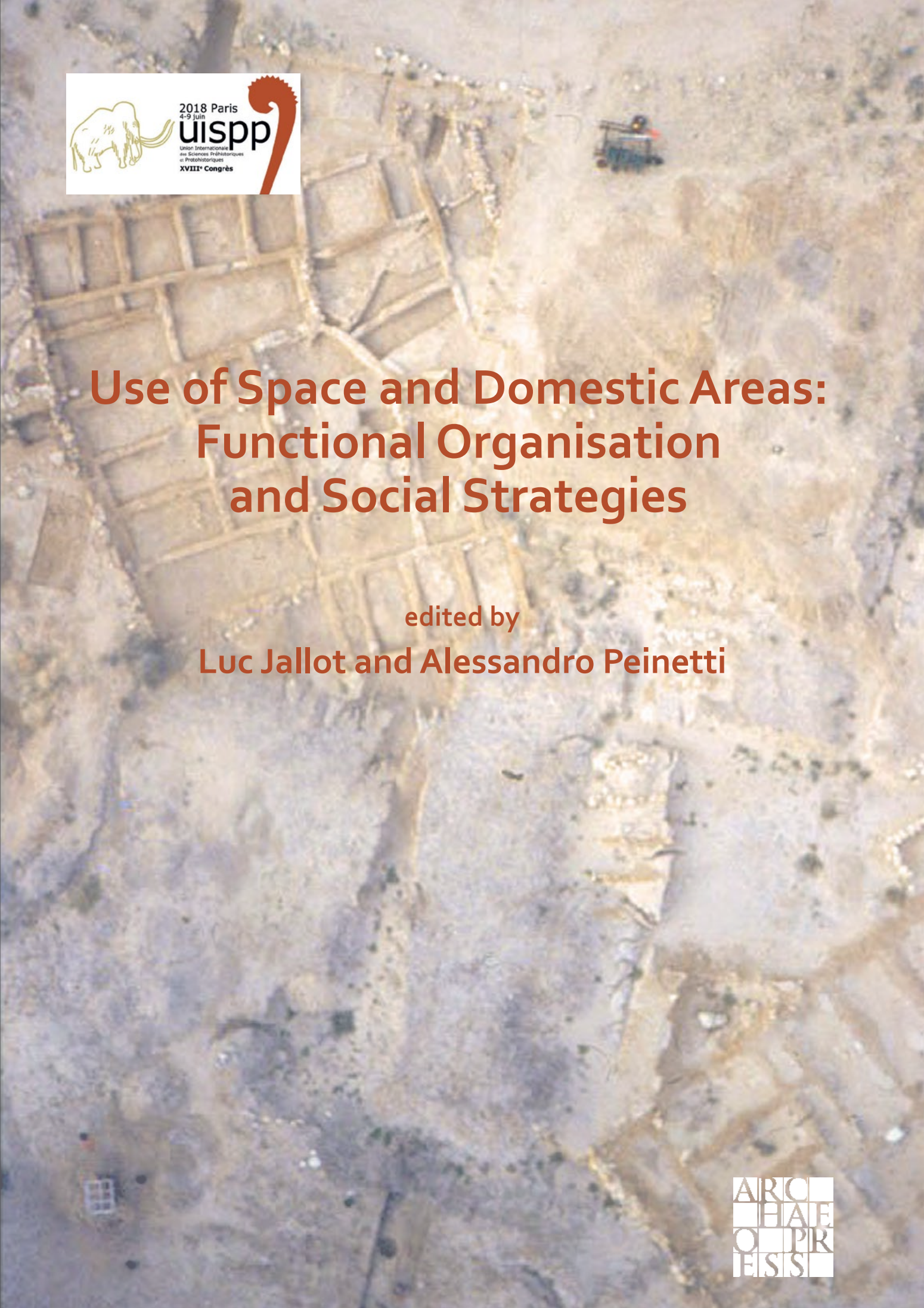

Use of Space and Domestic Areas: Functional Organisation and Social Strategies

edited by
Luc Jallot and Alessandro Peinetti

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Use of Space and Domestic Areas: Functional Organisation and Social Strategies

Proceedings of the XVIII UISPP World Congress
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Foreword to the XVIII UISPP Congress Proceedings

UISPP has a long history, originating in 1865 in the International Congress of Prehistoric Anthropology and Archaeology (CIAAP). This organisation ran until 1931 when UISPP was founded in Bern. In 1955, UISPP became a member of the International Council of Philosophy and Human Sciences, a non-governmental organisation within UNESCO.

UISPP has a structure of more than thirty scientific commissions which form a very representative network of worldwide specialists in prehistory and protohistory. The commissions cover all archaeological specialisms: historiography; archaeological methods and theory; material culture by period (Palaeolithic, Neolithic, Bronze Age, Iron Age) and by continents (Europe, Asia, Africa, Pacific, America); palaeoenvironment and palaeoclimatology; archaeology in specific environments (mountain, desert, steppe, tropical); archaeometry; art and culture; technology and economy; biological anthropology; funerary archaeology; archaeology and society.

The UISPP XVIII World Congress of 2018 was hosted in Paris by the University Paris 1 Panthéon-Sorbonne with the strong support of all French institutions related to archaeology. It featured 122 sessions, and over 1800 papers were delivered by scientists from almost 60 countries and from all continents.

The proceedings published in this series, but also in issues of specialised scientific journals, will remain as the most important legacy of the congress.

L'UISPP a une longue histoire, à partir de 1865, avec le Congrès International d'Anthropologie et d'Archéologie Préhistorique (C.I.A.A.P.), jusqu'en 1931, date de la Fondation à Berne de l'UISPP. En 1955, l'UISPP est devenu membre du Conseil International de philosophie et de Sciences humaines, associée à l'UNESCO. L'UISPP repose sur plus de trente commissions scientifiques qui représentent un réseau représentatif des spécialistes mondiaux de la préhistoire et de la protohistoire, couvrant toutes les spécialités de l'archéologie : historiographie, théorie et méthodes de l'archéologie ; Culture matérielle par période (Paléolithique, néolithique, âge du bronze, âge du fer) et par continents (Europe, Asie, Afrique, Pacifique, Amérique), paléoenvironnement et paléoclimatologie ; Archéologie dans des environnements spécifiques (montagne, désert, steppes, zone tropicale), archéométrie ; Art et culture ; Technologie et économie ; anthropologie biologique ; archéologie funéraire ; archéologie et sociétés.

Le XVIII° Congrès mondial de l'UISPP en 2018, accueilli à Paris en France par l'université Paris 1 Panthéon-Sorbonne et avec le soutien de toutes les institutions françaises liées à l'archéologie, comportait 122 sessions, plus de 1800 communications de scientifiques venus de près de 60 pays et de tous les continents.

Les actes du congrès, édités par l'UISPP comme dans des numéros spéciaux de revues scientifiques spécialisées, constitueront un des résultats les plus importants du Congrès.

Marta Azarello
Secretary-General /
Secrétaire général UISPP

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Lieux de vie et espaces domestiques : organisations fonctionnelles et stratégies sociales / Use of space and domestic areas: functional organisation and social strategies

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La sélection et la hiérarchisation des documents archéologiques livrés par la fouille de structures en creux, de bâtiments ou de sols d'occupation, appartenant à des installations de plein air, de grottes ou d'abris permettent de dessiner une image de l'organisation de l'espace domestique et de la manière dont sont distribuées les activités. Cette reconstitution implique également d'identifier les modes de subsistance, les chaînes opératoires employées tant dans la production d'objets que dans la construction. Elle s'appuie par conséquent sur une réflexion interdisciplinaire, croisant les données des approches de l'archéologie et celles de l'archéologie environnementale. Elle ouvre ainsi la porte à la compréhension des stratégies sociales et économiques des sociétés pré-protohistoriques et sur leur évolution.

L'ancrage au sol de la société, retranscrit ainsi par la structuration de l'espace habité et par la culture matérielle, selon la répartition des activités, offre ainsi la possibilité d'appréhender l'organisation même des communautés comme le rôle de ses acteurs. Son étude touche à des problématiques diverses comme celles liées aux techniques d'exploitation et de consommation des ressources, aux systèmes de production et d'échanges, ou encore à celles liées à la spécialisation et à la répartition du travail. Elle interroge également le rapport entre l'homme et son milieu. La manière d'habiter et de gérer le territoire ne doit plus être considérée comme une simple réponse aux contraintes environnementales, mais plutôt comme le résultat d'une interaction entre traditions culturelles, structures socio-économiques, climat et composantes du paysage. Cette dynamique donne lieu à des réponses multiples. L'organisation villageoise en est ainsi l'expression. Des tendances et des régularités dans les modes d'aménager et d'utiliser l'espace ne sont pas seulement le reflet de contingences matérielles, mais elles expriment également la structuration symbolique et idéologique de la pensée.

Il n'en demeure pas moins que la documentation archéologique, sous toutes ses formes, est, par nature, imparfaitement conservée. L'image « palethnographique » offerte par la fouille peut être biaisée, à la fois par les processus post-dépositionnels que par les choix inhérents aux contraintes des opérations de recherche de terrain. C'est donc la question de la représentativité des vestiges qui est en jeu dans l'interprétation et qui a été en partie dépassée, sans pour autant être résolue, par les démarches interdisciplinaires mises en place ces 25 dernières années.

Les différentes contributions de ce volume illustrent ainsi l'avancée des recherches interdisciplinaires, aussi bien sur le plan méthodologique, que sur celui de la compréhension de la fonction des espaces et de leur organisation, à différentes échelles, de la maison au village voire au territoire.

De plus, les cas d'étude présentés sont issus de contextes environnementaux et culturels variés, ce qui permet d'explorer la diversité des solutions adoptées par les sociétés du Néolithique et de l'âge du Bronze pour aménager l'espace domestique et le village. La question de la division du travail, de la spécialisation des espaces et de la complexification de l'organisation sociale est également abordée.

Le premier article de L. Czerniak réexamine certaines conceptions courantes concernant l'architecture néolithique des maisons LBK. La reconstitution architecturale de ces grands édifices se base en effet sur les seules structures négatives, notamment celles qui matérialisent leurs systèmes d'ancrage au sol, car les sols d'occupation sont mal conservés. En s'appuyant sur des exemples polonais, l'auteur suggère l'existence de mezzanines et d'étages qui pouvaient occuper la totalité de la surface des maisons et pas uniquement leur partie antérieure, comme dans le modèle « classique » proposé pour ces bâtiments. Cette hypothèse peut amener à la révision des estimations démographiques si ces parties en élévation avaient une fonction d'habitation et non seulement de stockage. Un deuxième point traité est le possible rôle symbolique plutôt que structurel de certains poteaux de grande taille plantés au sein de ces habitations.

La contribution de N. Degasperi, G. Steffé et G. Tasca présente les principaux résultats de la fouille de l'habitat, parfaitement conservé, de Lugo di Romagna (Italie). Il s'agit d'un des sites-clés pour comprendre la manière dont l'espace était structuré au Néolithique ancien en Italie septentrionale, région où ces sites sont non seulement peu nombreux, mais également difficiles à interpréter en termes d'organisation spatiale. L'analyse des architectures de Lugo di Romagna et de la répartition de différentes catégories de mobiliers permet de visualiser un espace déjà fortement structuré et ancré sur le territoire. L'étude porte notamment sur un bâtiment incendié, mais elle montre aussi l'existence d'aires d'activités extérieures et celle d'un système de palissades et de fossés, reconstruit à plusieurs reprises.

Dans son article, T. Percan s'intéresse à la question de la représentativité des vestiges dans le cadre de l'interprétation du site de Sv. Križ (Istrie, Croatie). Les contraintes imposées par la réalisation de fouilles préventives n'a permis d'explorer que de petites surfaces. L'auteur met en avant deux problèmes auxquels l'archéologue est confronté. Le premier est celui de la précision et fiabilité des datations des niveaux d'occupation fournies par le mobilier archéologique, sur cet site d'habitat qui atteste d'une longue occupation au cours de l'Âge du Bronze. Il souligne que, malgré le nombre de sites dans la région, les sériations chrono-typologiques demandent à être affinées. Le deuxième problème réside dans la difficulté de proposer une interprétation fonctionnelle des espaces sur la base des vestiges architecturales et de la culture matérielle sans disposer d'une vision spatiale large, mais seulement de petites surfaces de fouille.

La question des difficultés d'interprétation des sites palafittiques est développée dans l'article de M. Baioni, C. Mangani, F. Bona, N. Martinelli, C. Nicosia, R. Perego, T. Quirino et E. Saletta. Les auteurs s'appuient sur la présentation des travaux menés sur le site de l'âge du Bronze de Lucone di Polpenazze (Italie). Pour un tel type de site, la répartition des activités domestiques et des activités de production, ainsi que la fonction des structures d'habitat et leur réelle extension, sont particulièrement difficiles à identifier de manière précise. En effet, l'archéologue ne dispose souvent que des résidus d'activités en position secondaire et d'un palimpseste complexe de poteaux qui ont servi de fondations aux habitations. Pour affiner les reconstitutions, les auteurs ont mis en place un projet interdisciplinaire qui a permis de caractériser l'évolution des structures d'habitat au cours du temps ainsi que les différentes opérations de réfection du bâti. Les activités domestiques, le système de production et les modalités d'exploitation du territoire proche sont ainsi perçues à travers une étude fine des processus de formation de la stratigraphie en contexte d'habitat et l'analyse des résidus d'activité.

La problématique du rapport entre l'homme et son environnement et des changements au cours du temps des modes d'occupation et des modalités d'implantation des édifices sur un même site est abordée dans l'article de F. Gonzato, C. Mangani, N. Martinelli et C. Nicosia. Les travaux d'archéologie préventive conduits à Oppeano (Italie) ont mis en évidence les traces de plusieurs occupations dispersées sur le territoire, datées entre le Bronze ancien et le Bronze moyen. Des traces d'occupations répétées, séparées par une sédimentation naturelle, ont été mises en évidence sur un de ces sites. Chaque phase est marquée par la présence d'édifices sur pilotis ou de bâtiments construits directement sur le sol. Les auteurs suggèrent que la durée limitée des occupations et les changements dans les modes de construction peuvent être liés à l'évolution du paysage, aux conditions pédologiques locales et aux choix de ces communautés de s'implanter dans des contextes humides.

L'article de S. Fábián et A. Rajna porte sur l'un des problèmes les plus difficiles en termes de reconnaissance de la structuration spatiale de l'habitat : celui des sites qui présentent seulement des concentrations de fosses sans que les sols d'occupation soient préservés. L'étude comparée de deux sites énéolithiques de la plaine hongroise a mis d'abord en évidence des regroupements de fosses qui pouvaient, en terme fonctionnel, appartenir à une unique unité d'habitation ou unité familiale. Ces fosses peuvent être destinées tant aux activités de stockage ou de combustion mais aussi avoir servi de dépotoirs. L'étude de la répartition du mobilier a ainsi permis d'identifier les activités menées au sein des maisonnées, ce qui a conduit les auteurs à s'interroger sur une éventuelle spécialisation des ces dernières pour certaines taches et à définir le statut de certains espaces à vocation collective.

Les modalités de changement de l'organisation économique et sociale au cours du temps sont appréhendées dans l'article de V. Azzarà. Elle analyse la répartition des activités et la structuration de l'espace bâti de deux sites du Bronze ancien de la Péninsule arabique, au Sultanat d'Oman. L'étude diachronique des techniques et de la syntaxe architecturale, ainsi que l'analyse des activités menées dans les différentes espaces qui composent les deux habitats, amènent à d'intéressantes observations sur les relations entretenues entre les différentes unités familiales et leur évolution. Elle met également en évidence une graduelle mais partielle spécialisation des taches au sein des différentes maisonnées. Ces phénomènes sont accompagnés par une complexification de l'espace habité en termes d'agencement des espaces.

Le dernier article de G. Recchia, E. Lucci, G. Fiorentino, C. Lemorini, C. Minniti, V. Mironti et G. Siracusano porte sur l'analyse spatiale d'une série d'espaces datés du Bronze récent du site de Coppa Nevigata (Italie). Ils mettent en exergue la difficulté d'interpréter des espaces occupés sur la longue durée et sur la nécessité de considérer les processus de sédimentation et les évidences archéologiques comme des objets dynamiques. La caractérisation qualitative et fonctionnelle, ainsi que la quantification et l'étude de la répartition spatiale des différentes vestiges et résidus d'activités (mobilier céramique, lithique, métallique, faunes, restes carpologiques et anthracologiques, etc.), ont donc permis d'évaluer le potentiel informatif de ces vestiges, pour ensuite tenter de reconnaitre l'organisation des différentes activités au sein de l'espace. Le statut particulier de cet espace, par rapport aux connaissances acquises sur d'autres parties du site, est ainsi discuté.

Chacune des contributions témoigne de la diversité des problématiques attachées à la question des lieux de vie des communautés du Néolithique et de l'âge du Bronze. Elles montrent aussi les différentes stratégies de recherche mises en œuvre pour y répondre, qui relèvent aussi des différentes sensibilités des chercheurs et des écoles de recherche autour d'un même sujet. Ce volume est destiné à présenter la multiplicité de ces regards. Nous espérons que sa publication ajoutera une pièce à la réflexion archéologique autour de l'organisation de l'habitat et de sa variabilité dans le temps et l'espace, avec toutes les implications sur l'interprétation des dynamiques sociétales passées qu'elles comportent.

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The selection and the organisation of archaeological data issued from the excavation of negative structures, buildings or occupation surfaces in open-air sites, caves and rock shelters allow the reconstruction of settlement patterns, intra-site use of space and activity areas. This reconstruction involves the identification of the subsistence strategies and the *chaînes opératoires* employed in the production of objects and the shaping of built space as well. This kind of research leans on an interdisciplinary work, crossing data from different archaeological and environmental archaeological approaches. It opens new perspectives for the understanding of the social and economical strategies of prehistoric societies and their evolution.

The organization of the inhabited space and the material culture are the direct expression of the deep integration of societies to their cultural and natural environment. According to the distribution and the patterning of activities, the organization of human communities and the role of their actors could be brought to light. This analysis involves various issues such as those related to the exploitation and resource consumption techniques, the specialization and the division of labor, the social organisation and inequalities, the relationship between the human and the environment. The way of inhabiting and managing the territory at different scales should no longer be seen as a mere response to environmental constraints, but rather as the result of an interaction between cultural traditions, socio-economic structures, environment and landscape components. This dynamic gives rise to multiple responses. The settlement organization is, among others, the expression of these complex dynamics. Tendencies and regularities in ways of build and using the space don't only reflect material contingencies, but they are also expression of the symbolic and ideological structures of thought.

Nevertheless, the archaeological data is, by its own nature, imperfectly preserved. The 'palethnographic' image offered by the excavations can be biased, both by post-depositional processes and by the choices inherent to the constraints of the field researches. The question of the representativeness of the archaeological data is central in the interpretation processes and has been partially overcome, without being solved, by the interdisciplinary approaches carried out in the last decades.

The various contributions of this volume show the progress of the interdisciplinary research, both methodologically and in terms of understanding of the use of space on different scales, from the household to the village or even to the territory. The case studies presented here come from different environmental and cultural contexts, which make it possible to investigate the modes of organization and the perception of the inhabited space and to explore the diversity of the solutions adopted through time and space. Questions about the division of labor, the specialization of spaces and the complexification of the social organization are also addressed.

The purpose of the first article by L. Czerniak is to re-examine some of the current ideas regarding the Neolithic architecture of LBK houses. The architectural reconstruction of these large buildings is actually based on the only negative structures, especially postholes, because the occupation surfaces related to these buildings are usually poorly preserved. Based on Polish examples, the author suggests the existence of mezzanines and upper storey that could occupy the entire surface of the houses and not just their anterior part, as in the 'classical' model proposed for these buildings. This hypothesis may lead to the revision of demographic estimates if these upper storeys had a housing function and they were not only used for storage. A second point dealt with the possible symbolic and non-structural role of some large poles standing within these dwellings.

The contribution of N. Degasperi, G. Steffé and G. Tasca presents the main results from the excavation of the perfectly preserved settlement site of Lugo di Romagna (Italy). This is one of the key-contexts for understanding how space was structured in the Early Neolithic in northern Italy,

despite the small number of sites and the difficulties of interpretation of spaces often encountered on the field. The analysis of the built space of Lugo di Romagna and the distribution of different categories of artifacts makes it possible to visualize a strongly structured space, deeply anchored on the territory. The study includes a burned building, but also shows the existence of outdoor activity areas and a system of palisades and ditches rebuilt several times.

T. Percan's presentation of the results of the excavations conducted in Sv. Križ (Istria, Croatia) highlights some issues relating to the representativeness of the evidences in an archaeological site. The constraints imposed by the realization of preventive excavations made it possible to explore only limited areas through the realization of small trenches. A first problem for the archaeologist is the correct dating of archaeological layers by the study of material culture on a site that attests a long occupation during the Bronze Age. In spite of the number of sites in Istria, chrono-typological frameworks need to be refined. The second issue concerns the need to give functional interpretation to spaces based on architectural remains and material culture without having a broad spatial vision, but only small excavation areas.

The difficulties of interpretation of pile-dwelling settlements are developed in the paper by M. Baioni, C. Mangani, F. Bona, N Martinelli, C. Nicosia, R. Perego, T. Quirino and E. Saletta. The authors present the works in progress on the site of the Bronze Age of Lucone di Polpenazze (Italy). For such a site, the distribution of domestic and productive activities, but also the function and the real extension of the different pile-dwellings, are difficult to identify on the field. The archaeological interpretation relies on discarded activity residues and a complex palimpsest of poles serving as foundation for the buildings. The development of an interdisciplinary project on the site allows then the authors to characterize the evolution of the built space and recognize the various building maintenances over time. The domestic activities, the production system and the exploitation strategies of the nearby territory are thus perceived through a detailed intra-site analysis of the formation processes of the stratigraphy and the study of different activity residues.

The relationship between the human occupation and its environment, with changes over time in terms of settling and building strategies within the same site, is discussed by the paper presented by F. Gonzato, C. Mangani, N. Martinelli and C. Nicosia. The preventive archeology work carried out in Oppeano (Italy) has revealed the traces of several occupations scattered on the territory, dating between the Early and the Middle Bronze Age. The traces of repeated occupations, separated by a natural sedimentation, have been found on one of these sites. The different phases of the settlement show the presence of pile-dwellings and buildings constructed directly on the ground. The authors suggest that the short life span of the different overlapping occupations and the changes of building techniques are linked to the evolution of the landscape and soil conditions over time, in a context where human communities decide to establish themselves in a humid environment.

The article by S. Fábián and A. Rajna addresses one of the most difficult problems in terms of identification of spatial settlement patterns: that of sites that only present concentrations of pits without preserved occupation surfaces around them. The study and comparison of two Eneolithic sites of the Hungarian Plain first brought to light groups of pits that could, in functional terms, belong to a single residential unit or household. Several of these pits were used for storage or combustion activities and filled by waste. The study of the occurrences and the distribution of different categories of artifacts made it possible to identify the activities carried out within the households and to wonder about a possible productive specialization of some of these. It is also a question of defining the status of certain areas that may have a collective function.

The dynamics of change of economic and social organization over time are discussed in the article by V. Azzarà, which analyzes the distribution of activities and the organisation of the built space of two Early Bronze Age sites in Oman. The diachronic study of techniques and architectural syntax, as well as the analysis of the activities carried out in the different spaces within the two settlements,

lead to interesting observations concerning the relations between the different residential groups. A gradual but partial specialization of tasks within different households is also highlighted. These phenomena are accompanied by a complexification of the inhabited space in terms of arrangement of spaces.

The last article by G. Recchia, E. Lucci, G. Fiorentino, C. Lemorini, C. Minniti, V. Mironti and G. Siracusano deals with the spatial analysis of a series of spaces of the site of Coppa Nevigata (Italy), dated to the Late Bronze Age. They highlight the difficulty of interpreting spaces permanently occupied over time and the need to consider sedimentation processes and archaeological evidences as dynamic objects. The qualitative and functional characterization, the quantification and the study of the spatial distribution of different artifacts and activity residues are carried out to test informative potential of these materials and to recognize the activity areas and the use of space. The particular status of the area presented in the paper, compared to the knowledge acquired on other parts of the site, is discussed.

Each of the contributions shows the diversity of issues concerning the interpretation of the living spaces of pre-protohistoric communities. They also show the diversity of approaches carried out to answer them, which also fall under the different sensibilities of scholars around the same subject. This volume is intended to present the multiplicity of these looks. We hope that its publication will add a piece to archaeological reflection about the organization of ancient settlements and its variability in time and space, with all the implications for the interpretation of past societal dynamics that they entail.

Acknowledgement

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Luc Jallot and Alessandro Peinetti

The visible and the invisible. A fresh look at LBK longhouse interiors

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Abstract

Over the past 50 years, we have got used to looking at LBK longhouse interiors through the eyes of P.J.R. Modderman and later A. Coudart. However, the internal divisions and interpretations, which they suggest, are difficult to apply to the eastern LBK. An analysis of houses from Lesser Poland illustrates that a different structural design was used in this region, but the division of longhouse interiors adhered to the same concept as that noted throughout the LBK. The new interpretation is based on three fundamental tenets. Firstly, not all posts used in the construction of LBK longhouses served a structural purpose. Secondly, not all major divisions of longhouse interiors are immediately visible in the archaeological record because not all of them required the use of solid structures in the form of earth-fast posts. Thirdly, it cannot be ruled out that LBK longhouses may have had a habitable, full-length upper storey.

Keywords: The Early Neolithic, LBK, longhouses, social structures

Résumé

Au cours des 50 dernières années, nous nous sommes habitués à examiner l'intérieur de la maison rubanée (LBK) à travers les yeux de P.J.R. Modderman et plus tard de A. Coudart. Cependant, les divisions internes et les interprétations qu'ils suggèrent, sont difficiles à appliquer au Rubané (LBK) orientale. Une analyse des maisons de la Petite Pologne montre qu'une conception structurelle différente a été utilisée dans cette région, mais que la division des espaces intérieurs des maisons longues a adhéré au même concept que celui observé dans l'ensemble de la LBK. La nouvelle interprétation repose sur trois principes fondamentaux. Premièrement, les poteaux utilisés dans la construction des maisons-longues de LBK n'ont pas tous servi à des fins structurelles. Deuxièmement, toutes les divisions principales des intérieurs des maisons longues ne sont pas immédiatement visibles dans les archives archéologiques, car elles n'exigeaient pas toutes l'utilisation de structures solides sous la forme de poteaux. Troisièmement, il ne peut être exclu que les maisons longues de LBK aient eu un étage supérieur habitable sur toute la longueur de l'édifice.

Mots-clés : Néolithique ancien, Rubané, LBK, maisons longues, structures sociales

1. Introduction

Over the past half-century, we have become used to looking at LBK longhouse interiors through the eyes of Peter J.R. Modderman (Modderman 1970, 1972, 1986) and Anick Coudart (Coudart 1998, 2015). LBK houses are reconstructed as sturdy structures with large oak posts generally dividing the interior into three parts (or 'modules', or 'sections'). All buildings had a central section (or 'central part'), where the spaces between transversal post rows were slightly larger than in the remaining parts of the buildings. Most houses had a rear section (or a 'north-west part'). This part of the house was often (especially in western LBK) marked by an external wall trench and on the inside was divided off from the centre by two transversal post rows set closer together and forming a '*corridor*'. Some buildings had a front section (or a 'south-east part'), often demarcated internally by a corridor. The south-east area could be characterised by transversal post rows consisting of double posts, or by very closely set transversal post rows, perhaps supporting a raised upper floor for storage (see: Hofmann 2013: 36; also: Stäuble 2005; Rück 2009).

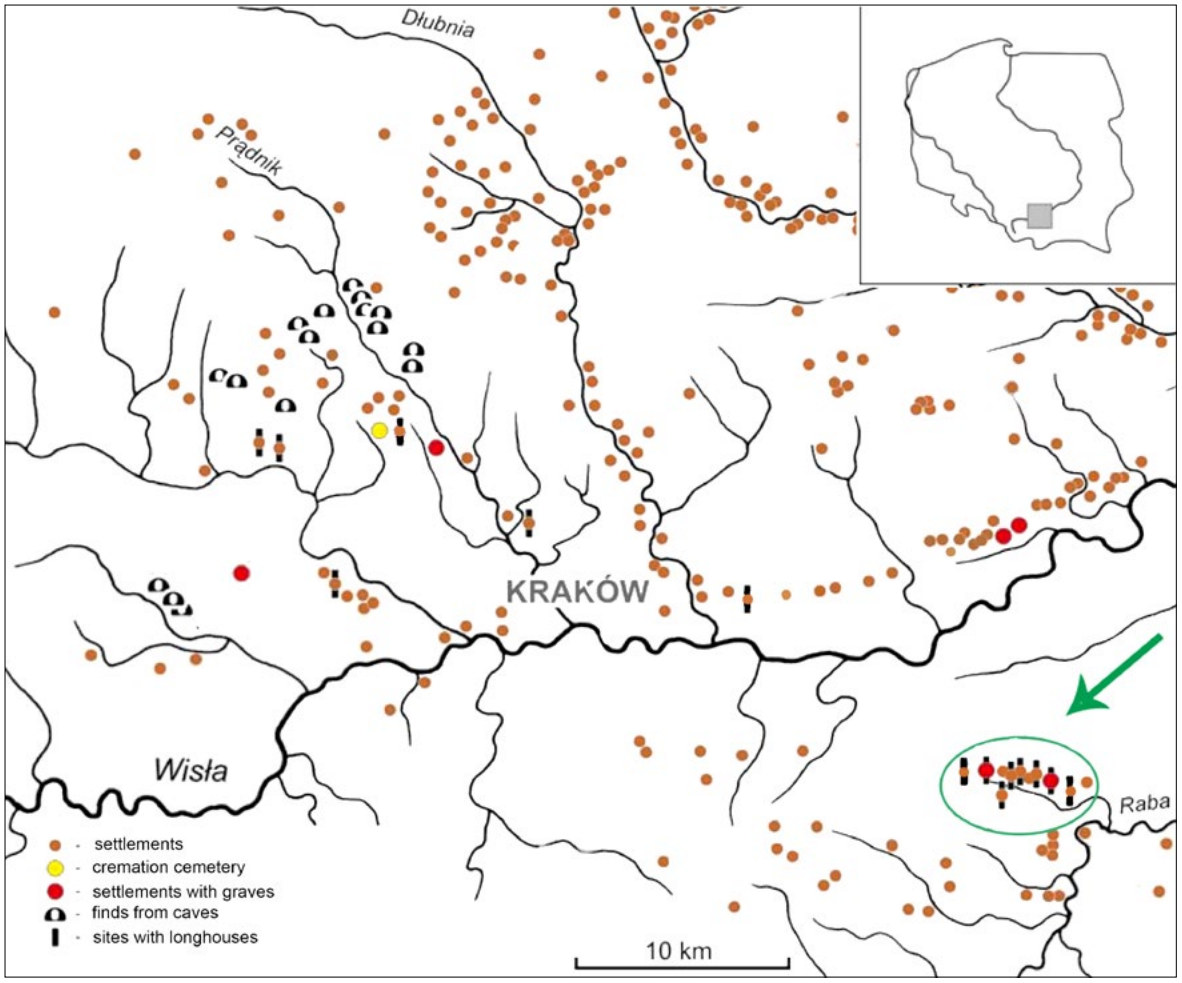

Figure 1. Distribution of the LBK sites in Lesser Poland. Green arrow: sites in Tusznica river valley (e.g.: Brzezie 40; Targowisko 10/11) mentioned in text (after Czekaj-Zastawny 2008 with modifications).

However, descriptions and divisions suggested by them do not match with the LBK in Lesser Poland (Figure 1) where longhouses lack two significant structural features: foundation trenches and 'corridors'. In the last resort, they can be considered insignificant when supported by a famous among the LBK researchers 'diversity in uniformity' formula (Modderman 1988). However, an attempt to critically look at this phenomenon allows for three observations, which make me look for other solutions. Firstly, not all major divisions of longhouse interiors are immediately visible in the archaeological record (e.g.: Stäuble 2013). Secondly, not all posts used in the construction of LBK longhouses served a structural purpose – some had a symbolic meaning. Thirdly, much more attention than before should be paid to the question of whether LBK longhouses may have had a residential, full-length upper storey (Czerniak 2016). Considering the above, quite detailed issues, I will raise three general and significant ones.

The first of them is a question who lived in longhouses? I think that in the case of LBK house reconstruction, the traditional thinking concentrated on structural features should be reversed and priority should be given to arguments resulting from the social analysis. By this, I mean organisation and the size of a group forming a household, length of houses life, who built the house, what customs regulated the inheritance of the house and setting up new households.

Does the second problem concern the interpretation of what was the essence of LBK longhouse diversity (e.g.: Hofmann 2013; Hofmann and Lenneis 2017)? In my opinion, the complexity of

the front section structure and – to a certain degree – also the length of houses determined it. The significance of the front section – because of the highest concentration of posts – is usually interpreted by the presence of a granary in the attic (Modderman 1970: 106-107; Stäuble 2013). However, it is likely that the front section did not have structural significance, but was themain entrance that served to present the heritage and status of the household (Figure 2).

The third problem concerns the general division of the house interior. Interpretation of 'corridors' is of fundamental significance (Coudart 2015). This is the main criterion for the interior division. In the paper, I will prove a thesis that the interiors of all LBK longhouses were divided into two premises. However, at present, this division is not always visible because it was not marked by the 'corridors'. Whereas, the front section did not belong to the interior, but functioned as a main entrance, which took various forms – from a door in single façade wall to multi-row porticos. What is more, I think that there was a residential storey above the whole.

In the present paper, I will deal with the above problems using the example of houses and buildings in LBK villages situated in the vicinity of Kraków (Poland). Until recently, the site in Olszanica was the best-known from this area (Milisauskas 1986). In the years 2003-2007, the Kraków Motorway Archaeology Unit excavated a series of new LBK sites in a broad territory within the framework of rescue excavations, where around 130 longhouses were excavated. A number of particularly interesting observations concern a cluster of seven LBK villages located south of Krakow, in the Tusznica valley (Figure 1: marked by the green arrow), and north of Krakow, at Modlnica 5, (Czerniak 2013; 2016: figs 1, 2).

2. What is and what is not visible?

Things that are visible and invisible are in an important contrast, which allows us to look critically at the suggested reconstructions (see also: Rück 2009; Stäuble 2013). A residential upper storey is hard to spot among traces of LBK structures but it cannot be excluded that such a storey existed. The front part is most associated with the presence of the storey because it seems to be appropriate to sustain the extra weight. However – as in an illusionist's show – it distracts attention from the possible presence of storey in all houses and we are convinced that a small storey was only in these (exceptional) houses which had the front part.

The floors of LBK houses are not preserved (exception one site at Jablines, near Paris? – Hachem 2000); they could be the best recording medium of actual divisions of the house interior. On the other hand, examples from Çatalhöyük testify that only a small part of the divisions left traces in the form of posts and foundations. However, we can observe there more complex functionally and symbolically divisions visible in the form of thresholds, curtains, platforms, plastic decorations and a way of painting or covering the floors with mats with different weave (Hodder 2006; Hodder and Cessford 2004). In case of the LBK such divisions aren't visible but they were probably of a similar nature.

Moreover, only in some regions 'corridors' are visible. However, their absence – as in Lesser Poland – does not have to be proof of another kind of division of the house, but maybe only of another structure of partition wall (Figure 3). What results from the above?

Repetitive patterns created by posts arrangement inside houses can be interpreted as an expression of high intensity of symbolism and rituals presented in construction technology. But, relatively not many results from it in the matter of detailed division of interior and functions of the rooms. Taking into consideration changes in time and regional differences, I am convinced that the LBK longhouses did not differ in terms of the general division of interiors but only in the length and degree of the front section extension. A question of the presence of a residential second storey is

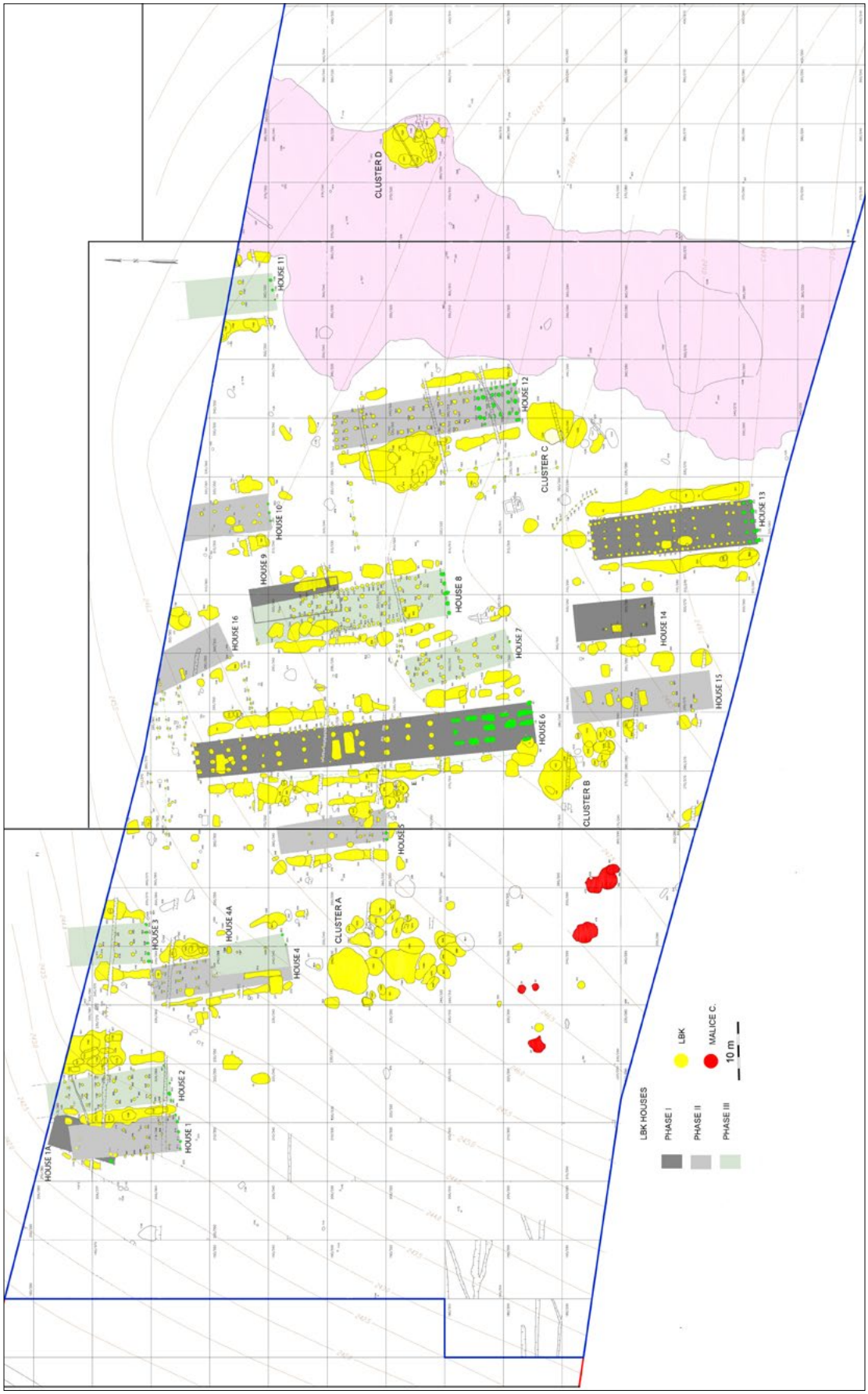

Figure 2. The LBK village at Brzezie, site 40. In green are marked the posts of the front section functioned as a main entrance, which took various forms – from a door in single façade wall to multi-row porticos.

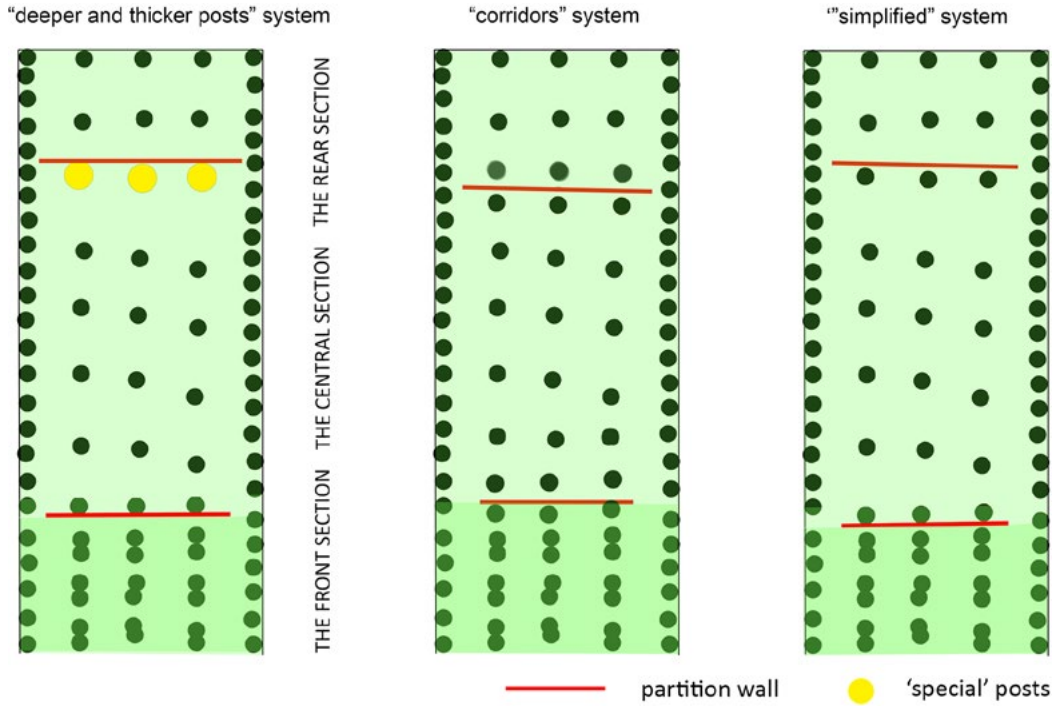

Figure 3. Three separation's system of the rear/central sections (modules) in the LBK houses in Lesser Poland.

the most controversial. However, conclusions from social – rather than architectonic – analyses speak the more in this matter.

3. Who lived in longhouses?

Most popular interpretation assumes that longhouses were built with communal effort of an egalitarian village society (Coudart 2015; Bickle 2013) and were used by small family groups no longer than the life of one generation (Modderman 1970; especially: 'Hofplatzmodell' – e.g. Lüning 2005; see also: Bickle and Whittle 2013). But in this situation, what should be expected is that the spirit of egalitarianism and cooperation would be expressed by houses little differentiated in terms of sizes and interior divisions, the quality of building materials, as well as effort needed to build them. Whereas, the opposite opinion is true. Houses are strongly differentiated and seem to better fit, in this respect, to transegalitarian societies (in the sense given by Hayden 1995). Instead, there are hypotheses that refer to other causes. For example, it is assumed a complex model of the origin of the inhabitants (Pavlů 2013: small houses belonged to groups derived from local societies of hunters – gatherers) or a complex model of cooperation based on different economic profile within the village (Hachem 2000; Gomart *et al.* 2015). In both cases, observations from Cuiry-lès-Chaudardes are cited, indicating a greater consumption of wild animal meat by the dwellers of shorter houses. In my opinion, these facts may also support a different model of organisation, which I am presenting below.

