279
model iv, 9, 13–15, 23, 35–36, 38–40, 65, 68, 98, 172, 181, 197–198, 201, 245, 250, 259, 282, 293, 297, 328, 335, 340–341, 346, 349–350, 352–353
montage 277, 279
mortise, mortise-and-tenon vii, 94, 205–207, 209, 256
mould iv, 5, 9, 11, 13–14, 16–30, 32–40, 52, 90, 106, 201–208, 210, 219
mounting 20, 277
music 164, 327, 336, 338
musical instruments 326, 338, 342, 345, 350

N

naiskoi 253, 298
naopoioi 250, 275
nuisance i, 3, 42–43, 45–47, 49–52, 54, 261, 277–278

O

offering 165, 193, 198–199, 204–205, 213, 268, 281, 339
oolitic 146, 265
open-air, outdoor ii, vii, 2–5, 17, 69, 72, 96–98, 121, 125, 127, 130, 132–136, 141, 146, 148–150, 152, 157, 161, 203, 220, 247, 267, 269, 276, 280, 286, 317–318

P

paint(ing) vii, 6, 92, 164–171, 173, 226–227, 300, 329
paradigm 250
patron 143–144, 169, 172, 252, 256
Peloponnesian War 39, 46, 218, 258
Penteli, Pentelicon vi, 110, 113, 115, 118–120, 288
peri-urban/suburban 2, 42–43, 46, 48, 50, 52, 54, 231, 233, 244, 246, 256
Persian invasion, Persian Wars 216, 249, 252, 278, 298, 304
pick 81, 112–114, 133, 152, 318
light pick 112–113
pigment(s) 6, 50, 166, 171
pinakes 212, 298
plaque(s) 258, 326
plaster(ing) iv, vi, 10, 38, 66, 103, 105, 172, 283, 312, 326, 331–332, 341
plastic (creation, decoration) v, vii, 72–73, 116, 185–188, 195, 199–200, 205, 209, 211–212, 237
point vii, 4, 10, 23, 25–27, 29–30, 32–33, 37–38, 41, 52, 88, 113–114, 116, 130, 137, 139, 142–143, 163, 165, 167, 169, 171–172, 194, 200, 212, 250, 256, 265, 272, 283–287, 291, 293, 310, 312–313, 318, 327–328, 330–332, 334–340, 342, 345–346, 348–351, 353

polis, poleis vii, 42–43, 45–46, 50, 52–54, 70, 72, 78, 128, 200–204, 207–212, 244, 275, 304, 306, 317
politics, political 2, 5, 39–40, 43, 45, 54, 110, 134, 180, 216, 244, 248, 251, 253–254, 261–262, 267, 269, 278–279, 309
polychrome, polychromy ii, 6, 163–167, 170–173
poros (stone) 249, 265–267, 273, 275–276, 298
  marly poros 265
portrait vii, 6, 166–167, 170, 172, 258, 264
potter v, 30, 85–86, 88–89, 91, 182, 201, 203, 219, 229, 238, 244
pottery 2–3, 5, 11, 21–22, 39, 42, 51, 60–61, 65, 68–69, 79–80, 84–89, 91, 175, 184, 197, 199, 214–215, 218–222, 226–233, 235–239, 241–246
  impressed/stamped 60–61, 63–64, 72–73, 189, 194–196, 199, 229, 238–239, 241, 245–246, 249
  strigilated 238–239, 241
  vacuolated 237–239, 241
  with plastic decoration 195
pottery production 2, 5, 69, 80, 84–87, 214–215, 219, 222, 230–231, 233, 238, 241–242, 244–246
prytaneia 250
punch 313
Pylaea 268–269, 273
Pythian Games 265, 275

Q

quarry, quarries 3–4, 7, 86, 92, 95–100, 108–114, 116–122, 124–125, 127–136, 138–156, 159–162, 165–166, 169, 172, 214, 217, 262, 272, 275–278, 285–288, 291–293, 307, 310–311, 318, 324
  quarrying channel(s) 313–314
  quarrymen 3, 99, 110, 113, 120–122, 135, 141, 143, 146, 152–153, 161, 261, 282, 285, 293

R

recycling 5, 296–297, 309–310, 317, 319
regional identities 200–213, 262
relief 3, 60–61, 93–94, 109, 118, 135–143, 181, 183, 189–190, 194–195, 205, 257, 263, 273, 298–306, 316, 339
  funerary, grave 299, 302–303, 305, 381
  votive 301, 303
remodelling 72, 77, 169, 251, 265–266, 269, 278
replica 327, 333, 337, 341
research history 298, 337
resources 5, 115, 117, 123, 133, 196, 199, 230–231, 233, 241–244, 246, 281, 287, 290, 294, 311, 325, 332
restoration ix, 101, 169, 263, 265–267, 284
retting 64–65
reuse, re-use ii, 5, 62, 65–66, 122, 189, 267, 295–311, 314, 317, 319–320, 323–324
ritual v, 2, 6, 86, 90, 200, 203, 213, 226, 238, 241, 262, 265, 267, 297, 304, 307
riverine 231, 236

S

Samian Ware 90
sanctuary, sanctuaries v, viii, ix, 2, 4–5, 13, 20, 43, 48, 50–52, 66, 71, 77, 106, 110, 113–114, 119–122, 128, 141, 169, 201–204, 206–208, 210, 228, 235, 245, 248–251, 253, 256, 260–269, 271–273, 275–278, 286, 293, 298–300, 302–304, 306, 308, 311, 313, 317–319, 337
scaffold(ing) ii, 261, 277–278
setting 1–2, 4–5, 7, 26, 54, 68, 98, 142, 170, 215, 251, 262, 265–266, 323
shipwreck 318–319
  Mahdia shipwreck 127
  Majorca shipwreck 127
site-plan(ning) 3, 269
sketch(ing) iv, vi, 18, 110, 148
smith(ing) 309, 338
  metalsmith 121–122
smoothing 112, 116, 118, 120–121, 204, 209
social anthropology 231
socio-natural network 230–246
space, spatial i, ii, v, 2–5, 8, 14, 17, 19, 42–43, 46–48, 50, 52, 54, 69, 70, 77, 79, 84, 87, 99, 101, 103, 106, 110, 121, 125, 163–165, 168–173, 178, 181, 184, 196, 198–199, 201–203, 212, 215, 218, 224, 231, 233, 236, 241–242, 246, 261–262, 265–267, 272, 275, 282, 296–297, 302, 306, 310, 314, 318, 323, 334–336, 339
specialised, specialisation i, 1–6, 52, 55, 63, 65–66, 68, 72, 77, 88, 90–91, 109–110, 124, 163, 166, 169–170, 172, 175, 181, 200–201, 203, 215, 228–229, 235, 244, 260–261, 263, 266, 275, 277, 279, 281, 305–306, 313, 324, 350
specification 57, 197
spolia, spoliation ii–iii, ix, 5–6, 107, 128, 295, 298, 308–311, 313, 315–321, 323–325
steatite 269
stone(s) v, vi, vii, viii, ix, 2–3, 6, 20, 26, 39–40, 55, 57, 62, 71, 77–78, 80–81, 84, 95–100, 103–104, 109–110, 112, 114, 118, 120–122, 124–125, 127–132, 134, 145–146, 150, 165–166, 168, 170, 173, 178, 189, 196, 216, 218, 220, 234, 236, 248–249, 256–257, 263, 265, 272–273, 276, 282, 285–294, 298–300, 302–308, 310–319, 323–324, 328, 345
  stone masons(s) 40, 110, 120, 306
  stone resources 311
stratigraphy 258, 269
stuccoing 272

T

Tabula Peutingeriana 232
Tanning 42, 47, 50, 65, 81
Tax, Taxation 52, 54, 275
template 32, 250
tenon vii, 205, 207, 209, 256

theory of science 326, 328
titanolithos 265
tool iii, 27, 63, 113, 130, 133, 152, 191, 204, 308, 310, 313, 315–316, 330, 334–335, 337, 348–350, 352–353
tortoise 285, 326, 328–329, 331, 333, 336–337, 340–342, 346
torus 257, 259
traction 276–277
transportation 1, 4, 29, 99, 109–110, 121, 142, 181, 217–218, 220, 241, 269, 272, 276, 278, 285–286, 290, 292, 294, 306, 338
treasury, treasuries viii, 114, 249, 263–269, 272–273, 275, 277
triskeles 258