An alternative (transegalitarian) picture can be built referring to DNA evidence and stable isotopes. According to DNA evidence, the LBK societies were formed by mobile colonists who originated from the Middle East (Haak *et al.* 2010; Brandt *et al.* 2013; Hofmann 2015; see also interpretation based on material culture analyses: Jakucs *et al.* 2016). Therefore, we should rethink the social-political organisation of the LBK. The colonisation model requires different demographic, organisational and ideological characteristics than the model of transformations of local hunters – gatherers societies. In short, colonisation needed more demographic potential, and probably also a higher level of intragroup competition or even aggression.

Isotopic analyses show a correlation between the co-occurrence of male graves equipped with stone axes and the permanent occupation of one location, and a diet that was strongly connected with agricultural products than in other cases (Bentley *et al.* 2012; Bickle and Whittle 2013). Therefore, within the LBK villages, households that were privileged in access to the best agricultural areas could function. Moreover, research on plant cultivation shows uneven access to the most valuable agricultural lands and multi-generation use of fields (Bogaard *et al.* 2011).

All in all, what seems to be reasonable is a transegalitarian model of the LBK social organisation in which competition between households for access to the most valuable areas, and also probably for the right of its inheritance, took place. In this model, what seems to be more probable is that the household was considerably larger (with a variety of kinship relations) than a nuclear family.

In Lesser Poland, in villages dated to the classical and late LBK phases, we can see a large variety of LBK houses both in size, structural complexity and solidity of construction (Figure 2). It seems to fit better to the transegalitarian model than to egalitarian one. However, we have to look differently (not only pragmatically) at the functions of the house. The house was a shelter but also – or maybe even primarily – a means of expressing identity, power and economic status of a household. Therefore, when interpreting the structure of the LBK longhouse one must also look for elements that serve to display symbolism. Also, the usage life of the longhouse in this type of social system could definitely be longer than one generation (see Stäble 2005; Rück 2009).

In the above-outlined context, it seems reasonable to consider the social organisation model defined as '*House societies'* by C. Levi-Strauss (1982). This subject in the last two decades has been widely discussed among both anthropologists and archaeologists, including in reference to the LBK (from more important papers: Borić 2008; Carsten and Hugh-Jones 1995; Gillespie 2000; Hodder 2013; Waterson 2013). However, applying this model to the LBK societies is not obvious. As A. González-Ruibal says (2016: 3) '*the existence of social inequalities is for us key in the definition of house societies, because house societies are composed of houses with unequal access to power and capital (economic, social and symbolic').* In my opinion, the results of the isotope research referred to above allow for such an interpretation. Also, monumental longhouses, demonstratively differing in length and solidity of construction, and especially in main entrances, seem almost a perfect manifestation of 'House societies'. Let us try to look at traces of the LBK structures from this perspective.

4. What was the function of the front section?

The front part is given a double meaning. Firstly, here was the main entrance with potentially rich symbolism. Secondly, it was a special structure that stood out with 'exceptional concentration of posts'. The function of this structure was to support a granary located on the storey (Modderman 1970). The first interpretation refers to the research of ethnographers and architects. On this basis, Anick Coudart states: '*the front part of the dwelling (which may include the space outside, immediately in front of the house) is never neutral. It is the transition between the interior and exterior, and signals the household's function, status, and identity*' (Coudart 2015: 314). The other interpretation tries to answer the question: what does '*exceptional concentration of posts*' mean? The concept of a granary above the front part is based on the assumption that the function of this structure results from much larger carrying capacity. It seems logical but another interpretation is also possible. Exceptional concentration of posts could only serve one purpose: to express '*the household's, status, and identity*'. This is especially probable in the case of transegalitarian societies that attached great value to the demonstration of their status. These societies could express the power of the household through the amount of posts exposed in the front section. Oak posts were valuable themselves, which resulted from their durability and the huge amount of work that was needed to obtain them. In the case of their appearance, the posts could have been additionally carved, painted and decorated with trophies or heirlooms testifying the origin, a long and complex history and splendour of the residents ('House'). Houses with the most extensive front part also

have other distinctive features such as large sizes, more solid posts, and a central location within the village (see: Czerniak 2018).

Depending on the status of the house, the main entrance had various forms, from a door in simple façade wall to multi-row porticos (Figure 2 – posts marked in green). Therefore, if the front section has functioned as the main house entrance that this section should be excluded from what is defined as the house interior. The front section wasn't a separate type of room whose presence distinguished only a certain category of houses, but, as a whole, it was an entrance. Each house had an entrance. Differences given to the entrances are a separate subject.

5. Could LBK longhouses have a residential second storey?

If the exceptional concentration of posts in the front section were considered a visual and not a structural phenomenon, then the main obstacle to the hypothesis accepting the presence of a residential second storey over the whole house would be removed.

Only Harald Stäuble openly rejected such a possibility arguing that the stability of the structure was low (Stäuble 2005, 2013). However, it is difficult to consider this to be a decisive opinion of an architectonic expert because the posts could be dug much deeper down than it can currently be observed. Furthermore, the structure and size of LBK posts/structures seem very solid in general when looking at houses from other parts of Europe. Several architectural solutions could be implemented to support an upper storey. What also seems to be significant is the observations of Anatolian and Balkan houses, which probably had a residential second storey, and those structures do not appear to be any more solid (Roodenberg and Alpaslan-Roodenberg 2008; Tripković 2010).

There is also a question of the use of observations that in all LBK houses triple transverse posts were fixed much deeper than posts of external walls. Eva Lenneis thinks that it was necessary to support a very massive roof (Lenneis 1997). But we do not know anything reliable about the weight of the roof structure. And, why were the solid posts unable to support a residential second storey and roof? The weight of the roof structures of the post-LBK houses probably did not change, being supported on a much smaller amount of internal posts, even the load was partly shifted to the side walls.

Of course, the fact that solid posts are present itself does not lead to a conclusion that the house had a residential second storey. Then, why am I stubbornly presenting a hypothesis of the presence of the second storey? It means a vast, additional living space, the probable presence of which would have serious consequences on the estimation of the LBK demographic potential. It would be ideal if the presence of the second storey could be proved on the grounds of an analysis of the structure traces. Unfortunately, even in case of well-preserved houses of the Anatolian Neolithic, proving the presence of the second storey is not obvious (Barański 2017). Therefore, rejection of the above hypothesis only because of a lack of sufficient data is unjustified according to me. What is more, the above way of thinking can be reversed, and conditions concerning the social organisation and the origin of the LBK societies can be used.

I mean, first of all, that societies, for which competition played an important role, should have preferred a large number of household members. Secondly, the large amount of labour that was required to construct the house created a problem which could only be faced by a large group of people. In the competition model, this was a task for a household, and not for a communal one. Additionally, it is worth recalling the occurrence of hamlets composed of single houses in the LBK (e.g. Łoniowa, see Valde-Nowak 2009). Their presence as far from other villages as possible seems to indicate that the inhabitants were able to build their houses without the assistance of other people. Thirdly, traces of repairs and extensions of the houses may indicate a long, multi-generational use, which also supports the conception of a large number of household members.

Fourthly, two storey houses at that time were reported in Anatolia and the Balkans (Roodenberg and Alpaslan-Roodenberg 2008; Tripković 2010). The contribution of Balkan standards in the creation of LBK longhouses is rather disputed (Lenneis 1997; contrary: Czerniak 2016). Undoubtedly, in their unique form and structure longhouses are the work of the early LBK societies from the area of Transdanubia. However, the presence of groups belonging to the Vinča culture among them (Bánffy, E. 2013; Jakucs *et al.* 2016) opens the way to look for house patterns, as at least a social institution, also in the Balkans.

6. House interior divisions. What function did the corridors serve?

'Corridors' are considered to be the main key to the division of the house interior. An additional criterion is the changeable arrangement and intensity of transverse posts occurrence, as well as the presence of foundation trenches around the rear section (Coudart 2015). However, in Lesser Poland, separation of the rear section using these criteria is only possible in reference to about 5% of the investigated houses. On the grounds that I stated before that in Lesser Poland, houses had different internal divisions (Czerniak 2016). The new reflection about this was inspiration for the concept of the present paper. I currently think that such division occurred although it requires a complex justification.

Harald Stäble drew attention to one additional way of marking the boundary between the rear and central section in older houses (Stäble 2005: 165-167; also Coudart 2015; Zastawny and Grabowska 2014). This is a row of three deeply set posts. In Lesser Poland, three times more such cases are registered than using the other criteria together. Also, in this region, a row of three deeply set posts distinguishes older houses. Generally, three observations arise. Firstly, 'the deeper posts' were older equivalents of the 'corridors'. Secondly, in Lesser Poland, the system consisting of a row of three deeply set posts was abandoned at the beginning of the middle phase ('music note'). They were not replaced by a system of 'corridors', as it can be seen in the 'western LBK', but by one row of 'regular' transverse posts ('simplified' system – Figure 3). This can be considered a specific technological innovation, which allowed for the use of fewer posts, probably without any changes done to the internal division, symbolism and structure of the house. Thirdly, the substitution of 'three deeply set posts' for a 'regular transversepost' must have caused that the described boundary disappeared for archaeologists.

Deeper (and thicker) posts not only were more solid, but also looked more solid. They were probably also more valuable. Therefore, it is probable that these posts were not hidden inside the wall dividing two important sections of the house, but they were particularly exposed ('special' posts – Figure 3). It may also be suggested that they would have been more visible to those entering the central section of the house if the partition wall was connected to the posts from the back side.

Visual function combines the presence of the 'three deeply set posts' with a symbolic function (interesting considerations on this subject were presented by Stäble 2005). Perhaps their construction in deeper pits took place in public as a founding act, which started the construction of the house. The use of more imposing posts could have demonstrated the solidity of the structure and symbolically transferred this property to the whole house (interesting examples from Madagascar are quoted by Daniela Hoffman 2013: 40).

The use of internal posts of a 'regular' diameter in later phases removed the 'archaeological trace' of the partition wall, but it did not have to change the actual division of the house interior (as Figure 3 shows). However, it must have been significant in the sphere of symbols associated with the construction of houses, because the change did not concern exceptional houses: biggest, monumental in character and occupying a central location within a village. These were still built according to 'old standards'. This fact indicates that the 'old standards' were remembered, and

abandoning them in the case of other ('ordinary') houses was completely deliberate, exposing differences between houses of special status and ordinary ones (Czerniak 2018).

7. Summary. Differentiation of the houses

The need for a new reconstruction of the LBK longhouse is the most closely related to the occurrence of new data on the origin and socio-political organisation of the LBK. The competition model that I have attempted to outline presents other conditions, especially for the characteristics of a group that lived together in a longhouse. Such a group that created a household was probably multigenerational, more numerous than it was earlier assumed and perhaps more connected by identification with the house than by biological relationships ('house societies'). In this model, the presence of a residential upper storey in longhouses is very probable.

In my opinion, we should abandon the 'canonical' division (typology) of longhouses ('*modular model*') because it does not properly describe the essence of their diversity. All houses consisted (on the ground level) of two rooms and a more or less complex main entrance (the front section). Differences between houses were expressed by length and the number of posts used in the front section which functioned as the main entrance. A separate category was made up by 'exceptional houses' that were distinguished by their length of c. 40 m and the most extended, porticos entrance (see: Hofmann and Lenneis 2017; Czerniak 2018).

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The Early Neolithic household remains of Lugo di Romagna, Fornace Gattelli (North East Italy)

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Abstract

The Early Neolithic site of Lugo di Romagna (Northeastern Italy) has been found during quarry works at about 13 m under the terrain surface. This circumstance allowed the preservation of part of the ancient village soil surfaces and of the complete collapse of a dwelling. This finding was at all exceptional for Northern Italy, where the remains of Early Neolithic soil surfaces are extremely rare and scarcely preserved. During the excavation (1983-2001) a section of the fence structures of the village has been brought to light. They consist of a ditch and, in a first phase, an earth bank, replaced in the following phase by a palisade. The hut, rectangular in shape, measures 10 x 7 m and is divided into two rooms. The perimeter walls have a shallow foundation trench, in which were planted stakes that supported a texture of smaller woods covered with clay daub (wattle and daub technique). On the floor of the house, consisting of a layer of earth, there are the holes for the roof support poles. In the house there were a central hearth and an oven which, together with other accessory structures, constitute a real integrated fire management system. The house was destroyed by a fire. In the excavation the collapse mass of the daub of the walls was recognized, which is only partially permanently sintered, while it is mostly only reddened by heat or not cooked. It is therefore likely that the fire was not intended to transform the daub, but it was an accidental episode or may be a destructive act. The circumstances of preservation of the archaeological context – a house in full operation destroyed by fire and immediately buried by a flood – allowed to see directly a house context of the early Neolithic, thus being able to document – unique case in northern Italy – the functional articulation of the spaces inside and outside the house.

Keywords: Lugo di Romagna, northeastern Italy, Early Neolithic, enclosure structures, architectural remains

Résumè

Le site du Néolithique ancien de Lugo di Romagna (Italie nord orientale) a été découvert dans une carrière d'argile à 13 mètres de profondeur. Cette circonstance a permis la conservation d'une partie des sols d'habitat et des niveaux d'effondrement d'une maison entière. C'est une découverte exceptionnelle pour l'Italie Septentrionale, où les traces de sols d'habitat du Néolithique ancien sont extrêmement rares et partielles. Une partie des structures de l'enceinte du village a été mise au jour. Elles consistent en un fossé et, dans un premier temps, en un mur en terre, remplacé dans la phase suivante par une palissade. La cabane, de forme rectangulaire, mesure 10 x 7 m et est divisée en deux salles. Les murs du périmètre ont une tranchée de fondation peu profonde, dans laquelle étaient calés les poteaux qui supportaient un clayonnage recouvert s de torchis (technique définie wattle and daub). Sur le sol de la maison, constitué d'une couche de terre, se trouvent les trous pour les poteaux de soutien du toit. Il y avait dans la maison un foyer central et un four qui, avec d'autres structures accessoires, constituent un véritable système intégré de gestion du feu dans la maison. La maison a été détruite par un incendie. La masse effondrée du torchis des murs a été reconnue lors de la fouille. La plus grande partie du torchis a été peu ou pas impactée par la chaleur tandis que seul un faible pourcentage de cette masse a été intégralement cuit. L'incendie était donc probablement le résultat d'un épisode accidentel ou d'un acte de destruction et non pas une action délibérément entreprise par les habitants du village.

Les circonstances de préservation du contexte archéologique – une maison en pleine activité complètement détruite par un incendie et immédiatement ensevelie par une inondation – ont permis de caractériser un

contexte domestique du début du Néolithique, permettant ainsi de documenter – un cas unique en Italie du Nord – l'articulation fonctionnelle des espaces à l'intérieur et à l'extérieur de la maison.

Mots-clés : Lugo di Romagna, Italie nordorientale, Néolithique ancien, enceintes, structures d'habitat

The Neolithic site of Lugo di Romagna Fornace Gattelli (province of Ravenna, North Eastern Italy) (Figure 1) was identified in a clay quarry 13 m below the surface and investigated between 1984 and 2001 by the Heritage Service of Emilia Romagna, with the scientific direction of Giuliana Steffè and Patrizia von Eles and the technical direction of Paolo Boscato and Nicola Degasperi (Degasperi, Ferrari, Steffè 1996; Degasperi, Ferrari, Steffè 1998; Steffè, Degasperi eds. 2019). The site is located in the alluvial plain about 17 km from the Apennines, on the border between the Po Valley and the Italian peninsula; today it is 30 km from the coast, while in the Neolithic age it was very close to the edge of the lagoon (Fontana, Correggiari, Juračić 2014).

The settlement belongs to the Fiorano culture (Bernabò Brea, Miari, Steffé 2019), and has a sufficiently homogeneous chronological range between 5320 and 4940 cal BC (2σ). The explored part of the site, almost 1000 square meters, comprised two areas spared from quarry works with exceptionally well-preserved traces of structures pertaining to the fence system and to a house (Figure 2); the good preservation of the remains is due to the rapid succession of a large fire quickly followed by a thick alluvial episode.

The ***fence structures*** have been investigated for a length of about 60 meters; they form a functional system, organized in 2 successive phases.

In the most ancient phase (phase 1: Figure 3) there was a small ditch of the interrupted trenches type (Figure 3, blue), and along its internal edge a small earthen wall. The wall was high just over

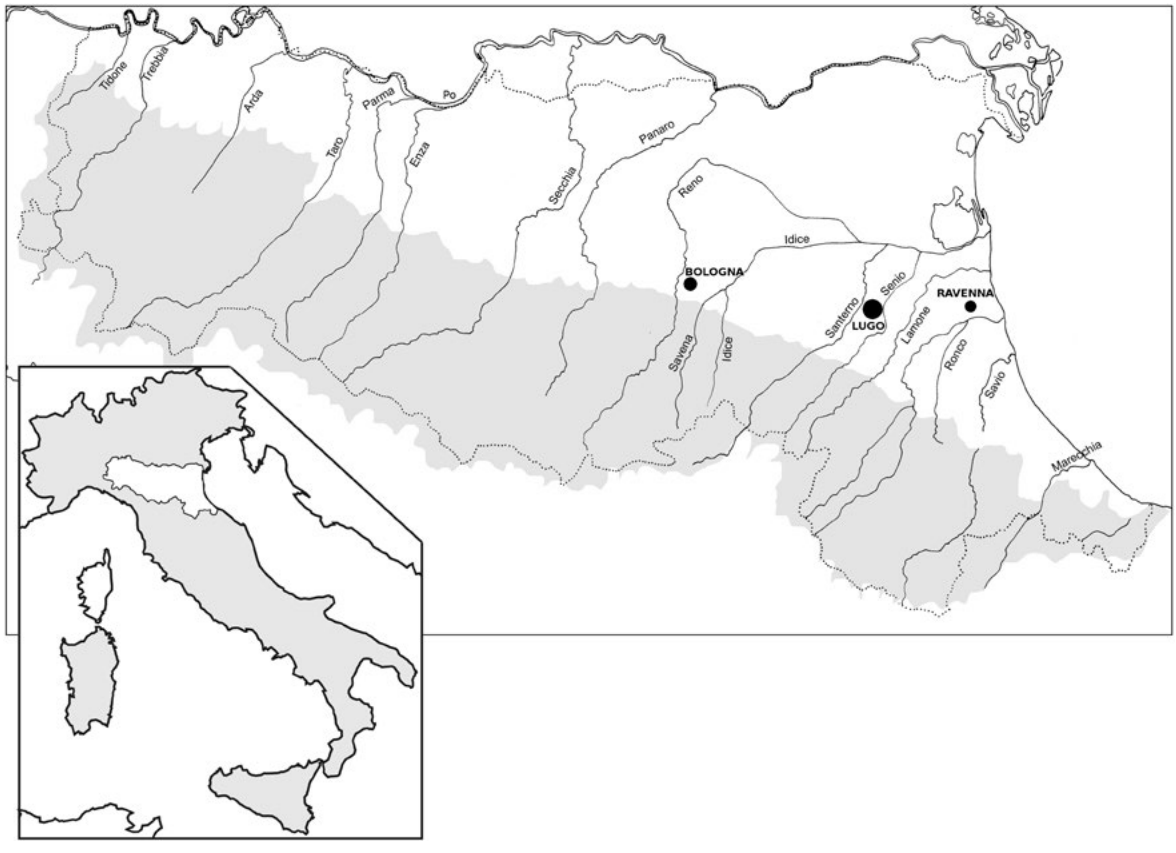

Figure 1. Localization of Lugo di Romagna in Northern Italy.

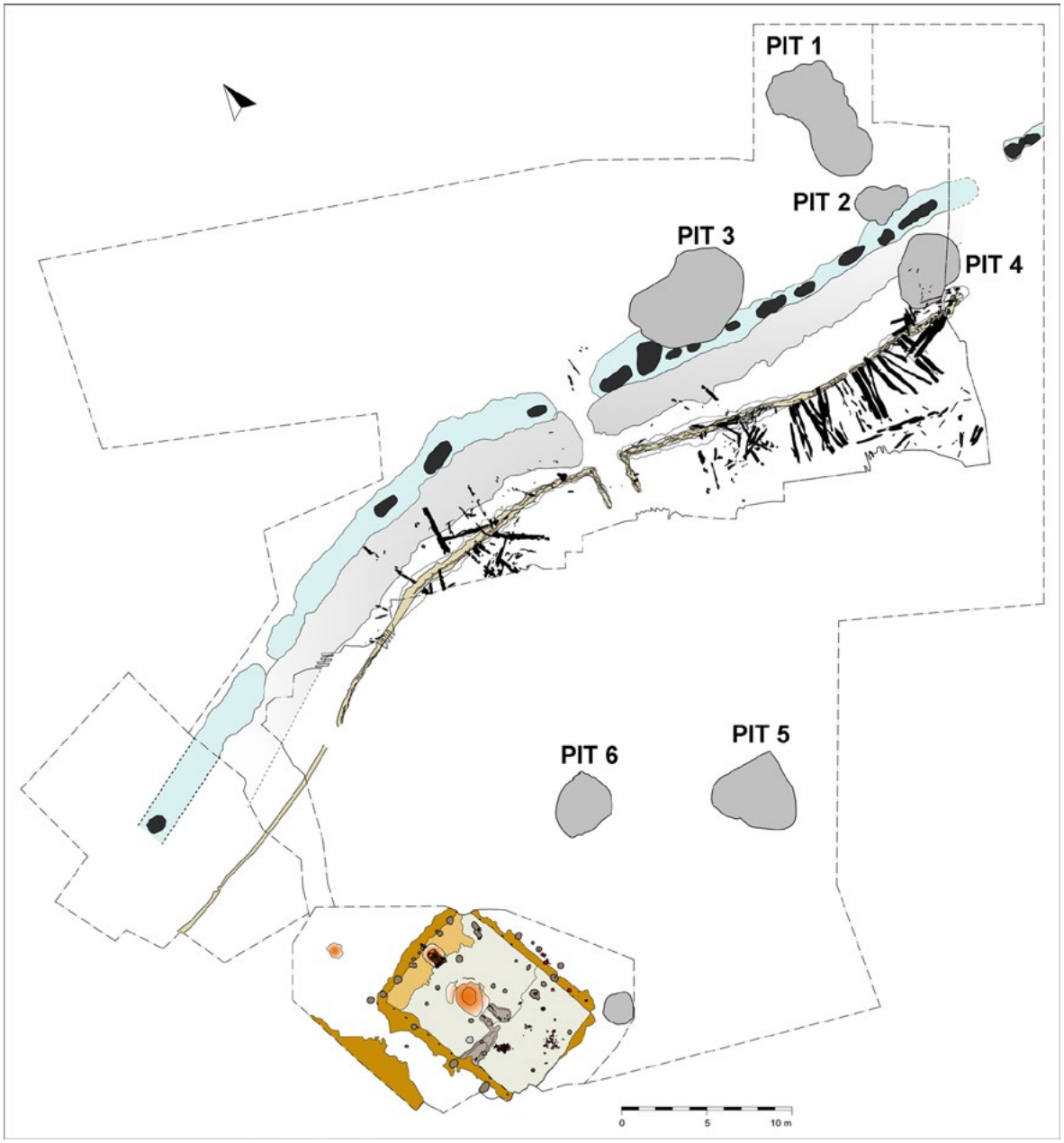

Figure 2. Plan of the excavated area.

1.50 m above the ground, with an interior wooden structure and planked faces (Figure 3, brown). Both features – the ditch and the wall – had a parallel curvilinear course with corresponding openings.

In phase 2 the ditch is still in use (Figure 3, blue), but along its internal edge there is now a great stake fence (Figure 3, red). This new feature has the same course and the same openings as the older wall, which by this phase has collapsed (Figure 4). This reveals the existence of a stabilized net of paths and openings between outside and inside the settlement. The carbonized remains of most of the palisade planks collapsed on the ancient surface have been found, very well recognizable but very poorly preserved. Their length allows to assume that the height of the palisade was about 3 m above the ground, a height that characterizes this phase with an emphasized 'defensive' function (Figure 4).

In the second phase the openings in the enclosures are the same as in the first phase; among them, the most important is opening A (Figure 5), configured in a half-moon shape and particularly

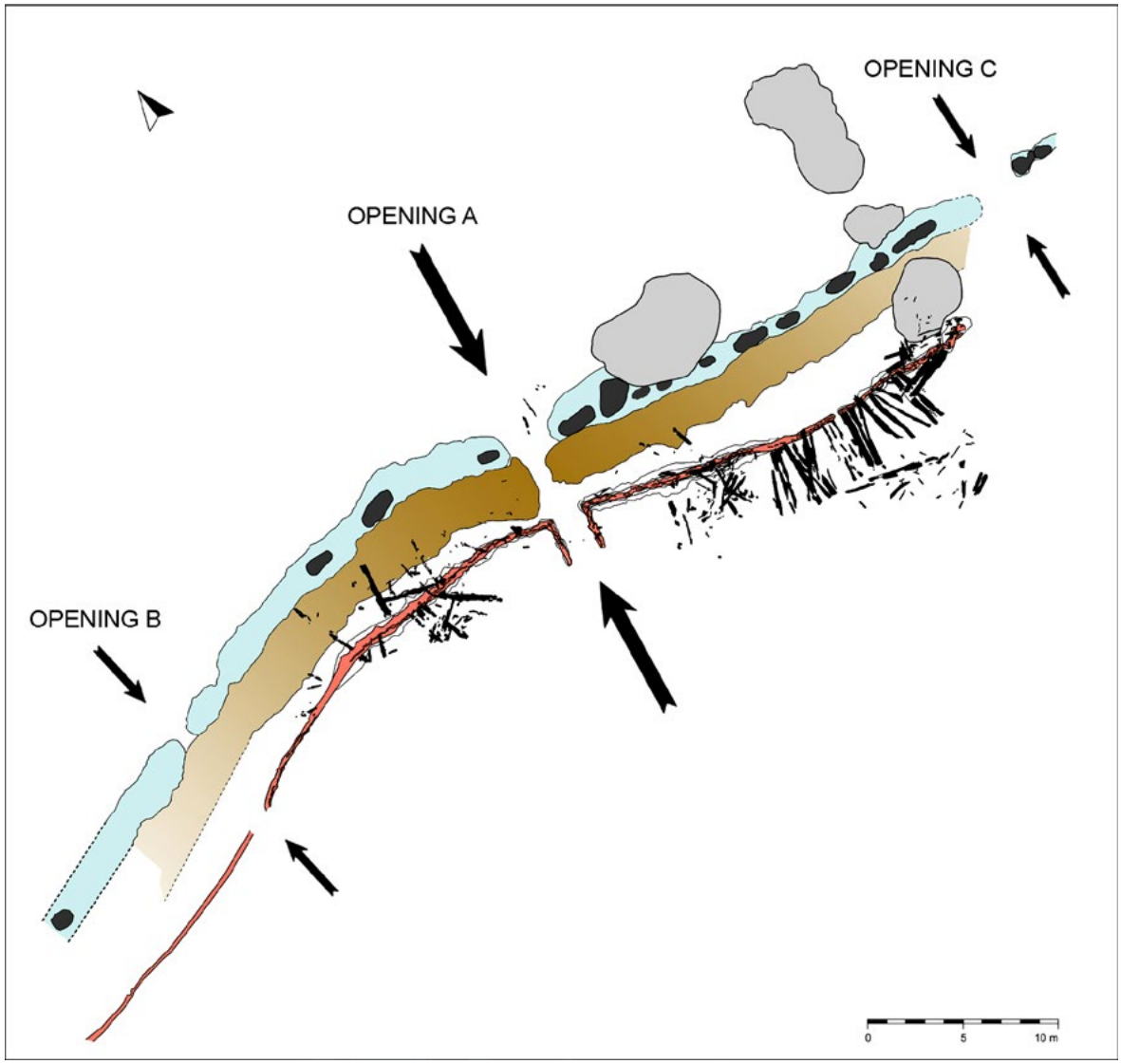

Figure 3. Remains of the fence structures of the village.

well built. The posts used in the second phase of the enclosure consist of oak logs radially split and planted in a narrow foundation trench; they are hardened at the base with fire, to prevent the natural degradation of the wood.

On the basis of the curvature of the explored part of the enclosure features the whole village area is estimated as covering 1.5 to 2-3 hectares.

Four ***large pits*** have been found in the explored area outside the fence (Figure 3, grey). They are interpreted as sediment quarries for building activities (daub for hut floors or

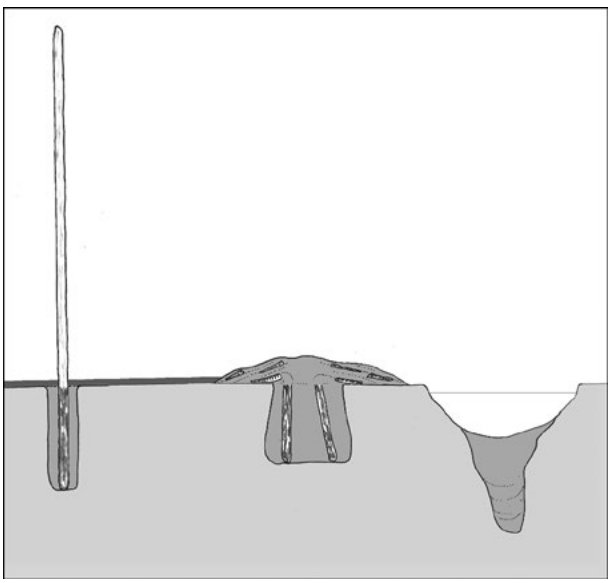

Figure 4. Section through the fence structures of the village.

Figure 5. Fence structures, phase 2: opening A.

walls, clay for hearths or ovens). Their position reveals the inhabitants' care for maintaining the integrity of the village inner space. The volume of soil extracted from these holes is about 13 cubic meters, which corresponds to the estimated total volume of the collapsed daub of the hut (see below).

The ***hut*** lies about 10 m from the fence. It has a rectangular plan (Figure 6), roughly N-S oriented, 10 m long and 7 m wide and traced on the ground with the excavation of a small perimeter trench, about 15 cm deep. The walls were made by a mixed technique of *wattle and daub* and internal facing of vertically placed planks, which recalls the so-called *timber frame*. The detailed analysis of the impressions preserved on the daub fragments provided important data on the support frame, which was made mostly of horizontal elements supported by spaced vertical stakes planted in the foundation trench. The planks of the internal facing, in many cases found carbonized and excellently well preserved (Figure 7), allow to estimate the height of the walls at the end of the sloping roof about 1.50 m. The perimeter walls are independent from the posts sustaining the roof, which are planted with a regular grid scheme in the floor of the hut, covered by an earthen pavement. The roof posts are complete oak trunks, these too were hardened at the base with fire. The rectangular plan of the house is divided into two rectangular rooms, the one to the south interpreted as a sort of annex to the main body of the hut, perhaps partially open and protected by the overhang of the double roof pitch. This hypothesis is based on the absence of daub along the southern side of the house, neither sintered by the fire nor raw. Lacking our knowledge of other buildings in the village, it is not possible to evaluate the orientation of the possible opening on the southern side, also with respect to the enclosure. As observed by Pessina (2019), similar structures are known in italian Neolithic (Dal Molin site near Vicenza, with large or narrow porch: Tiné *et alii* 2005; Casale del Dolce near Rome: Zarattini, Petrassi 1997; Catignano, Abruzzo: Tozzi, Zamagni 2003).

In the house there were a central hearth and an oven (Figure 6), the latter with three phases of partial renovation; these features, together with some holes filled by ashes, probably designed to keep the embers alive, suggest the existence in the house of an integrated functional *system* for the management of fire.

The last phase of the oven (oven B3) was particularly well preserved (Figure 8): it was rectangular in shape with a barrel vault and was N-S oriented, measuring 1.02 m x 0.52/0.58 m with an interior surface of 0.62 square meters; the vault was 0.40 m high. This feature was particularly suitable for preparing foods, above all for baking cereal bread, and for cereals roasting preliminary to grinding.

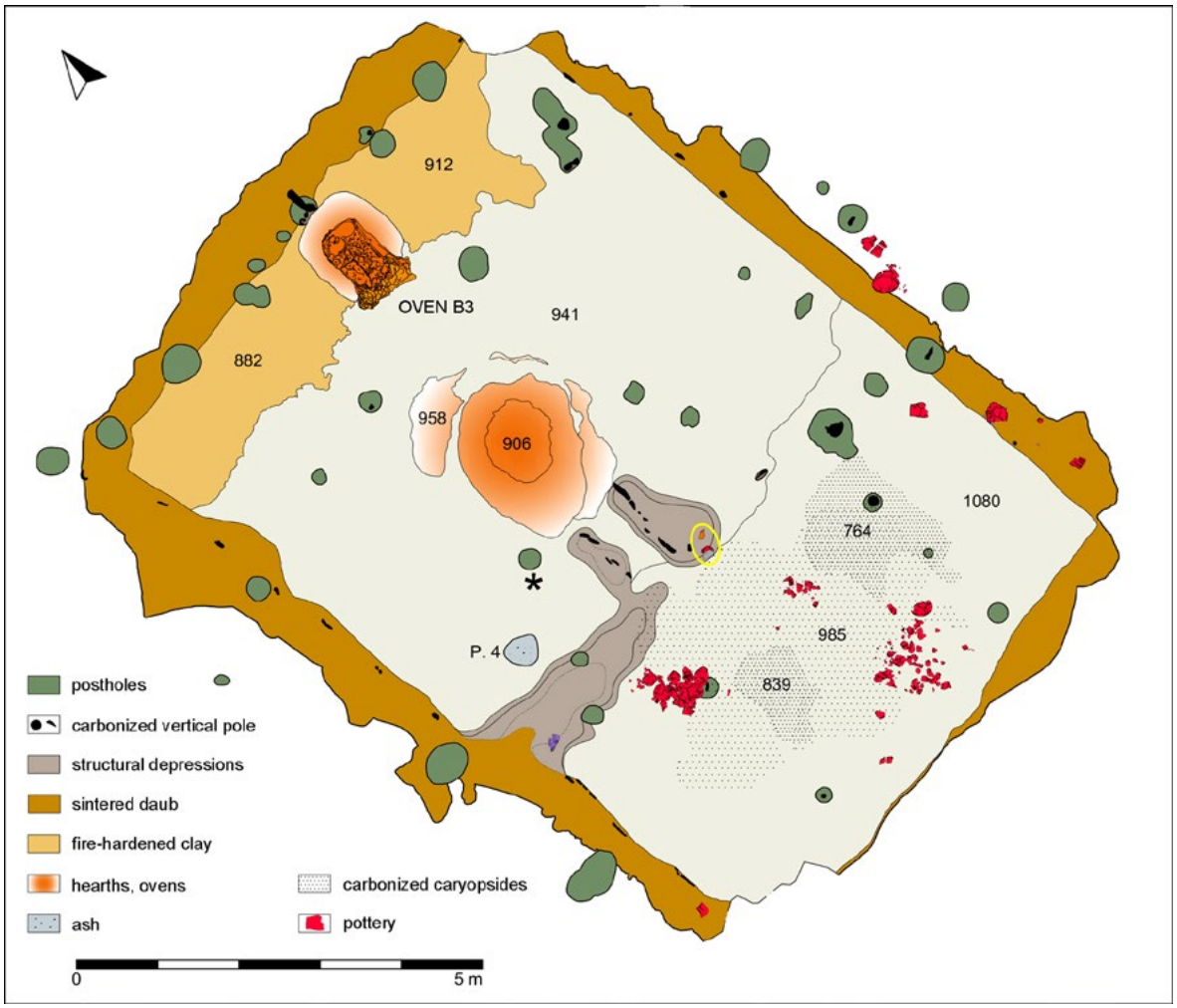

Figure 6. Plan of the hut.

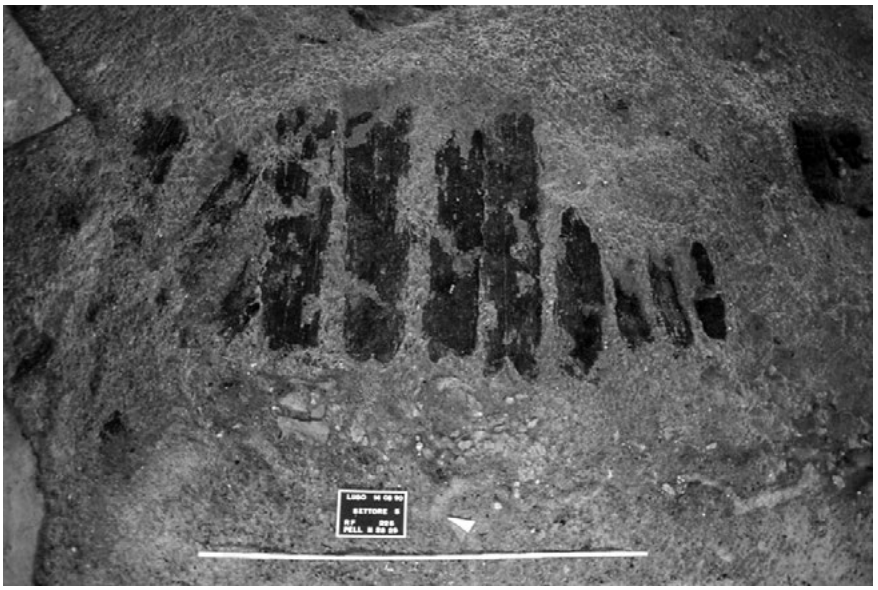

Figure 7. Carbonized planks of the internal wall facing of the hut.

This latter activity is well testified by the abundant remains of carbonized kernels found on the hut's floor and in a garbage pit near the house (Pit 5); in the filling of this pit there was a great amount of domestic rubbish, such as ceramics, lithics and personal ornaments.

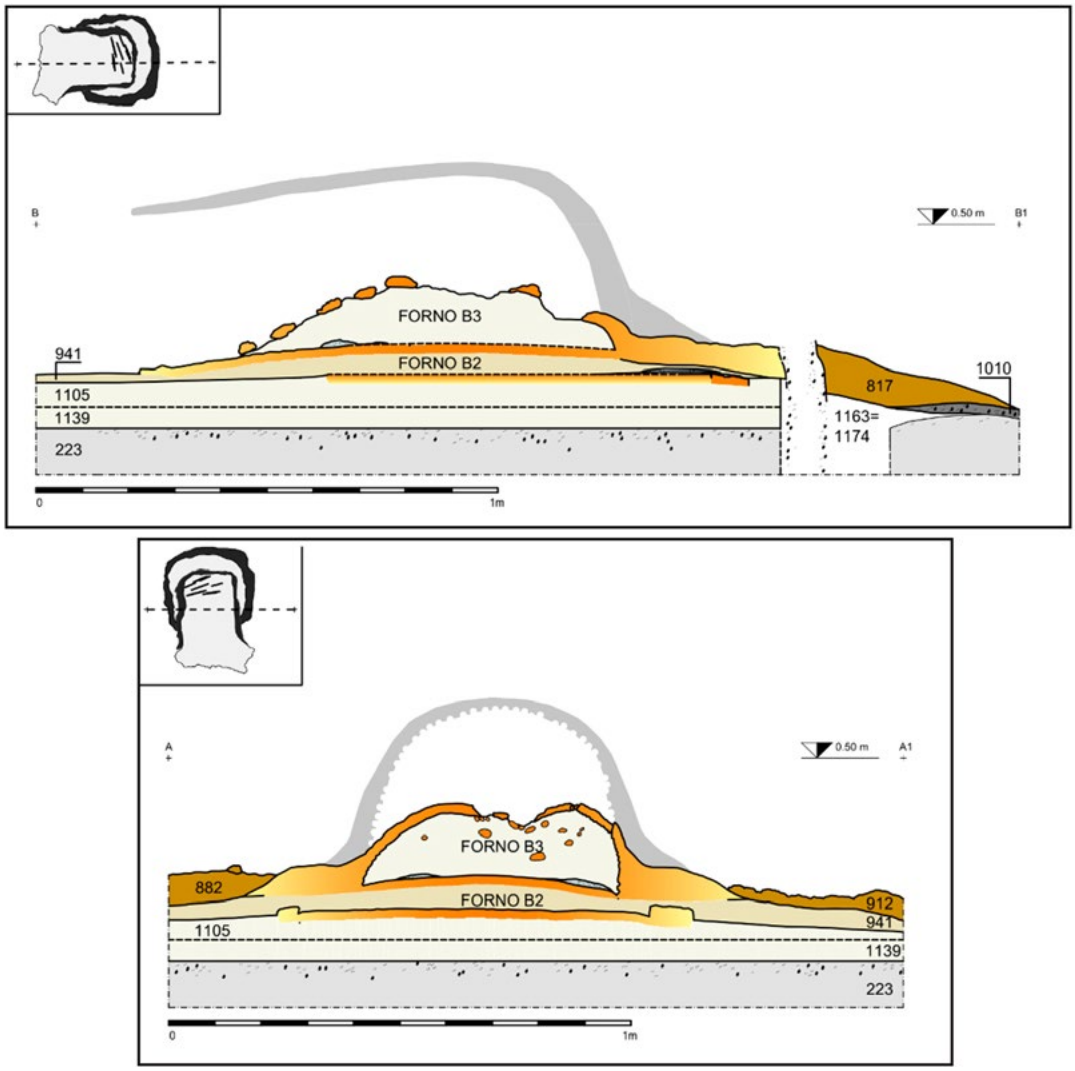

Figure 8. Reconstructive section through the oven B3.

The lithic industry and the pottery production of Lugo di Romagna are referred to the Fiorano Culture as today known (Bernabò Brea, Miari, Steffé 2017) and contribute to outline the possible scenarios of early Neolithic development in Romagna (Ferrari, Steffé 2019; Dal Santo 2019), in particular as regards the relations between the Po Valley and the Italian peninsula area (Figure 9) (Dal Santo, Ferrari, Steffé 2019), relations that characterize Romagna further in the Neolithic and after.

A further element of interest lies in the possibility of examining the arrangement and distribution of the material culture elements in relation to the different structural contexts identified: this is an interesting aspect also for the light that these data can throw on other Fiorano sites less well preserved than Lugo as regards the ground surfaces and the structures above ground.

Besides pottery and lithics, a number of artefacts and personal ornament items in hard animal materials have been found and only a few fragments of polished stone. Both come from the ditch and some of the pits (Pit 1 – where they probably entered fortuitously – and Pit 5, used as a rubbish pit), but also from the floor levels inside and outside the fence and from the hut area.

Considering the distribution of ceramics and lithics outside the village, there is evidence of a particular concentration near Pit 1: as an example, fifteen lithic artifacts pertaining to the same unit of raw material are the debris linked to a single event of rhomboid production.