U

unfinished vi, ix, 2, 4, 109–110, 112–122, 129, 172, 266, 272, 276, 279, 305
urban i, 2–4, 8, 12, 42–43, 45–52, 54, 77–79, 81, 91–92, 99, 154, 156, 161–162, 201, 204, 210, 231, 233, 235, 237, 241, 243–245, 278, 286, 293, 298, 310–311, 313, 317, 319, 323
  urban elite 310

V

vista 262, 266
votive v, 6, 13, 77–78, 121, 135, 142, 201–202, 210, 218, 226, 232, 261–263, 265, 267, 269, 275, 278–279, 301, 303

W

wagon 218, 276
waste 12, 15, 25–28, 30, 36, 43, 45, 50, 54, 71, 77, 84–85, 97, 101, 120–121, 153, 203, 221, 310
  waste management 310
wedge(s) vi, ix, 129–130, 133, 146, 286–287, 318
workforce ii, 3–4, 32, 68, 247, 254, 261, 266, 275, 278, 281–282, 294
workshop(s) i, ii, iv, v, viii, 2–4, 6–7, 9–41, 47–48, 50, 52, 55, 57, 60, 63, 65, 68–69, 71–73, 76–77, 90, 121–122, 124, 134, 163–166, 168–173, 175, 180–181, 184, 190, 196, 199–201, 209, 212, 214–215, 219–222, 224, 228–229, 233, 235–237, 241–246, 249, 255–260, 272, 275, 278, 297, 305–306, 309–311, 317, 323, 330–332, 334–335
worksite(s), working site(s) 2, 5, 27, 43, 250, 261, 263, 266, 272, 275–276, 280, 287, 304

LOCORUM

Asia Minor

Aizanoi 317
Alabanda 133
Anazarbos 323–324
Aphrodisias 6, 163–164, 166, 169–173, 310, 323
Bithynia 142
Caria 134, 169
Cilicia 308, 319–323
Claros 308, 311, 316–319, 324, ix
Clazomenae 2
Corycian Cave (Clifftop Temple-Church) 308, 319–322, 324
Ephesus 43, 46, 169, 317, 319
Göktepe 166–167, 169
Gordion 341
Halicarnassus 113, 169
Harpyies piller (Xanthos) 256
Heraclea at Latmus / Heraclea Latmia (ad Latmum) 133, 311
Heroon of Pericles (Limyra) 255, 258, 260
Hierapolis (Phrygia) 3, 263, 267, 277, 310, 324
Inscribed Pillar (Xanthos) 256–257
Ionia 248
Kalabaktepe, temple of Athena 2
Labraunda 308, 311–316, 318–319, 324, ix
Lagina 316
Limyra 255, 258–260, viii
Lycia 5, 255–258, 260
Lydia 277
Miletus 2, 70, 114, 116, 119, 275, 280, 293, 316
Mylasa 133, 265, 311, 313
Myndos 133
Nereid monument (Xanthos) 255, 257–260
Pergamum, Pergamenes 263, 275–276
Phrygia 3, 263
Priene 46, 275
Sagalassos 310, 317
Sömek, Silifke 136
Xanthos 5, 255–259

Balkans

Brač island (Croatia) 142
Cernavoda, Dobrudja (Romania) 142
Hajdučka Vodenica (Serbia) 143
Novae (Bulgaria) 142
Sirmium (modern Sremska Mitrovica) 142
Upper Moesia 143

Black Sea Region

Borysthenes 70, 72, 77–78
Histria 72
Olbia Pontica i, 2, 69–70
southern temenos (Olbia Pontica) 70–71

Central Europe

Bavay 79–80, 88–90, 95, 99–100, 106
Bourlon 89
Britannia 91
Brohltal (Germany) 143
Cambrai 80, 88, 99
Colijnsplaat 100
Douchy 95–100
Dyle river 80
Famars i, 4, 79–81, 84, 87–90, 92–93, 95–96, 99–100, 106–107
Fanum Martis i, 4, 79–80, 83, 91–94, 102–103, 106
Gaul (Gallia Belgica, modern France, Belgium, Netherlands), Gauls i, 3–4, 79, 83–84, 88–92, 101, 107, 143, 262
Heure river 80
La Rhonelle (Famars) 93, 101, 103, 106
Lezoux 90
Mont Houy 80, 86
Norroy-lès-Pont-à-Mousson 143
Nouvelles 106
Noyon 89
'pea garden' (Famars) 101
Petit-Enghien 89
Pont-sur-Sambre 88–90
Rhine river 88, 90–91
Rhonelle river 101
Scheldt river 80, 90, 96, 100
Selle river 96–97
Technopôle (Famars) 84–86, 88–90, 93–94
Tongres/Tongeren 81, 90, 100
Tournai 80, 84
Wörth (Germany) 143

Cyprus

Cyprus 62, 65–66
Idalion 65
Nymphaeum of Kafizin 65

Greece

Aegean Islands

Agathonisi 4, 133, 280, 283–284, 286
Agia Eirene 128, 130–131
Amorgos 64
Apollonas 110, 112, 114, 116–118, 121–122
Argos 45, 48, 52–53, 124–125, 127–130, 132–134, 201, 248, 251–254, 262–263, 275, 341
Avlaki 128–129, 131–132
Avlemonas 110, 121–122, 130
Cnidus 275
Cos 124–125, 127, 130, 132–134, 299
Cyclades 3, 60, 64, 68, 112, 249, 253, 265, 276
Delos 43, 45–46, 50, 68, 125, 133, 248–251, 253–254, 264, 267, 277, viii

Dodecanese 3–4, 124–125, 127–132, 134, 301–302
Emporio 128
Eretria 48, 50, 113
Euboea 110, 119, 122, 143
Gyali 125, 127
Halasarna (modern Kardamaina) 124–125, 127, 132–134, 299, 301, vi
Kamiros 301
Karaviotis 129, 132
Karystos 110, 119, 122, 143
Kastraki 280, 282–288, 291–294
Kefalos peninsula 125, 133
Kimolos 62, 134
Koukounaries 119
Kythera 110, 121–122, 130
Lefkos Cape 132
Lindos 130, 136
Loutra 127
Mandraki 128, 134
Marmari 110, 119
Melanes 110, 112–114, 116, 118–122
Melos 61, 134
Naxos, Naxian(s) 48, 109–110, 112–120, 122, 237, 249
Nikia 127–128, 131, 134
Nisyros 3, 124–128, 131–134
Pacheia 131, 133–134
Palaiokastro 128, 131
Paloi 127
Paros, Parian(s) 2, 45, 68, 116, 119, 121–122, 135, 166, 248–249, 257, 266
Pergoussa 131, 133–134
Pharangi 116–117
Phlerio 116–117
Polyaigos 134
Rhodes, Rhodian(s) 14, 20, 40, 48–49, 52, 130, 132, 136, 255–256, 265, 277, 298, 301
Samos 40, 62, 113, 119, 255
Siphnos, Siphnian(s) 114, 263–265, 267–269
Styra 110, 119
Telos 124, 133
Tenos 3
Thasos, Thasian(s) 5, 43, 45–46, 116, 118, 135–136, 139–140, 142, 144, 153, 203, 248, 252–254, 265, 277, 279
Trapezina 129, 132
Xobourgo 3

Epirus, Ionian Islands, Macedon, Thrace

Corfu 48, 190, 201, 264
Figaretto 201
Kassope 48, 52
Macedon 60, 68, 301
Mon Repos 201
Nestos river 301
Olynthus 43, 46–47, 51
Philippi 136, 139
Strymon river 301
Thermes (Xanthi) 136, 143
Xanthi 136, 143