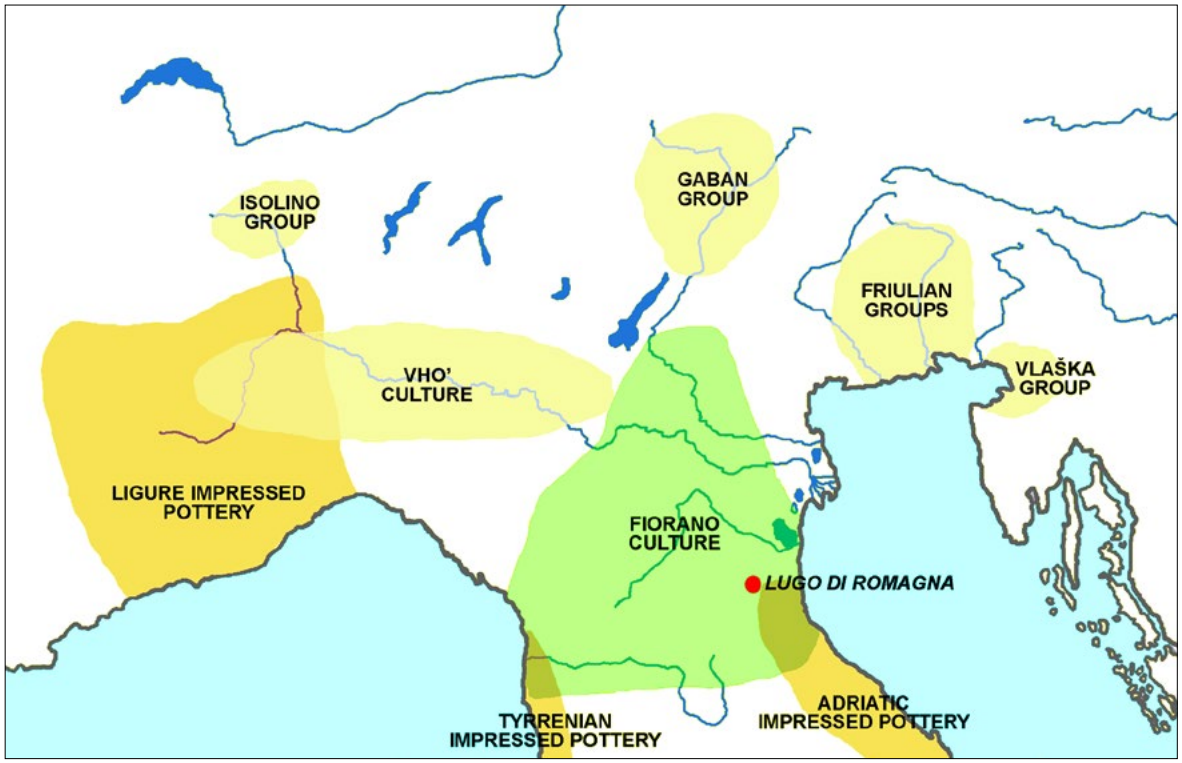

Figure 9. Early Neolithic groups of Northern Italy
(after Pessina, redrawn).

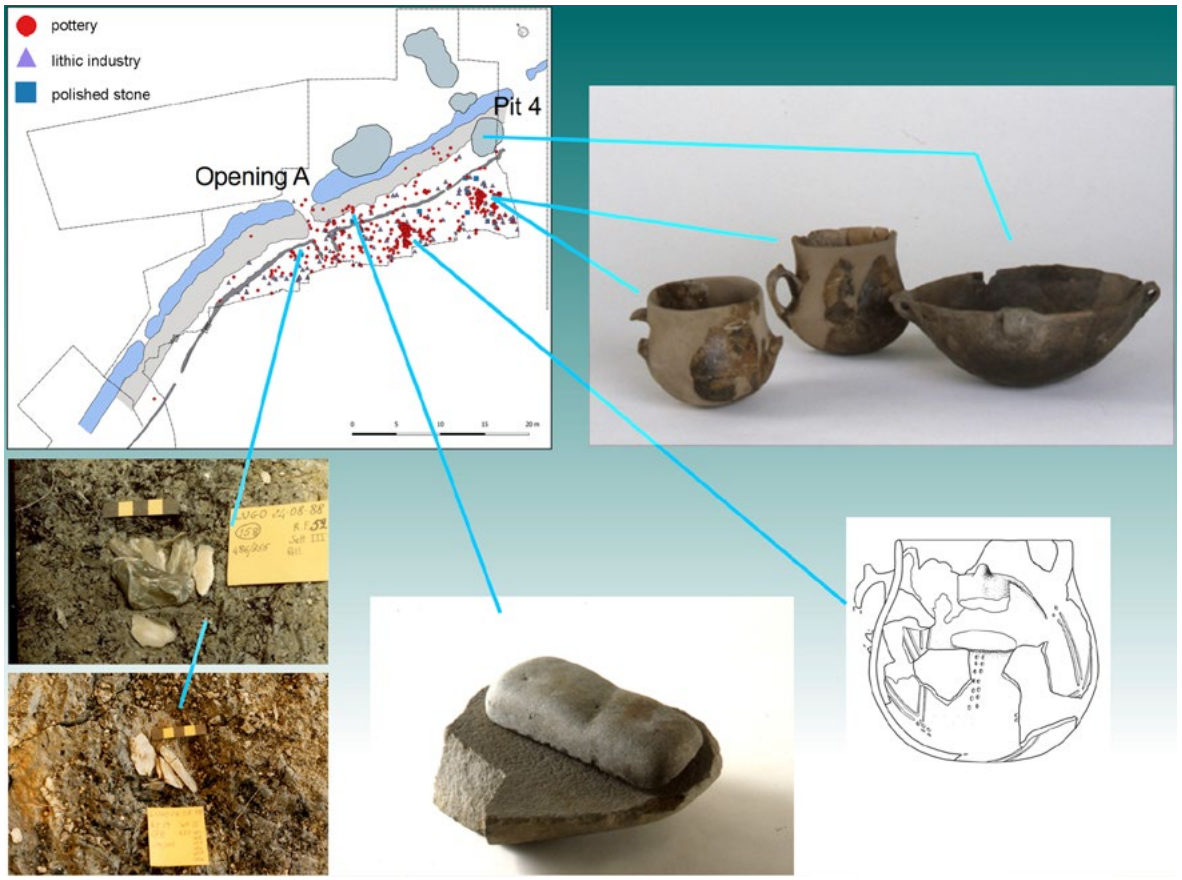

Figure 10. Artifacts distribution within
the enclosure structures.

Within the enclosure structures, the distribution of finds is widespread and abundant (Figure 10).

Some concentrations can be noted near some traces of structures dismantled in ancient times. The presence of some almost entirely reconstructed little pots, as well as that of a grinding mill and a rubbing stone, could suggest that these areas were dedicated to some kind of activity. An intact bowl comes instead from Pit 4. Worth noting, west of Opening A, are a group of 12 lithic artifacts, not obtained from the same raw material and probably kept in a small perishable container, which was lost accidentally or stored and then abandoned or forgotten.

The area of the hut offers, also from the point of view of the distribution of the materials, many elements of interest both as regards the outside floor, unfortunately only partially preserved, and the inside floor, which relates to the last phase of life of the hut. Starting from the outside, we notice, even in the considerable and abundant distribution of finds, some concentration areas.

In the ***northern area***, around a hearth, a probable area for the treatment of cereals has been found, characterized by numerous fragments of millstones, ceramic and lithic fragments and lenses of carbonized cereal kernels. On the west side, in the corridor separating our hut from the collapsed remains of another probable house, in addition to abundant ceramics and lithics, many daub fragments have been collected. On the opposite side, a small flint-working area has been identified consisting of 15 bladelets in 'alpine' flint that can be assembled into three groups, which are probably the result of one or more working episodes.

The analysis of the ***interior of the hut*** is rich and complex (Figure 11); we offer here just some food for thought. The most evident aspect is the difference between the North room and the South room. In the first, pottery is almost absent, except for some small sherds scattered on the floor; this is partly true also for the lithic artefacts, but it should be emphasized that the greater concentration of lithic elements with traces of use and of flint tools is exactly in this room. The impression is that the northern room was kept neatly clean and that it was certainly equipped with furniture in perishable material (wood, carpets, leather, tissues) but not with objects related to the storage / transformation / preparation of food.

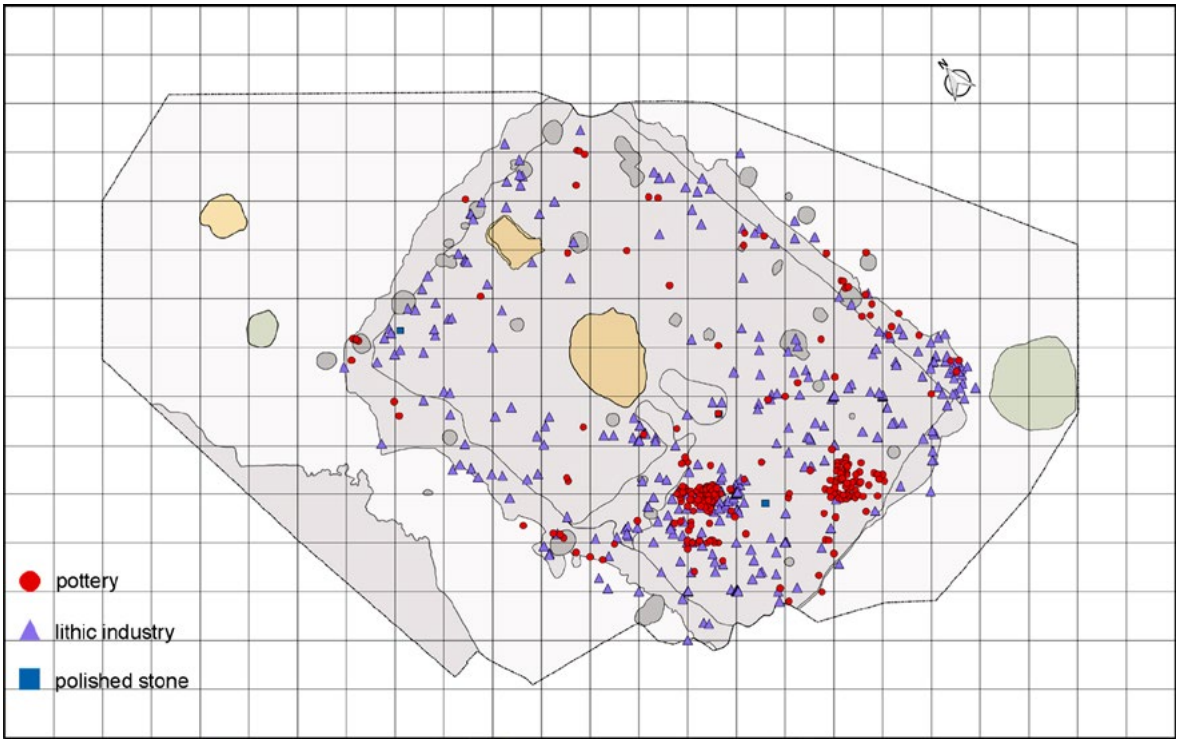

Figure 11. Artifacts distribution in the interior of the hut.

The situation in the southern room is very different: there were a lot of carbonized caryopsides of cereals (barley, spelt and summer wheat) extensively dispersed and, at the center of the room, an almost pure pile of spelt (*Triticum dicoccum*). The grains had been threshed and 'stripped' just before the fire and were ready for consumption. Millstones were absent, while there was a notable concentration of lithic artefacts on the floor levels. There were three large lithic cores in early stages of exploitation and, in the SE corner of the hut, three tools grouped and vertically fixed in the sediment of the floor. Finally, a set of pottery storage vessels found in this room confirms its interpretation as a deposit and a store room for food stocks.

Four pots could be completely recomposed (bowl, flask, globular cup, jug: Figure 12), other ones were more fragmentary (some bowls and a Ripoli flask). Furthermore, close to the eastern wall of the room there were two jars, which retained part of their contents (in one case charred apples). All the pots had been involved in the collapse of the hut, so we do not know whether they were resting on the ground or, at least in part, hanging on the wall; moreover, also for the cereal remains, we could hypothesize hanging containers in perishable material.

In the vessel 'group photo' (Figure 12) a carinated jug ('boccale Fiorano', the most typical and representative container of this cultural group) appears (Figure 12, center), which in reality is not part of the southern room kit. If it is true, in fact, that bowls and carinated jugs are the most represented types in Lugo, in the southern room of the hut various bowls appear, while carinated jugs are totally absent.

The only carinated jug found in the hut was laying inside a hole, that was located under the hut floor along the line which divides the North and the South rooms. The vessel was placed upside down and associated with a fragment of a millstone and a fragment of daub from the mouth of a previously dismantled oven. It is in all evidence a ritual deposition.

A second ritual deposition, near the fence of the inhabited area, includes a miniature pot of the same shape, overturned above a dog leg in anatomical connection.

Other two ritual depositions are related to the foundation and the construction of the dwelling: under the floor have been found the remains of an infant cremation, held just before the construction of the house, while in one of the central postholes there was the burial of a fetus.

Figure 12. Pots from the southern room of the hut. The carinated jug (boccale Fiorano) in the center of the image comes instead from a ritual deposition found in the center of the hut, under the pavement.

The choice of the carinated containers for the above cited ritual depositions is of great interest, as it is the pottery form most produced in the Fiorano culture and the most widespread, for import or imitation, in many contemporary cultural groups. The reasons for such a success could be found in the importance of the practices – that would have been excluded from the purely domestic sphere – of which these vessels (and probably their content) would have been, at least in part, a symbol or a vehicle.

The exceptionally preserved evidences of Lugo have been studied with a multiplicity of specialized approaches, that allowed to reconstruct many aspects of the Neolithic inhabited area; however, we know that the house was not isolated: in fact there are some traces of other houses. The house appears alone because the neolithic surface in the rest of the quarry area has been destroyed by the quarry activity, but in a narrow area between the house remains and the dig wall has been found a great amount of collapsed fired daub, probably pertaining to another house. Moreover, outside the quarry area traces of neolithic domestic remains have been found with exploratory core drillings beneath the estimated area of the village. Therefore, we have not plans or the chronological range of other domestic features. However, chronological data of the fence structure and of the explored house are coherent and can be assumed as the chronological range of the village. Then, knowing that there were several houses in the village, the fact that it was possible to investigate only this single structure makes it difficult to extend the results to a broader level.

In this regard, some considerations can be offered:

- in the enclosure structures, the height of the palisade and the reinforced main entrance indicate a defensive function, similarly to what is proposed for ditches and palisades that surround the villages of the *Linearbandkeramik* (LBK) or *Rubané* in central and western Europe during the early Neolithic; among these, the defensive character is more pronounced in the villages located on the edge of the cultural areas (Pessina 2019), as it is for Lugo, situated at the southeastern edge of the Fiorano culture area;
- some character of the Lugo house could have some similarities with the LBK longhouses tradition (Coudart 1998), such in particular the parallel rows of roof poles which divide the interior in minor spaces; the dimensions of the house are comprised in the lowest dimensional range of the danubian longhouses (Modderman 1970; Oross 2010, fig. 7.3). The construction technique of the walls is coherent with the tradition of the wattle and daub houses of the Neolithic of the Balkans and Southern Italy, as the Slatina house in Bulgaria (Nikolov 1990) or the examples from Acconia (Shaffer 1983; Ammerman *et alii* 1988), Trasano (Tasca 1998), Balsignano (Fiorentino, Muntoni 2002; Muntoni 2007) in southern Italy. A timber frame technique seems to have been used for the coating of the interior side of the walls, were have been found the carbonized remains of standing aligned planks.
- the fire that destroyed the entire system composed by hut and fence structures seems attributable to a single, perhaps intentional act: this is assumed on the basis of the stratigraphical correlation documented between the fire levels of both the explored areas, where it is recognizable a systematic destruction of both wooden and wattle and daub structures, followed by the abandonment of at least this area of the village and its very quick alluvial cover; moreover the house is destroyed during its phase of full use; the fire is followed by the definitive abandonment of the site. On the other hand, the scarce percentage (about 4-5%) of permanently fire-hardened daub with respect to the mass of daub used for the hut walls, found raw or only fire-reddened, would exclude an episode of ritual destruction. In fact, as shown by several experiments, the 'accidental' fire of a wattle and daub house – i.e. without accumulating into the house more firewood as additional fuel besides the posts and the wattle of the walls and the reeds and rafter of the roof – allows to permanently sinter only a little part of the walls daub, quantified by Bankoff and Winter in about 2.5-3% of the whole coating (Bankoff, Winter 1979; Cavulli, Gheorghiu 2008); to explain the large amounts of sintered daub that are attested in several Neolithic sites of Southern Italy, and

that are assumed to correspond at houses, many scholars have hypothesized that the houses were filled with much more fuel (Shaffer 1983, 1993; Gheorghiu 2008; Cotiugă 2009). The reason for this practice would have been to produce large amounts of well sintered daub for reuse purposes (Shaffer 1983; Gheorghiu 2008); in the southern Balkans is very common during the Late Neolithic and the early Chalcolithic the complete destruction of the houses at the moment of the abandonment by a fire with production of great amounts of sintered daub, provided by great quantities of firewood as added fuel. The diffusion of deliberate house burning in Late Neolithic and Chalcolithic in south-eastern Europe has been defined as Burnt House Horizon (Stevanović 1997; Tringham 2005) and is interpreted as a ritualized form of social memory of the house and its site (*domicide* or *domethanasia*: Tringham 2005, 2013; Jordanova *et alii* 2018; for the discussion of the Italian data see Tinè 2009, pp. 164-165).

In the Lugo house, though, as said before, the quantity of daub completely sintered seems more coherent with the hypothesis of a 'accidental' fire, that is without filling the house with added fuel. The fire seems though generalized to all the known structures of the village, impossible to define whether for a hostile act or not, and is followed by the definitive abandonment of the site.

For many millennia the village of Lugo di Romagna has been buried under many meters of alluvial clay, until the quarry activity partly destroyed it while, at the same time, ensuring the site was found and investigated. Today, the quarry activity has ceased and in its place there is a little pond: the technical and economic difficulties make the parts of the ancient village which are still intact inaccessible today, but buried by earth and several cubic meters of water. However, the large amount of data gathered during the excavations is now forthcoming in a monographic edition (Steffè, Degasperi 2019) and offer the possibility of further analysis and study. We hope that the scientific community will seize these opportunities for years to come.

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Sv. Križ – St. Cross (Istria, Croatia): some remarks on the food preparing and storaging during the Bronze Age in Northern Adriatic Region

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Abstract

Sv. Križ (eng. St. Cross) is a Bronze Age hillfort situated in northern Istria (Croatia). The Croatian Conservation Institute carried out rescue archaeological excavations in 2011. Remains from the Neolithic, Bronze Age, Roman period and Middle Ages were found. The Bronze Age horizon is the most significant. Fragments of different pottery forms were collected. Some were decorated with plastically applied motifs (horseshoe forms, plastic ribs with or without finger imprints, tutuli etc.) as well as different types of shallow channels (incisions).Several drywalls and a fireplace are part of one house/building/dwelling. The remains of a grindstone with a pestle, together with a lot of bigger pots for foodstuffs storage (pithoi) point out that this part of the settlement was used for food processing and storage. Fragments of tripods, trays, portable stoves, clay rings and similar elements connected with a kitchen, indicate that this building was used for food preparing too.

Keywords: hillfort, Bronze Age, pottery, food preparing, food storaging

Résumé

Sv. Križ est une colline de l'âge du Bronze située au nord de l'Istrie (Croatie) entourée de plusieurs murs de défense. Des fouilles archéologiques de sauvetage ont été effectuées en 2011 par l'Institut croate de conservation. Des vestiges du Néolithique, de l'âge du Bronze, de l'époque romaine et du Moyen Âge ont été trouvées. L'horizon de l'âge du Bronze est le plus significatif. Des fragments de différentes formes de poterie ont été recueillis. Certains étaient décorés d'éléments plastiques appliqués (en forme de fer de cheval, nervures avec ou sans empreintes de doigts, tutuli, etc.) ainsi que de différents types de solcatures peu profondes. Plusieurs murs et foyers en pierre font partie d'une maison, d'une zone de stockage et d'une cuisine. Les restes d'une meule de pierre avec un pilon, ainsi que beaucoup de grands pots pour la conservation des produits alimentaires (pithoi) indiquent que cette partie du village était utilisée pour la transformation et le stockage des aliments. Des fragments de trépieds, de plateaux, de réchauds portatifs, de tores et d'éléments similaires reliés à une cuisine, indiquent que ce bâtiment servait aussi à la préparation des aliments.

Mots-clés : colline fortifée, âge du Bronze, poterie, préparation des aliments, stockage des aliments

1. Introduction

It is known that Istria abounds in fortified settlements surrounded by defense walls better known as hillforts or *castellieri*. Actual towns are often built at the same places. One of these settlements was Sv. Križ kod Čirkoti (eng. St Cross, it. S. Croce) (Figure 1, Figure 2) just above Završje (it. Piemonte d'Istria) in the county of Grožnjan (it. Grisignana). Istria is a peninsula shaped in a triangle around 100 kilometers long and 75 kilometers wide. There is a stair-like uplift with Ćićarija plateau (1273

[1] Tihomir Percan recently passed away. In agreement with his family and colleagues we have decided to publish the original manuscript of his article, of primary importance for the characterization of the Bronze Age in Istria. We met Tihomir the day of the session and we worked together all along during the review process of the paper. We keep the memory of a sunny, kind and passionate person. We would like to thank Tihomir's family and Josip Višnjić (Croatian Conservation Institute) for providing the agreement for the publication of the contribution, which we hope will disseminate the work done by Tihomir on Istrian Bronze Age contexts.

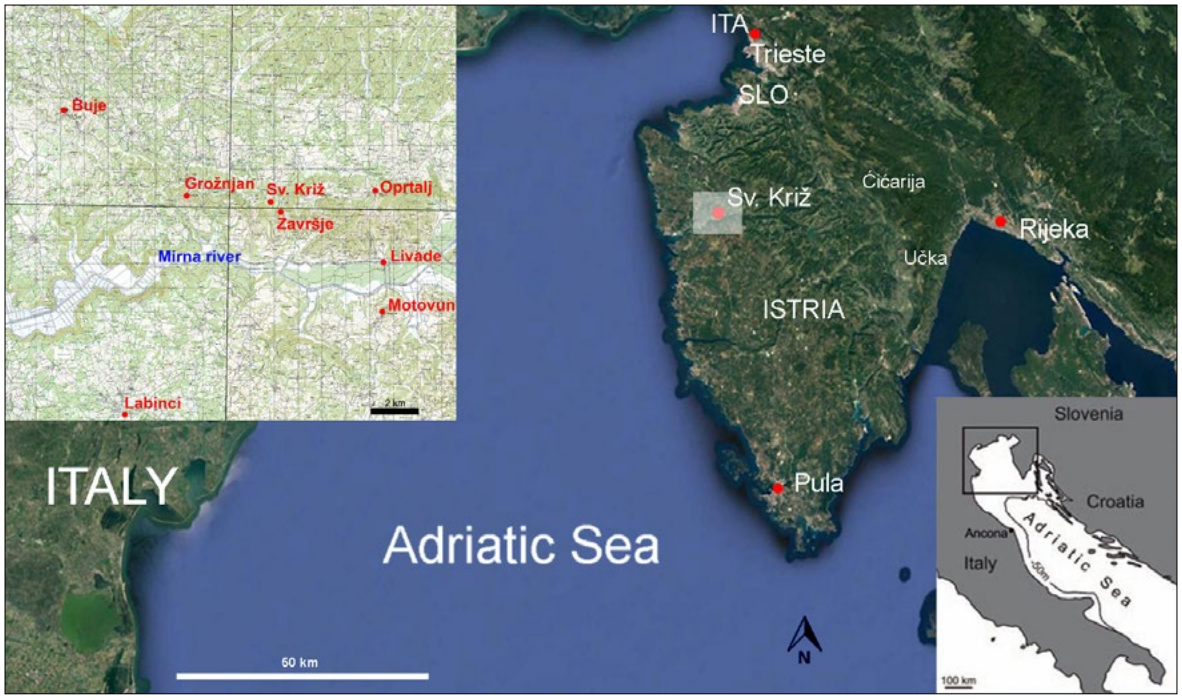

Figure 1. Geographical position of Sv. Križ.

meters high) and Učka (1396 meters high) on its northeastern side. The so-called Adriatic Gates are found behind the Ćićarija plateau. The Gates represent the passage between the Alps mountain chain and the Dinarids. This passage, the natural extension of Mediterranean's deepest maritime way into the European continent, is one of the most important passages towards central Europe i.e. Danube's sailing system (Hänsel, Mihovilić and Teržan 2015: 45). The micro region by the Mirna River has been inhabited since prehistory. It is a grey impermeable flysch area on the northern Mirna River slopes at around 400 m altitude where a number of important archaeological sites can be found. The natural communication through the valley has been an important factor for the continuous settlement of the surrounding areas during prehistoric times, Roman period and the Middle Ages. That is why settlements like Sv. Križ, from where most of the Mirna valley could be controlled, gained importance and accumulated wealth.

2. Istrian hillforts (gradine or *castellieri*)

During Bronze and Iron Ages, hillforts were the primary settlements on the entire Istrian peninsula. A number of these kind of settlements on elevated positions, with strategical characteristics, natural protection and good conditions for community development, has been recorded on both sides of the Mirna River. Close to Sv. Križ, which has been mentioned as a hillfort in literature as early as the beginning of the 20th century under the name St Croce (Marchesetti 1903: 95), it is important to note the hillfort of Sv. Juraj (eng. St George) 0.5 kilometers west, and places like Završje, Grožnjan and Oprtalj which have been inhabited since prehistory (Buršić-Matijašić 2007: 436, 437, 442, 449-453).

First hillfort mentions date back to the middle of the 19th century (1850-1851) when Pietro Kandler, historian and archaeologist from Trieste, created a map recording several hillforts – *castellieri* (Burton 1877: 16; Hänsel, Mihovilić and Teržan 2015: 27; Marchesetti 1903: 2). The work of C. Marchesetti was the basis for studying hillforts through the entire 20th century (Marchesetti 1903). A newer hillfort display was given by Klara Buršić Matijašić in her monograph on Istrian hillforts (Buršić-Matijašić 2007), and also, Monkodonja excavations systematical research has been recently published (Hänsel, Mihovilić and Teržan 2015; Hellmuth Kramberger 2017).

Despite the large number of hillforts documented in K. Buršić Matijašić's work (Buršić-Matijašić 2007), only a few have been explored in detail. There is no basic information for most of them: settlement lifespan, size, as well as internal organization and link to the surrounding area and functioning within the system of a larger number of hillfort settlements. Up to the middle of the 20th century intensive cattle breeding affected vegetation in the area, which was significantly scarcer than nowadays. That is why drywall remains, hilltops or terraced slopes were easier to detect. Reduction in the number of inhabitants in the rural area and the end of cattle breeding led to spreading forests and vegetation to what used to be passable areas. It has made difficult to recognize certain hillfort parts such as defense walls or entrances which can be discovered by using new technologies (LIDAR). It is the only way to get some insight into the way the settlements were spread as well as facilitate future research which could then be focused on the parts where more information on the organization within the settlement could be collected. An example of these non-destructive excavations is found in the area around Rovinj (Müller, Čuka and Hellmuth Kramberger 2017: 23-24, Sl. 2) and Vrsar (Gerometta and Matijašić 2017: 20-21, Sl. 4-5). That is why every excavation is relevant in order to gather more information and draw conclusions on their occurrence, development and abandonment.

3. The settlement and its surrounding

The Sv. Križ site represents the most dominant angle in wider area with the highest altitude of around 370 meters. There is a wide road leading to the Sv. Križ hilltop from north to south on the eastern slope. Along the road there are many well-preserved drystone walls made out of local sandstone. Parts of visible remains of defense walls are made out of the same stone. There was a larger settlement surrounded by two concentric defense walls (Buršić-Matijašić 2007: 451) in the Bronze Age in this place. The defense walls (Figure 2: a, d) can be seen even today. The remains of the hillfort entrance (Figure 2: b) are still very visible on the western edge of the first terrace. According to data, the surface of the hillfort settlement amounted to 2 acres, while the settlement itself was irregularly shaped – the defense walls followed the natural configuration of the hill. There are terraces by the defense walls where a lot of archeological material (ceramics, bones) is found. A rather thick cultural layer is found on the highest plateau.

Figure 2. Aerial photo with defence wall segments, entrance and trench 4; a, d: defense walls; b: hillfort entrance; c: trench 4 (Photos: Tihomir Percan, Ivica Pleština, Josip Višnjić).

There was probably a settlement here in the Roman period, which was confirmed by a number of *tegulae* and amphorae spread around. The settlement's existence in the Middle ages is confirmed by the finds of coarse ware on the northern slope, as well by the toponym Sv. Križ (St Cross).

Field research and air photos of the settlement area confirmed the existence of a dry-stone wall system. However, a large part is covered by vegetation. For this reason, without LIDAR data, is impossible to determine their exact number, preservation stage and a more precise position on the hill. According to data, there are several walls on the western side. The first two walls are concentric and encompass the settlement, while the rest are situated on the western slope and surrounds the terraces. Most of these walls are well preserved which means they were probably reconstructed or even built in recent periods. These walls today represent borders between land lots with different owners. This does not necessarily mean that these walls did not exist in the same position in the Bronze Age. This premise is difficult to prove without excavations.

4. Archaeological excavations

In 2011 the Croatian Conservation Institute in cooperation with the Istrian water supply ltd, conducted rescue excavations at Sv. Križ. Four trenches (trench 1, 2, 3, 4) covering 58 m2 have been excavated. Excavation was directed to the uplift's highest plateau and gave interesting results, even though they covered a small area. Trenches 1 and 2 didn't reveal any archaeological layer, while trenches 3 and 4 showed archaeological finds and cultural layers from the Neolithic to the Bronze Age and the Roman period.

Trench 1 (2 x 2 m) was set on the second terrace far from the archeological site which was established by excavation results, i.e. in non-existent cultural layers. Trench 2 was set on a terrace below trench 1. There was a dry-stone wall between these two trenches which follows the terrain configuration and spreads around Sv. Križ hill. It is easily connected to the hillfort's defense wall, however since any archaeological finds haven't been found, it was most probably built for terracing the slope before the occupation.

Since the rescue excavations have been conducted after the new water supply branch route had already been dug through with machines, it was agreed that two trenches on the highest plateau, 25 m^2 each, would be excavated (trenches 3 and 4). Both trenches were divided into 1 m^2 quadrants. They were set up several meter east from the water supply route, while the defense wall is situated by trench 4 where cultural layers were the thickest. The wall kept the soil from erosion.

4.1. Trench 3

Trench 3 was situated on the western part of the highest plateau, around 15 meters away from the inner defensive wall. The preserved stratigraphy was here quite thin. Within this trench there were not enough finds which could point out the function of this part of the settlement. The remains of a couple of postholes belonging to a dwelling have been recorded (SU 6, SU 7, SU 9, SU 10). Although the precise position of the walls can't be determined, it is certain that there was a dwelling there. This assumption is supported by the finding of trimmed, sleek bedrock in one part of trench 3, which was used as a walking surface (SU 4). But the dimensions of the assumed dwellings could not be determined because of the trench's dimensions (5 x 5 m). Remains of similar postholes could probably be found in new research. There was also an oval shaped pit (SU 8 – 0.85 x 0.65 m, depth 0.35 m) on the southern part of the trench 3 interpreted as a pottery hoard or a storage pit. Similar hoards characterize the Bronze Age and are well documented on several sites like Vela peć (Bencetić 2018: 1-20) or Kalnik (Karavanić and Kudelić 2011: 5-30). Since the function of this part of the site can't be determined, trench 3 and its finds will not be taken into consideration in this article. The pottery hoard (SU 8) will be the topic of a separate paper.

4.2. Trench 4

The situation in trench 4 (Figure 2: c) was almost identical to trench 3 at the beginning of the excavations. The upper layer (SU 1), which in this case was slightly thicker than in trench 3, was represented by brown humus soil with grass and rocks and small potsherds. Underneath SU 1, a brown soil (SU 2) was found with a large number of materials like *tegula* and amphora fragments. SU 3 was quite darker than SU 2, but still contained a lot of pottery fragments. The difference according to the previous SU 2 is that there was practically no Roman period material. Also, the number of Bronze Age pottery sherds was getting higher and lower fragmented. Rather, there were bigger pieces including numerous bottoms, handles, decorated fragments... It was apparently the first layer which was not disturbed by ploughing. Below SU 3 in some parts of trench 4, clusters of big and medium stones (SU 5) were found. In the other parts of the trench and between stones, a darker soil is found (SU 4). SU 4 was similar to SU 3, only the pottery concentration was larger with bigger pieces.

After part of the stones were removed in SU 5, several postholes were recorded (SU 8, SU 11, SU 13) along with accompanying stone construction (SU 16) (Figure 3; Figure 5; Figure 6). In the places without stones, the soil was still dark with numerous finds (SU 6). In the southern part below SU 6 there was a brown soil layer with no rocks (SU 7) while on the northern part small and medium rocks were found (SU 10). The SU 7 was quite thin and belonged to the Neolithic. The bedrock (SU 19), just below SU 7, was trimmed, sleek and formed a walking surface.

Along the eastern profile (Figure 3a) below SU 6, a pit (SU 15) which contained a number of pottery pieces, charcoal, calcinated bones and seeds was found. Below SU 10, and partly below pit SU 15, a layer of a grey sandy soil (SU 20) was found while underneath another pit was detected (SU 23). The pit was rich in finds and dug into SU 22, in a layer of clay (Figure 3a; 13). The bedrock was trimmed here, too (SU 19). There is a height difference between the northern and the southern parts of the trench, so the step in the bedrock was used as basis for a wall on a lower level dwelling. Also, SU 25

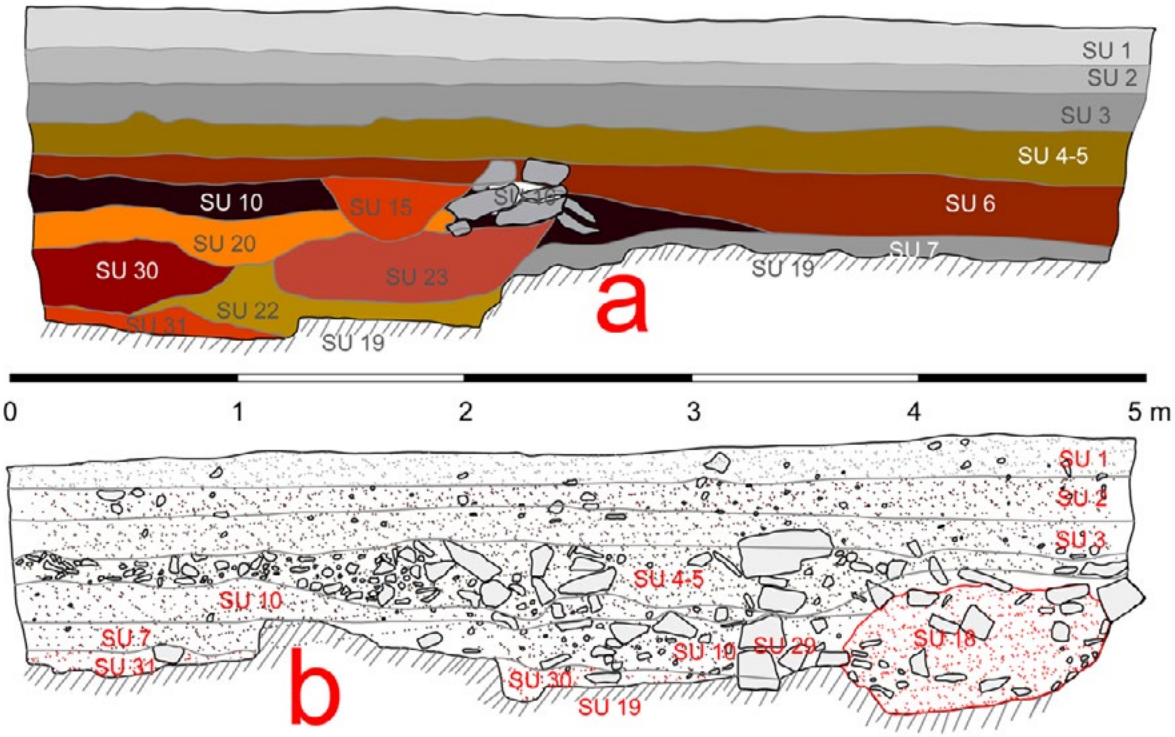

Figure 3. Schematic view of eastern (a) and drawing of western (b) profile in trench 4 (Drawing: Katarina Jerbić).

Figure 4. Cluster of pottery in SU 30 (Photo: Goranka Perković).

and SU 27 were dug into SU 22. Besides the mentioned layers and pits, a fireplace was found (SU 18) which contained bigger pieces of burned sediments and charcoals and was surrounded by a stone construction (SU 29) (Figure 3b; Figure 7). In the northwestern corner below SU 20, partly dug in SU 22, an ocher colored soil layer with a lot of rocks was found (SU 30). The most pottery pieces were found in SU 30 (Figure 4) and it seems it was a walking surface from the final phase of life at Sv. Križ.

Only another layer was recorded below SU 30 – it is a dark brown soil (SU 31) found between the bedrock. The trimmed bedrock (SU 19) was found below SU 30 in the northern and below SU 7 in the southern part of trench 4.

5. Discussion of the results from trench 4

Research results suggest two functioning phases at Sv. Križ. The first, probably the eldest one, probably belongs to the final stages of Early and Middle Bronze Age and shows elements of large vessels (SU 23, SU 25, SU 27) inserted into a layer of clay (SU 22) (Figure 3a; 13). The second, younger stage, belongs to the Late Bronze Age and is seen in structural elements like post holes (SU 8, SU 11, SU 13), structural remains (SU 16), fireplace parts (SU 18, SU 29) as well as the remains of walking surfaces (SU 20, SU 30) (Figure 5). SU 10 and SU 15 belong to this stage as well.

It is important to emphasize that during the building of dwellings in trenches 3 and 4, the bedrock was trimmed, sleeked and adapted to being used as floor. The stones were probably used for building living facilities and defense walls but maybe terrace walls as well. The bedrock falls down in stair-like terraces on the Sv. Križ hill towards the foot of the hill while the height between terraces is different.

The remains found in trench 4 are surrounded by a stair like bedrock on the southern side and by a wall (SU 16) towards its eastern side (Figure 5; Figure 6). The stair-like parts of the bedrock had been used for building the lower parts of the wall and separate the dwellings from one another. By the wall (SU 16) a pit with large storage jars or pithoi and bowls (SU 15) was found, above the pit SU 23. It shows the dwelling continues towards the east, but probably not far. It can be concluded according to the pits' positions (SU 15, SU 23, SU 25, SU 27), which are all found by the eastern side

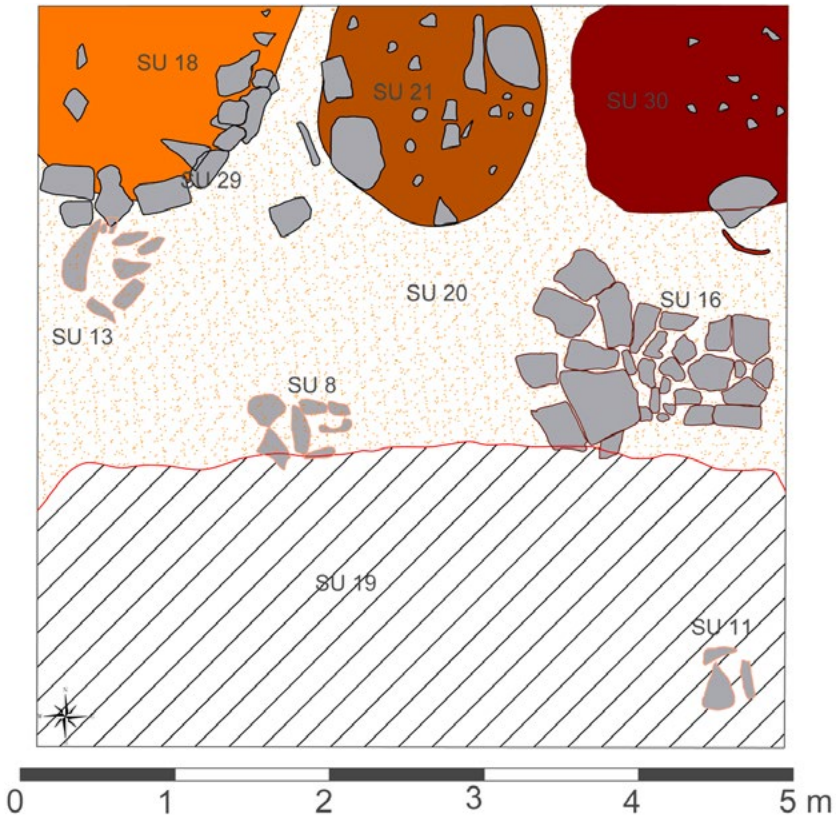

Figure 5. Schematic view of structural remains from Late Bronze Age phase in trench 4.

of the trench. Perhaps, the eastern dwelling wall laid a couple of meters beyond if we assume that the large storage tanks were next to the dwelling's wall. There were also two postholes there, which could have been support elements for the wooden roof. In the northwestern part of trench 4, the remains of a fireplace surrounded by a small wall (SU 29) were found (Figure 3b; Figure 7). It is presumed that food was prepared here and kept in containers in other parts of the dwelling. Nevertheless, we do not know if the area was a specialized kitchen for a particular product. The fireplace was probably situated in the corner of the building. The corner of this facility was then probably just outside the corner of the NW trench. Based on

Figure 6. Wall (SU 16) remains (Photo: Goranka Perković).

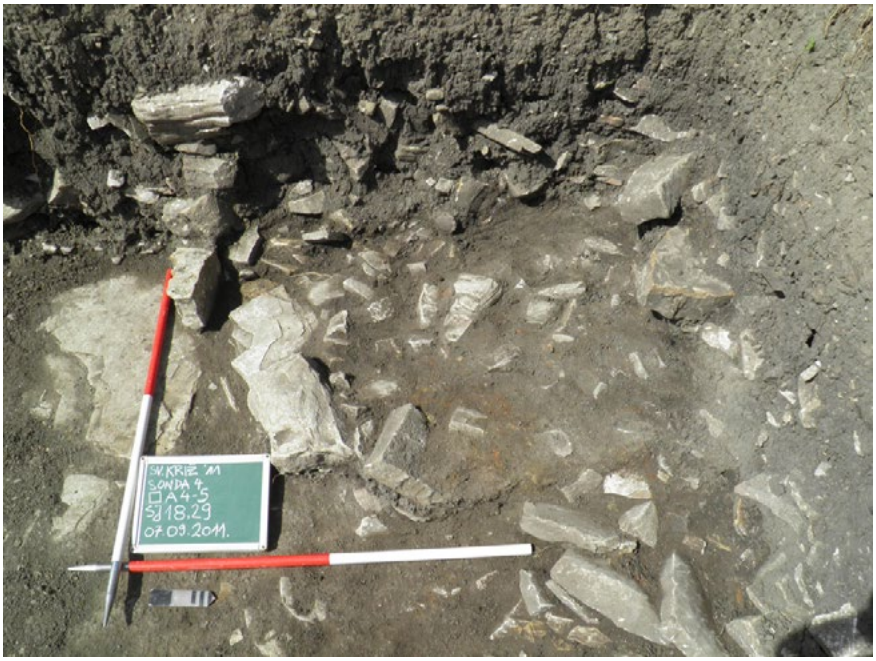

Figure 7. Fireplace (SU 18) in trench 4 (Photo: Katarina Jerbić).

this data, certain building dimensions can be determined. Its assumed width should be 5-6 meters and the length 7-8 meters. Clusters of medium and big stones were seen everywhere, but with a particular concentration on the south side, suggesting the existence of a stone construction in the vicinity. The data could be proved only by conducting new researches.