Mainland Greece, Peloponnese

Acarnania 136, 179, 183–184, 190, 194
Aetolia, Aetolians 4, 175, 179–180, 183–184, 190, 194, 197, 272, 278
Agia Barbara 269–271
Aigion 56
Alyzia 136
Amalias avenue (Athens) 2, 9, 11–14, 16–18, 20–28, 30–38, 40
Anagyrous 250
Anaploga (Corinth) 66
Ano Petralona (Athens) 4, 214–221, 223–229
Aphidnae 250
Arcadia 251, 262, 278
Archontochori 136
Argolid 194
Argos 45, 48, 52–53, 124–125, 127–130, 132–134, 201, 248, 251–254, 262–263, 275, 341
Asopos 110, 122, 138–142
Athens 2, 4, 9, 11–12, 17–19, 22, 24–39, 41–43, 46–48, 50–52, 54, 114–115, 122, 124–125, 127, 134–135, 138–139, 214–229, 248–251, 253–258, 260, 270, 279, 298–303, 307, 316, 326, 338–339, 351
Attica 46, 60, 68, 123, 190, 194, 220, 226, 248–249, 256–257, 260, 303, 317
Bassae 251, 257
Boeotians 275
Castalia (fountain, Delphi) 102, 275
Copais 141
Corinth, Corinthian, Corinthian(s) I, 3, 39, 42–43, 48, 50, 55–56, 65–66, 68, 101–102, 130, 135–137, 140–141, 143–144, 201, 204–206, 218, 255, 267, 272, 275- 276, 313
Corinthian Gulf 3, 68, 276
Cynosarges (Athens) 50
Delos, Delian League 43, 45–46, 50, 68, 125, 133, 248–251, 253–254, 256, 264, 267, 277
Delphi 4, 52, 54, 114, 248, 251, 261–270, 272, 275–279, 319, 344
Dyme 2-3
Eleusis 226, 251, 262, 338
Eleutherae 293
Elis 3, 64–65
Epidaurus 6, 272, 276–277
Erechtheum 33, 249, 257–260, 266, 338, viii
Eridanos 12–13, 51, 299, iv
Gytheion 137–138, 140–142
Helike i, 3, 55–66, 68
Hephaesteum (Athens) 12, 17, 34, iv
Heraeum (Argos) 248, 251–252
Hymettus 51, 110, 122
Ilissos 50, 135, 249, 257, 306

Isthmia (Hexamilion) 57, 62, 66, 277–278, 311
Isthmus 50, 136–137, 139–143
Kalapodi 278–279
Kastri (Archontochori) 136
Kerameikos 2, 12–13, 19, 47, 50, 220, 226, 299–304, 306–307
Kerynites 57
Khostiai 66
Kirrha 269, 271, 275–277
Krissa 269
Laconia 110, 130, 135–140, 144
Larissa (Argos) 251
Laurium 52
Lebadea 265
Lechaion 276
Lycabettus 12
Megaris 68
Messenia 68, 181, 194
Molykreion 272–273
Mycenae 50, 57, 66, 196
Naupaktos, Naupaktian(s) 184, 190, 265
Olympia 1, 12, 20–21, 29–30, 263, 272
Pancrateion (Athens) 50
Parthenon 6, 43, 249, 257, 263, 276
Patras 2–3, 5, 316
Peloponnese 60, 65, 68, 137, 180, 190, 194, 204, 251, 257, 265, 276
Perachora 134
Phocis 194, 264–265, 272, 276, 279
Piraeus 45–46, 50, 114, 130, 216–218, 297, 338
Plataea 265
Pleistos river/valley 269
Prosilion (Gytheion) 136, 138–139
Prosymna 251
Rachi (Isthmus) 50, 62, 66
Sacred Gate (Kerameikos, Athens) 12–13, 299, 307, ix
Saronic Gulf 60, 68, 194
Selinous river 56–57
Selinus 2, 46, 48, 237
Sicyon 68, 276
Smenos river 137
Sparta 114, 253, 339, 351
Stamna 4, 175–176, 178, 180–185, 188–190, 192–199
Sunium 249
Syntagma Square (Athens) 9, 12, 19, 39
Tanagra 60, 253
Tegea 278
Temple of Athena Nike (Acropolis, Athens) 249, 257, 259
Thebes 190
Thespiae 250
Thessalians 270
Thyia / Thyiae 269–270, 275, 278
Vari Cave 135
Vatheia Mouzi 138–139, 141–142, vi
Vouraikos river 56