5.1. Chrono-typological analysis of ceramic material

Along with the findings connected to food processing and preservation, it is important to revise the pottery material belonging to various vessel types. Different types of handles were found (Figure 8). The most characteristic types of handles found at Sv. Križ are triangular with or without plate (Figure 8: 2-4, 7), and parallels are best found at Monkodonja. Considering their wider purpose and usage, they have been recorded on almost every pottery type (Hellmuth Kramberger 2017: 244, 245, T. 104, 7; 120, 7). They are placed chronologically in the Late Middle and the beginning of the Late Bronze Age (Cardarelli 1983: 92-93, T. 18: 113) or in the Middle Bronze Age (Mihovilić 1997: 43). Besides Monkodonja, they can be found on hillforts like Gradac-Turan (Mihovilić 1997: 43) or Elleri (Lonza 1977: T. II). They are also well known from number of cave sites like Vaganačka cave (Forenbaher and Vranjican 1985: 11, T. 7: 1-3), Garbinovica (Čuka 2014: 21-22, T. III: 7, T. XVI: 99, T. IV: 15) or Srbani (Čuka 2009: T. VI: 29) where they are dated in Middle Bronze Age.

Several strap handles have been found (Figure 8: 6). These types of handles are, according to the material from Monkodonja, usually found on shallow and deep bowls and cups (Hellmuth Kramberger 2017: 244; Buršić-Matijašić 1998: T. 16, 24). These kinds of handles are typical for Late Early and Middle Bronze Age according to Čović (Čović 1983: 126) or for Middle Bronze Age (Buršić-Matijašić 1998: 72).

The horizontal handle finds (Figure 8: 5, 8, 10, 11) are probably connected to large vessels. This is the case of a large pithos decorated with a horizontal plastic band and horseshoe-shaped applications as well as horizontal handles with a prominent edge. There are linguiform handles with fingerprints too (Figure 8: 11), as well as the simple ones with oval thickening. Similar examples of handles on pithoi are found on Monkodonja (Hellmuth Kramberger 2017: 258; T. 112, 1; T. 138: 5). Horizontal handles with fingerprints in the middle are usually seen on jars and pithos, according to the Monkodonja material analysis (Hellmuth Kramberger 2017: 259). They are also

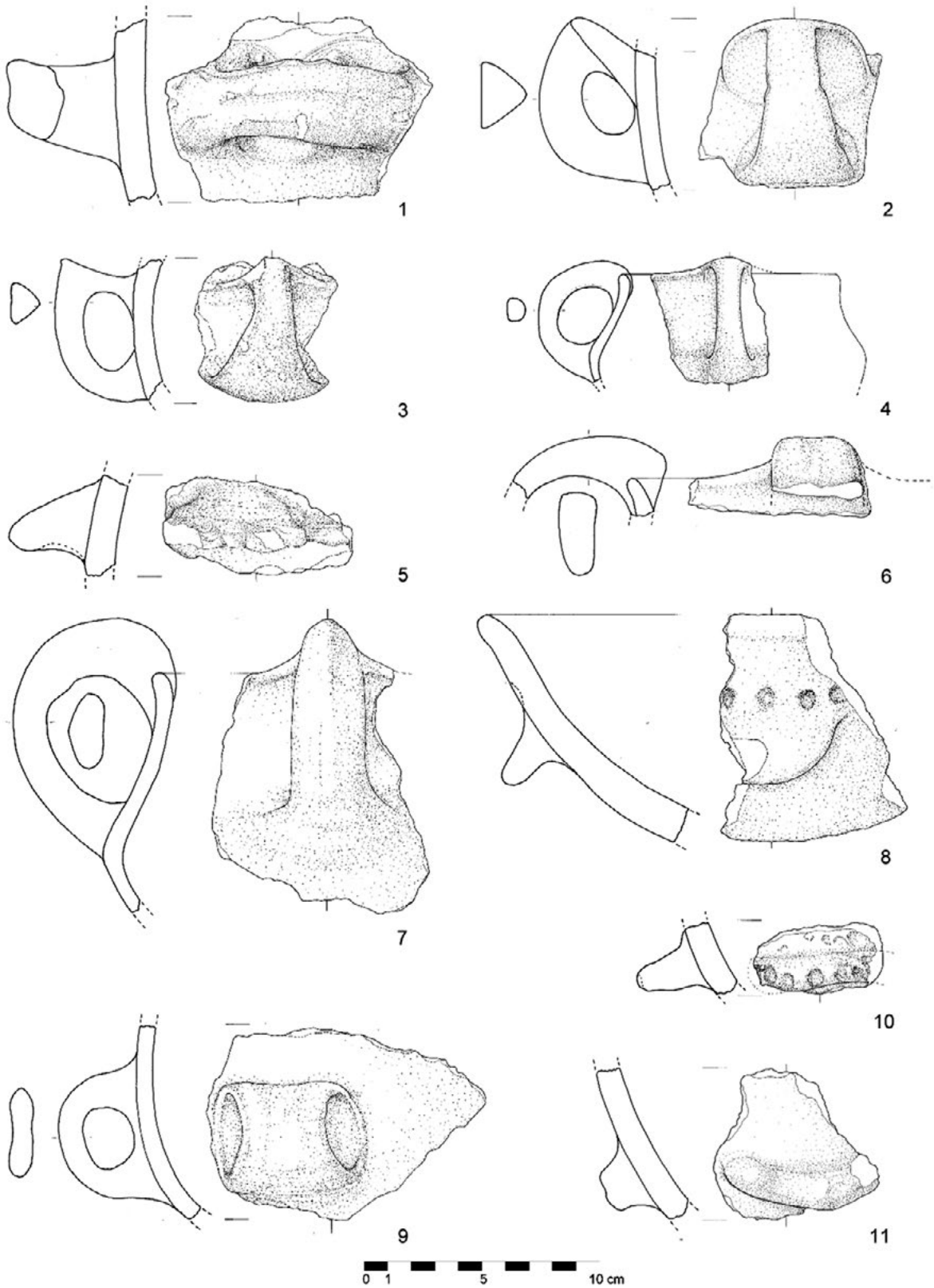

Figure 8. Drawings of different types of handles from Sv. Križ, everything pottery;
1: SU 23; 2: SU 10; 3: SU 7; 4, 7, 9, 11: SU 15; 5: SU 4; 6, 8, 10: SU 20. M. 1:4
(Drawings: Dalibor Branković).

Figure 9. Some decorated fragments found during the excavation (Photo: Tihomir Percan).

known from Garbinovica (Čuka 2014: 21, T. XVI: 96), Srbani (Čuka 2009: T. IV: 23) and Gradac-Turan, where they belong to Istria II phase (Hänsel, Mihovilić and Teržan 1997: 98, sl. 46). This type of handle is a novelty in that period (Čović 1983: 117). In Vaganačka cave they are also dated to the Early and part of the Middle Bronze Age (Forenbaher and Vranjican 1985: 10). One of the handles is decorated with impressions and shows a similarity to a handle found at Monkodonja (Figure 8: 10) (Hellmuth Kramberger 2017: 259; T. 101, 8). Linguiform handles (Figure 8: 5) are among the most common pot and pithos handles of all sizes. On other types of vessels, these kinds of handles are rare. A similar conclusion could be done for thearch-shaped handles (Hellmuth Kramberger 2017: 259). These handles are small and less convex and wider.

A number of simple nubs or buttons or ones surrounded by concentric channels or incisions lines were found (Figure 9; Figure 10: 1, 2). These decorations are found during Middle Bronze Age and are still used through the Iron Age. Comparisons are found on Monkodonja (Buršić-Matijašić 1998: T. 48; Hellmuth Kramberger 2017: 262-290) but also in Iron Age Nesactium (Mihovilić 2001: 86, fig. 74, T. 8: 2, T. 28: 5). A horizontal plastic band (Figure 9; Figure 10: 3, 5) is present on a fragment of the bell-shaped pithos (Figure 12: 1), which is a common ornament in these kind of vessels (Hellmuth Kramberger 2017: 268). An applied arch-shaped band (Figure 10: 6), in combination with a button/nub-shaped ornament situated in the middle, is also observed below the arch on a pithos. Horizontal and arch-shaped plastic bands with fingerprints are a common find among material from Sv. Križ (Figure 9; Figure 10: 3, 4). Forincised decorations of parallel incised lines are to be mentioned on several fragments (Figure 10: 7). This kind of decoration is typical for bottoms (Hellmuth Kramberger 2017: 274). Some fragments are decorated with impressions (Figure 10: 10; Figure 11: 1). In Istria, this kind of decoration can be found in Eneolithic pottery from Brijuni, in Bronze Age settlements but also in Iron Age. Good examples are from Sveti Mihovil (Zlatunić 2008: T. 2: fig. 2), Brijuni (Vitasović 1999: T. VI: 1), Jačmica (Jerbić Percan 2011: T. 8: 5) and Pupićina cave (Hulina, Forenbaher and Miracle 2011: T. 4: 4) and elsewhere.

There were two examples of handles with button-like endings, i.e. bulges (Figure 11: 1; Figure 16: 1), recorded at Sv. Križ, one of which was found on a vessel which was completely restored. This vessel with one handle resembles a jug. There's a decoration on the vessel's belly with impressions through its entire extent. The impressions end at the bottom of the strap handle going up to the rim and a little bit above it, where it ends in a button-like bulge. The closest two parallels are almost equally distant, one is situated south from Sv. Križ at the Monkodonja hillfort (Hellmuth Kramberger 2017:

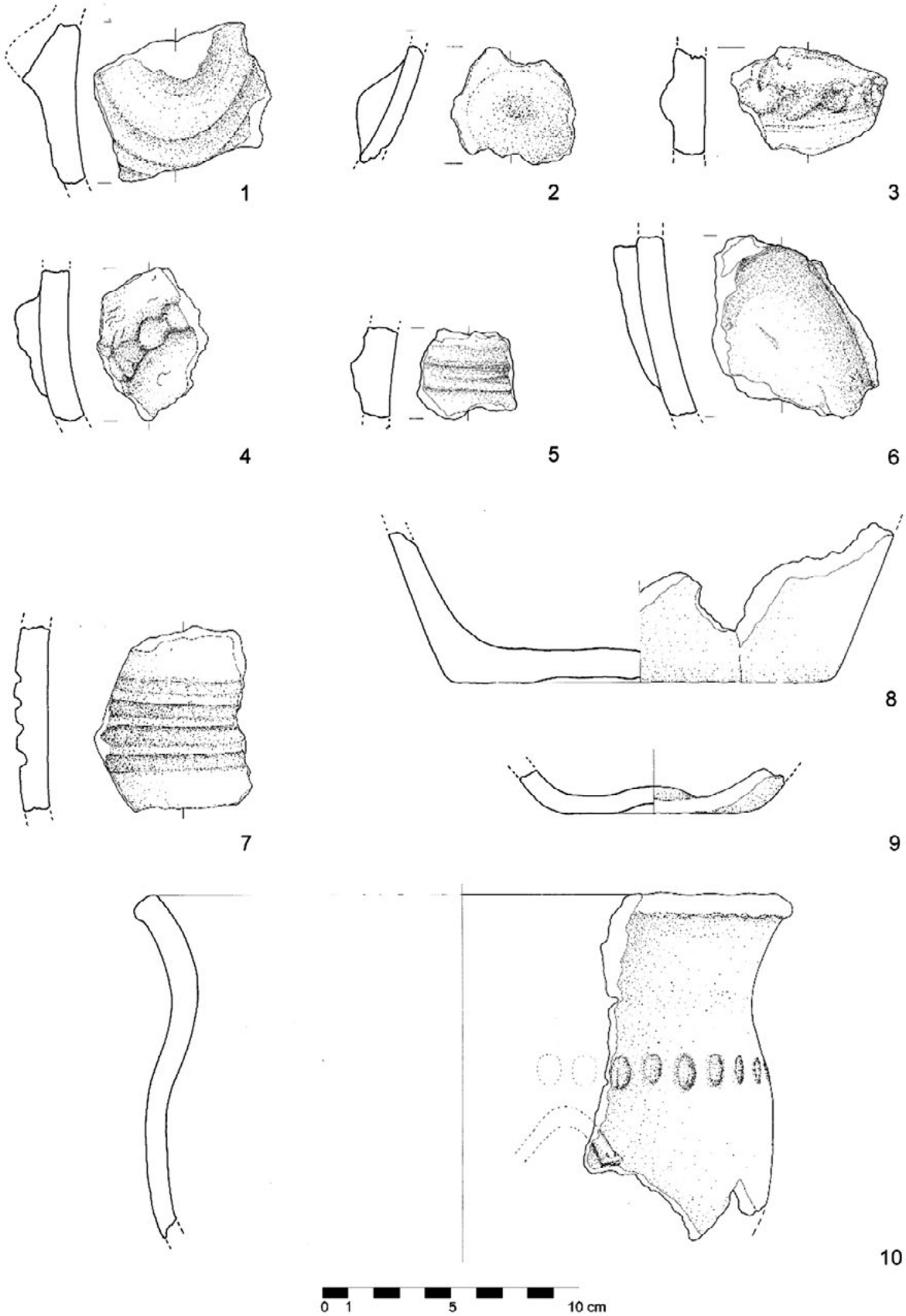

Figure 10. Drawings of decorated fragments and bottoms, everything pottery;
1, 3: SU 21; 2, 4-7, 9: SU 20; 8, 10: SU 15. M. 1:4
(Drawings: Dalibor Branković).

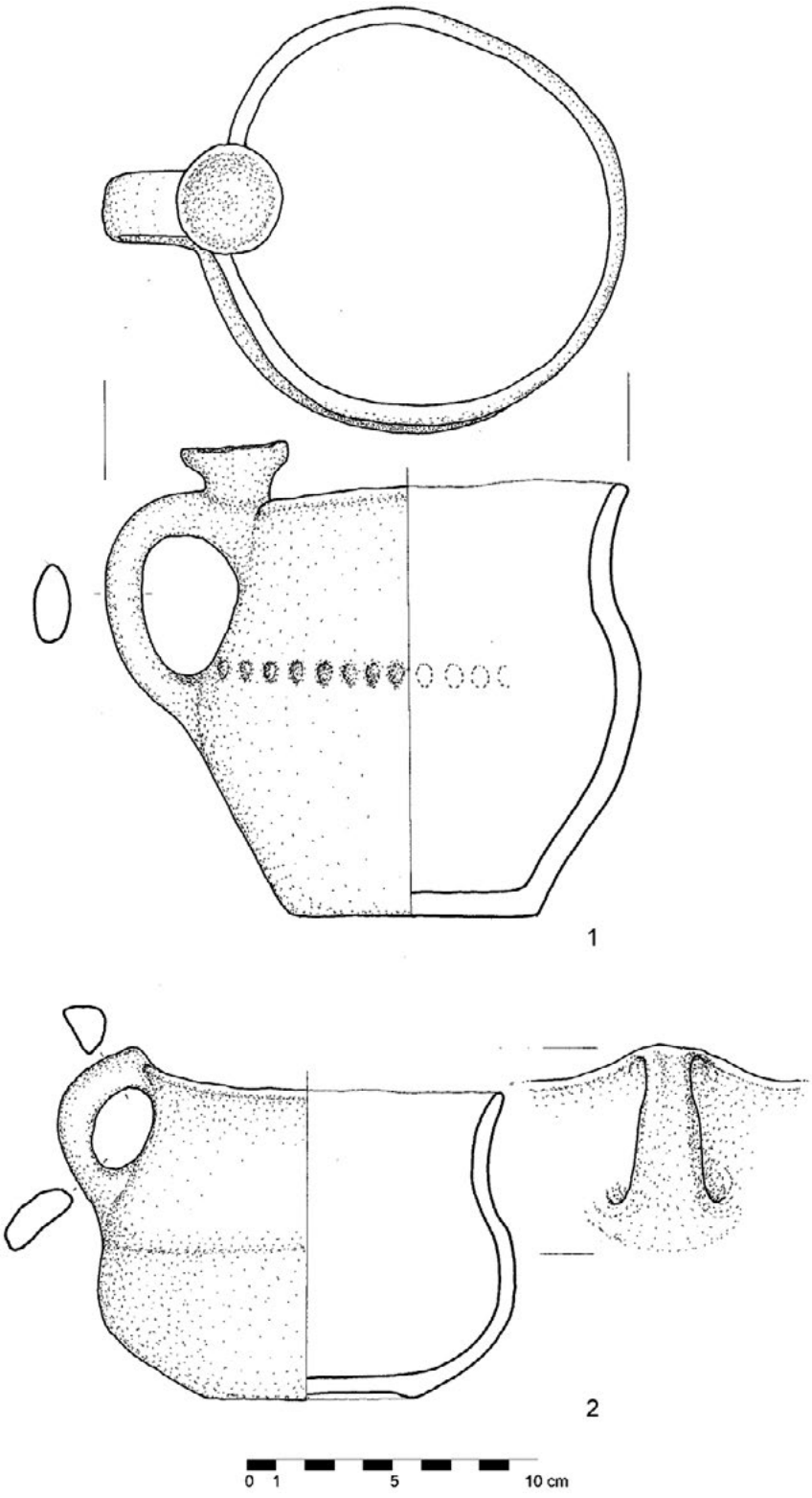

Figure 11. Drawings of reconstructed vessels from trench 4, everything pottery; 1: SU 20; 2: SU 30. M. 1:4 (Drawings: Dalibor Branković).

254, 349, 350, Sl. 222d; Sl. 225f; T. 71, 7), while the other was found on the Montedoro site near Trieste (Maselli Scotti 1997: 161, T.5: 20). Although the button-like ornament is almost identical, there are two major differences. The ornaments from Monkodonja and Montedoro are on triangular, not on strap handles as the ones from Sv. Križ. The other difference is that the button-like ornament is found next to the connection between the handle and the body of the vessel, not on the handle's arch. These specimens from Monkodonja and Montedoro are connected with Early and Middle

Bronze Age. According to T. Urban these kinds of bulges characterize Middle Bronze Age sites situated mostly in the lowland area of the Po River between Cremona, Brescia and Livenza River flow (Urban 1993: 192, 193, sl. 103: 91, 92; 199, sl. 106, 200). These handles were found in the material of the Early Bronze Age pile-dwelling settlement of Lavagnone on the Garda Lake (Rapi 2002: 119, SL. 5, 213; 147, SL. 18, 2). The Early Bronze Age of this settlement is dendrochronologically dated between 2070 and 2032 BC (Griggs, Kuniholm and Newton 2002: 19-23). In this case the handle with button-like bulge could be the oldest element indicating early dating in Sv. Križ. Nevertheless, this

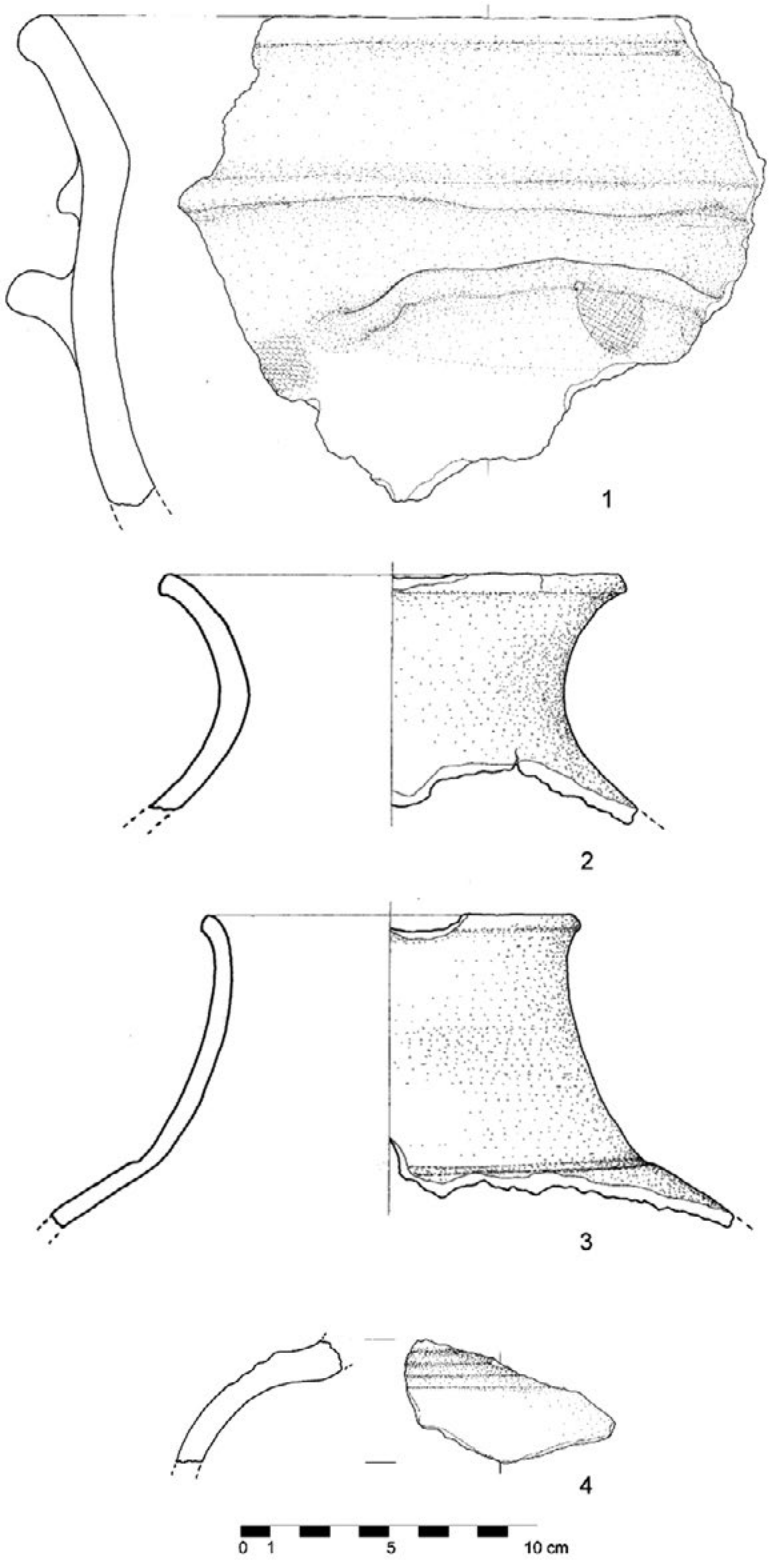

Figure 12. Drawings of different types of pithoi and bottles, everything pottery; 1: SU 23; 2: SU 25; 3, 4: SU 20. M. 1:4 (Drawings: Dalibor Branković).

kind of button-like ornament from Sv. Križ could also be a regional 'reinterpretation' of button-like ornaments found at the top of elongated appedix associated with strap hadles (known as *cilindroretta*) relating to the Middle and Late Bronze Age. For instance, in Emilia-Romagna (Italy) the button-like ornaments (*cilindroretta*) identify the beginning of Late Bronze Age (Cattani 2009: 250). They are found on more than 125 sites in northern Italy and date to the late Middle or Late Bronze Age (Bronzo medio – recente) (Cattani 2009: 251-253). In S. Biagio (Larga Piazzetta) (Morico 2009: 89, fig. 7: 44-51), Sesto al Reghena (Botti and Tasca 2006: 320, fig. 2: 15; Gnesotto 1994: 306, 308, fig. 1), Stevenà di Caneva (Gnesotto 1994: 306, 308, fig. 3: 3, 4), Boscat (Botti and Tasca 2006: 321, fig. 1: 6-8), Gradisca di Codroipo (Botti and Tasca 2006: 321, fig. 1: 11), Rividischia di Codroipo (Botti and Tasca 2006: fig. 1 : 13) the ornaments date to the beginning of Late Bronze Age. One handle, more similar to the Sv. Križ specimens, was also found in Porpetto (Italy), where it was dated to late Middle and beginning of Late Bronze Age (Botti and Tasca 2006: 323; Vitri *et al*. 1994: 287). Given both specimens were found in layers (SU 20, SU 21) connected to the building remains dated to the Late Bronze Age, this confirms their dating in this stage of life on Sv. Križ.

Some pieces are decorated with concentric incised channels set between neck and belly and are defined as pieces of a rounded globular thin necked bottle (Figure 12: 4). A part of the bottle is also on Figure 12: 2. Similar ones are known from Monkodonja (Hellmuth Kramberger 2017: 116-129).

All fragments from Sv. Križ show typical ceramic forms and Bronze Age hillfort settlement layouts, both in Istria and Carst of Trieste.

5.2. The use of space: functional analysis of artefacts, structural features and ecofacts

Probably the most significant evidences of food storage are the remains of several larger ceramic containers. Part of this material (jars and pithoi) shows plastic bands, handles, nubs, incisions or channels on the external surface (Figure 12: 1). In SU 23 several fragments of a bell-shaped pithos were found. There's a horizontal plastic band going from its neck to shoulder through the entire extent. Two horizontal handles and two horseshoe shaped band ornaments are also attested. The fragments were found inserted into a layer of clay (SU 22), probably realized to stabilize the bottom of the container. The pottery fragments are partially collapsed, but they were clearly preserved *in situ* and they are a marker of storage activity. There was a cluster of several vessels above them (SU 15) where pieces of smaller bowls and a larger pot or pithos need to stand out. The information shows us that the area was used for storage activities through a longer period of time. During this period at least one reconstruction or exchange of old pots with new ones took place. The bottom of pithos from SU 23 (with ornaments and handles) was used as a stabilizer to the SU 15 vessel. On the other hand, the pithos from SU 23 use the layer of clay (SU 22) as a stabilizer. The ceramic from SU 15 is a part of a younger, most probably Late Bronze Age phase, while the pithos from SU 23 belongs to the final phase of Early or Middle Bronze Age. The ceramics from SU 23 (Figure 8: 1; Figure 12: 1) shows also the possibility of the existence of the so-called anthropomorphic ornaments as found on Monkodonja and wider northern Adriatic area (Hellmuth 2012: 25-27). It is known that large jars and pithos represent a characteristic form of vessels in the Bronze Age in Istria and in northern Adriatic area (Hellmuth 2012: 20, 27). Besides this type of pithos which is chronologically the oldest, another one featuring barbotine can be determined in the same period. At least 5 more vessels, whose remains can be attributed to large food-storage vessels, were found. This only emphasize that it is an area with high concentration of large vessels, i.e. pithoi. There is a higher concentration of pithoi on some areas of Monkodonja and these parts are defined as storages (Hellmuth 2012: 24; Hellmuth Kramberger 2017: 305-306). Similar pithoi could be find in Buje (Višnjić, Percan and Pleština 2010: 41, 42, T. I: 1), Bale (Buršić-Matijašić 2010: 28, T. 1: 9), Vrčin (Buršić-Matijašić 1997: 136, T. 2: 10), Nesactium (Mihovilić 2001: T. 113: 1) or Gropi-Guran (Mihovilić 2007/2008: 62, T. 1: 7). They are all connected with Early and Middle Bronze Age. The best known material comes from Monkodonja. Here we have fragments and reconstructions of these kinds of pithoi; bell-shaped, with barbotine ornament and other ones that can be connected

Figure 13. Remains of pithos from SU 23 stabilized in clay (SU 22) (Photo: Goranka Perković).

with fragments found at Sv. Križ (Hellmuth Kramberger 2017: 195-201). According to this, we can see that these kinds of pithoi are typical form in the Early and Middle Bronze Age (Hellmuth 2012: 20).

Bottom parts of some of these pithoi were found *in situ*, dug and stabilized into a clay layer (Figure 13) which ensured their stability, especially if they were full. A similar example was found on Monkodonja where they were stabilized with rocks (Hellmuth Kramberger 2017: 306). In Akrotiri (island of Thira in Aegean Sea, Greece) we can see that pithoi were stabilized in clay, like the ones from Sv. Križ. The similarity with Akrotiri it's also in the number of small vessels that were used for taking out the products from pithoi (Hellmuth Kramberger 2017: 306). There are more than 8 cup shaped vessels or small jars found in Sv. Križ (Figure 11: 2; Figure 14; Figure 15). Some of them are surely connected to pithoi or bottles but there is a possibility that they were used for heating purposes too, like it was suggested for cups from Bronze Age horizon from Pupićina cave (Forenbaher and Kaiser 2006: 192-193). These kinds of cups have already been produced during Middle Bronze Age in regions of Istria and *Caput Adriae* (Cardarelli 1983: 92) but are also well known in Late Bronze and Early Iron Ages (Mihovilić 2001: 49).

Figure 14. Reconstructed cup (Photo: Mladen Mustaček).

Among the material which can be connected to food preparation, there are a couple of tray pieces (Figure 16: 5, 7), two legs of a tripod (Figure 16: 4), a couple of clay ring pieces (Figure 16: 2, 3) and a millstone with round pestle (Figure 16: 6, 8) used for grain processing. The presence of numerous types of grain remains goes in favor of this theory. The grain was probably held

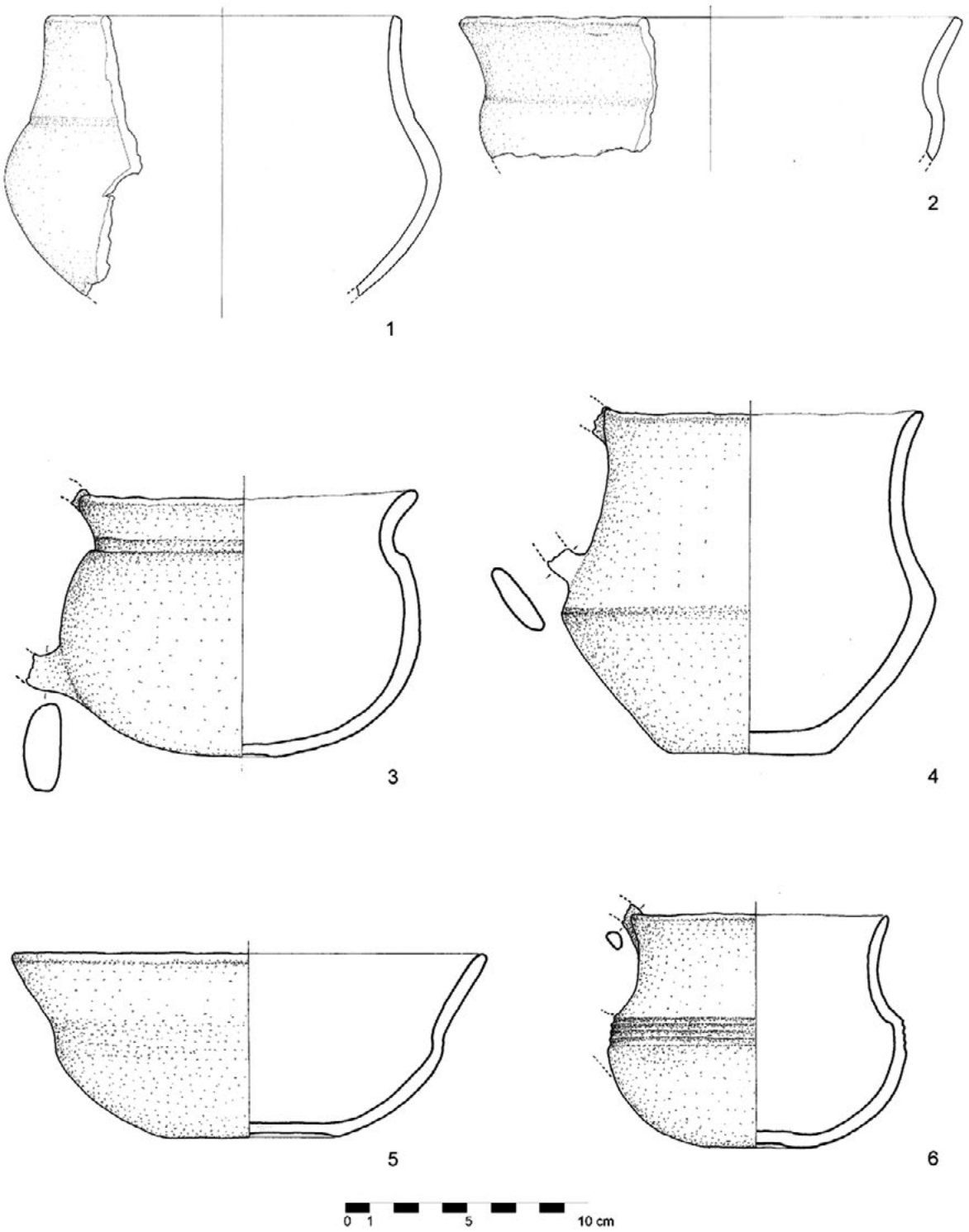

Figure 15. Drawings of different types of vessels, everything pottery;
1, 2, 5: SU 15; 3: SU 27; 4, 6: SU 10. M. 1:4
(Drawings: Dalibor Branković).

in big storage containers and then processed. The millstone and a pestle were found in SU 6 which belongs to Late Bronze Age.

Considering tray pieces fragmentation, it is difficult to determine whether they belong to tripods, *pyraunos* or just simple trays. This kind of trays are well known from various Istrian Bronze Age

sites such as Školjić near Funtana (Mihovilić 1995: 32, T. III: 9-11) and Monkodonja (Hellmuth Kramberger 2017: T. 9: 5, T. 23: 6, T. 131: 3, T. 132: 5). They are also a relatively common find in the Late Bronze and Early Iron Age settlement context of the southeastern Alpine area. Therefore, they are not chronologically sensitive (Gerbec 2018: 87). The tripod pieces (Figure 16: 4) were found in SU 2 and SU 6. These layers contained both prehistoric and ancient pottery pieces and can't serve as a relevant dating support. They can be compared to similar material in Istria since it is one of the most characteristic ceramic forms on Bronze Age hillfort sites in Istria. The best comparisons are probably found in the material from Monkodonja (Hellmuth Kramberger 2017: 215-220), Školjić near Funtana (Mihovilić 1995: 32, KARTA II, T. III: 8), Pasjak (Starac 1993: T. 1: 6), Kunci (Kos 2005: 57, T. 2, 3), Punta Kašteja (Mihovilić 1979: 49, T. 4: 10), Vrčin (Buršić-Matijašić 1997: 144, T. 10: 262), Elleri hillfort (Lonza 1981: 66, 72) and elsewhere – like on the islands of Cres and Lošinj (Blečić Kavur 2012a: 104, 105, sl. 3). They are also well known from Karst and Slovenian sites in Bronze Age like Sermin, Brgod, Farjevka na Babnem polju and elsewhere but also from Iron Age sites like Most na Soči or Ormož (Gerbec 2018: 94, T. 4: 33-35). They were primarily used as a type of mobile fireplace. That has been proven by the fact that almost every oven-plate found at Monkodonja had burning traces on its upper side which indicates that there was fire burning on them, and not underneath (Hellmuth Kramberger 2017: 215, SL. 183a-b). In Hotinja vas in Slovenia analyses of lipids were made on a *pyraunos*. Based on these results it had been concluded that the top surface was used for roasting and cooking. Either way, in the future, the results of analyses of lipids and other analyses will be of special importance for our knowledge of their usage (Gerbec 2018: 97-98). Tripods' legs are usually oval-cut, which is the case of the two examples from Sv. Križ. It has been determined that they appear at the end of the Early Bronze Age, for example in the Gradac Turan site (Mihovilić 1997, 43, 50, 51, T. 1: 6, T. 8: 15), but they are also often found in the Iron Age, at least in Istria (Mihovilić, 1995: 34, KARTA II; Mihovilić 2001: 47, 48, T. 102: 14, 22, T. 103: 13-14) and Slovenia (Gerbec 2018: 94). Except from the mentioned parallels in the neighboring areas, they can be found in the distant eastern Mediterranean areas like Cyprus and Crete where they belong to Early Bronze Age. It has already been proposed that this shape comes from this region (Hellmuth Kramberger 2017: 219, 220; Mihovilić 2001: 47, 48).

Clay rings (Figure 16: 2, 3) are a part of frequent material found in the Bronze Age settlements in Istria and all through the Iron Age, as well. Clay rings were found in Kaštelir by Nova Vas (Sakara Sučević 2004: 91, br. 735), as well as Iron Age Nesactium (Mihovilić 2001: 48, T. 102: 15-18; 104: 6-15). There are two interpretations for these rings. They were used as support for vessels on tripods or above an open fire as proposed for a part of the clay rings found in Slovenia (Gerbec 2018: 94-95, 99). Perhaps, they were also used as loom weights (Panella 1998: 372, 373; Saracino and Maritan 2012: 544, 547-548). Chronologically speaking, these and similar clay rings have existed without major morphological changes since the Late Bronze Age throughout the Iron Age. The ones found on Borgo S. Zeno date to the Late Bronze Age (*Bronzo finale iniziale*) (Panella 1998: 372). Smaller ones can be linked to weaving and were used as loom weights (Panella 1998: 372, 373). The same hypothesis is formulated for different sites in Veneto (Saracino and Maritan 2012: 543-544, 547-548). The smaller fragment (assumed dimensions – thickness: 3 cm, diameter: 12 cm, inner diameter: 5 cm) (Figure 16: 3) could be seen as loom weight. The other specimen (Figure 16: 2) from Sv. Križ is larger (assumed dimensions – thickness: 5 cm, diameter: 16 cm, inner diameter: 6 cm) and has traces of burning and therefore it was probably used for cooking purposes. Along with the hypothesis that they were used in the kitchen, it is also possible they were used for weaving (Panella 1998: 373). It is also possible they were first used as loom weights and then re-used as clay rings to support vessels during time. We believe at least one find (Figure 16: 2) from Sv. Križ was used as vessel support, but we cannot confirm it without doubt. We can only infer that they belong to the younger stage of life at Sv. Križ, Late Bronze Age (SU 6).

The context of finding of these tray pieces, tripods, rings and a millstone with a pestle is important. Although a part of them was found in the upper horizons (tripod pieces), the fact they were

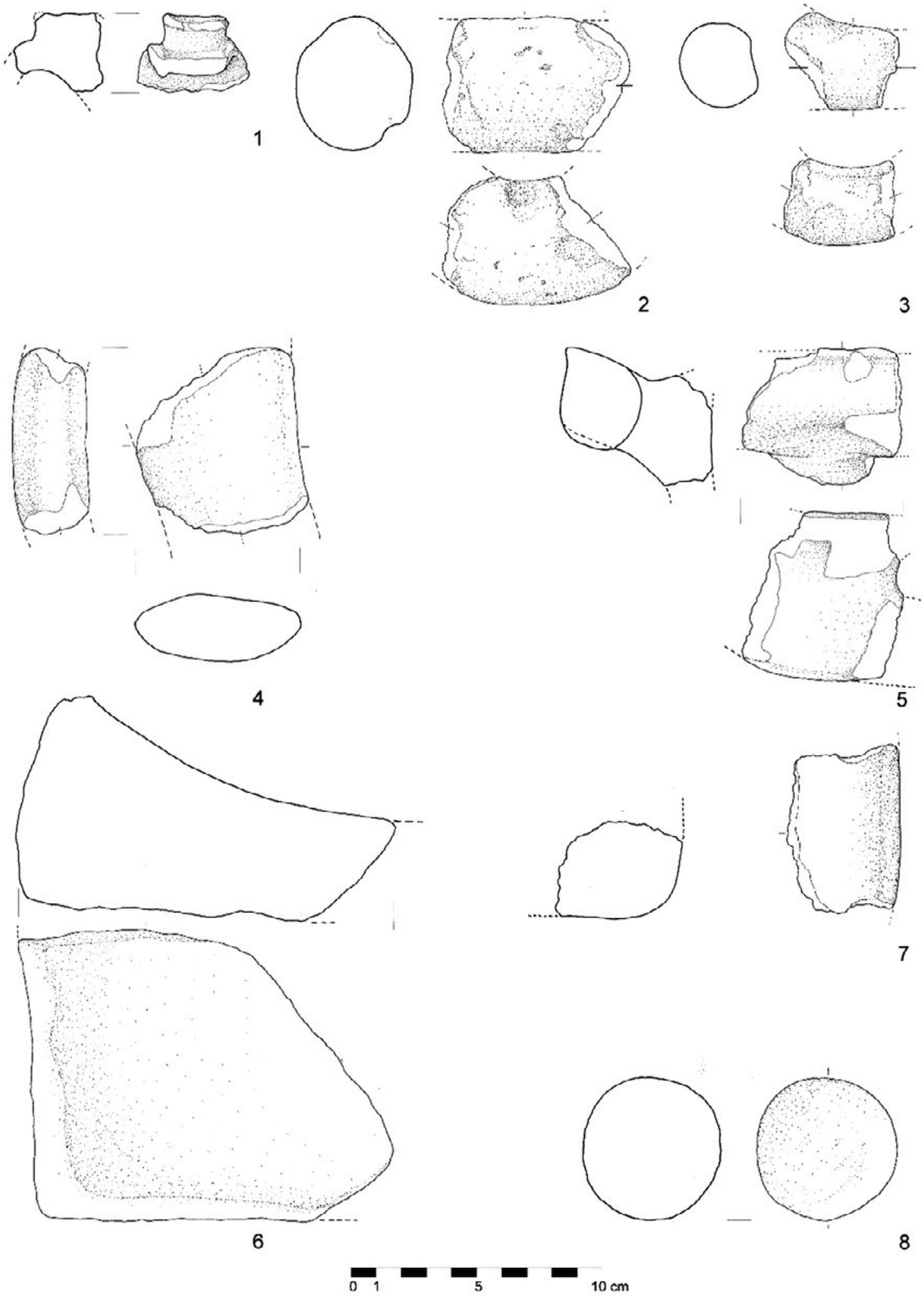

Figure 16. Drawing of a fragment of pottery (1) and findings connected with food preparing (2-8); 6, 8: stone; 1-5, 7: pottery; 2, 3, 6, 8: SU 6; 4, 5: SU 10; 7: SU 20; 1: SU 21. M. 1:4 (Drawings: Dalibor Branković).

found within the facility with large containers and fireplace speaks in favor of the existence of an organized and specialized area for keeping, cooking and processing food.

The seed analysis, conducted by Antonela Barbir, shows the existence of many different types of grain, fruit and weeds. Most data were gathered in SU 27. It represents one of several large containers found *in situ* and dug into SU 22 and belongs probably to Middle Bronze Age. A large number of grains like millet (*Panicum millaceum L.*), rye brome (*Bromus secalinus L.*), one-sided-Einkorn (*Triticum monococcum L.*) and two-fold-Emmer wheat (*Triticum dicoccon*), spelt (*Triticum spelta L.*) and barley (*Hordeum vulgare L.*) was detected (Barbir 2019: oral communication). Most of them were charred and that could indicate food processing. However, most probably both activities, cooking and food storage, took place in the same area. Remains of white sorrel (*Chenopodium album L*) and common knotgrass (*Polygonum aviculare L.*) have also been found. These kinds of plants were probably collected, cooked and eaten together (Barbir 2019: oral communication). White sorrel was used as food in the second part of the 20th century in southern Istria's rural areas (Jelenić 2019: oral communication; Percan 2019: oral communication).

Some of the grains and plants were found in the fireplace (SU 18) and they were all charred which indicates they were cooked there. The presence of fig seeds is also interesting (*Ficus carica L.*) because they weren't carbonized, which means they were put in the container either fresh or dried. Two pieces of grapevine (*Vitis vinifera L.*) seeds were found. It couldn't be determined whether they had been cultivated. But, given the period in question, they most probably were (Barbir 2019: oral communication). The grapevine seed, if it was cultivated, can be linked to bottle fragments where wine could have been stored. If that's the case, there is a direct connection to the Mediterranean and Greece whose influences reached the northern Adriatic. In that period vine growing wasn't known in regions along Danube (Kroll 2015: 108). Based on the analysis of vine seeds from 66 sites in Italy, half of which are from Veneto, Emilia-Romagna, Trentino-Alto Adige, it has been proven that a wild vine sort prevailed in northern Italy during the Early Bronze Age. The cultivation began in the Middle and peeks in the Late Bronze Age (Marchesini, Marvelli and Rizzoli 2015: 3-5, fig. 2). It can similarly be inferred for Istria. We have to bear in mind that it is possible the vines evolved cultivated by the indigenous inhabitants. Other notions that came from the Mediterranean improved the grape production technology (Marchesini, Marvelli and Rizzoli 2015: 7, fig. 1). Of course, these are all assumptions which can be confirmed only by new research and seed and lipid analysis. Some vessels shaped as cups were probably used for drinking. It shows their purpose maybe in wine consumption. There's also the possibility that these vessels were used for taking out different types of grains, liquids and other ingredients (Figure 11; Figure 14; Figure 15: 1, 3-6). Parts of these cups and jars (Figure 11: 2; Figure 14) are well polished. Food or liquid could be heated and consumed in these vessels. This kind of example is known from Pupićina cave (Forenbaher and Kaiser 2006: 192-193).

6. Final remarks

There is no absolute dating till now, so more precise conclusions can't be drawn concerning the exact chronology and time when the settlement was inhabited. The interpretation of the excavated structures, layers and findings is preliminary and only a new excavation would help better understanding of the site itself. The time period where the storage facility could be set, according to the information gathered, is the Late Early and Middle Bronze Age, with a final horizon dated even in Late Bronze Age. Although the excavated area is quite small considering the size of the entire settlement and although this research couldn't answer a number of questions and problems concerning dating and time of usage, it is certain that several conclusions can be drawn. According to typical finds in trench 4, there was a storage and a food preparation area there. It is obvious that there are parts or areas in Bronze age hillfort settlements which were primarily used for cooking and food storage. It can be assumed that similar storage areas existed in other parts of the Sv. Križ settlement. It can also be concluded that supplies preservation and

storage within bigger areas (kitchens) made part of a supply system on a larger scale and that most probably every household didn't dispose of its own supplies or cooking area. More likely, there was a common kitchen were food for the entire community was prepared. These kinds of conclusions are based on systematic research on Monkodonja confirmed by findings of larger pottery types which can be connected to food preparation (Hellmuth Kramberger 2017: 308-309). Although we can't speak of a pattern since there is no information from the rest of the site, we can see some similarities on Sv. Križ too. Furthermore, we have to remind that maybe there was a different kind of socio-economical organization on Sv. Križ. If that's the case, it could be that each household had their own kitchen and/or storage space. But, based on current data we need to point out the first hypothesis concerning one (or more) larger cooking/storaging area. Since there are not enough data and paleobotanical results suggest different types of food, we can't speak of a specialized storage area for just one of the products. According to Sv. Križ's position, people there probably didn't lack in food of vegetal or animal origin. Their strategic position above the communication line through the Mirna River which they controlled, and the vicinity of the sea to trade on the rest of the Mediterranean, made it possible for them to accumulate wealth. During the Bronze Age we can talk of the first large cultural Mediterranean *koiné* of the Old World. This affected and enabled the bridging of gaps between physical and cultural distances and the linking between different worlds (Blečić Kavur 2012b: 215, 216).

Without larger excavations, new researches and various analyses it is difficult to interpret the exact use of space at Sv. Križ. Only in that way we can better understand this topic and grow our knowledge about Bronze Age settlements in Istria.

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Daily life in a north Italian Early Bronze Age pile dwelling: Lucone di Polpenazze del Garda (Italy – Brescia)

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Abstract

Current excavation at Lucone di Polpenazze (Brescia – ITA) – a pile-dwelling village dating to the beginning of the Early Bronze Age, situated in a small intramoraine depression west of Lake Garda – has yielded many data, revealing the daily activities that took place on platforms above the water. This operation was conducted by cross-referencing data from different fields (dendrochronology, palaeobotany, archaeozoology, micromorphology) with plentiful archaeological information, using a GIS program. This analysis made it possible to identify waste-dumping areas, house structures and storage areas, and to recognize certain activities that were performed frequently in the huts. The pile dwelling has dendrochronological dates between 2034 and 1967 BC. The abundant archaeological finds can be attributed to the Polada Culture, characteristic of the Early Bronze Age of northern Italy.

Keywords: Early Bronze Age, Northern Italy, Polada culture, pile dwelling, daily activities, architectural elements, food storage

Résumé

Les fouilles en cours à Lucone di Polpenazze, un village sur pilotis du début de l'âge du Bronze situé dans un petit bassin inframorainique à l'ouest du lac de Garde, ont fourni des nombreuses données qui ont permis de reconstituer les pratiques et les activités quotidiennes qui se déroulaient sur les plateformes en bois des maisons sur pilotis. Cette opération a été rendue possible en croisant les résultats de diverses analyses (dendrochronologiques, paléobotaniques, archéozoologiques, micromorphologiques) avec l'abondance des données archéologiques et le traitement des données avec un programme SIG. L'analyse ainsi réalisée a permis d'identifier les zones de déchets des maisons, la structure des habitations, les zones utilisées pour le stockage des aliments et de déterminer certaines activités fréquemment réalisées dans les bâtiments. Le village sur pilotis a été daté par la dendrochronologie entre 2034 et 1967 avant J.-C. L'abondant matériel

archéologique mis au jour a pu être classé dans le contexte de la culture de Polada, caractéristique de l'âge du Bronze ancien dans le nord de l'Italie.

Mots-clés : âge du Bronze ancien, Italie du Nord, culture de Polada, palafitte, activités du quotidien, architecture, stockage

1. Introduction

The Pile-dwelling settlement model was introduced into northern Italy during the Neolithic (Baioni, Borrello and Visentini, 2005), but became most widely distributed in the beginning of the Bronze Age, when it was characteristic of the Polada Culture, the main cultural group of the Early Bronze Age in the central part of northern Italy. There are many pile dwellings that have been dated, mostly to the Early Bronze Age and Middle Bronze Age (2100-1500 BC), and many are subject to archaeological excavation. Research carried out in these contexts has furnished interesting information about the types of structures used, the modifications of settlement strategies linked to environmental transformations (Balista and Leonardi 1996, Baioni *et al.* 2018a) and some important dendrochronological sequences of regional importance (Martinelli 1996, 2007).

In only a few cases does the research involve a sufficiently large portion of settlement and include a sufficient number of dendrochronological measurements to allow reconstructions in plan to be proposed. In this paper we present the first results concerning Area D of Lucone di Polpenazze del Garda, particularly important because they refer to an initial phase of Early Bronze Age.

2. The site

Lucone is one of the best preserved intramoraine hollows surrounding Lake Garda (Figure 1). It consists of a sizeable depression which once contained a small lake, now in large part reclaimed, located in the northwest corner of the morainic amphitheatre surrounding Garda's southern shore. Its environmental characteristics, together with numerous areas featuring abundant archaeological remains, make Lucone a site of primary importance for the study of Bronze Age settlement dynamics.

The archaeological site was known locally in the 19th century, but was rediscovered in the 1960s. Surveys carried out in the 1980s defined five different areas with archaeological material, distinguished by the letters A, B, C, D, E. Only the Lucone A and Lucone D areas have been excavated; pile-dwelling settlements were found in both (Figure 2).

Area A was investigated between 1965 and 1971. The site seems to have had a fairly long duration, from the onset of the Early Bronze Age to the end of the Middle Bronze Age, corresponding in Italian chronology to a period between 2100 and 1400 BC (Guerreschi 1981; Baioni, Bocchio and Mangani 2007).

Area D was identified in the early 1980s and in 2007 the Museo Archeologico della Valle Sabbia resumed excavation of the site (Bocchio 1988; Martinelli 2007; Poggiani Keller and Baioni 2007; Baioni 2011, 2013).

The resumption of excavations at Lucone in 2007 was accompanied from the beginning by the adoption of digital tools for the management of all excavation data. In particular, a Geographic Information System model was produced (Quirino 2018), which allows the integration of previous and newly acquired data, with two consultation scales: a macro-scale comprising the topographic survey of the depression with the positioning of excavation areas and other data from non-destructive investigations, and a micro-scale featuring the stratigraphic detail of area D (individual plans, phase plans and a macro-plan with all the stratigraphic units) and data from multidisciplinary

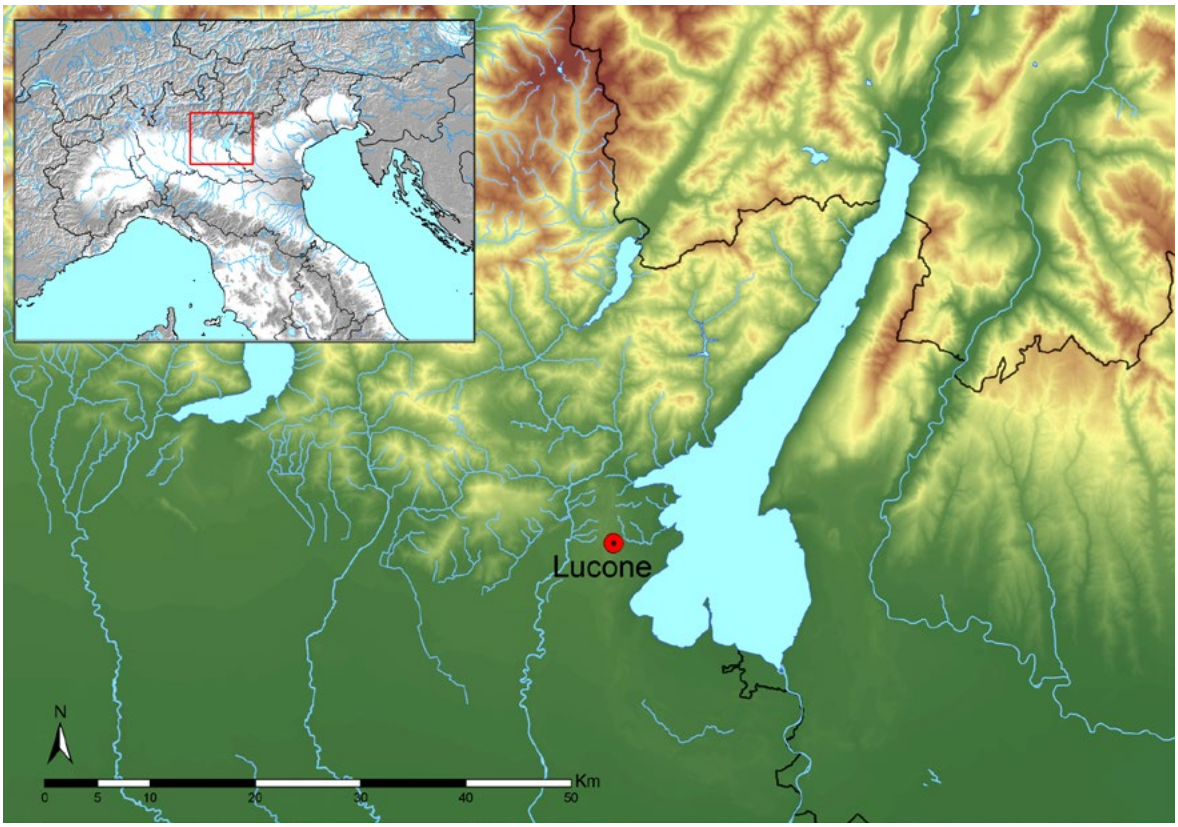

Figure 1. Location of the Lucone site in northern Italy and with respect to Lake Garda (elaboration GIS by Tommaso Quirino).

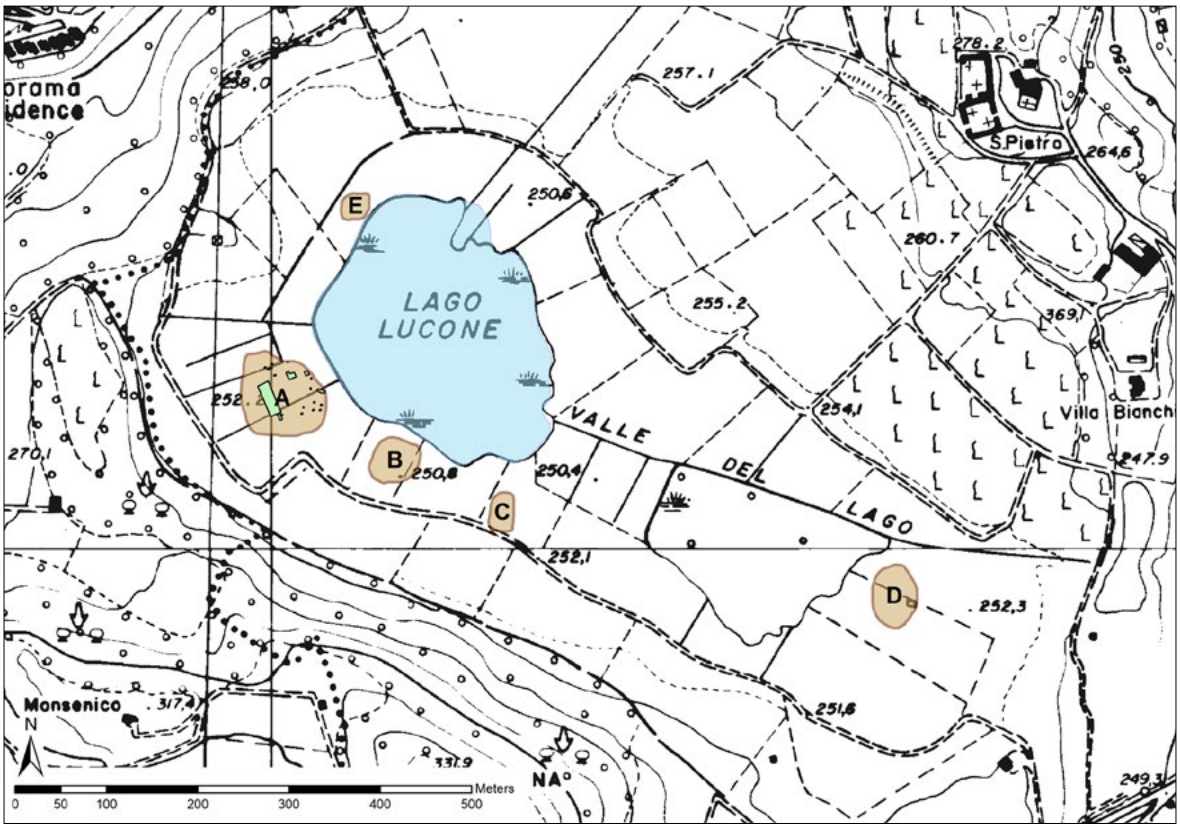

Figure 2. Map of the Lucone basin with the main archaeological sites (A, B, C, D, E) and the excavation areas (in green) (CTR Regione Lombardia, elaboration GIS by Tommaso Quirino).

research. The aim of this project is to guarantee the efficient and effective management of the archaeological record, in both the data-collection and interpretative phases.

The GIS software's analytical potential thus facilitates the different phases of the research, helping to cross-check various data and producing thematic and distribution maps, in addition to permitting various kinds of spatial analysis.

With regard to Lucone D, combining results obtained from surface surveys, micromorphology studies and core transects, we can hypothesize a settlement area covering just under 1 hectare (between 7380 and 9630 m^2). At present the excavation area consists of two contiguous sectors, with a total of area of 343 m^2:

- Sector 1, fully excavated and partly closed (190 m^2),
- Sector 2, currently being excavated (153 m^2).

Unless otherwise specified, this article refers to Sector 1 for which an overall study is ongoing. The excavation of Sector 2 is still in progress. This is a particularly interesting area, since it is here that very important structural elements have been brought to light, such as two 8-metre-long oak beams with 25 rectangular holes. These two timbers are currently undergoing conservation treatment. A 3D scan of them has been performed and a study is under way to understand their function.

Lucone D was a smaller, shorter-lived settlement than Lucone A, with a number of interesting features. The settlement had two main phases: it was founded in 2034 BC, and later rebuilt after a fire; the latest felling of trees used for the rebuild occurred in 1967 BC (dendrochronological dates). Both construction phases fall within the Italian Early Bronze Age 1 (EBA1a/b), corresponding to BzA1a and BzA1b or BzA1 and Early BzA2a in Central European Chronology (see David-Elbiali and David, 2009).

From a stratigraphic perspective, two phases – LUD1 and LUD2 – may be clearly recognized.

Phase LUD1: first period of use of the inhabited area, represented by a quite thin stratified archaeological deposit. This is the deepest part of the stratigraphy, exhibiting characteristics of a waterlogged environment, with good preservation of horizontal wooden elements, and rather low index of fragmentation of bones and pottery. Between the peaty silt (gyttja) layers that constitute the basic components of the stratigraphy there are heaps of waste building material of low thickness and elongated shape, rarely preserving intact ash lenses.

LUD1 is divided into LUD1a, which represents the dumping that occurred during the use of the inhabited area, and LUD1b – its destruction by a fire which affected the entire part of the village corresponding to Sector 1.

Phase LUD2 represents the reoccupation of the area after the fire. It comprises thicker and more intricate stratigraphy, characterized also in this case by the contrast between areas of continuous deposition of layers with a plant-based matrix and large dumps of waste material, that in this phase become large and complex, containing dozens of interleaved lenses and patches of various sorts.

Analysis of the Harris matrix showed that further subdivisions could be defined for phase LUD2. At the moment we propose a primary distinction between LUD2a and LUD2b, marked by a series of displacements of the village's main rubbish piles. In addition, we have tentatively indicated as LUD2c the final phase of the occupation of the area, characterized by the deposition of extensive lenses of potsherds that immediately preceded its abandonment.

3. The artefacts

Only an overview of the most significant characteristics of the artefacts found is given in this paper; the existing literature and forthcoming papers should be consulted for further details. The number of archaeological finds from Lucone is considerable, as usual in prehistoric pile dwelling sites. Moreover, the possibility of reconstructing the vessels from Lucone is very high: almost all the large vases were broken in situ. Small and medium-sized vessels are mostly intact.

The most common objects are mugs (Figure 3, 1-9), amphorae and jars of various shapes and sizes, typical items of the early phase of the Polada Culture, with parallels from contexts such as

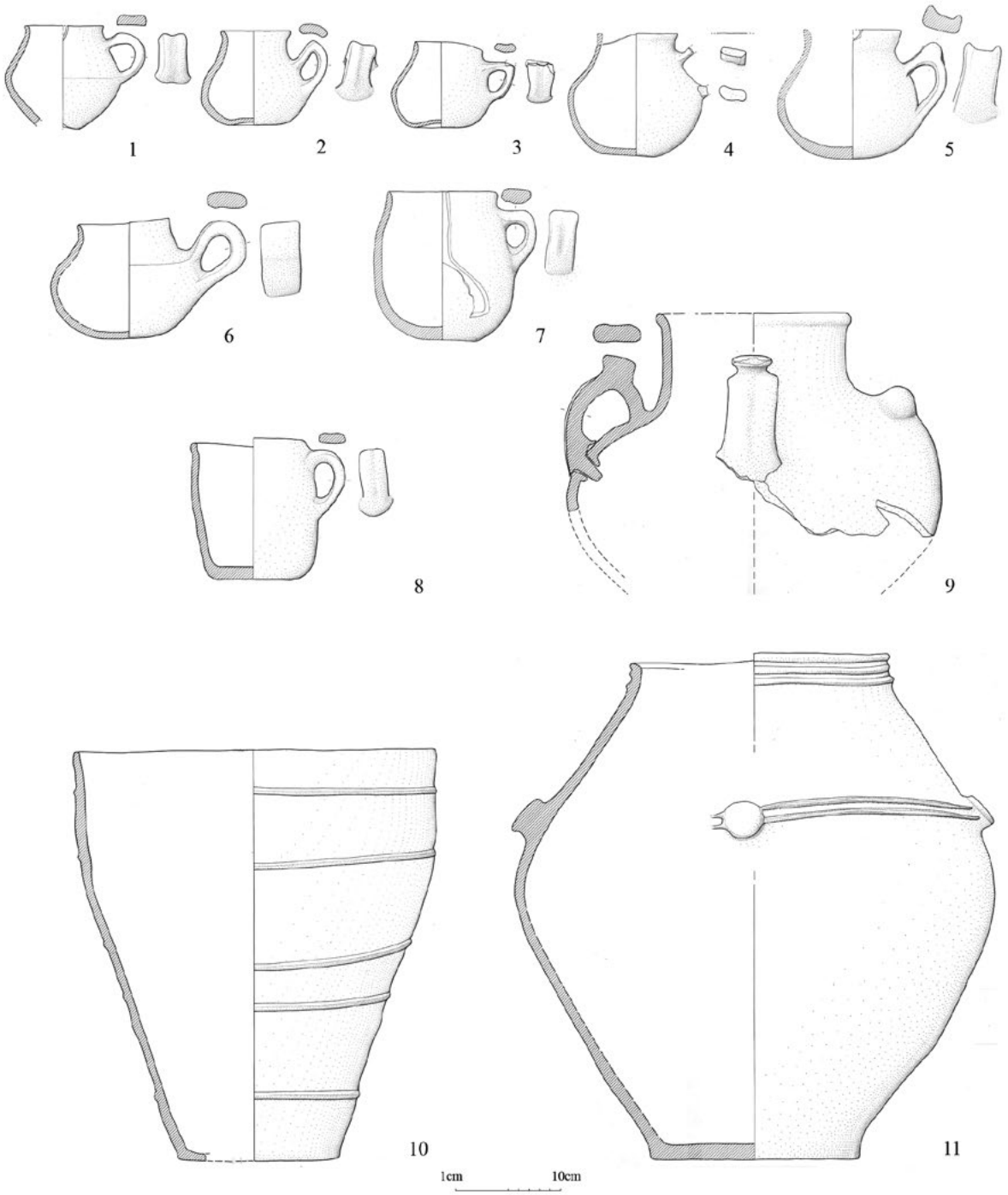

Figure 3. Lucone di Polpenazze, Site D. Ceramics from the fire level
(drawings by Mimosa Ravaglia)

Lavagnone (phases 2 and 3 – Perini 1981, 1989; Rapi 2007) and Bande of Cavriana (Piccoli 1982). There are a few cups, and some sieves and toy vases. Many pots have large dimensions and distinctive shapes, such as the large biconical vessels with bosses (Figure 3, 11) and truncated-cone shaped vessels (Figure 3, 10). As far as decorations are concerned, most are added features; engraved motifs are rarer. In addition to pottery, the site has yielded bronze artefacts such as axes and daggers, stone items such as wristbands, and bone objects such as pins. Wooden tools, for example sickles (straight or bent), whisks and hoes (examples are shown in Baioni and Gulino 2016), come from many areas of the excavation. There is also evidence of equipment for spinning and weaving (spindles and loom weights) and fragments of linen fabric (Gleba and Baioni 2018). Among the ornamental elements, there are numerous beads, both in stone and faience. The presence of beads made from S*taphylea pinnata* seeds and *Prunus* stones should also be noted (Perego *et al*. 2010; Heiss *et al*. 2014). The discovery of faience beads (Bellintani 2011) and so-called 'Enigmatic tablets' (in German *Brotlaibidole*) reveals a network of exchanges with central Europe (Baioni and Poggiani Keller 2015).

4. Botanical remains

The site of Lucone offers a good opportunity for a multidisciplinary investigation of palaeoeconomy and palaeodiet (Badino *et al.* 2011; Perego 2017). The preservation of subfossil plant remains, particularly seeds and fruit, is excellent, allowing their precise identification. In addition, they can be recovered in huge quantities from each stratigraphic unit, although a substantial difference exists between the two settlement phases of the Lucone village. Layers of the first settlement phase (phase LUD1) are waterlogged and the preservation of plant remains is excellent. The plant spectrum is rich and includes not only useful plants but also species from natural environments that are essential for a palaeoenvironmental reconstruction. The plant remains preserved in the layers of the second settlement phase (phase LUD2) are mainly charred. The preservation here is less favourable, as these layers are affected by seasonal groundwater level oscillations and thus become periodically drier.

A wet-sieving technique was adopted to recover plant remains and ruminant faeces, using sieves with 4, 2, and 0.35 mm mesh sizes. A total of 38 surface samples has been analyzed, 22 of these with a fully quantitative analysis, yielding 146 different plant taxa.

Sixty-four goat and sheep dropping samples were analyzed for plant macro- and microfossil content in order to get information about husbandry practices. The taxa identified here, the types of remains and the high frequencies of minerogenic particles and micro-charcoal support the hypothesis that the animals pastured in the surrounding area even in the cold season, spending the night in the village. Some samples can be related to the practice of feeding animals with cultivated plants (i.e. by-products of cereal crop-cleaning, flax capsule fragments and apple/pear pericarp). The few detected herbaceous taxa indicate mainly ruderal habitats and fallow fields, which could have been an important source of fodder, too. The pollen spectra contained evidence that in spring and summer the animals grazed in a largely open landscape with scattered shrubs and stands of trees (especially oaks). Wetland vegetation was also used as animal pasture.

The cultivated plants found as plant macroremains are mainly cereals and flax (*Linum usitatissimum*). In addition, another domesticated plant recovered in Lucone site was safflower (*Carthamus tinctorius*) of which few achenes were found in both settlement phases. The importance of this plant is linked to production of oil-seeds and its use for dying textiles.

The most important cereal crops were emmer (*Triticum dicoccum*), 'new glume wheat' (*Triticum* nn, possibly *T. timopheevii*) and, to a lesser extent, barley (*Hordeum vulgare*). In addition, there were also other cereals such as naked wheat (tetra- and hexaploid naked wheat) and spelt (*Triticum spelta*),

showing a very high cereal diversity. With regard to new glume wheat, in 2011 ears were also recovered (Perego and Jacomet 2013). The preservation of these remains is mainly due to charring, but uncharred waterlogged cereal remains have also been found.

Flax was mainly cultivated for its stem fibres from which linen is manufactured, as testified by the discovery of a linen fabric belt. Nevertheless, a huge amount of linen seeds (both charred and uncharred) as well as capsule fragments were also found, suggesting the considerable consumption of this plant as food. Pulse crops have not so far been documented at Lucone.

Besides cultivars and possible cultivars, many wild plant taxa have been identified. Most of the plants gathered for food consumption were pear, crab apple, fig, oak, hazel, strawberry, blackberry, plum and wild grape. The great range of collected plants found at the site of Lucone indicates a good knowledge and rational use of wild plant resources. These plants came from varied habitats in the surrounding area, including wetland and mixed oak forest (and their borders), dry pastures with shrubs, etc. The abundance of light-demanding species (e.g. *Cornus mas, Rubus* sp., *Sambucus* sp.) indicates the great expansion of forest borders or forest clearance, mostly as a result of opening of the forest through human activities. The most abundant collected plant was the cornelian cherry (*Cornus mas*): it was a popular food, most probably eaten fresh or maybe used to prepare something like jam. Wild edible plants such as fig, and cornelian cherry too, grew well in the climate of the Garda region. The sub-Mediterranean climate which characterized this region facilitated their growth and ripening. Consumption of certain fruits which could also be eaten as dried fruit was also favoured; they could have been easily stocked and kept for a long period. This fairly large amount of edible wild plants demonstrates that an important contribution was still made by gathered species to food supplies during the Bronze Age in northern Italy.

5. Animal remains

With regard to the animal remains recovered from both phases (Bona 2018), domestic animals were more common than wild ones (92% in LUD1 and 94.7% in LUD2). Thus in both phases wild animals are attested in low percentages, so hunting – though still practised – was of marginal importance to the economy of the village. Among domestic animals that most represented is the pig (in both phases more than 45.5%), followed by ovicaprids (38-39%) and cattle (14-16%). These proportions between the three main domesticated mammals reveal an uncommon situation, and not only for Garda area pile-dwelling sites of the Ancient Bronze Age.

Analysis of the frequency and age of death of the taxa indicates for what purposes the domestic mammals were bred: the pig for meat and ovicaprids for milk and meat, whereas cattle were mainly used as working animals.

The high number of wild animal taxa identified show that hunting was very diversified, indicating a good capacity for exploitation of environmental resources. The deer is the most frequent wild animal, followed by the wild boar. A large number of carnivores were also hunted, including the bear. The beaver was a common prey as well as the marsh turtle.

On the basis of this archaeozoological study it is possible to make some palaeoenvironmental inferences. The presence of animals strongly linked to woodland (deer, bears, roe deer and wild boar) indicates the presence of dense forest cover. There are also animals that testify to the abundance of water, in the form of both lakes and rivers (marsh turtles and beavers).

The areas dedicated to agricultural activity would have been kept to the minimum necessary for the needs of the village. The few cattle raised by the villagers show that only limited areas bordering the village were used for animal raising. Breeding pigs does not require extensive pastures, since

they live very well in the forest in a semi-wild fashion. The ovicaprids would also have found adequate nourishment on the morainic hills.

6. The structures

A total of more than 1200 vertical and horizontal wooden elements have been identified at Lucone (1060 in Sector 1), all of which have been carefully catalogued. 367 samples were subjected to dendrochronological analysis.

Identifiable felling events appear to have numbered at least 29 between 2034 and 1967 cal BC. Numerous felling episodes occurred very frequently, often in consecutive years. This situation makes analysis of the planimetric distribution in order to identify the buildings extremely difficult, since it is not possible to distinguish the main phases of the restructuring process and also gives rise to the suspicion that the timber was stored. Thus wood felled in different years may have been used for the construction of the same structure, and vertical poles that survived the fire reused.

Wood analysis has currently been carried out on about 500 elements, including the samples subjected to dendrochronological investigation. Research has shown that deciduous oak sect. *ROBUR* is almost exclusively used for vertical poles: only one pole was made of deciduous oak sect. *CERRIS* (Baioni *et al.* 2018b). The horizontal elements, however, belong to various wood types, although the deciduous oak remains among the most frequent taxa. At the moment it is not possible to understand which felling event followed the evident episode of fire that allows the history of the village to be divided into two phases. So far, analysis of the established felling dates for the horizontal wooden elements involved in the fire has shown that the most recent of these date to between 2025 and 2017 BC and therefore the fire might have occurred immediately after the latter event.

The horizontal components have been preserved above all, but not exclusively, in the levels corresponding to the fire and are mostly composed of planks, boards, beams and joists (Figure 4). There are several moulded planks. Roof parts such as a beam with a non-passing square hole and diagonally-cut ends, perhaps part of a truss, were also involved in the fire.

7. The organization of the settlement

As often happens in these 'post field' pile dwelling sites of the Italian EBA, the identified poles belong to various construction phases and only by combining dendrochronological dating and spatial analysis using GIS can the relationships between poles be found.

At present, spatial analysis has been carried out only for part of Sector 1, using the 274 dated poles found there. Precise dates are available for 68 of them, while for another 138 date ranges of varying size have been determined on the basis of sapwood estimates. Exact dating was impossible for the rest of the posts. GIS sofware has proved to be an essential tool for studying this particular settlement, where numerous and frequent tree-cutting episodes and probable wood storage make it difficult to identify the vertical posts used to build individual structures. For this reason we had to proceed by means of experimental trials, and required a tool that could manage all the data, allowing comparisons to be made using different, closely-spaced chronological intervals (Using sapwood estimates, for each sample to be dated the first and last possible felling years need to be considered). GIS fully responded to these needs, also allowing spatial representation and perfect interaction with the database in which the dendrochronological dates of each post analyzed were entered. Limiting ourselves to the most ancient phase, a first spatial analysis has already allowed us to note that the group of poles felled in the range 2035/4-2033 BC and that of the poles set up in 2032-2031 were positioned in different ways.

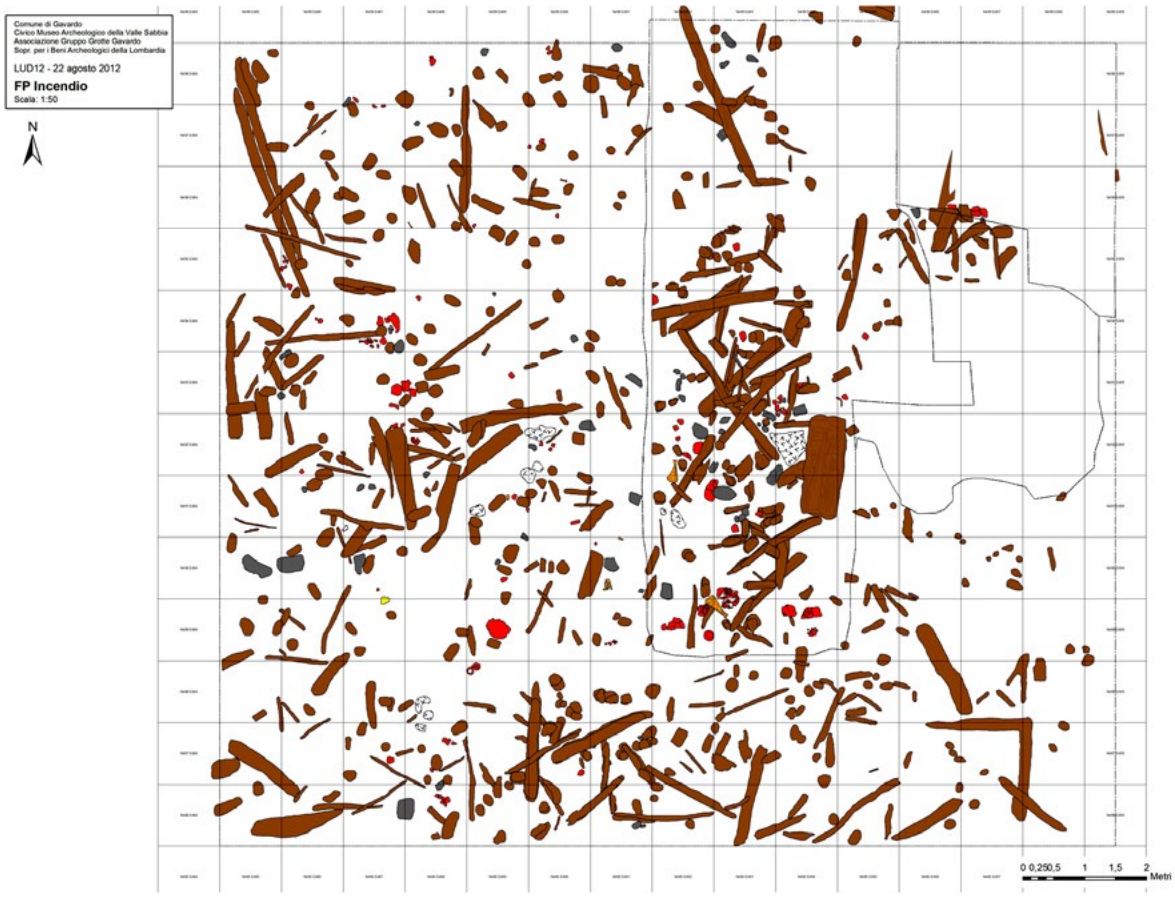

Figure 4. Lucone di Polpenazze, Site D. Plan of fire level with the main horizontal wooden elements (elaboration GIS by Tommaso Quirino).

From this first observation it was possible by means of careful analysis, also using dendrotypological observations, to highlight for the interval 2035-2033 a first hypothetical structure that is rectangular shape and encircled by a row of posts (Figure 5).

For the range 2032-2031 three other structures have been identified of which we were not able to define a complete plan, because parts of them continue beyond the excavation area (Figure 6). It is important to note that these were built around the oldest structure, whose space is respected. These structures seem to have the same orientation, with a short side towards the centre of the lake. The houses appear to have variable dimensions, but their width is around 5 metres.

To the west, where unfortunately the wood sampling is yet to be completed, numerous fragments of plaster have been discovered. These belong (at least in part) to three conical structures in unfired clay which may perhaps be interpreted as raised silos. This type of structure has never been documented among Bronze Age pile dwellings, but resembles a similar construction (although rectangular in plan) found in Iron Age settlements – for example that discovered in Lovara near Villa Bartolomea in Veneto (Moffa 2002, 2008, fig. 33). Similar structures, with circular or square plans, are known in other parts of Europe, such as Southern France (Nin 1999, p. 271).

Not far from this area, in the corner of the northernmost house, were found 3 vases of the same shape and size (Figure 2, 11), full of ears of different cereal species (barley, emmer, the 'new glume wheat' and tetraploid naked wheat). The form has parallels from various other sites, including the Oppeano site (Verona), (see Gonzato *et al.* in this volume).

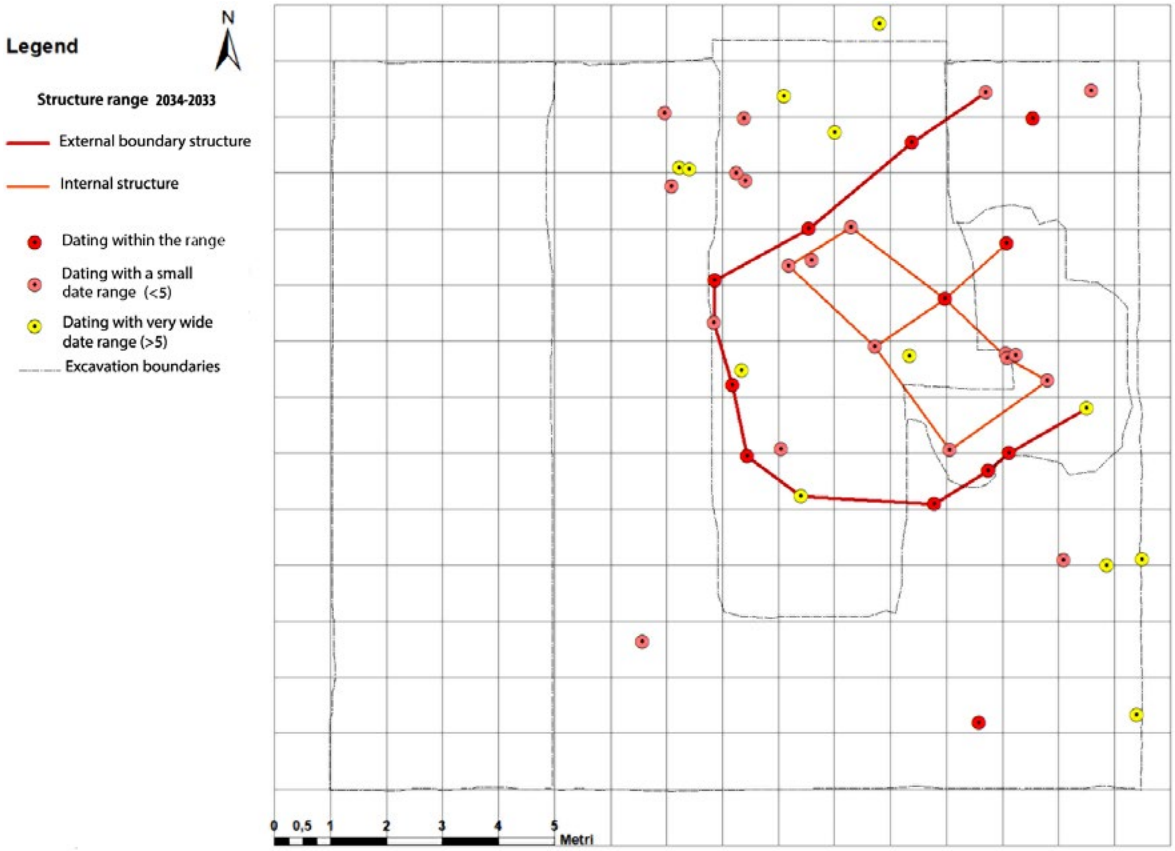

Figure 5. Lucone di Polpenazze, Site D. Reconstructive hypothesis that uses the posts of the range 2034-2033 BC (elaboration GIS by Emanuele Saletta).

Comparison between the positioning of collapsed wooden structures and reconstructed house plans was only partially successful. At only a few points in the excavation are collapsed planks and beams located within the house areas defined by our proposal.

An interesting fact emerges from comparing the hypothetical planimetric data and the distribution analysis by squares of the pottery fragments, which are concentrated above all around the perimeters of or in the spaces between the buildings, and not in the parts below them.

A different relationship is found between the house plans and the waste heaps of the village's first phase LUD1. The oldest structure does not seem – at least in the area of the excavation – to have been associated with any rubbish dumps, while the other three structures are each connected with at least one (Figure 5).

8. The waste heaps

The analysis of waste heaps found next to or below the houses is of great importance for interpreting what kind of activities took place on the wooden decks. The dumps are complex accumulations of mm-thick laminae with different compositions. Dark-coloured laminae are mainly composed of plant remains and are intercalated with light greyish brown laminae containing unburnt or and burnt silt loam and ash. The micromorphological study of thin sections has led to the conclusion that the latter laminae are formed of a mixture of fragments of calcareous material quarried from the glacigenic substrate surrounding the site and from the soils formed on it (Cremaschi 1987).

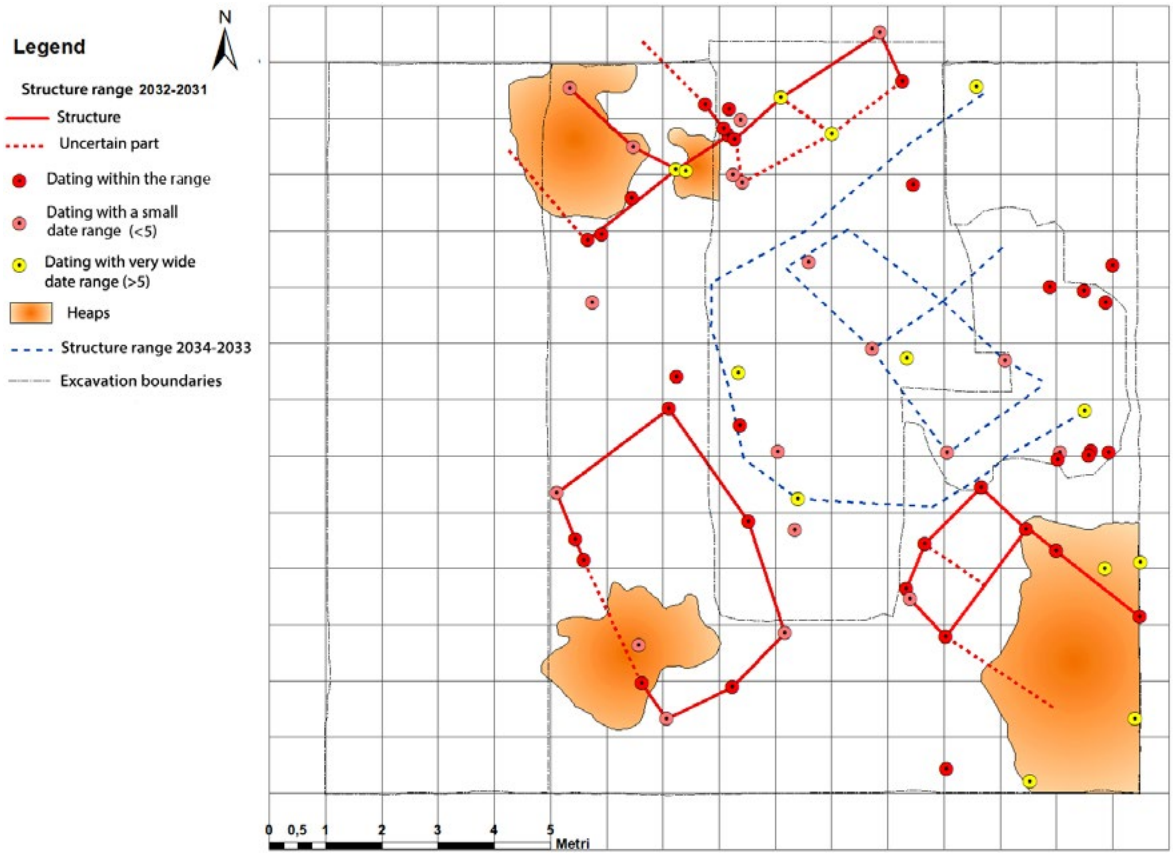

Figure 6. Lucone di Polpenazze, Site D. Reconstructive hypothesis using the posts of the range 2032-2031 BC (elaboration GIS by Emanuele Saletta).