Italian Peninsula, Sicily

Apennines 5, 230–234, 236–238, 241, 243–244, 246
Apulia 3
Arno river 231
Campania 203, 210
Carrara 92, 104, 106, 142, 166
Como 269
Croton 203, 205, 207, 212, 275
Cumae 203
Epipolai (Syracuse) 293
Etruria / Etruscans 230–231, 244–245
Felsina (Bologna) 233, 238, 241, 243–244
Forcello di Bagnolo San Vito 233, 235–237, 241, 245
Francavilla Marittima 208
Halaesa 50
Incoronata 203–204
Italy 7, 50, 68, 101, 165–166, 169, 203, 211, 232, 269, 297, 303, 307
Ligurian 232
Locri 48, 201, 205–206, 211, 213, 344
Luna (modern Carrara) 142, 166
Magna Graecia 4, 68, 200–203, 212, 237
Marzabotto 233–237, 239, 241, 243–245
Messina 212
Metapontum 11, 202–213
Murlo 14–17, 20, 23
Ostia 39, 317
Pithecusae 203
Pompeii 10, 50, 170–171, 334–335, iv
Poseidonia 203–205, 210–213
Reno river 244
Rhegium 203
Rome 50, 84, 142–144, 166, 171–172, 303, 309–311, 318, vii
Saepinum (modern Travestere) 50
Selinus 2, 46, 48, 237
Siris 203, 212
Sybaris 45, 68, 202–204, 208–210, 212, viii
Tarentum 200–201, 203–204, 209–213, vii
Tivoli 169
Tyrrhenian 146, 231, 244
Umbria, Umbrian 232
Venice, Venetic/Venetian 232, 303

Near East and Levant

Bīsotūn /Behistun, Iran 136
Doura-Europos 293
Sidon 257, 260

North Africa

Alexandria 45, 54, 285, 323
Bou Gaba 155, 157, 161
Bulla Regia 156, 158–162
Carthage 156, 157–158, 160–162, 318

Chemtou 146, 152
Dougga 152, 156, 158–162
Egypt 45–46, 60, 62, 64, 68, 165, 277, 323
Elfahs 146, 148–149, 153
Gigthi 156–157, 159, 161–162
Guebellat 149
Hill of Byrsa 157
Hmaïma es Sghira 155, 161
Jebel Ben Klab 149, 151–152, 160–162, vii
Jebel Ouahchi 146
Jebel Oust 145, 146, 148–150, 152, 160–162
Jebel Rouas 148, 151–152, 160–162
Jebel Saïkha 152–153, 155–156, 159, 161–162
Mahdia 127, 146
Matmata 152, 155
Medenine 146, 152, 159, 161
Meninx 156–157, 159, 161–162
Merbah Grouz 155, 161
Monastir 146
Oudhna 156, 158, 160–162
Oxyrhynchus 323
Sejnane 146
Simitthus 7, 153
Thuburbo Maius 148, 156, 158–162
Tunisia 145–168
Zaghouan 146, 153
Ziqua 156, 157–158, 160–162

PERSONARUM

Historical

Agathon 270, 300
Akidon 275
Alcamenes 9, 33, 39
Alcmaeonids 248, 266, 299
Alexander the Great 65, 256, 306
Anytos 50
Apollonius 201
Archedamos 135
Benedetto da Montevarchi 164
Benvenuto Cellini 164
Caligula 143
Calliteles 277
Caracalla 142, 319
Claudius 143
Cleon 50
Cypselus 267, 277
Daochus 270, 278
Dexileos (stele of) 257, 302
Dionysius 201
Domitian 143
Elyanas 257
Eprios Agatheinos 315
Erbinna 256–257, 259–260
Euainetos 278
Euterpidas 272
Euthydemos 299
Exekias 1
Georg Wilhelm Friedrich Hegel 165
Geta 142
Hecatomnid 133, 311–312, 314
Herodotus 57, 70, 218, 248, 250, 265, 269
Hippias 201
Homer 175, 218, 251, 269, 342
Idrieus (Hecatomnids) 312, 314
Kheriga (Gergis) or Kherei 256
Kleudamos 277
Korallion 300–301
Krito 301–302
Kuprlli 256
Leonardo Da Vinci 10, 164
Licinius 142
Majorian 310
Nericcus 89
Nero 135, 141, 143
Nicodamos 276
Onesagoras 65
Pantaleon 201
Passion 276
Pausanias 12, 64, 217, 269, 303
Peisistratus 51, 250, 253, 256
Pericles 254–255, 258–260
Phidias 1, 20–21, 48, 265, 272, 277
Philoxenus 201
Pliny 57, 127, 145, 232, 265, 269
Plutarch 217, 232, 276–277
Polycletus 9–10, 40
Praxiteles 303
Scopas 1
Septimius Severus 142, 167
Sosicles 40
Strabo 46, 124, 133, 263
Stratocles (stele of) 258
Telecles 40
Theodorus 40
Thrasyboulos 39
Thucydides 39–41, 46–47, 216, 218, 250, 253–254, 306
Tiberius 143
Timarista 301–302
Trajan 143
Valerius Valerianus 142
Vespasian 143
Zenon 65