The ash mixed with these fragments provides important information about the nature of the fuel that was used, with a broad spectrum that includes wood, herbivore dung, herbaceous plants, and cereal processing residues (chaff). Often coprolites were identified mixed within ashy layers. Their composition (they contain a calcium phosphate – as revealed by SEM-EDS analyses on uncovered thin sections) points to carnivore-omnivore, probably human, producers (Brönnimann, Pümpin and Ismail-Meyer 2017).

The organic laminae are instead composed of plant remains including twigs, bark, leaves, seeds (sometimes burnt), burnt cereal caryopses, tissue fragments, carbon and numerous phytoliths, often in anatomical connection.

Analyses have therefore determined that the heaps are not *in-situ* structures, but rather formed by the repeated dumping of waste derived from the cleaning of cooking installations inside the houses, with the regular maintenance and remaking of the earthen lining. They contain valuable information about the activities that took place on the decks, which to date have never been found. Further analysis may provide data on food types and preparation techniques. The lack of bioturbation (i.e. traces of the passage of soil fauna and roots) suggests an environment with an exposed surface, undoubtedly wet, but not perennially flooded. Capillary rise was also surely active during the heaps' accumulation, making their environment of formation even wetter. The observed fine laminations could have been interpreted as the result of slow sediment settling in a standing body of water. Nevertheless, analyses permitted the rebuttal of this hypothesis. The laminations do not appear to be the result of deposition under water, but rather the progressive and repeated accumulation of waste under wet conditions, with an absence of bioturbation.

9. Conclusions

Lucone D shows great potential for study of the environmental, economic, and structural aspects of a pile dwelling during the Early Bronze Age in northern Italy. An interdisciplinary approach (geoarchaeological, botanical, archaeozoological) in fact allows us to reconstruct both individual actions and practices and operational chains used by these ancient communities to adapt to the particular lake environment. The extraordinary preservation of the wooden elements, accompanied by the extensive application of dendrochronology and dendrotypology, allows some hypotheses to be made regarding the spatial definition of the structures in the settlement. This is one of the first attempts made in Italy to reconstruct a portion of an Early Bronze Age pile-dwelling area of the type 'with a high deck with field of poles', characterized by an expanse of vertical poles with no apparent order, composed of all the piles installed during the life of the settlement (for a classification of the different types of pile dwellings see Balista and Leonardi 1996, and Baioni *et al.* 2018b).

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Different ways to handle the domestic space by comparison: the case of Bronze Age villages in Vallese di Oppeano (Verona – ITA)

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Abstract

Two new settlements were discovered during preventive archaeology in the Bussè plain (Vallese di Oppeano-Italy), not far from the already known Feniletto pile dwelling. The first settlement (named 4C) dated to the Early Bronze Age, whereas the second one (4D) dated to the Middle Bronze Age.

Site 4C is a pile dwelling; it had a short life and was abandoned after an alluvial event. Because of the latter, we assume that people have moved to the north to the site named 4D. Site 4C and 4D are in fact separated by a meter thick sandy-silty grey alluvial layer, deriving from overbank activity of the river Adige.

In site 4D, four phases have been identified, each one clearly separated by gyttja or silty layers, the thickness of which suggests the alternation of short wet and dry events. In the levels pertaining to phase 2 the best preserved wooden structures were found.

The paper aims to show on what ground Bronze Age people changed settlement strategies in this area.

Keywords: Northern Italy, Early and Middle Bronze Age, wooden huts, settlement strategies, wetlands

Résumé

Dans la plaine de Bussè (Vallese di Oppeano-Italie) deux nouveaux établissements ont été découverts au cours d'opérations d'archéologie préventive, non loin de le palafitte de Feniletto, le premier (4C) daté de l'âge du Bronze ancien, le second (4D) daté de l'âge du Bronze moyen.

Le site 4C est une village sur pilotis, a une vie courte et a été abandonné après un événement alluvial. Puis nous supposons que les gens se sont déplacés vers le nord sur le site nommé 4D: les relations stratigraphiques entre les deux villages ont malheureusement été coupées par un canal successif.

Sur le site 4D, 4 phases ont été distinguées, chacune clairement séparée par des couches de gyttja ou de loam, dont l'épaisseur suggère l'alternance de courts événements humides et secs. Dans les niveaux de la phase 2, les structures en bois les mieux conservées ont été préservées.

Cette contribution vise à montrer le lien entre le type de substrat, l'environnement et les stratégies d'occupation des communautés de l'âge du Bronze dans la plaine de Bussé.

Mots-clés : Italie du Nord, âge du Bronze ancient et moyen, maisons en bois, stratégies de peuplement, zones humides

1. Introduction

The municipality of Oppeano is about 20 km south of Verona, a territory rich in archaeological evidences spanning from Bronze to the Iron Age. In a stretch of floodplain named Bussè (close to Vallese di Oppeano) and reclaimed during the 12th century AD (Bosco 2015, 150), the Feniletto Late Bronze Age pile dwelling (ca. 13th-12th century BC) is known since the end of the 19th century AD (De Stefani 1869; Alfonsi 1919). In 2014, during preventive archaeology operations linked to the construction of the Zimella-Cervignano D'Adda pipeline, two new settlements were discovered. Unfortunately, an incision by a natural channel cut the stratigraphic direct relationship between the two sites. Site 4C, to the east, dates to the Early Bronze Age (20th-middle 17th century BC). Site 4D, on the west, dates to the Middle Bronze Age.

This paper aims at illustrating the results of the studies carried out so far in order to understand the different settlement strategies employed in the same geographical area during Early and Middle Bronze Age (Bronze Age chronology after Cupitò and Leonardi 2015).

2. Vallese-Oppeano, site 4C, 2015 excavation

As part of the work on the construction of the pipeline, a further excavation was carried out in 2015 south of the main one (2014), which is not taken into account in this contribution, as it focuses on the 2015 excavation. The excavated area, rectangular in shape, was originally 10 m long and 5 m wide. At a later stage, due to logistical complications caused by the abundant rise of groundwater, the area of the investigation was reduced and the excavation was concentrated in the western half of the original sector (Figure 1).

During the **first phase** of the village, a hut was built in this area. Only traces of vertical wooden elements (postholes) were preserved and waste heaps have been identified, as well as anthropic materials such as potsherds and flint (**phase 1a**, corresponding to the village foundation). At present, it is not possible to clearly understand if this structure was of pile-dwelling type or if it was a hut built over a preparation (in Italian *bonifica*) i.e., an insulating structure – wooden platform, pebbles level, backfill etc. – built directly on the ground, to obtain a well-insulated floor. The hut was destroyed by fire (**phase 1b**) as shown by the numerous charred collapsed wooden elements, that were dendrochronologically dated by Nicoletta Martinelli (Martinelli in print), placing the construction of the structure to a point immediately after 1989-88 ± 10 cal BC. The absolute date of the last preserved ring with the waney edge was obtained from cross-dating against the regional chronology GARDA1 and it is accompanied by an error of ± 10 y due to wiggle-matching.

Pottery also shows clear traces of the action of fire, since sherds are clearly deformed by high temperatures. It has been possible to reconstruct some shapes almost entirely (Figure 2, 1-2). The comparison with finds from other settlements of the Garda region, particularly Lucone di Polpenazze (Baioni *et alii* this volume) and the nearby pile dwelling of Lavagnone (Rapi 2002, fig. 8,177), corroborates the dating of the destruction of the hut to an advanced moment of the Early Bronze Age 1 (Figure 2, 2).

After a short time, on the basis of the archaeological finds, waste heaps formed on a peaty level that covered the remains of the abovementioned fire (**phase 2**). Most likely, the area of the fire was not re-inhabited, but used for dumping of waste from neighbouring huts.

Since conjoinable pottery fragments from the waste hips allowed to completely rebuild some vessels, we can assume that huts occurred in close proximity to the heaps.

Since the area is very small and the only element preserved is the wooden beam (CL13), we can only hypothesize that in **phase 3** one (or more) structure was present in the immediate vicinity of the investigated area.

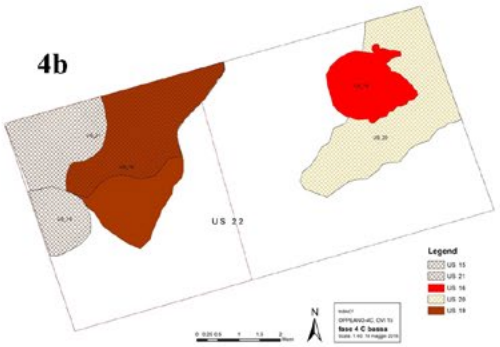
=> Abandon (US11)

Phase 4b:

Waste heaps

Phase 4a:

horizontal wooden elements

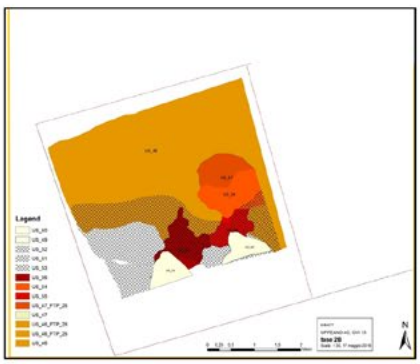


Phase 3:

Structure present in the immediate vicinity of the investigated area

Phase 2:

Waste heaps



Phase 1b:

Fire of the first structure, post **1990 cal BC**

Phase 1a:

Birth of the village

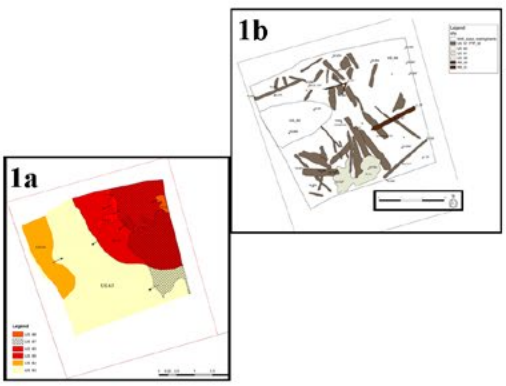


Figure 1. Vallese-Oppeano, site 4C, excavation 2015: the sequence.

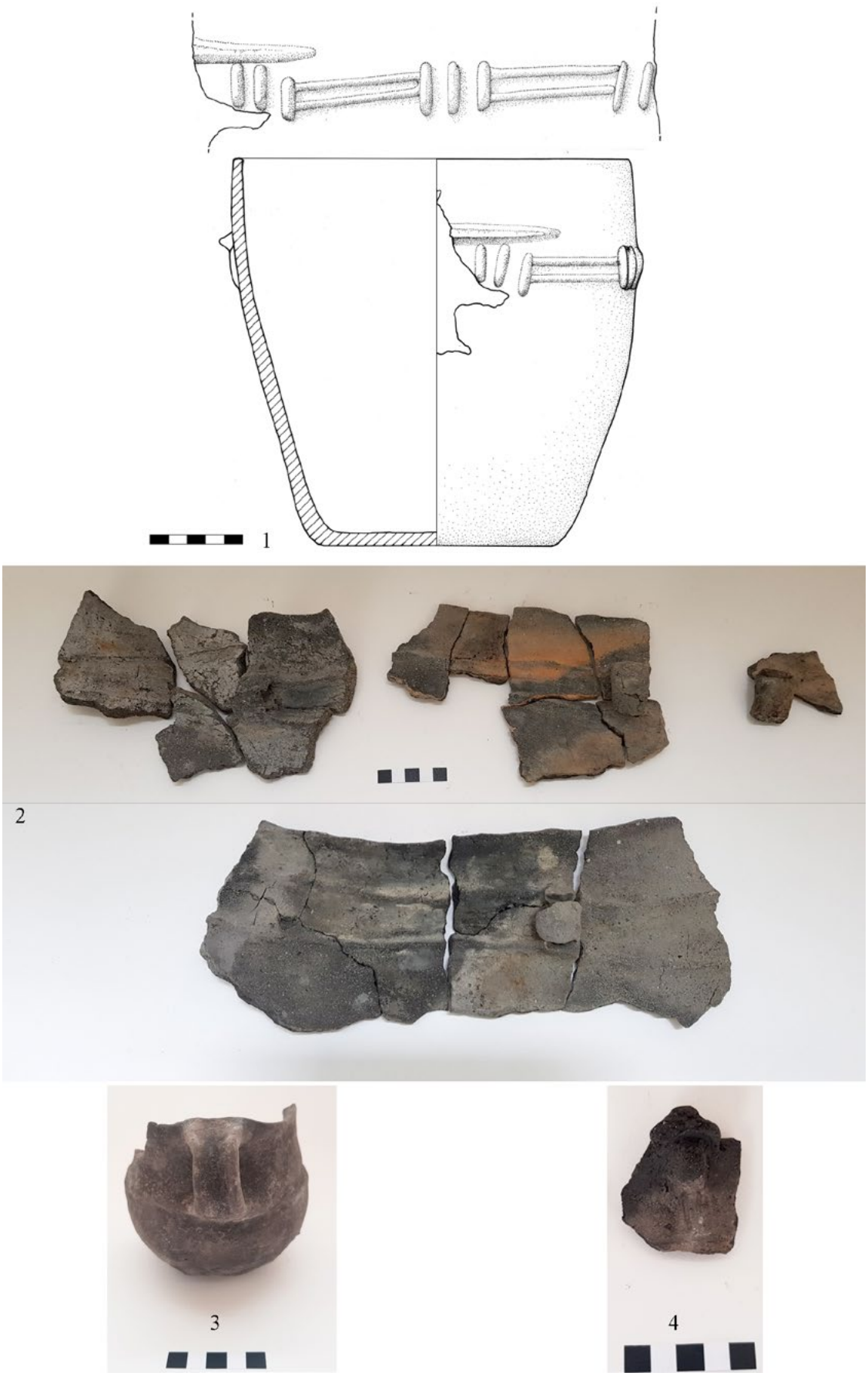


Figure 2. Vallese-Oppeano, site 4C, excavation 2015. 1-2: Phase 1B; 3: Phase 4, base; 4: Phase 4, top (drawing by Lina Comunian).

Above a level with high concentration of charcoal and potsherds, which lied directly on a peat layer (pertaining to **phase 3**), with non-structured organic fibres (probably a natural growth layer), another structure was found (**phase 4a**). The latter was made up by horizontal wooden elements, which most probably constituted a phase of reorganisation of the area, perhaps a new preparation (*bonifica*) (Figure 3). The material culture pertains to a moment of passage between the end of EBA 1 and the beginning of EBA 2.

The top of phase 4 (**phase 4b**) is characterized, once again, by waste heaps rich in small mud plaster fragments, probably the result of a reorganization of neighbouring structures. Pottery belongs mostly to the beginning of EBA 2. The upper stratigraphic units have been interpreted as the outcome of alluvial accretion that followed the abandonment of the site.

Despite the small size of the excavated area, which hampers the chances of a thorough reconstruction, it is possible to recognise an alternating sequence in the use of space. In the first phase there was a hut, destroyed by fire. The area was then covered by a thin layer of peat, which indicates that the area underwent wetter conditions. In phase 2 the area is not re-inhabited, but used for dumping of waste material. Phase 3 represent again a moment of flooding, and decay of the structures, a set of processes that most liked resulted in the formation of the phase 2 waste heaps. At the end, on a natural layer, there is a structure made

Figure 3. Vallese-Oppeano, site 4C, excavation 2015: Phase 4, base.

up of horizontal wooden elements, perhaps a preparation (*bonifica*). The dwelling in the area ends with a thick grey alluvial level.

As for the chronology, at present it has not been possible to recognize a precise subdivision of the phases of dwelling of the area, since chronological attribution of the individual phases is still being developed. The first occupation of the village in this part of the excavation ends with a fire dated to a moment immediately after the beginning of the 20th century BC. The overall development takes place between the end of EBA 1 and the beginning of EBA 2.

The absolute dates coming from the 2015 excavation area are perfectly comparable with those obtained for woods found in the first area of the excavations (2014) along the pipe-line: 2000-1998 BC for 3 posts with the waney edge and the range 2007-1983 BC – identified through sapwood estimate – for other 4 posts.

These results are important for the reconstruction of the settlement dynamics of the region, as they identify – at the present state of the research – the oldest pile-dwelling village in the Veronese plain (Martinelli 2007).

3. Vallese-Oppeano, site 4D

The same grey alluvial episode that seals site 4C constitutes the base of the stratigraphic sequence in site 4D. The latter has four dwelling phases, briefly described below, each one clearly separated by gyttja/peat or by organic silt layers (Figure 4).

Phase 1 is characterized by wooden elements, but there is no certain evidence of huts. It is important to underline the presence of a channel oriented N-S filled by organic sediments, anthropic materials and waste. Above the channel a wooden structure similar to a platform was found. Archaeological findings date this phase to MBA 1.

Phase 2 contains the best preserved wooden structures. A series of structure remains, marked by standing wood partitions delimiting frequently restored hearts and floor sequences (with intercalated hearth rake out finely bedded layers) has been recognized (Gonzato, Mangani, Voltolini in print). These structures were rectangular in shape, and bound by horizontal wooden elements and by a wattle and daub wall (Figure 5). The structures, all N-S oriented and with the same dimensions (4 by 5 metres), were interpreted as huts. It is important to stress that these structures do not show evidences of destruction by fire. Furthermore, the absence of finds probably indicates that the site was abandoned on purpose, following a precise choice, probably in response to progressively wetter environmental conditions.

More than 900 samples were taken for dendrochronology from the best-preserved timbers, but the first results come from the analysis of 11 vertical posts. Three different mean curves were elaborated. The most interesting one is given by the series of four vertical planks from two buildings, named F and G, which proved to be felled at the same time. The couples of vertical elements are located along the adjacent N-S walls of both structures and were fixed into the soil at the same distance. That suggests that the structure F and G were contemporaneous (at least during one phase) and built according to the same structural module. The series from the site 4D are still undated, due to the lack of a regional oak chronology for MBA 2. This chronological attribution is at the moment based upon archaeological materials.

Phase 3 stratigraphic units were characterized by finely laminated waste heaps containing, daub fragments, charcoal, pottery, bone, shells, etc. occurring all over the excavation area. In this moment, a palisade, rebuilt in two stages, was built in the eastern side of the settlement. Dwelling structures pertaining to this phase were most likely built on posts and resting higher than the ground level.

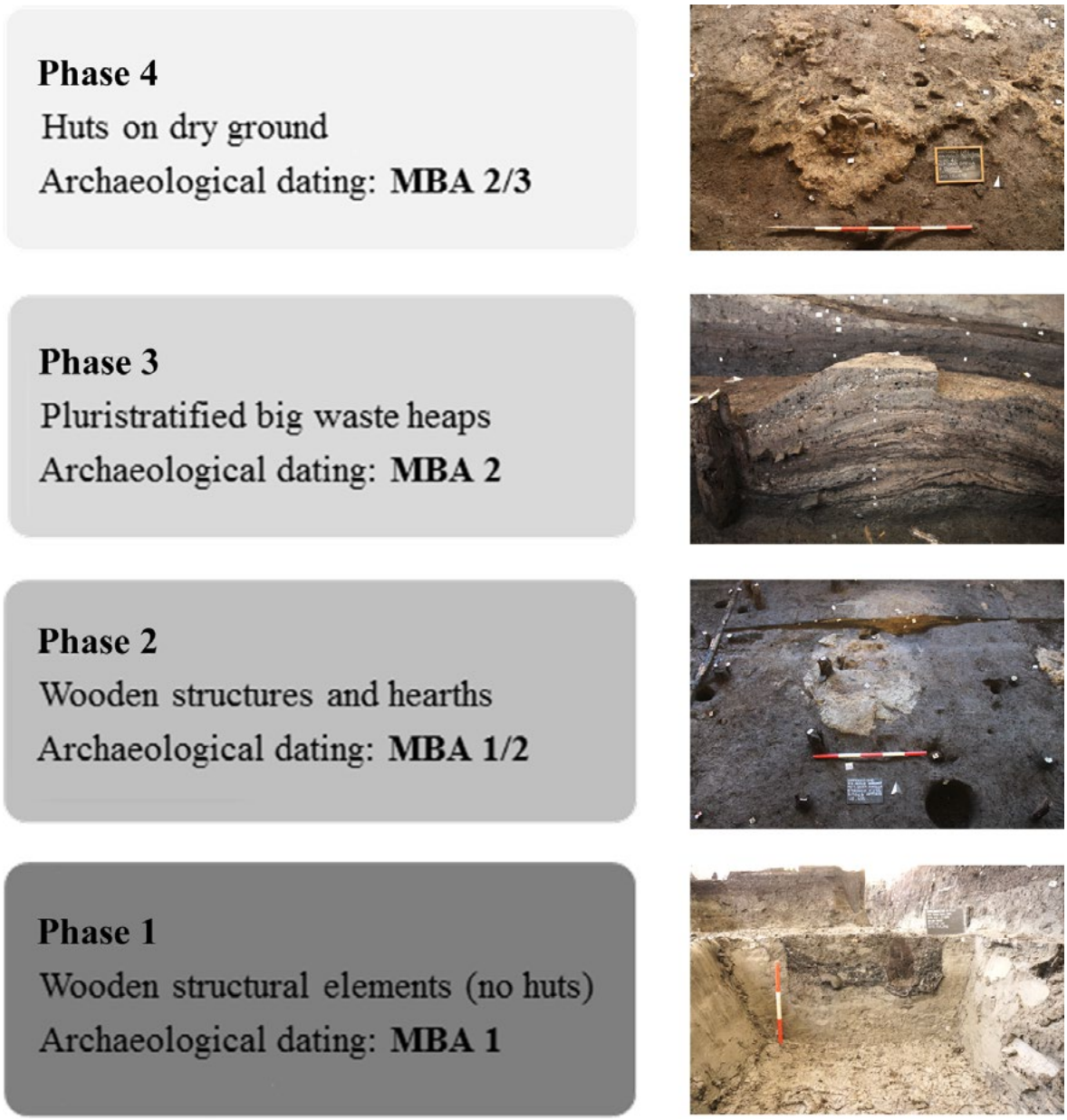


Figure 4. Vallese-Oppeano, site 4D: the sequence.

Materials indicate a MBA 2 chronology (Figure 6, 1). The progressively wetter conditions in this phase probably led to the construction of a ditch-rampart system in the next phase.

Phase 4 is characterized by a rampart and ditch with a very complex internal structure that involved the use of wooden containment structures (*cassoni lignei*) in the lower levels (Gonzato, Baldo, Mangani 2021). Human occupation (i.e., huts) is very scanty compared with the previous phases, with only small evidence of dwelling such as sherds, dated to MBA 2-3, and layers rich in burned mud plaster, plaster and wattle (Figure 6, 2).

The stratigraphic sequence, the analysis and the study of the structures indicate the succession of several superimposed settlements with different building strategies. It is clear that the first human presence was on dry soil, as it was set on a minerogenic alluvial layer (Phase 1, early MBA) on which numerous negative structures (post holes and pits) were dug. The first sure evidence of a real settlement corresponds with phase 2 (MBA 1), in which huts are built directly on the ground over dry soil or on a preparation (*bonifica*). The presence of gyttja in these

Figure 5. Vallese-Oppeano, site 4D: a detail of Unit F, Phase 2a.

Figure 6. Vallese-Oppeano, site 4D.
1: Phase 3, MBA2; 2: Phase 4, MBA 2-3.

layers is most likely the result of a slow increase in the water level, which sealed the structures and allowed for their exceptional preservation. A layer of gyttja devoid of any archaeological materials occurring between phases 2 and 3, suggest a period of prolonged abandonment due to flooding of the area. The peat deposits testify that water progressively disappeared, although the area was still susceptible to flooding. This kind of environment might correlate with the construction of proper pile dwellings (Phase 3, MBA 2). At the end of the sequence, during the late MBA 2-early MBA 3, the loam deposits suggest that dry soil condition were re-established (Phase 4), probably also thanks to the construction of the ditch-rampart system.

4. Late Bronze Age in Vallese di Oppeano area

In order to understand this territory were used we have to briefly look at two other sites: the trackway (Vallese di Oppeano 4E) and the Feniletto pile-dwelling settlement.

The trackway (Gonzato and Nuvolari 2019; Gonzato 2020), of which only a small part has been excavated, is made up of a roadway delimited by woven twigs, comparable in technique with the

Figure 7. Vallese-Oppeano, site 4E: trackway from north-east.

wattle and daub structures recognised in site 4D-phase 2, and with two small ditches running along its sides (Figure 7). Vertical planks present the last preserved ring with waney edge dated to 1384 cal BC (±14), confirmed by one radiocarbon date (3065 ± 25 BP). The dendrochronological sequences have been dated against the site chronology of Tombola di Cerea, a pile dwelling about 20 km south of Oppeano, with MBA and LBA finds (Durante Pasa, Fasani, Pasa 1969; Salzani *et al*. 2018).

We assume the end of the Middle Bronze Age for the construction of the road, which probably continued to be used along the Late Bronze Age – because of the presence of LBA potsherds –, together with the site of Feniletto, located very close to the east (Salzani 1985).

5. Conclusions

As demonstrated by the 4C and 4D sites stratigraphic sequences, the dwelling and building modalities changed depending on natural and utilitarian matters. The stratigraphy of the two sites, also corroborated by a series of core drillings, shows that a thick alluvial layer originated from the Adige river sealed the 4C site and deposited the sediments on which the 4D site is set.

We can stress that, as time went by, people moved westwards, from the 4C village in Early Bronze Age, to 4D settlement in MBA and, finally, to Feniletto, in Late Bronze Age, never ceasing to live in the Bussè Valley, as confirmed also by absence of gaps in the sequence of archaeological materials, with cover the whole period, until the Italian Final Bronze Age (ca. 12th-11th century BC). The dwelling in this territory will resume during the Final Bronze Age 3 (10th century BC) on the higher terrains of the Adige sandur where the present-day town of Oppeano occurs, to continue afterwards in the early Iron Age.

Author contributions

F.G. and C.M. designed the research and write the paper; C.N. analysed the data regarding geomorphology and N.M. the dendrochronological samples; the archaeological excavation was carried out by AnteQuem under the scientific direction of F.G..

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‘Where the house has no trace…’ Reconstructing the basic cluster of everyday life on the Late Copper Age sites in Hungary

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Abstract

In recent decades, studies have begun questioning the widely accepted notion of the Baden Complex as a homogeneous culture, as often interpreted based on the material culture. Currently, this complex culture, which emerged in large territories of Central Europe in the second half of the 4th millennium BC, is considered as a loose set of communities unified by some cultural cohesion. To understand the social changes behind the distribution of seemingly identical material culture in this period, we need to know the context where the processes took place. Among many other questions, we still lack necessary knowledge about the internal structure of Late Copper Age settlements, the locations of activity areas and the social organization of human communities. The main goal of our investigation is to delineate the smallest social units, the households, at Late Copper Age settlements. This paper is based on the authors’ PhD research (Fábián 2014; Rajna 2016).

Keywords: household unit, activity area, symbolic activity, community interaction, Protoboleráz, Baden Complex

Résumé

Les études des dernières décennies ont pu remettre en question la notion largement acceptée du complexe de Baden en tant que culture homogène, telle qu’elle est souvent interprétée à partir de la culture matérielle. Récemment, cette culture complexe, qui a émergé sur des vastes territoires d’Europe centrale dans la seconde moitié de l’IV e millénaire av. n. è., a été considérée comme un ensemble lâche de communautés, unifiées par une certaine cohésion culturelle. Afin de comprendre les changements sociaux dans une aire géographique qui montre une culture matérielle homogène, il est donc nécessaire de connaitre le substrat social dans lequel ces changements ont eu lieu.

Parmi de nombreuses autres questions, nous ne connaissons toujours pas la structure interne des zones habitées à la fin du Chalcolithique, ainsi que la localisation des zones d’activité et l’organisation sociale des communautés humaines. L’objectif principal de notre enquête est de caractériser les unités sociales les plus petites et les maisonnées de l’âge du Cuivre tardif.

Mots-clés : maisonnée, zone d’activité, activité symbolique, interaction communautaire, Protoboleráz, complexe de Baden, fin du Chalcolithique

1. Introduction

Among the archaeological periods of the Carpathian Basin, the Baden Cultural Complex is the first which – after the Middle Neolithic period – seems to have unified large areas again, and transgressed traditional geographical boundaries. The complex plays a major role in Central Europe and the Carpathian Basin between c. 3600-2800 BC (hereafter Late Copper Age). In recent years, questioning of the concept of the Baden culture as a cultural unit (Balcer 1988; Bondár 2010; Furholt 2008a, 2008b, 2009, 2015; Furholt *et al.* 2008; Horváth 2014; Pelisiak 1991; Sachße 2005, 2008, 2010) has made characterization of the settlement patterns of the period, especially

at a regional scale, increasingly important. However, in order to understand the background of the economic and cultural changes that took place during the Late Copper Age, it is important to examine one of the building blocks of society: households and household units. The sources for such an analysis were primarily the settlement historical data from the large-scale excavations preceding the construction of the M7 highway and the track correction of Route 4 in Hungary, and a large amount of complex find material. The archaeological traces of households and household units as the scenes of community interaction form an important interpretative level, determining numerous characteristics of the life and material culture of the community (Winter 1976: 25; Wilk and Rathje 1982: 617-618; Rapoport 1990: 9-20; Blanton 1994; Hendon 1996; Bailey 1996: 143; Souvatzi 2008; Jongsma and Greenfield 2003: 21; Douglass and Gonlin 2012). In our research starting from the study of the elements of the smallest, spatially definable community level, the household as an analytical unit (Wilk and Rathje 1982: 617-618; Rapoport 1990: 9-20; Bailey 1996: 143) through the study of the locations of everyday and symbolic activities we attempt to reconstruct the organizational levels of a socio-economical network of Late Copper Age communities (Douglass and Gonlin 2012). At the end of our investigation our aim is to be able to draw conclusions about the prime movers of the cohesion of the so-called Baden Complex. A household cluster is a group of features that are normally connected to a dwelling place (Winter 1976: 25; Grygiel and Bogucki 1981). In some prehistoric periods, such as the Baden Complex, the well-defined group of features that can be interpreted as houses are rare or unidentifiable. One of the most important questions in the Hungarian archaeological literature regarding research on the internal structure of Baden settlements concerns the buildings themselves. The authentic data on buildings on the settlements of the Baden communities lacks and the features published as houses can be hardly interpreted as dwellings (Fábián 2013: 618-619). Along with the explorations of recent years, we know more than 2000 sites of Baden culture in Hungary (Bondár 2003: 11). The number of traces of suspected building found in archaeological literature is actually insignificant. If we look at the reports, we can see that much of the traces are questionable (Fábián 2013: 618). In these cases, larger pits and pit complexes were interpreted as houses, especially if they contained remains of hearths, but in later analyses their identification as dwellings was refuted (Bondár 2003: 11-12; Kalicz 2003: 16). If we look to the dwelling places of the preceding Early and Middle Copper Ages, they are timber-framed, above ground structures of various sizes, continuing earlier traditions (M. Virág 2004: 125-136, 2007: 68-70). Although traces of timber-framed buildings have not been recovered from Late Copper Age contexts, the existence of wattle-and-daub walls is indicated by fragments of daub and plaster, and daub fragments with reed impressions found in pits. One possible explanation for the lack of archaeological traces of houses and the predominance of pits at Baden settlements is the use of so-called sleeper-beam buildings (Kalicz 2003: 16; Fábián 2013: 619). Such structures are known primarily from ethnographic analogies, since the traces of the timber slots of sleeper-beam houses are difficult or impossible to detect archaeologically (Fábián 2013: 619). In the absence of dwelling traces, other settlement features and their archaeological materials provide a starting point for the analysis of internal settlement structure (Hendon 2000: 43). From this base, we attempted to define the spatial and temporal limits of households and to determine the remains of which activities have been preserved within a household. To avoid confusion between the elements of a household cluster and a cluster of households, here we will use the term 'household unit' to refer to the group of features and activity areas.

2. Geographical and cultural setting of the selected sites

One of the starting point of the research is provided by the finds and observations on settlement structure made during the excavations at Balatonkeresztúr Réti-dűlő in 2003 and 2004 (Fábián 2007, 2013, 2014; Fábián and Serlegi 2009; Fábián *et al.* 2013). The site of Balatonkeresztúr Réti-dűlő is located 3 km from the southern shore of Lake Balaton, on the border of the Marcali ridge and the swampy Nagyberek (Figure 1). The site stretches in a 100 m wide east-west oriented strip defined by the M7 highway on the eastern slope of the Marcali loess ridge, down to the edge of the marshy Nagyberek. During the two yearly excavation seasons, 45,000 m^2 were investigated

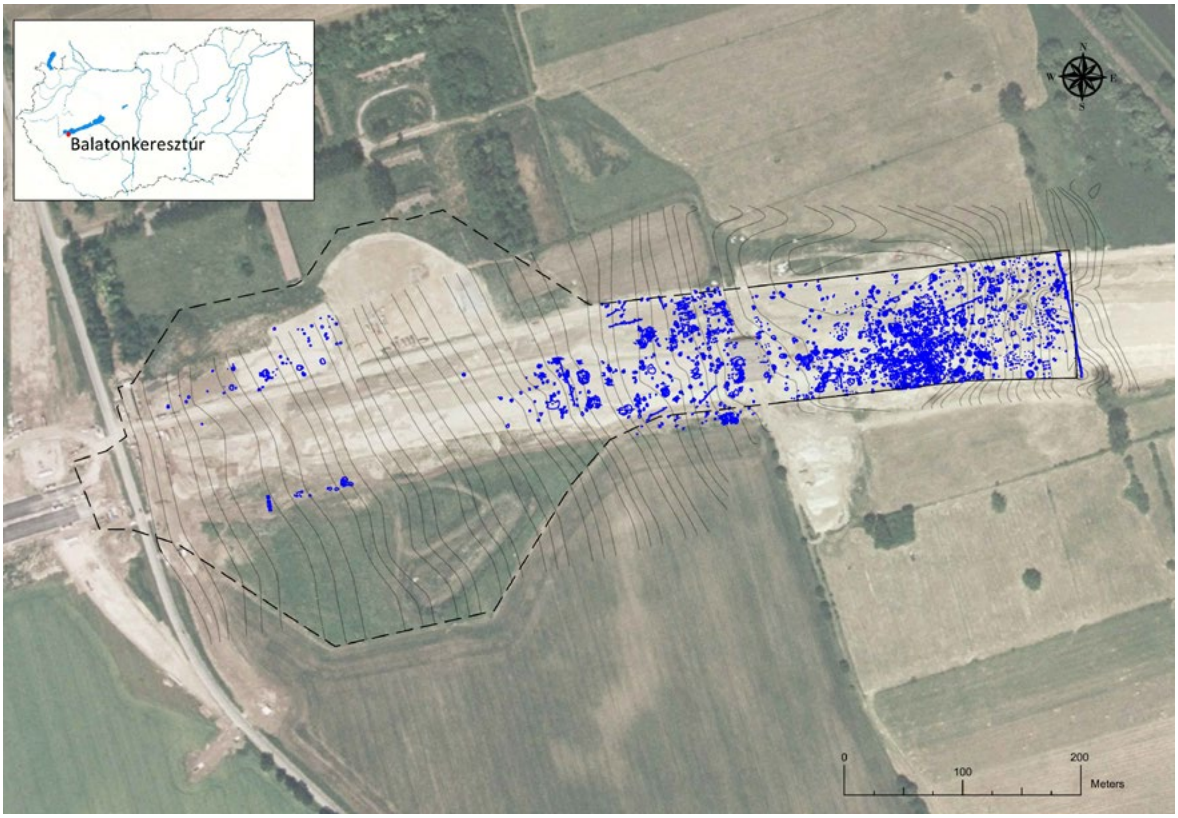


Figure 1. The site of Balatonkeresztúr Réti-dűlő lies at the southern shore of Lake Balaton.

and 2976 archaeological features were excavated and documented. Based on the material of the archaeological features of the occupations, nine archaeological periods could have been identified on the eastern slope of the hillside (Fábián and Serlegi 2009: 203-206). In the Late Copper Age, the population of the Baden Complex appeared in the area. More than 250 archaeological features could be connected to this chronological horizon. The core of the Baden settlement was located on the horizontal plateau and east of it, reaching down the slope of the loess ridge to the edge of Nagyberek. The Late Copper Age settlements were located in an identical geomorphologic environment, and the region was densely settled throughout the time of the Baden Cultural Complex. The investigated settlements yielded material from both the earlier and later phases of the Baden culture. The other similarly investigated site, Abony 49 (Figure 2), lies at the Northern part of Great Hungarian Plain, at the Danube-Tisza Interfluve. The site was excavated between 2003 and 2005 (Rajna 2011). The site was located next to a swampy area, accessible by the Cegléd-Újszilvás road. The excavated site was 41,000 m^2. Settlement traces of Neolithic, Copper Age, Sarmatian and Arpadian periods were found in the entire site from which 178 features were related to the Protoboleráz phase of the Copper Age. According to the current state of research, this kind of material belongs to the earliest phase of the Late Copper Age.

3. Methodology

In light of the materials recently excavated in sites of the Baden Complex on the southern shore of the Lake Balaton and in eastern Hungary (Bondár 2010; Bondár *et al.* 2000; Honti *et al.* 2002, 2004, 2007; Belényesy *et al.* 2007; Nagy 2010; Horváth 2014; Szilágyi *et al.* 2014), we consider the possibilities of delineating activity areas of everyday tasks as fingerprints of household units. Through the identification of analytical units and their comparisons, it will be possible to study the character of the activities carried out within them and if a certain division of labour and a network between households existed. Through our research we hope to determine whether all activities

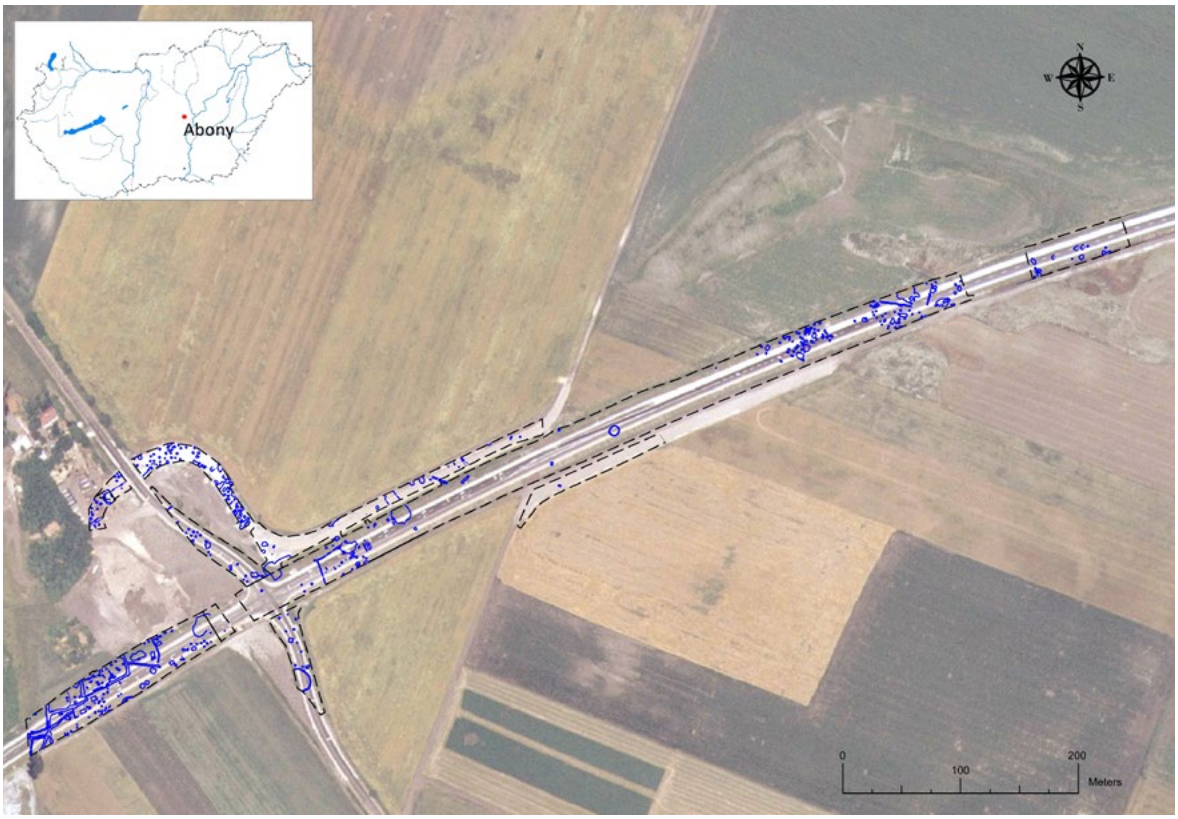


Figure 2. The site of Abony 49 lies in the northern part of Great Hungarian Plain, at the Danube-Tisza Interfluve.

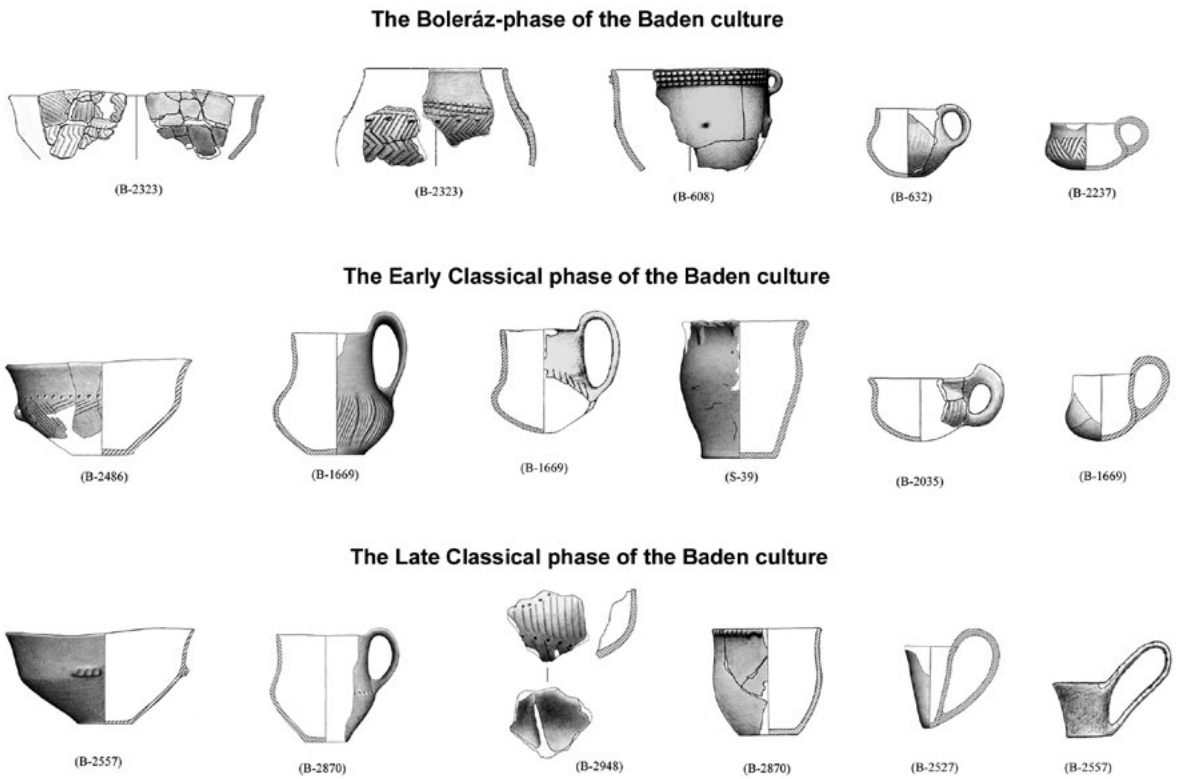


Figure 3. The main pottery shapes of the Late Copper Age Baden Complex from Balatonkeresztúr Réti-dűlő.

took place at all households, or if some were conducted by only some households, thus revealing potential connections between them. The examined sites are complemented by bioarchaeological and archaeometric analyses (archaeozoological, anthropological, petrographic, geochemical analysis and radiocarbon dating), and environmental archaeological data from Hungary (Gál *et al.* 2005; Zatykó *et al.* 2007). Our research is based on the premise that the archaeological identification of households is possible since the basic activities of everyday life were carried out in a delimited area and within a delimited timeframe (Winter 1976: 25; Wilk and Rathje 1982; Rapoport 1990; Blanton 1994; Hendon 1996; Jongsma and Greenfield 2003: 21). It is possible even if we do not know the archaeologically identifiable remains and the structure of the houses belonging to the households. In this case, households may be delineated with the help of observed or statistically demonstrable groupings of features, since pits leaving identifiable traces are connected in specific ways to residential areas, even if the traces of house structures are not preserved (Hendon 2000: 43). Results of the large scale excavations and the large amount of data give us the possibility to look for recurrent pattern at the above-mentioned sites and their archaeological finds. The first step was the definition of the various phases of Late Copper Age occupation and of the roughly contemporary features based on the finds. During the archaeological analysis of Baden pottery, we used the criteria of an internationally accepted typo-chronological system (Neustupný 1959, 1973; Němejcová-Pavúková 1964, 1979, 1981, 1984, 1991, 1998; Ruttkay 1995; Bondár 1982; Točík 1987; Mayer 1995; Endrődi 1997) (Figure 3) and the radiocarbon dates confirm these observations. In terms of absolute chronology, the Boleráz phase can be dated to 3550-3440 cal BC, the Early Classical Baden phase to 3475-3140 cal BC, and the Late Classical Baden phase to 3345-2945 cal BC at Balatonkeresztúr (Figure 4). Due to the small number of samples and the plateaus and wiggles of the relevant section of the calibration curve, the length of the life of the settlements and of its phases must be handled with caution. However, it is safe to say that the main phases of the Late Copper Age settlement of Balatonkeresztúr and the transitions between them are identical with those recognised in the whole distribution area of the Baden Complex (Siklósi 2009: 462-466; Stadler *et al.* 2001; Wild *et al.* 2001). According to the current state of research, the Abonys material belongs to the earliest phase, so called Protoboleráz phase, of the Late Copper Age Baden Complex which can be dated to 3717-3672 – 3680-3635 cal BC (Figure 4).

4. Investigating household units

Similarly, to many other Baden settlements in Hungary we can see that pits of various sizes and shapes make up 93% of the settlement features at Balatonkeresztúr, while the rest 7%, can be classified as oven, hearths, wells, postholes and burials (Figure 5). Due to this situation we had to base our investigation mostly on definition of the function of different kind of pits ('beehive-shaped' pit, small and large regular pits, irregular pits, pit-complexes). We could examine them like as relics of temporary activities of individual households. The typology of pits was conceived through the main characteristics of the pits. The shape, dimension, the treatment of the wall and filling of the pits may provide useful information for determining the function of the pit (Fábián 2014: 129-139) (Figure 6). The shape of the pits largely depended on the soil type and was closely related to the groundwater conditions of the area (Šumberová 1996: 63). Used these selection criteria we could detected that the most characteristic settlement features at Balatonkeresztúr, are the so-called 'beehive-shaped' pits. The characteristic shape of these pits enabled the inhabitants to close them and provide protection for the food or other objects (for example raw materials). In lack of botanical finds, the food storage function of these pits in Balatonkeresztúr is indicated only by the presence of intact or collapsed large storage vessels or postholes which surround it, suggesting use of roofed pits to store various kinds of objects and goods. In these cases, we might postulate the primary use of the pit. If we did not have such a helpful trait, the analysis of the layers that fill the pits and of the finds discovered in them played an important role in determining the secondary and tertiary functions of them. In certain cases, they received some sort of special, probably cultic/symbolic role, and human bodies or whole animal corpses were buried in them. The primary function of the pit-complexes must have been for clay extraction.

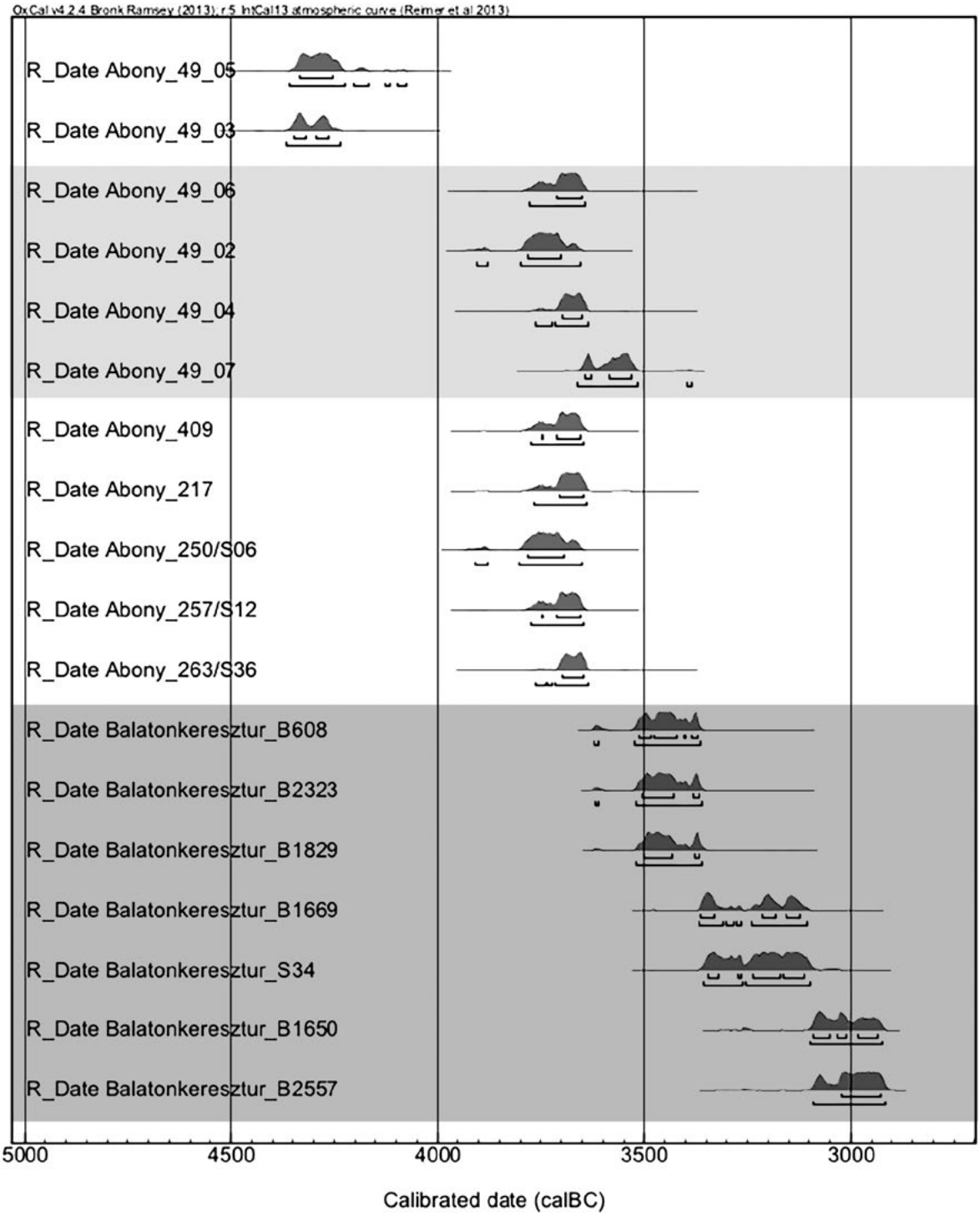
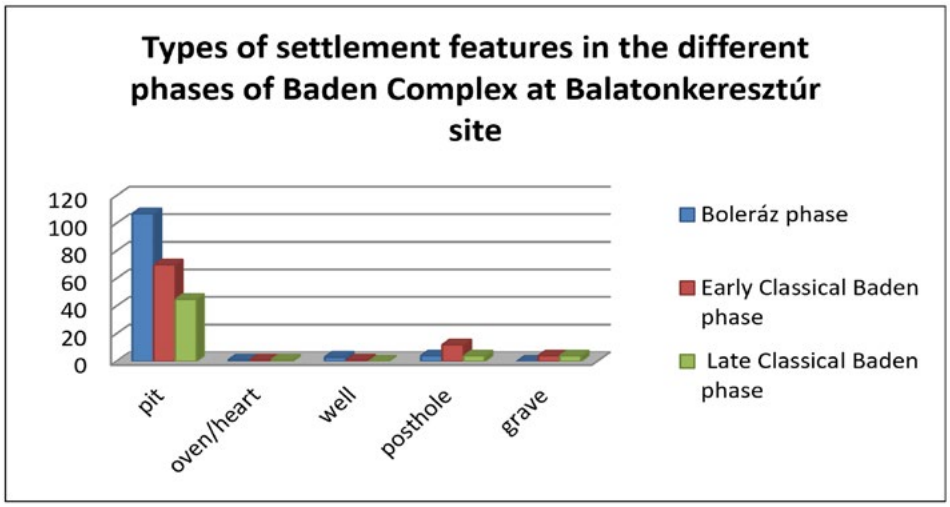


Figure 4. Calibrated radiocarbon dates from Balatonkeresztúr Réti-dűlő and Abony 49 highlighted in gray (The measurements were made at the Vienna Environmental Research Accelerator).

Later they may have been used as workplaces. These activities can be suggested by the presence of hearths, ovens, trodden levels, and post-holes inside the pits. Most of the times, however, only the tertiary function – that is keeping refusal – could be observed. Based on the above mentioned analysis of the roughly contemporaneous settlement features and their mapping on the whole area we tried to find recurring patterns (Fábián 2014: 174-185). Among the groups of features in all three phases of the Baden occupation empty areas surrounded primarily by storage pits and waste pits could be identified. These were provisionally identified as household units, while the



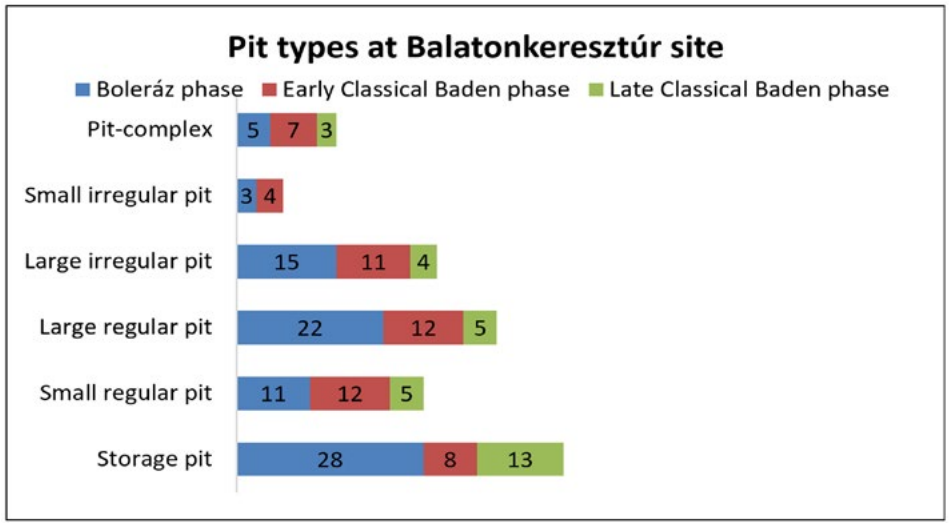


Figure 5. Types of the settlement features at Balatonkeresztúr Réti-dűlő Late Copper Age site.

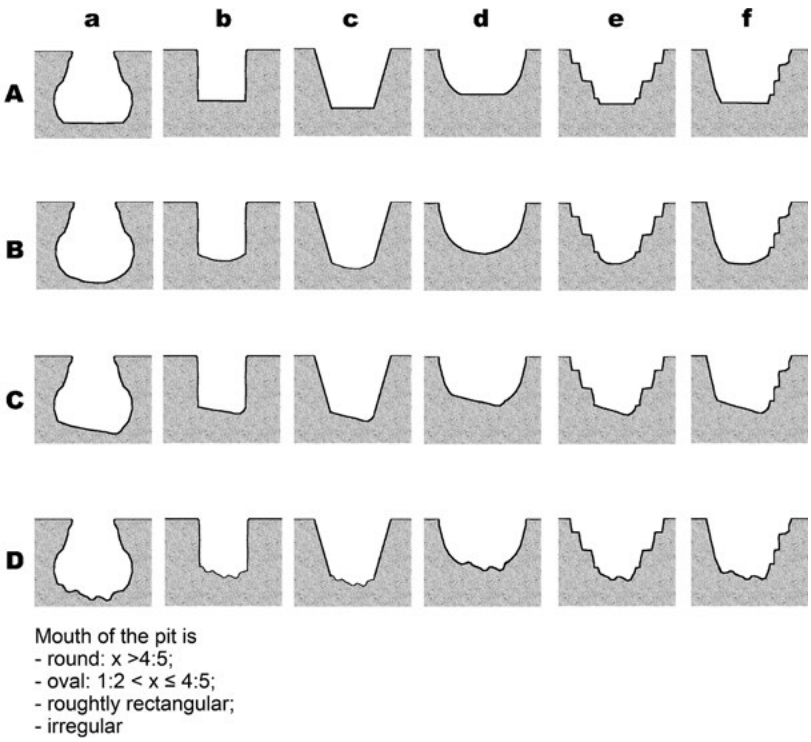


Figure 6. Classification of pit shapes.

empty areas are considered the location of houses or dwellings. The combination of phenomena could be identified in many cases as a group of features within a radius of 15-20 meters. Six of such groups of pits were found in the Boleráz period, four in the Early Classical Baden and one in the Late Classical Baden phase at the Late Copper Age settlement of Balatonkeresztúr (Figure 7). The study of the cluster analysis of the faunal remains found in the features from the Boleráz phase of Balatonkeresztúr and Abony 49 site carried out previously had similar results (Csippán 2012: 205-226) Four of the six households identified with the help of these two household localization methods at Balatonkeresztúr site were identical, thus the two methods confirmed each other (Fábián *et al.* 2013: 150-153, fig. 25). The above mentioned mapping of the settlement features was followed by the detailed qualitative and quantitative analysis of the material of the pits and the pits themselves (nature and abundance of finds, clustering of artefacts, function of the settlement features) according to the observed groupings (Fábián 2014: 186-318). During the lifetime of the pit, traces of diverse activities can be preserved, from which we can deduce the primary, secondary or tertiary function of the pit. An object which has been deposited at a given point in the pit's life cycle can be a determining feature of the social practice of the pit use. The life of the pit is ended when it has been filled up (Chapman 2000: 63-64). The depot can be symbolic and accumulated by the daily routine (Hill 1995). By the daily routine, objects can be placed in three major depositing processes where we can finally find them. Placement can be done for deliberate storage purposes or the object can be deposited in the pit as direct waste and of course we have to consider of the accidental loss of objects, which cannot be taken into account in the analyses (Needham and Spence 1997; LaMotta and Schiffer 1999: 21-22). Most of the items that have been deliberately put aside for storage purposes are presumed to have been deposited in dedicated storage pits, while the waste is likely to have been thrown into irregular hollow within the area of the household unit or into a pit that has lost its former function (Sommer 1991: 87-105; Schiffer 1987: 76-79, 89-97). Based on the location of the refuse to be discarded, we can talk about primary and secondary refuse and 'de facto refuse', whereby the primary could be disposed of at the place of the use, the secondary further away from the place of the use, and the 'de facto' waste could still be used in the place of activity (Schiffer 1976: 30-33). The use of further statistical methods and GIS analysis reveals further relationship between the finds and the pits scattered across the excavated area (Fábián 2014: 281-308, fig. 8.6.-8.27). The correspondence analysis of the finds and implements from the pits showed a general homogeneity of the variables, indicating that most objects and implements were uniformly used in these households (Fábián 2014: 304-306, 8.28.-8.30. ábra). One-way correlation investigated the co-occurrence and relationship of variables included in the data table in order to highlight connections between different kind of artefacts and finds. The matrix showed the strongest correlation between chipped stone implements and bone tools, indicating that these objects were part of the fundamental set of implements in a household, and in certain groupings, they may indicate household activities, such as manufacturing of tools, leather working or textile production (Fábián 2014: 306-308). This can be the starting point of the investigation of traces of social equalities and inequalities taking place within and between the households.

4.1. Household units at Balatonkeresztúr

The hypothetical outer space surrounding the house had the following constituents: 2-6 storage pits, 2-3 smaller or larger, regular pits (presumably some of them could have been storage pits deformed by later soil processes, 2-3 irregularly shaped pits or pit complexes and a hearth or oven (not attested in all household units), that in most cases is a hearth placed in a pit (Figure 7). The composition of features constituting a household unit could obviously vary within each household. The accumulation of ceramic sherds and animal bones could be observed in the southern part of the group of pits, which – based on ethnoarchaeological examples – may indicate the location of the entrance. The storage pits were located in a row along the side of the house (Alexander 1999: 83). The differences in size between them were probably due to functional differences or a damaged storage pit may have been replaced by a new one, while the old took on

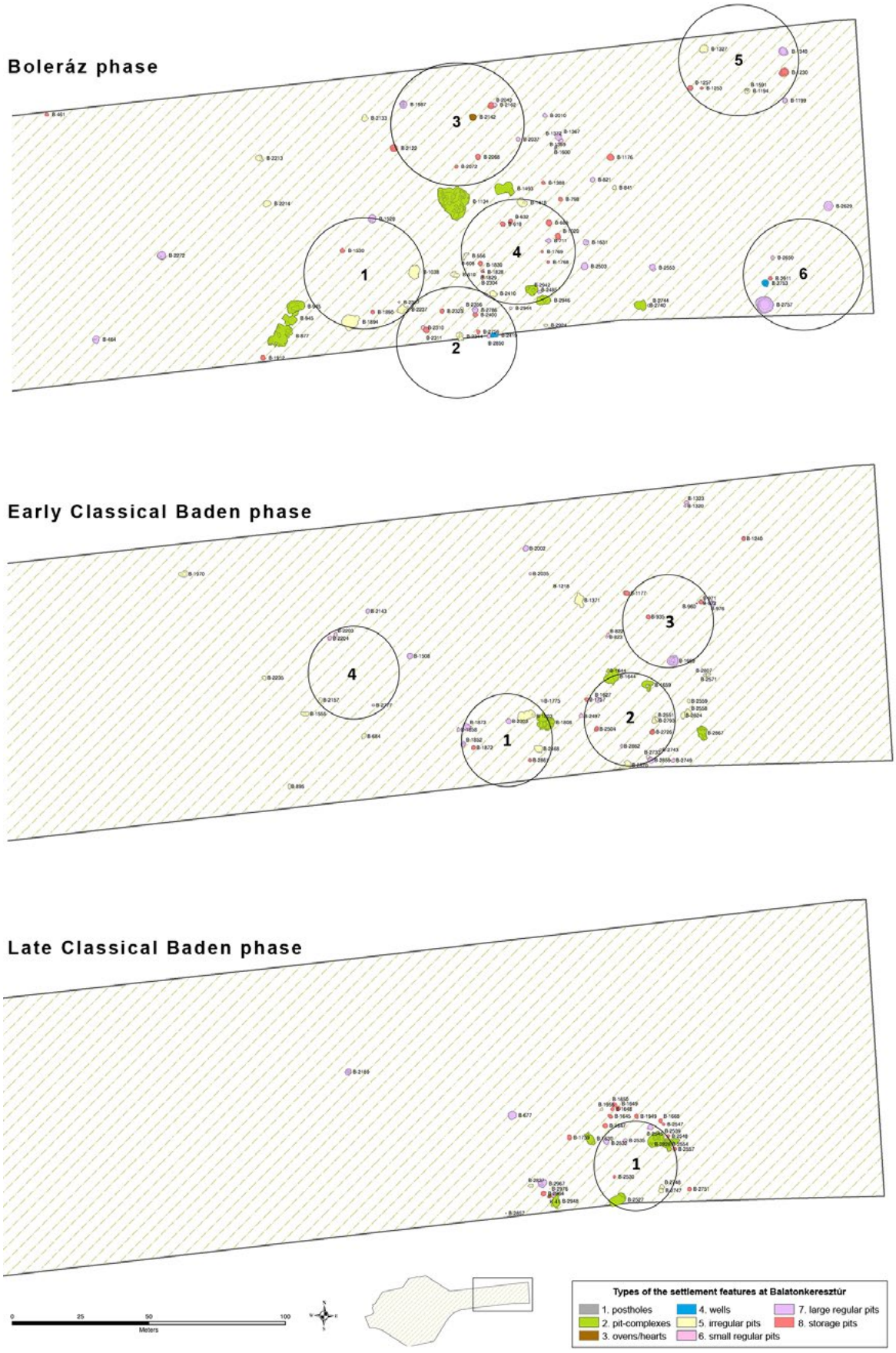


Figure 7. The investigated area and the spatial distribution of the hypothetical household units of the Boleráz, Early and Late Classic phases of the Baden Complex in Balatonkeresztúr Réti-dűlő.

a new function. The irregularly shaped pits located in a peripheral position may have served as household refuse pits. Larger pits and pit-complexes of this type may have served as workshop areas a bit further away from the house and many of them also contained temporary hearths. Stand-alone ovens were not found in most units, thus it may be assumed that either smaller, temporary hearths were used for cooking outside the buildings or food production may have been carried out within the houses of a yet unknown structure. It is possible that pit-ovens were not primarily connected to cooking at a household level, but to other activities that were carried out at a higher, settlement level. Such activities may have included drying, smoking, roasting grain or firing pottery. The presence of wells in the settlement can be only assumed on rather uncertain data. If there were some, they were not connected to the households, but to the whole community, or at least a number of households used them together. All assumed households contained the implements needed for food processing necessary for subsistence production, like vessels, grinding stones and cutting implements, and the kitchen waste associated with these activities (Figure 8). The process of grinding seemed to be especially important in two places, and in one it was associated with increased storage capacity, and with large number of vessel sets and kitchen waste. In some of the household units, the possibility of some form of domestic specialization may be suggested. Such specialization could have satisfied local demand of goods and was probably part-time based on the division of labour between the households. Bone tool manufacture and the repair of bone and stone tools were identified in almost all households. The remains of manufacture of stone tools are very scarce and particular raw materials were probably obtained regionally. Based on the distribution of finds, traces of textile production and leatherworking could be found in the all the three phases, but not in all households, and single household never had both, indicating some form of division of labour. In the light of the distribution of activities, it can be stated generally that there was a division of labour among the households of the Baden settlement. Based on the available data, a group of pits identified as a household unit of the Boleráz period can be highlighted due to its special character. The features of no. 4 household unit (B4HE) were clustered in an area of 15 m of radius. Storage pits were closed, forming pairs or rows, and surrounding an empty space. Some of the pits contained daub pieces suggesting collapsed wall of a house, some of them was filled up with a lot of archaeological material and some of them contained no artefacts. The statistical analysis of the ceramic materials excavated from the pits shows that three of the storage pits were full of pottery sherds including pieces of large storage vessels. The other four storage pits contained a homogeneous layer and little archaeological material, while the other type of pit-complexes were relatively full of household waste. In this case, we might have evidence for secondary or tertiary functions for some pits. A little bit further away human remains were found in a simple waste pits. In the middle of a smaller pit-complex, a cattle skull was situated while the amorphous pit contained burned clay, ceramic fragments, many animal bones, flint and bone tools, spindle whorl and shells. It will be the task of further analyses to determine if these are the traces of a single, special status household or of a simple household or of spatially and temporally divergent activities at a higher, settlement level, compressed together. The interpretation and comparison of these hypothetical households as units was carried out from a variety of standpoints in the case of Balatonkeresztrúr site: among others from that of consumption, specialization and diversity (Fábián 2014: 352-368). In our case study at Balatonkeresztúr, one of the most important features associated with the food production of the household, is storage capacity. It can be seen that most of the household unit has around 2-5000 litre capacity, with the exception of one household number B4HE, which can show a special status of this household in the Boleráz phase (Figure 9). Other important aspects of the household production and consumption are well represented by the animal bones (Fábián *et al.* 2013: 150-151). Social complexity brings clear differences in consumption, which is well demonstrated in the archaeozoological material (Bartosiewitcz 2006: 80; Csippán 2007: 300, 2012). The animal bones were also analyzed using Uerpmann's meat quality classes. According to this, the highest value (A-valued) meat comes from the vertebral column – except the caudal vertebrae – the bones of the shoulder area, the pelvic bones and the femur. The cranium with the brain, the jaws with the chewing muscle and the tongue,

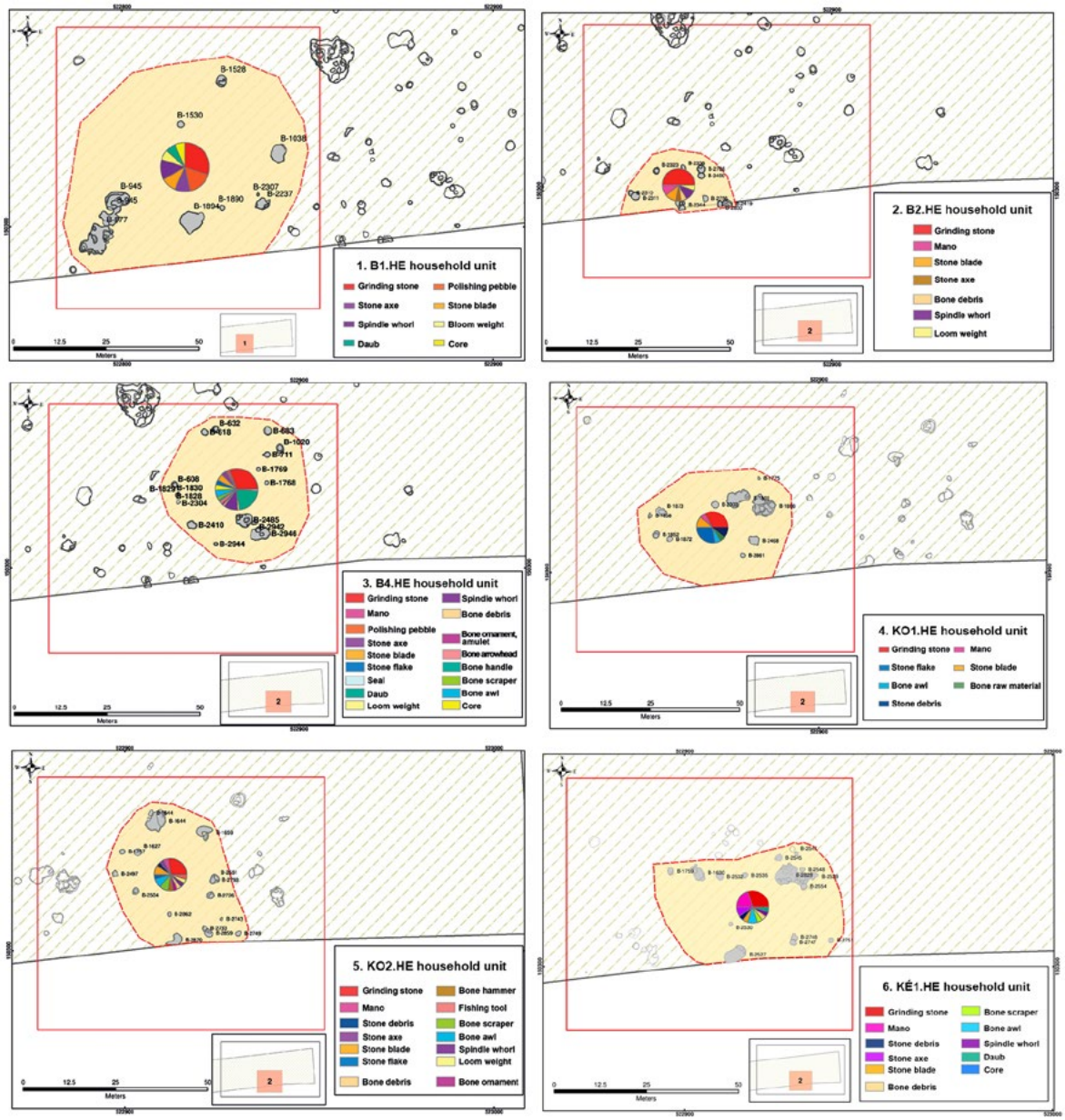


Figure 8. Location of the hypothetical household units and the chart of the archaeological materials connected to them in the Boleráz, Early Classical and Late Classical Baden phase in Balatonkeresztúr Réti-dűlő.

the sternum and the ribs and the lower end of the legs are of medium value (B-valued). The C-valued meat comes from the bones of the jowl, the caudal vertebrae and the dry limbs after H.P. Uerpmann (Uerpmann 1973). The hypothetical households are generally characterized by B-valued meat dominance. The chart illustrates also the consumed quantities of meat (Figure 9). Again, household B4HE contained four times as much meat as the others. We can detect a slow but gradual decline of the quantities during the life of the settlement. The analysis of the household vessel assemblages can be a starting point to identify the extent and complexity of the household units (Smith 1987; Kalla 2013: 13; Skibo 2013). If we compare the quantity of the different kind of vessel forms we can see a relatively balanced dispersion, with the exception of household B4HE, which again suggests a special status for this household, or traces of activities from the settlement level (Figure 9). For the analysis and comparison of the household units, we used the Simpson Diversity Index (Hirth 1993: 133-134; Beaule 2002: 169-173.) which shows that in the majority of the households various activities were carried out (Figure 10). In household

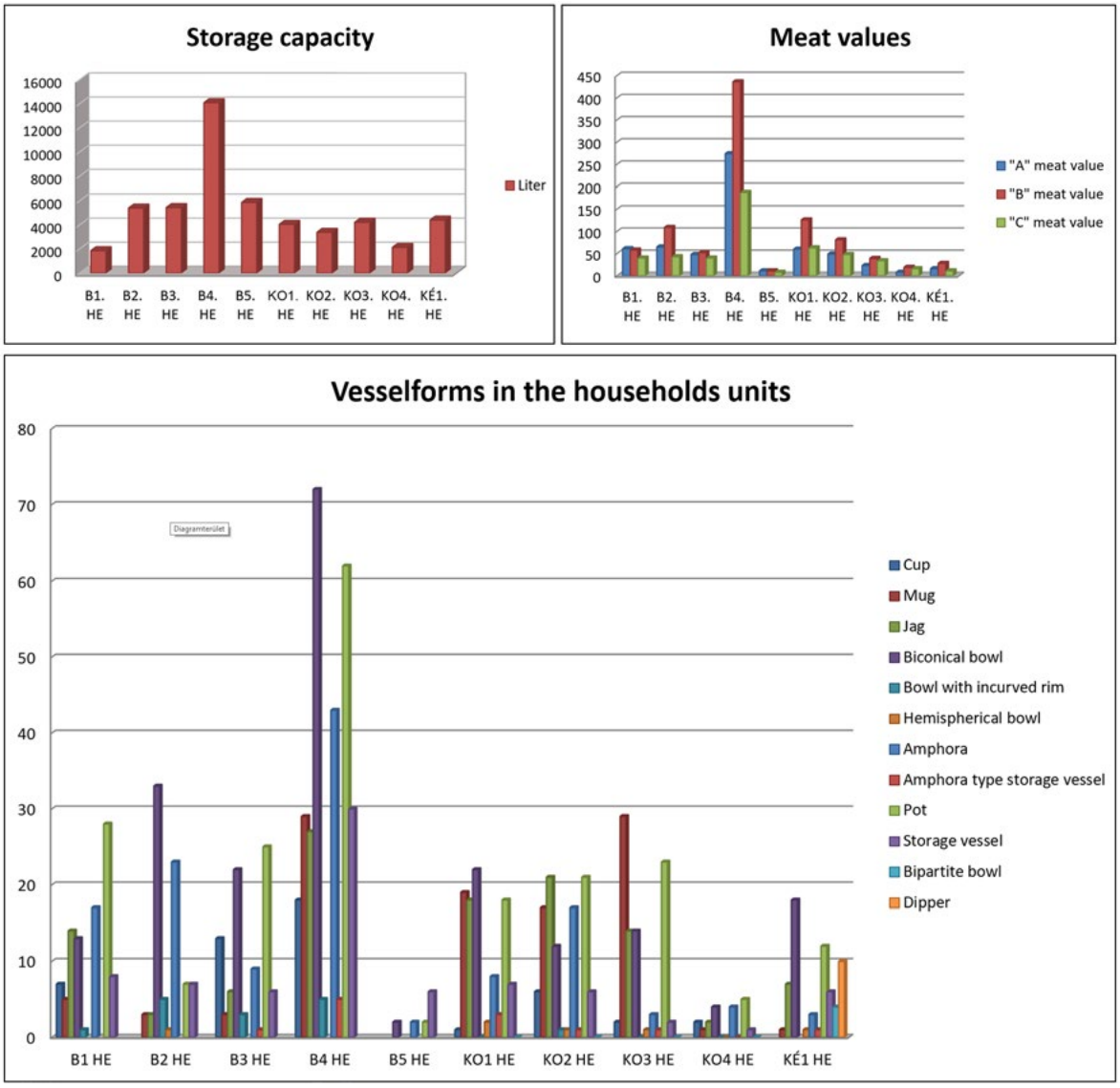


Figure 9. Storage capacity, meat consumption and vessel inventory of the hypothetical household units from Balatonkeresztúr Réti-dűlő.

B4HE we can detect several markers of textile production (weaving) and a wide range of tools for intensive food preparation alongside other activities. The former perhaps can be considered as a special activity of the household to serve the other households, and the latter can be related to the larger storage capacity and greater amount of animal bones. These two things can suggest complexity and the special role of this household within the community (Fábián 2014: 352-371).

5. Investigating activity areas at the community level

In addition to identifying the locations of everyday activities, we emphasise the identifiable traces of social activities of the communities under investigation. Analysis of traces of social activities reveals not only spatial organization but also the cyclical nature of community life and the regulation of repeated sacred or ritualized activities Through this the interpretation of the regulation of repetitive human activities and practices pointing beyond the ordinary becomes possible (Allison 1999; Hendon 2000; Hill 1995; Rappaport 1999; Salisbury 2012b). There are spaces of various levels of community life within these settlements; the level of households, the level of activity areas used jointly by all households, and the level of the settlement unifying all the households (Kalla 2013: 21).

	B1-HE	B2-HE	B3-HE	B4-HE	B5-HE	KO1-HE	KO2-HE	KO3-HE	KO4-HE	KÉ1-HE
Grinding stone/slab	8	9	2	24	2	6	6	1	3	5
Mano	0	2	0	1	0	1	1	0	1	3
Polishing pebble	5	0	0	1	0	0	0	0	0	0
Stone axe	3	0	4	3	0	0	1	0	0	2
Stone axe manufacturing discard	0	0	0	0	0	2	1	0	0	1
Stone blade/knife	3	2	3	4	2	2	2	1	1	1
Stone drilling tool	0	0	0	0	0	0	0	0	0	0
Stone scraper	0	0	0	0	0	0	0	2	0	0
Stone manufacturing discard	0	0	1	3	0	5	0	3	0	0
Core	2	0	1	3	0	0	0	0	0	0
Bone awl	0	0	0	4	0	1	2	3	0	2
Bone scraper	0	0	2	2	0	0	2	1	0	1
Bone hammer/axe	0	1	0	0	0	0	1	0	0	0
Arrowhead (bone)	0	0	0	2	0	2	0	0	0	0
Fishing tool	0	0	0	0	0	0	1	0	0	0
Raw material	0	0	0	0	0	1	0	0	0	0
Bone manufacturing discard	0	1	3	1	0	0	1	3	0	1
Spindle whorl/loom weight	5	3	1	8	0	0	2	9	1	1
Jewel/amulet	0	0	1	3	0	0	1	0	0	0
Stamp seal	0	0	0	1	0	0	0	0	0	0
Total N	26	18	18	60	4	20	21	23	6	17
IAD index	0,831	0,733	0,908	0,814	0,667	0,853	0,915	0,823	0,8	0,89

Figure 10. Comparison of the hypothetical household units at Balatonkeresztúr based on Simpson's Index of Diversity.

5.1. Balatonkeresztúr site

In two cases we can hypothesize the existence of special areas for particular activities linked to food production outside the area of household units in the Balatonkeresztúr site. The first one is connected to grinding activities and is identified in the settlement of the Boleráz period (B2HE) based on the concentration of large and heavy, intact grinding stones of the primary or 'de facto' refuse waste category (Schiffer 1976: 3). They are associated with stone slabs and manos. The other is a domed oven and the surrounding group of pits in the settlement of the Late Classic Baden phase, which – besides cooking – could have been used for food conservation, like drying and smoking. The quantity and quality of the ceramic material also raised the question of the place of pottery manufacture as a household activity. Pottery manufacture, especially of fine ware, can be considered an activity carried out above the household level, whose location may have been in the unexplored part of the settlement. Due to the lack of sufficient data, however, production at a regional level cannot be excluded (Fábián 2014: 352-371). It is often difficult to distinguish between the mundane activity and the ritual activity of the household unit. Often, subsistence activities

have their own symbolic meaning, and the ritual itself can be part of everyday life (Allison 1999: 11). Spaces between hypothetical houses are also the place of the interaction between the household units (Roderick 2012a, 2012b; Kalla 2013: 21). Symbolic activities were frequently attested in all three phases of the Late Copper Age settlements of Balatonkeresztúr. These can be detected in the household units by special finds, for example idols, ochre or human remains. Usually, most of the household units have some pits which contained ashy layers with charcoal and sometimes burnt animal bones. In these features a huge amount of animal bones was found, mostly representing A or B meat qualities, which may be connected with feasting activities. The occurrence of large quantities of sherds from serving vessels (cups, mugs, jugs and bowls) supports this hypothesis. Their strong presence in the life of the settlement indicates that these symbolic activities were of great significance at the household and settlement levels and at the regional scale as well (Horváth 2014). This is also shown by the change of function of the central area of the settlement. After the leading role in sacral life of the centrally located household unit during the Boleráz phase (B4HE), the area gradually changed into an empty space between households during the Classical Baden period. In the Late Classical Baden phase, a series of pits with animal sacrifices was found. By this time the function of the area changed and became the place of symbolic, collective activities (Fábián 2014: 371-378).

5.2. Abony 49 site

The obvious difference between the sites of Balatonkeresztúr and Abony 49 lies in the disparities of settlement structures. The pit complexes in the southern part of the Abony 49 excavation (Figure 11) and the material found there are different from the objects found in the northern part of the settlement. Most of the pottery material came to light in the southern pit complexes. After the typological analysis of the material of the site (with respect to vessel types, their morphology, and ornamentation), we can say that good quality, finer pottery – especially open vessels and bowls – are prevalent in the material from Abony 49. At the same time, there are few decorated pieces apart from the fine vessels with Furchenstich ornamentation at Abony. Petrographic analysis, made by Attila Kreiter (Hungarian National Museum), confirms that all examined finds from the site were locally made. There was, however, a great variety in the work of the Abony Protoboleráz's potters if compared to the Classical Baden's potters. It is logical to conclude that there were more potters – in proportion to the settlement's population – at Abony, manufacturing Protoboleráz pottery and leaving the marks of their own identity or that of their immediate community on the vessels. From the analysis of multiple correspondences, one difference is noticed: the more finely tempered potteries, serving types with thinner walls, such as bowls, mugs, cups, and jugs are typical of Abony 49. The glittery tempering in some fragments at Abony was particularly striking. The glitter (powdered hematite) is traceable in local soil samples. It's macroscopically discernible in the pottery, and petrographic tests also verified its presence. The existence of this temper also proves that the pottery was locally manufactured, using local materials. Complex statistical analysis underpinned earlier observations according to which serving vessels were more prevalent at the Abony settlement (Rajna 2016: 190-205). The northern-southern imbalance in finds distribution is also noticeable in the animal bone material. The southern part of the settlement yielded over 90% of it. We can consider this part of the settlement was special. Here the number of bones of hunted animals is far greater than a usual Baden site. Such a high proportion of hunted animal bones is unknown in other contemporaneous sites of the region. The number of aurochs *(Bos primigenius)* bones at the Abony site is unusually high (Figure 12). In addition, auroch bones occur predominantly in the pit complexes which also yielded a great amount of fine pottery (and, in one case, human bone). Thus it becomes clear that the auroch had a special role in the life of the settlement's population: hunting for it, eating its meat, placing its remains must have been a recurring event. The site has a unique special, double-sided character; the northern part contains less, but more special materials: a stamp seal, copper awls, Furchenstich style decorated ceramics. The archaeological assemblage and the depositional processes from the southern pit complexes indicate frequently repeated feasts in the settlement's life. Open vessel shapes, suited for serving

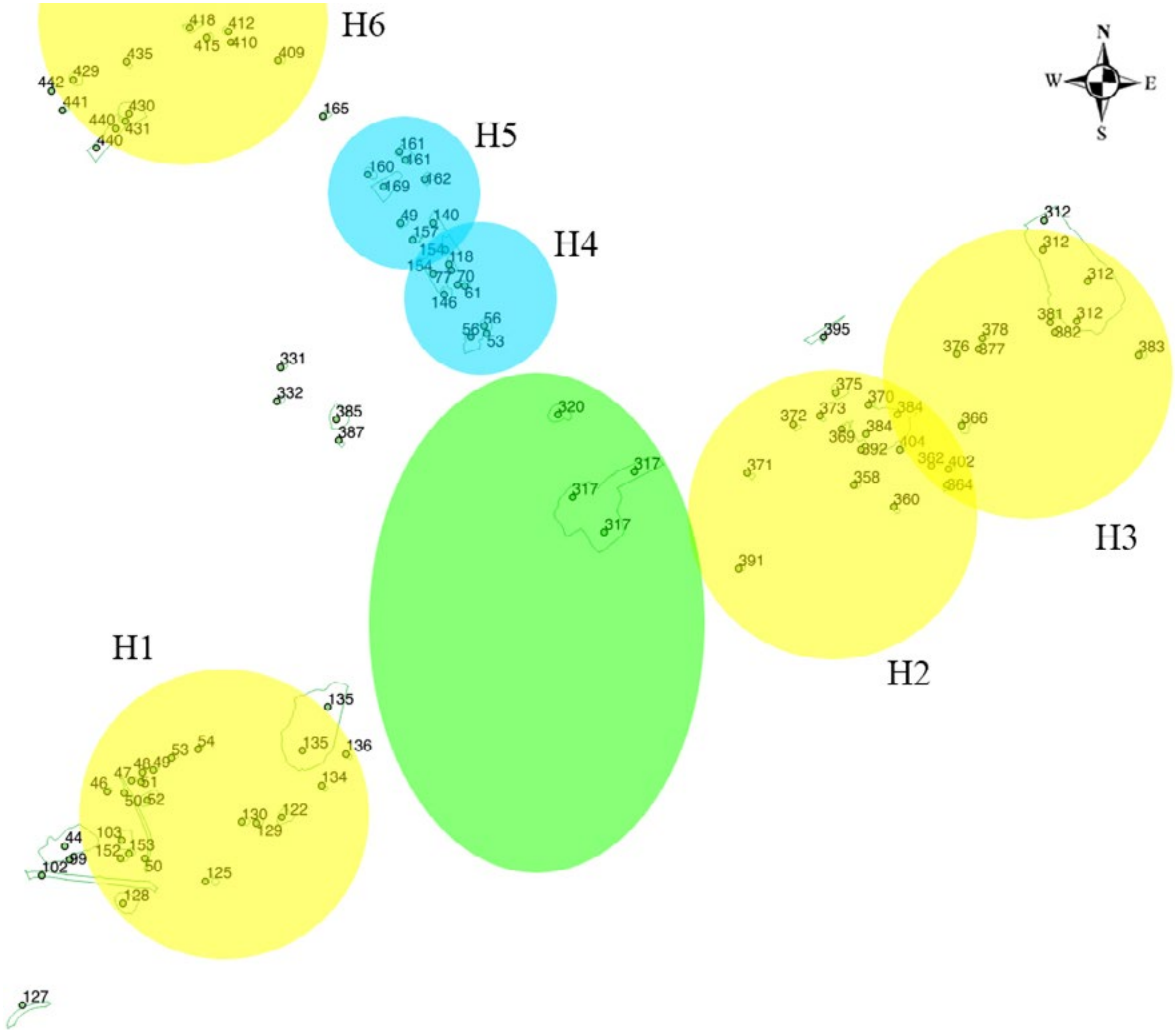


Figure 11. The investigated area and the spatial distribution of the hypothetical household units (H1-H6, households yellow and blue, and central area green) in Abony 49.