Divine/Mythical

Amymone 102
Apollo i, 45, 70, 84, 92–95, 101–102, 104, 106–107, 110, 113, 121, 135, 233–237, 239, 245, 248, 250–251, 254, 263–269, 271, 275–277, 279, 293, 299, 308, 317–319, 324
Ares 136, 317
Asclepius 135, 272

Athena 2, 11, 34, 38–39, 48, 70, 136, 248–249, 252–254, 256–257, 259, 263, 272, 275, 277–279
Attis 106–107, vi
Caelestis 156, 162
Cernunnos 90
Charon 302, 306, ix
Cybele 106, 135, 226, vi
Daphne 94, 102
Ephialtes 121
Gorgon 202
Heracles / Heracles i, 3, 50, 78, 110, 135–144, 265
Hermes 273, 332–333, 336, 341–342, 346
Hygeia 136
Iris (statue of) 257, 324
Liber Pater 142
maenad 101–103
Mars 92, 107
Marsyas 92, 94, 104, 107
Mercury 90, 106–107
Midas 104
Mithras 6, 136, 143
Nehalennia 100
nymph 102
Otos 121
Pan 107, 135, 138
Poseidon 66, 102, 128, 218, 278
‘Thracian rider’ / *heros equitans* 301

Ergasteria offers insights into aspects of creation, manufacture and processing in antiquity, viewing craftsmen and artists in their socio-cultural and geopolitical setting. New finds from Greece, North Africa, the Black Sea, Italy and Central Europe provide a trigger for discussion. Bronze foundries for life-size statues were the birthplace of proportions and harmony which imbued the perception of beauty, but could also be a source of nuisance. The mastery of modelling in any material evolved from coping with constraints in the course of manufacture, and craftsmen invented ways of overcoming obstacles. Polyvalent ateliers suggest the artisans' adaptability, in addition to their specialisation. An investigation of the first step in the process, namely the extraction of material, reveals that quarries were manned with a specialised workforce (stonecutters, sculptors) who carved the marble volumes to an advanced stage, prior to their refinement. Meticulous preparation was also crucial in the field of logistics, particularly in large-scale public works, such as temples or fortifications. Interaction of artists with architects and the workforce in general can be primarily observed in sanctuaries, which became open-air workshops of stonemasons, carpenters etc. Accordingly, part of the book is devoted to construction-sites, the mobility of craftspeople who propelled the diffusion of knowledge, and the range of practices employed in individual settings thereby allowing us to grasp both the diversity of artistic expression and the composite population that it may reflect. The mountainous, littoral, urban or suburban space in which manufacturing took place is also taken into account, along with the socio-historical context, which had an impact upon artisans, as politics and military coalitions could instigate or disrupt a creative process. Cases of adaptive reuse are evaluated from the viewpoint of aesthetics, ergonomics, managerial issues concerning spolia, and the technical skills required. The book benefits from the intersection of the contributors' perspectives, mirroring the multifaceted nature of the topic.

Elena C. Partida is a Research Archaeologist at the Hellenic Ministry of Culture. She leads interdisciplinary studies on the architecture and sculpture of the Graeco-Roman world with emphasis on ancient Greek sanctuaries, the archaeology of Delphi, Achaea and Paros. Author of museum and open-air exhibitions, she is a member of the Campana Reliefs Network, co-director of the architectural investigation of the Temple of Zeus at Lebadea, and co-editor of the collective volume *Listening to the Stones* (Archaeopress 2019).

Constanze Graml is currently a Lecturer on Classical Archaeology at the universities of Regensburg and Gießen, Germany. Her research interests centre on ancient Greek religion, sacred landscapes and digital archaeology, and she is currently conducting a study on the rock-cut reliefs of Philippi, ancient Macedon. She is a member of the Trochoeides Network on the study of the archaeology of pre-Classical Athens and co-editor of the associated conference proceedings *Rethinking Athens before the Persian Wars* (2019).

Universität Regensburg

Archaeopress Archaeology
www.archaeopress.com