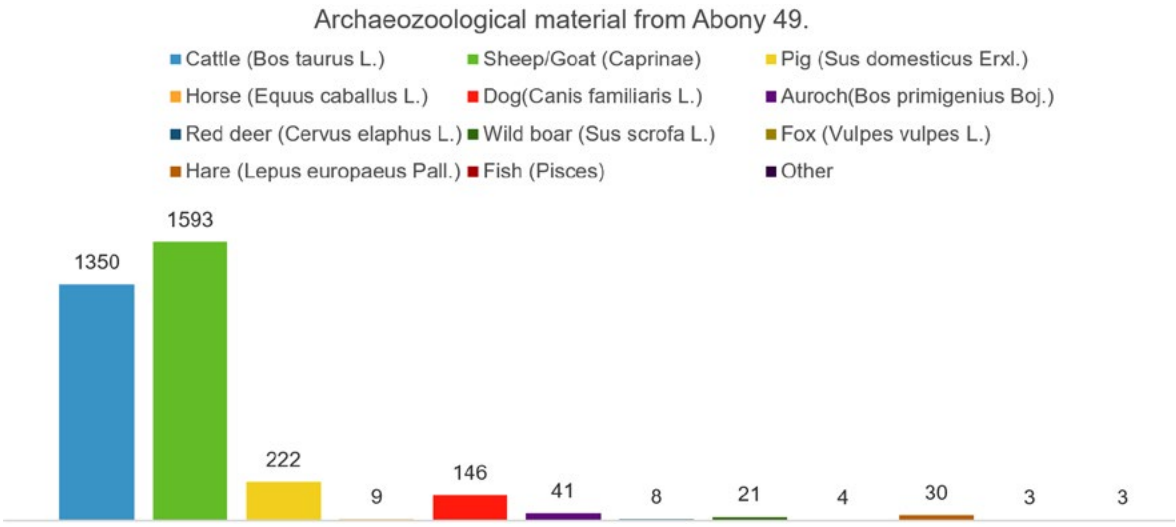


Figure 12. The distribution of the archaeozoological material from Abony 49.

food, and a large number of hunted animal bones, almost all of them bearing the mark of teeth, indicate this. The vacant area between the household units of the settlement was probably the scene of community bonding events.

6. Discussion

The spatial analysis of the different archaeological features and finds (e.g. pottery, stone- and bone implements, etc.) allows the identification of the household units. The statistical analysis shows the systematic repetitions among the archaeological finds, which reflect the systematic behaviour of the inhabitant of the settlements. The scattered household units had generally 2-4 storage pits, although there were a few with more (7-8) as well. The pits, primarily used for storage, surrounded the area of the assumed houses on two or three sides. At this stage of research, we may establish that no significant differences can be observed in the internal structure of the investigated settlements inhabited during the various phases of the Late Copper Age. In the light of the distribution of activities, it can be stated generally that there was some sort of division of labour among the households of the investigated Late Copper Age settlements. In some cases, like leatherworking or spinning and weaving, traces of the activity could be observed only in a few places, in a few household units, which may indicate a certain level of specialization among the households. In the case of the acquisition of the raw materials of chipped and ground stone tools and their manufacture, however, it is conceivable that the raw materials were acquired at a regional level, while exotic materials at a supra-regional level, and that mostly only the tools reached the settlements. Based on the analyzed data in this region the leading role in this activity was played by the Baden community of Balatonőszöd Temetői-dűlő (Horváth 2014). The interpretation and comparison of these hypothetical households as units was conducted from a variety of standpoints: among others, consumption, specialization, and diversity. Among the assumed household units, we observed some units which played a unique role within the community of the settlements. The existence of emergent social inequalities in the Baden culture has already been suggested in connection with rare copper finds, like the diadem from Vörs (Bondár 1998: 35), or the copper dagger and knife from Sármellék (M. Virág 1999: 37; Bondár 2002: 45). Perhaps in the Classical Baden phase a shift towards increased symbolic activities in public areas can be observed at other sites as well. Symbolic activity had a strong presence in the life of the Late Copper Age settlements. This indicates that these activities were of great significance at the level of households and the local community. The special phenomenon is the depositions of animal and human burials at Balatonkeresztúr site and the intensive ritual activities demonstrated in a number of places at Abony 49 which indicate the importance of sacral life in this period. Based on a large number of traces of communal symbolic action and of animal sacrificial pits, and the frequent occurrence of objects connected with the transcendent at the Baden sites of Balatonőszöd Temetői-dűlő, the central role of the settlement in the sacral life of the region is confirmed (Horváth 2014). The regional leading role of the Balatonőszöd settlement will become evident, if similarly, sized settlements and a similar volume of material will be analysed in the future. The South Lake Balaton region is characteristically rich in special and cultic objects, which may mean that the region played an important role in the life of the Baden Cultural Complex.

7. Summary

The fundamental aim of this research is to delineate the basic social unit and the average characteristics of Baden complex households for the region. This allows a better understanding of the structure of Late Copper Age Baden settlements and is the first stage of the research process; it also indicates the future directions of our research. In order to complete this picture, an integrated analysis of the work and research methodologies of numerous researchers will be needed. The project 'The changing horizons of material culture: a study of the locations of everyday and symbolic activities through a multi-level analysis of objects from Late Copper Age settlements' was developed to provide deeper understanding of the use of space and activity areas

in Baden settlements by bringing together researchers from several different Hungarian research institutions. Hopefully, the methodology applied to identify household units could serve as a starting point for research dealing with similar questions of settlement patterns in other periods.

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The rise of socio-economic complexity in non-urban societies: function, organisation, and social meaning organisation and social meaning of space in Early Bronze Age Eastern Arabia

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Abstract

This paper will focus on the arrangement and the function-related organisation of space as a proxy for the characterisation of social and productive units, and of socio-economic complexity, in pre-protohistoric non-urban societies, focusing in particular on Early Bronze Age Eastern Arabia.

Thoroughly explored, the sites of Ra's al-Hadd HD-6 (c. 3100-2600 BCE) and Ra's al-Jinz RJ-2 (c. 2600/2500-2000 BCE), located in coastal Oman, will be used as case studies to present an approach that integrates the three dimensions conceptualised by Amos Rapoport – within the scope of environment-behaviour research – as fixed-feature elements (buildings, walls...), semi-fixed-feature elements ('furnishing' of all sorts – including artefacts) and non-fixed-feature elements (people and their activities and behaviours). This relation is investigated in a diachronic perspective by combining the analysis of structural design with the analysis of systems of activities, examined through the distribution of ecofacts / artefacts, and including the various classes of manufacturing indicators.

Keywords: Socio-economic complexity, Spatial analysis, Systems of activities

Resumé

Cet article est axé sur l'étude de l'aménagement et de l'organisation fonctionnelle de l'espace en tant qu'indicateurs de la caractérisation des unités sociales et productives, et de la complexité socio-économique, au sein des sociétés pré-protohistoriques non-urbaines, en particulier les sociétés est-arabiques à l'âge du Bronze ancien.

Les sites côtiers de Ra's al-Hadd HD-6 (c. 3100-2600 av. N.E.) et Ra's al-Jinz RJ-2 (c. 2600/2500-2000 av. N.E.), en Oman, ayant fait l'objet de fouilles extensives, seront présentés comme cas d'études pour exemplifier une approche intégrant les trois dimensions conceptualisées par Amos Rapoport en tant qu'éléments fixes (bâtiments, murs...), éléments semi-fixes (tout type de mobilier – y compris les artefacts) et éléments non-fixes (les individus, leurs activités et leurs comportements). Cette relation est étudiée dans une perspective diachronique en combinant l'analyse du bâti avec l'analyse des systèmes d'activités, examinés à travers la distribution des écofacts et des artefacts, et notamment des différentes classes d'indicateurs de production.

Mots-clé : Complexité socio-économique, Analyse spatiale, Systèmes d'activités

1. Introduction

Middle-Eastern archaeology has long neglected regions and cultures that had seemingly been little involved in the development of production economy and state-structures, such as Eastern Arabia (Figure 1).

With the paradigm shift that has led to more systematic exploration of 'marginal lands' and non-urban cultural complexes, and to the acknowledgement of non-urban societies as legitimate agents of social complexity and economic diversification (cf. Tosi 1983, 1986), Eastern-Arabian prehistoric populations have been saluted for 'extracting wealth from a land of starvation' (Cleuziou 2009).

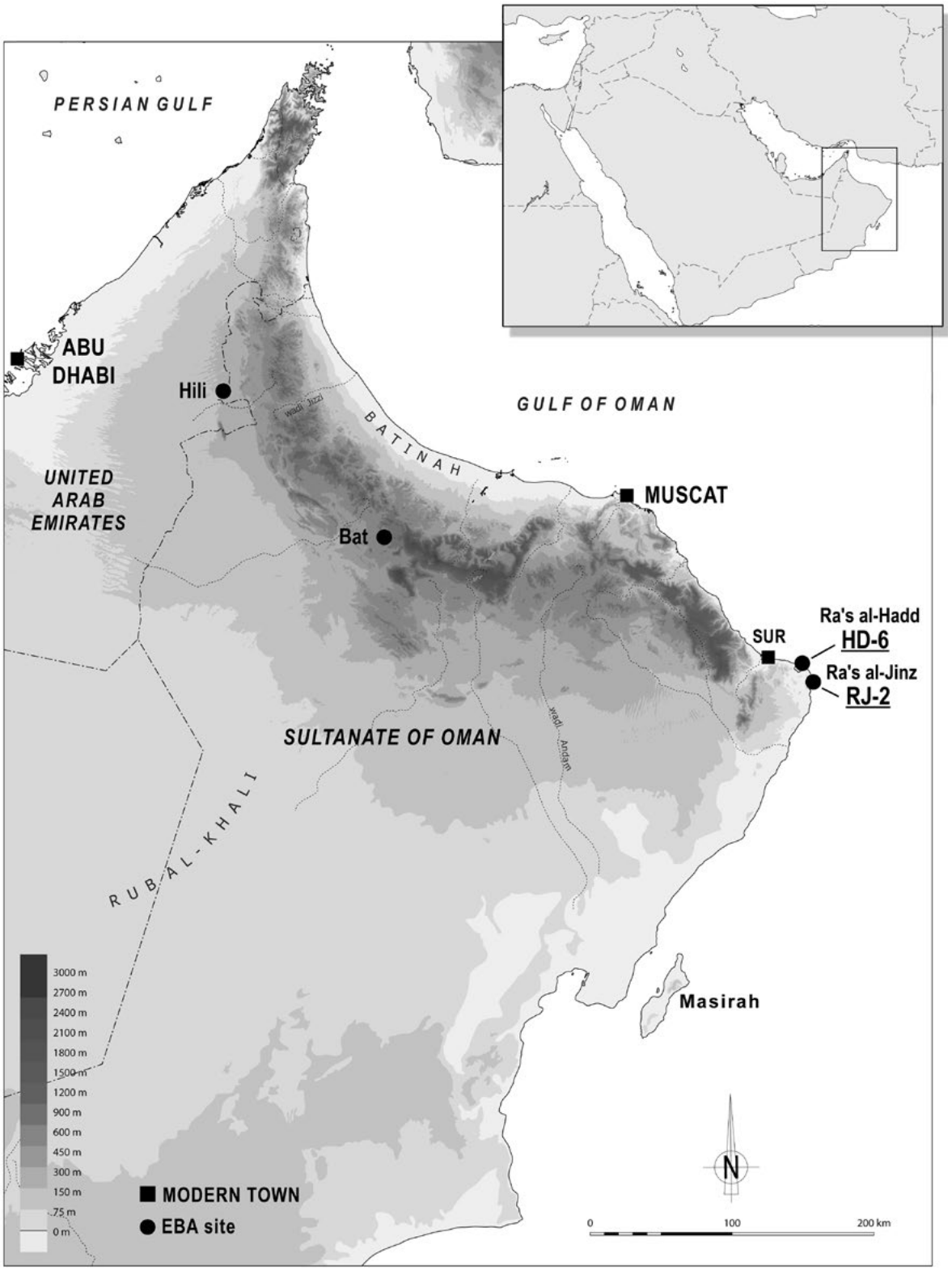

Figure 1. Map of Eastern Arabia, with the localisation of EBA sites mentioned in the text (Map: V. Azzarà, on a base map of H. David).

At the transition between foraging and production economy (e.g. Munoz 2017), and as a partner in the Middle Asian trade network (e.g. Carter 2013; Frenez *et al.* 2016), Early Bronze Age Eastern Arabia is an ideal setting for understanding the rise of socio-economic complexity within urban-less and state-less societies (cf. Thompson 2005).

Recent explorations have highlighted the development of specific adaptation strategies through which local populations countered the unfavourable ecological conditions of the region. Arabian Neolithic does not present the conventional 'Neolithic package', as agriculture is not attested in the region at least until the end of the 4th millennium BCE, and the transition between hunting-gathering economy and farming economy is not fully achieved until the second half of the 3rd millennium (e.g. Cleuziou 2009; Munoz 2017). Likewise, socio-economic structures of Eastern Arabian populations, lacking centralised state-structures and most-likely based on tribal alliances instead, are also quite distinctive (e.g. Cleuziou 2002; Cleuziou and Tosi 2007).

Still, the area is marked by major socio-economic transformations from the end of the 4th millennium BCE. At the very beginning of the Bronze Age (Hafit period, c. 3200-2600 BCE), such transformations are mainly represented in the archaeological record by a remarkable number of cairn graves (c. 50,000, cf. Bortolini and Munoz 2015) (Figure 2a-b), while evidence of settlement life and non-funerary architecture is scanty. Even so, sites such as Hili 8, in the U.A.E. (Cleuziou 1989), as well as Bat (Thornton *et al.* 2016) and Ra's al-Hadd HD-6 (Azzarà 2013, 2015), in Oman, show the appearance of permanent architecture and settlement complex at the very end of the 4th millennium BCE. Besides, a series of technological innovations, such as metalworking and pottery manufacture, mark the Hafit occupations, although the production appears to be rather limited during this period (Méry 2000; Weeks 2003).

We know in a greater detail the second half of the Early Bronze Age (Umm an-Nar period, c. 2600-2000 BCE). Monumental towers and graves have been identified in the whole region (Figure 2a, c) (e.g. Bortilini and Munoz 2015; Cable and Thornton 2013), and evidence of settlement life, although still rare, is more conspicuous (e.g. Döpper 2018). Technological innovation and the transition to a farming economy are more distinct in the archaeological record (Méry 2000; Munoz 2017; Weeks 2003).

However, while the rapid EBA socio-economic complexification is well acknowledged, its dynamics are not well understood. The transformations of Magan – as the region is known in cuneiform sources – throughout the 3rd millennium BCE, are explained as the outcomes of the relationships with allochthonous communities established in the region (e.g. Carter 2013; Potts 2005), or as the adaptive response to growing external demand for local raw materials (e.g. Cleuziou 2002; Cleuziou and Tosi 2007). Both these perspectives relegate local populations to a secondary role, but, although the interaction with urban societies cannot be underestimated (e.g. Frenez *et al.* 2016; Mery *et al.* 2017), local dynamics must be understood as central in the process of socio-economic diversification. By fostering economic disparity, local production strategies would have been one of the primary driving forces of socio-economic change, and hence of a strengthened connection of Arabian populations with the Middle Asian trade network (e.g. Azzarà 2015; Rouse and Weeks 2011).

Against this background, the investigation of settlement sites is paramount for grasping the local dynamics that led to diversification and specialisation of labour, economic interdependence at the regional and interregional level, and social complexification.

The built environment is a significant proxy for social complexity, and a valuable expression of the local dimension (cf. Rapoport 1969). Understanding how settlements integrated with the wider cultural landscape, how housing integrated settlements, and how communities coped with their needs at the level of the social units and beyond, is crucial to understand the socio-economic organisation of these populations. To explore these questions, and highlight the socio-economic dynamics at the local scale, I have delved into the organisation of the household, intended as the basic structuring element of the society (e.g. Azzarà 2012a; Wilk and Rathje 1982).

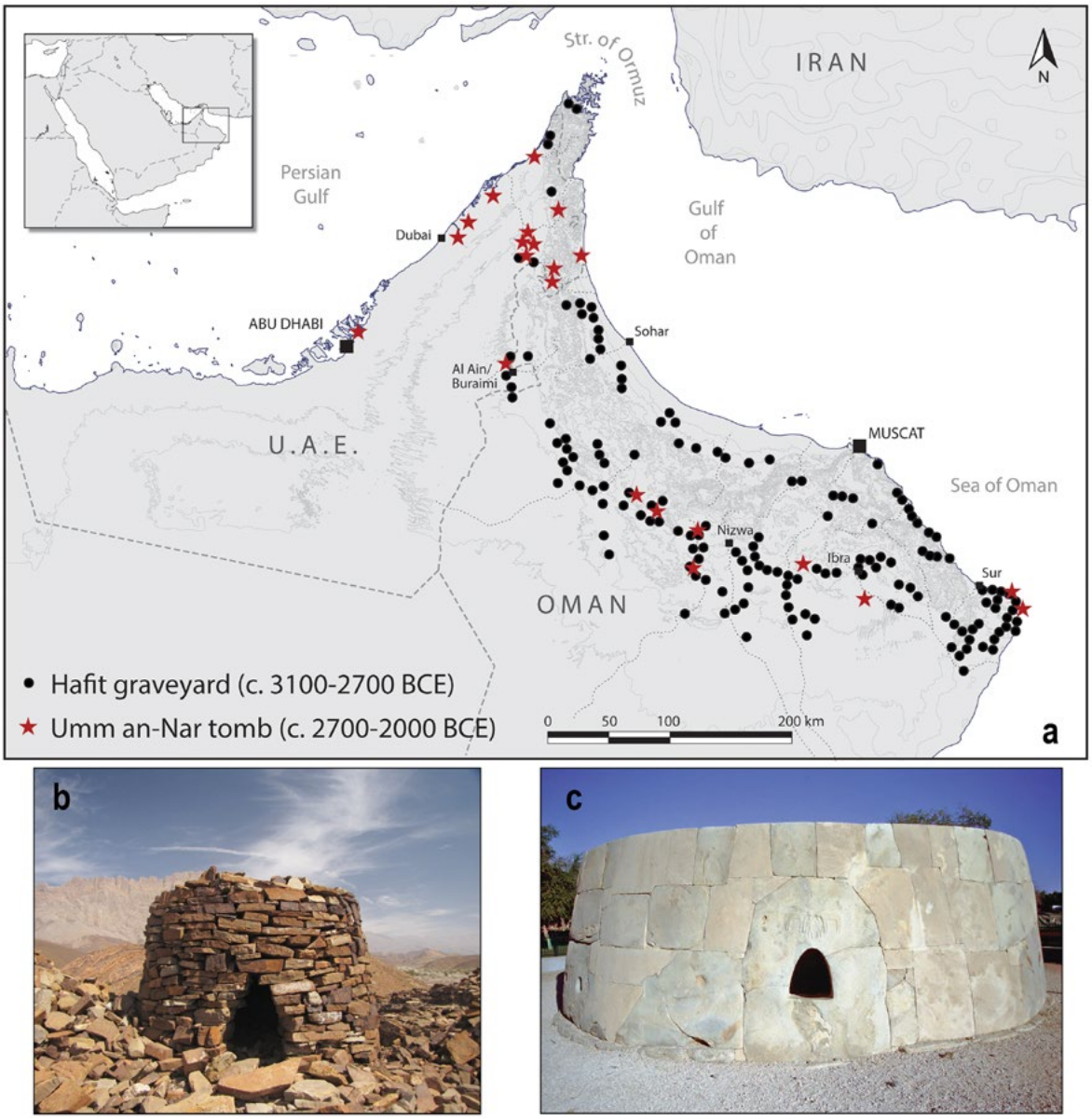

Figure 2. a) Map of the distribution of Hafit graveyards and Umm an-Nar monumental tombs in Eastern Arabia (map adapted after O. Munoz in Bortolini and Munoz 2015: fig. 4 and fig. 7); b) Example of a Hafit tomb (image https://commons.wikimedia.org/w/index.php?curid=9612649); c) Example of an Umm an-Nar tomb (image: C. Gagnaison/Mission archéologique française aux E.A.U.).

The settlement sites of Ra's al-Hadd HD-6 and Ra's al-Jinz RJ-2, among the few non-monumental settlements that have undergone extensive research in the area, will be presented as case studies hereinafter, in an evolutionary perspective.

2. The sites

Located at the easternmost tip of the Arabian Peninsula, in the niyabat of Ra's al-Hadd, the sites of Ra's al-Hadd HD-6 and Ra's al-Jinz RJ-2 have long been the object of field explorations in the context of the Joint Hadd Project directed by S. Cleuziou and M. Tosi (e.g. Cleuziou and Tosi 2000) (Figure 1).

Ra's al-Hadd HD-6 (c. 3100-2600 BCE), extended on about 0.5 ha, currently represents the only settlement of the Hafit period that has been the object of a detailed large-scale excavation in

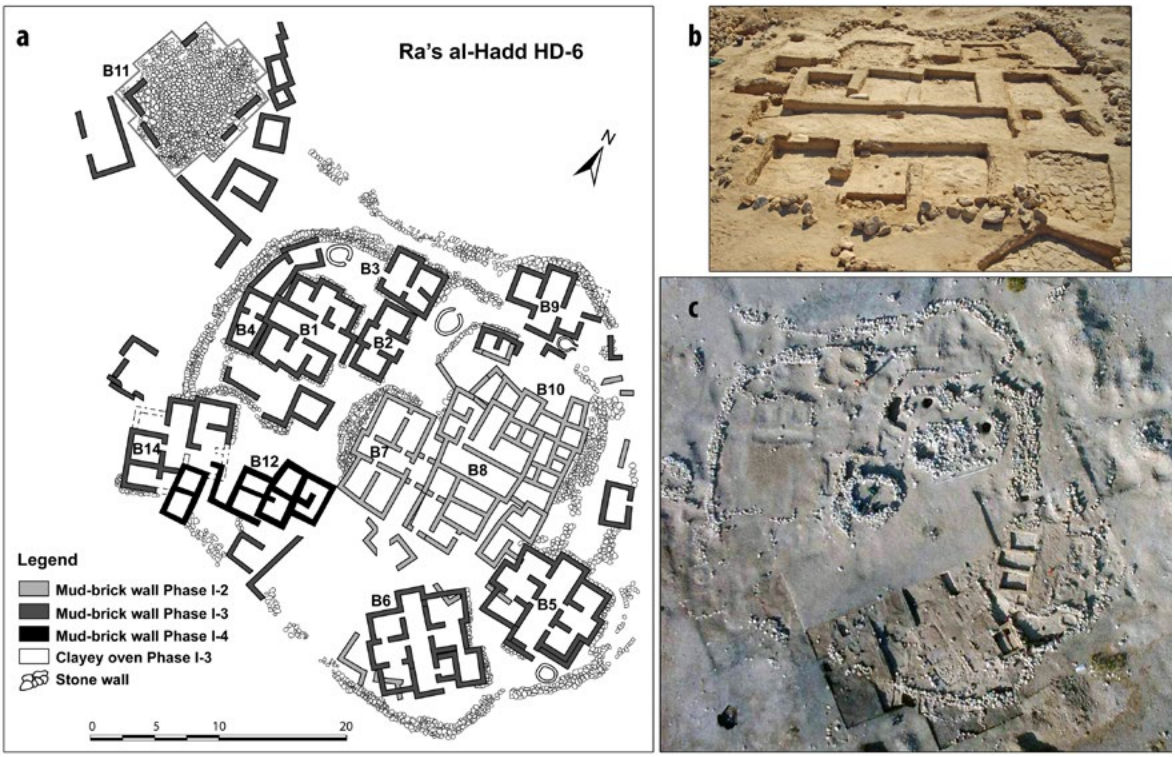

Figure 3. a) Plan of the Hafit occupation at HD-6 (plan: V. Azzarà);
b) Building 1 at HD-6, view from the north (image: M. Cattani, Joint Hadd Project);
c) Zenithal view of the settlement of HD-6 (photo: JHP).

coastal Sharqiyyah (Figure 3) (Azzarà 2015; Cattani and Cavulli 2004). The site lies on top of a sand dune bordered by a paleo-lagoon and, to the east, by a sandspit that separates it from the sea. The excavations have unearthed four main occupations, defined by structural-stratigraphic vestiges (Azzarà 2013, 2015). The first occupation of the area (Phase I-1, c. 3100-2900 BCE) was related to short-lived structures, sporadically detected underneath the levels of permanent buildings in adobe. Phase I-2 (c. 2900-2800 BCE) may be articulated in three structural sub-phases, and presents structures made of sandy mud-bricks. Structures of Phase I-3 (c. 2800-2650/2600 BCE), characterised by silty-clayey mud-bricks, occupy almost entirely the excavated area, and residual portions of walls suggest that they extended as well on top of the older buildings. This phase, divided into four structural sub-phases, marks the maximal expansion of the settlement. The last occupation, little explored so far, is characterised by a new modification of mud-bricks paste, now made of silt, clay and gravel.

At RJ-2 (c. 2600/2500-2000 BCE), the excavations have detected again four main occupations (Figure 4) (Cleuziou and Tosi 2000). The earliest evidence, labelled as Period I and represented by the remains of ephemeral structures, is dated to the 4th millennium BCE. Following the Neolithic occupation, the site was abandoned during the first centuries of the 3rd millennium BCE, while the vestiges attest a three-phase reoccupation during the Umm an-Nar period, spanning on at least 500 years, throughout the second half of the 3rd millennium BCE; during this period, the opposite side of the bay, to the north-east, was also occupied, as shown by the first explorations of RJ-3, which very likely formed with RJ-2 a single settlement, extended on 3 or 4 ha (Azzarà and De Rorre 2018, 2019). Similarly to HD-6, the three phases of RJ-2, identified as Period II (c. 2600/2500-2300 BCE), Period III (c. 2300-2100 BCE) and Period IV (c. 2100-2000 BCE), mark a sequence characterised by the evolution of both architectural features and the material culture. The transition between Period III and IV, in particular, is marked by a substantial modification of building techniques, with the passage from moulded mud-bricks to rammed earth or unmoulded elements (e.g. Azzarà and De Rorre 2018).

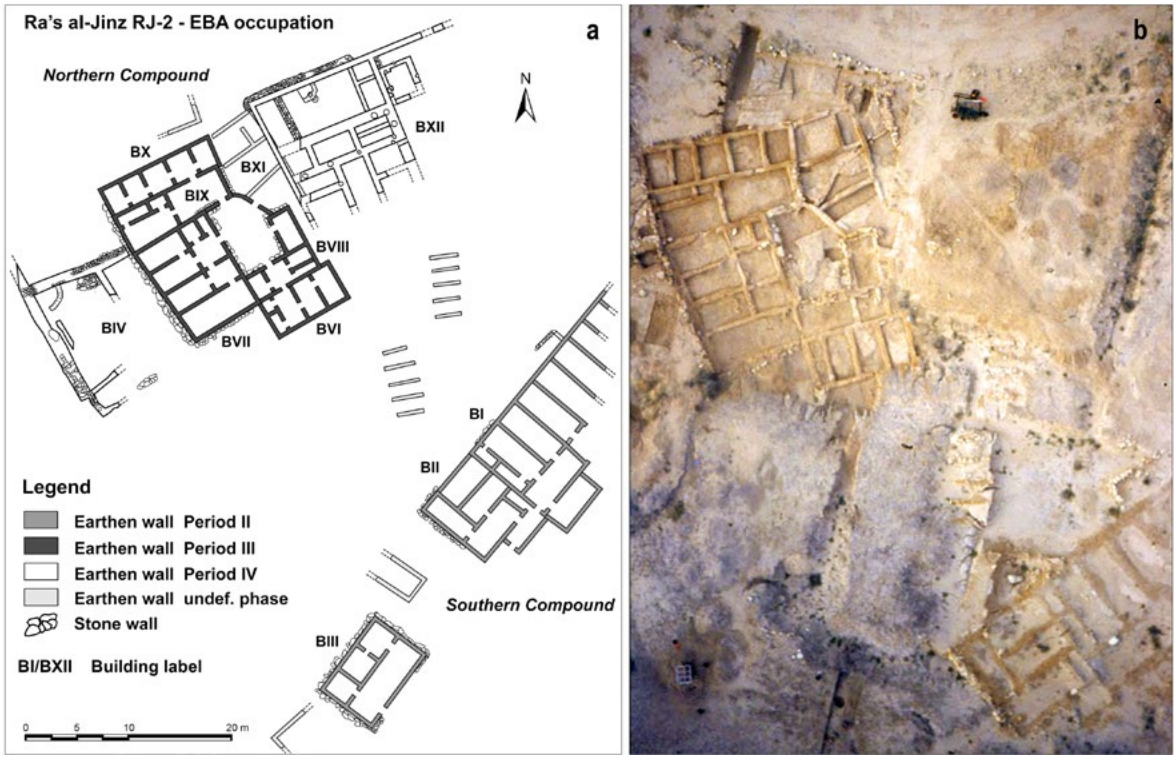

Figure 4. a) Plan of the Umm an-Nar occupation at RJ-2 (plan: V. Azzarà);
b) Zenithal view of the settlement of RJ-2 (photo: JHP).

For both sites, each phase was subdivided into several sub-phases, based on the construction of new structures or major refurbishments of the buildings – such as the erection or dismantling of walls, the displacement of accesses, the laying of new floors on top of previous occupations. Each sub-phase regroups a series of occupational episodes, for instance a succession of fireplaces and the related stratigraphic levels (e.g. Azzarà 2012a, 2012b, 2015).

For HD-6, the stratigraphic-structural sequence helped defining the chrono-typology of several classes of artefacts (Azzarà 2015), while the seriation of pottery and other elements of the material culture, and namely imported artefacts, was crucial for the phasing of RJ-2 (e.g. Cleuziou and Tosi 2000).

The seriations, formalised through Harris matrixes, obviously reflect a posteriori regrouping, and reveal the correlation among the elements assigned to specific phases, more than representing the sites as they have existed at a definite moment (cf., inter alia, Beeching and Brochier 2003). Still, the evidence indicates that these phases, although certainly more articulated, have existed, and they constitute the basis for the analyses presented here.

3. Methodology and Research protocol

In my approach to the household, I have integrated the three dimensions that Amos Rapoport (1990) – within the scope of environment-behaviour research – conceptualises as the fixed-feature elements (the buildings), the semi-fixed-feature elements (the furnishing, including all sorts of artefacts), and the non-fixed-feature elements (the social actors and their behaviours).

The third dimension obviously escape the archaeologists, who actually address the material remains of the past and can only rely on them to approach physically absent social actors; hence, archaeologists must consider the household as a social structure beyond the specific contingencies, rather than a single definite set of individuals (for more thorough considerations on the value

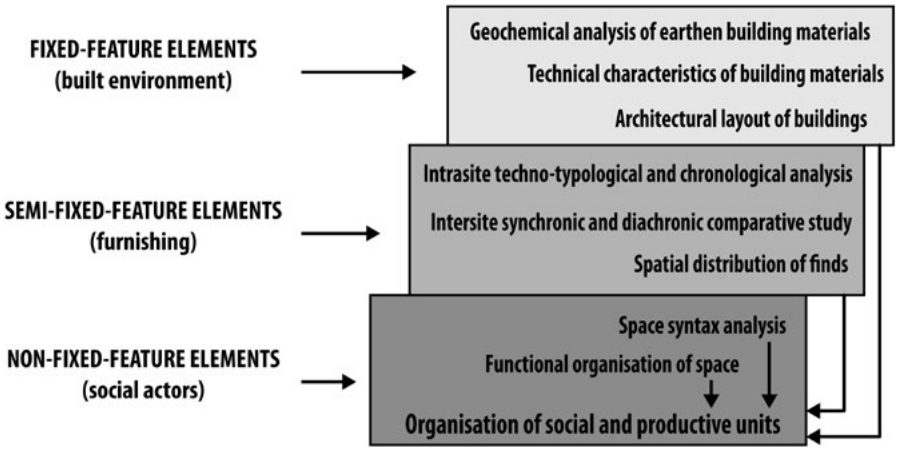

Figure 5. Schematic representation of the three main sections of the research protocol, and of the analyses conducted for each of the steps.

of archaeological approaches on the household, and more exhaustive bibliography, see Allison 1999; Azzarà 2012a). Nevertheless, the diachronic perspective typical of historical / archaeological approaches allows the investigation of developmental cycles of the social unit in the long term, along with its variability at both intrasite and intersite level.

Data available for HD-6 and RJ-2, which were excavated for more than two decades, allow an accurate analysis of the material culture and of intrasite and intersite variations, highlighting both the synchronic variability and the diachronic evolution at the level of the social unit and of the community. The research protocol was very similar for the two sites, and can be outlined in three main sections, related to the three constituting elements of the social unit – Rapoport sensu (1990) (Figure 5). Of course, the three sections were not strictly parted during the actual research process, as the results of each analysis mutually influenced the interpretation or re-interpretation of data.

The evaluation of the fixed-features elements was based on three main steps, combining qualitative and quantitative properties of space – building materials, geometrical characteristics and topological relations:

i) The geochemical analysis of earthen materials, aimed at defining intrinsic properties of materials (plasticity, porosity...) and the compositional variability related to mixing and tempering processes – hence the impact of craftsmen choices in the quality of materials (Azzarà 2015; forth.a.; cf. e.g. Love 2012, 2013).
ii) The analysis of the technical characteristics of building materials, such as the type of brickwork or the foundations systems, and the way they were used and associated, so as to evaluate the degree of technical know-how in building processes and the impact of external constraints (Azzarà 2013, 2018; Azzarà and De Rorre 2018; cf. e.g. Rapoport 1969).
iii) The analysis of the architectural layout, aimed at detecting morphological and metrological recurrences related to siting techniques and architectural models, and assessing the aspect of technical know-how associated with planning (Azzarà 2015, 2018, 2020; cf. e.g. Forest 1991; Ranieri 1997).

Following the architectural analysis, I have appraised the semi-fixed feature elements, i.e. the material remains related to the utilisation of space and the domestic or craft activities. Their analysis can be again outlined in three phases:

i) The techno-typological and chronological study of furnishing (namely artefacts) at the intrasite level, aimed at highlighting the evolution of technical procedures, based both on the existing literature and on new data (e.g. Azzarà 2015; Charpentier 1994; De Rorre 2007; Hilbert and Azzarà 2012).

ii) The review of techno-typological comparisons and composition of the assemblages at the intersite level, both in a synchronic and diachronic perspective (e.g. David 1996; Méry 2000; Weeks 2003).
iii) The spatial distribution of finds in a GIS environment, following the phasing and the different classes of the material culture (including the different elements of the operational sequences if applicable), which revealed a series of associations among different types of features, enhancing the function-related interpretation of artefacts, and highlighted consistent associations between finds and spaces (Azzarà 2015). Only the primary contexts were selected for these analyses, while levels of abandonment and collapse were discarded.

I have finally approached the non-fixed-feature-elements – the social actors – following again a three-step pathway:

i) The assessment of the syntactic qualities of buildings through the Space Syntax Analysis. Based on the assumption that spatial configuration, systems of circulation and accessibility of space reflect the social relationships and the interactions within the group, the Space Syntax Analysis evaluate the level of integration / segregation of the buildings and the relationship of every structure with its nearby environment, as well as the characteristics of integration and control of the rooms and the hierarchisation of spaces within a building (e.g. Cutting 2003; Hillier and Hanson 1994; Van Dyke 1999).
More specifically, this method aims at classifying spatial patterns by translating the architectural plan into mathematically characterised data, based on Graph Theory. Access analysis represents the spaces as points (cells) of a graph, within a *justified access graph*. The position of every cell within the graph depends on its distance (depth) from a given cell selected as the starting point; the graph is justified as cells having the same depth are placed on the same horizontal level, regardless of their position within the building. This representation highlights three main types of spatial connections: spaces connected to only one adjacent room (indicated in the graph as *a*), spaces with two connections (*b*), and spaces located on a ring, accessible through different circuits (*c*) (cf. Figure 9a, 11a). Based on these configurations, the properties of spaces are expressed through a series of values (cf. Table 1; for mathematical formulas, see Hillier and Hanson 1984): the *Mean Depth*, i.e. the mean of individual depths in a system; the *Relative Asymmetry*, comparing the depth of the system from a given point with the theoretical depth it could attain based on the number of spaces, with values closer to 0 indicating lower depth; the *Real Relative Asymmetry*, expressing the degree of integration of a space, which is higher for lower values (<1), while high values indicate a segregated space; the *Control Value*, indicating the potential control of a room on the spaces directly connected to it.
ii) The interpretation of the function-related organisation of space, supported by the association between the syntactic attributes of space and the results of distributional analysis of finds. Of course, preserved evidence does not necessarily or wholly reflect past activities; even the results of simple operations such as cleaning or displacing furniture may bias our interpretation. To reduce the bias, I have addressed the consistence of the assemblages in the long term, by comparing stratigraphic units during the same sub-phase, and then the persistence or variation among phases, so to evaluate the possible modification of space function.
iii) At last, I have combined this information to outline the organisation of the household, of work and of the work force at the micro-regional and regional level (e.g. Azzarà 2015, 2018, 2020, forth.).

The following paragraphs will evoke the main results of these analyses, whose detailed description goes beyond the scope of this paper, and will outline afterwards the socio-economic organisation of these groups from the perspective of the household and of the community.

4. The fixed-feature elements (the buildings)

The architectural study of HD-6 and RJ-2 has highlighted a real evolution of building crafts both at the instrasite and intersite levels.

The geochemical analysis of building materials was performed on a limited number of samples (Azzarà forth.), and has been expanded in the frame of a dedicated research project addressing the analysis of earthen building materials in EBA Eastern Arabia (Azzara and Degryse forth.). The results of the limited sampling are already significant.

The site of HD-6 displays three main types of moulded mud-bricks, each characteristic of a different phase, and well standardised throughout the associated occupation (cf. supra); the three modules are marked by a small variation in size, as they measure respectively 58 x 38 x 5 cm, 50 x 40 x 6 cm and 55 x 36 x 6 cm, and by a macroscopic variation in paste composition (Azzarà 2013). A total of 14 samples of building materials from Phase I-2 and I-3, and one sample of clayey raw material collected in the nearby paleo-lagoon, were analysed through particle size, XRF and XRD analyses. The results show that, consistent with macroscopic observation, paste composition of mud-bricks is uniform through each phase, while the mixture used for the preparation of the paste had different proportions of fine and coarse fractions through time; mineralogical phases and chemical components, on the other hand, were consistent in all the samples, indicating that the source of clayey sediments was constant through time. These analyses suggest that the differences in mud-brick fabrics were a result of mixing and tempering, hinting at deliberate choice in the production process; the clayey sediments of the paleo-lagoon, namely, were mixed in different proportions with the loose deposits of the sandspit bordering the site towards the sea (Azzarà 2013, 2015, forth.). A mixture richer in binders (clay) would have resulted in more plastic modules, with a higher resistance to deformation. If it was a deliberate choice, the modification might be a technical expedient aimed at improving structural strength.

This hypothesis is supported by the variation observed on building techniques, showing that the masons used other expedients to improve structural stability. For instance, the foundations of Phase I-2 consisted of regular strip footings, located only underneath the walls, while during Phase I-3 the buildings were built on platforms occupying the entire surface of the buildings. This kind of foundation helped regularising the surface and provided sufficient rigidity to spread the bearing loads uniformly, although it was unlikely related to the presence of a second floor (Azzarà 2013).

The variation of building layout is also significant, marked by growing regularity through the occupations. During Phase I-2, Buildings 7, 8 and 10 are not associated with an enclosed outdoor and form a huddled agglomeration, where buildings abut each-other without an apparent patterning. This kind of agglomerations is replaced by the more symmetric and compact structures of Phase I-3, which form clusters gradually organised around common spaces, as exemplified by Buildings 1, 3, 4, and whose planning is also consistent (Figure 6). A series of buildings in particular present a tripartite configuration; a cultural influence from nearby regions must be taken into account, but it is worth considering that the tripartite model seems to emerge from a gradual standardisation of the plans designed during Phase I-2 (Azzarà 2013, 2020).

As a whole, the diachronic analysis of architectural evidence of HD-6 highlights a technical advancement, reflected by the appearance of expedients probably aimed at reducing the impact of the dune settlements – the utilization of more elastic building materials within more compact and symmetric structures, with a regular plan and steadier foundations (Azzarà 2013). Such progressions hint at increasing workers' technicity and specialisation.

At RJ-2, the variation of spatial layout is quite substantial as well (Figure 7) (Azzarà 2020; Azzarà and De Rorre 2018). During Period II, the buildings were aligned along the same axes and, at the

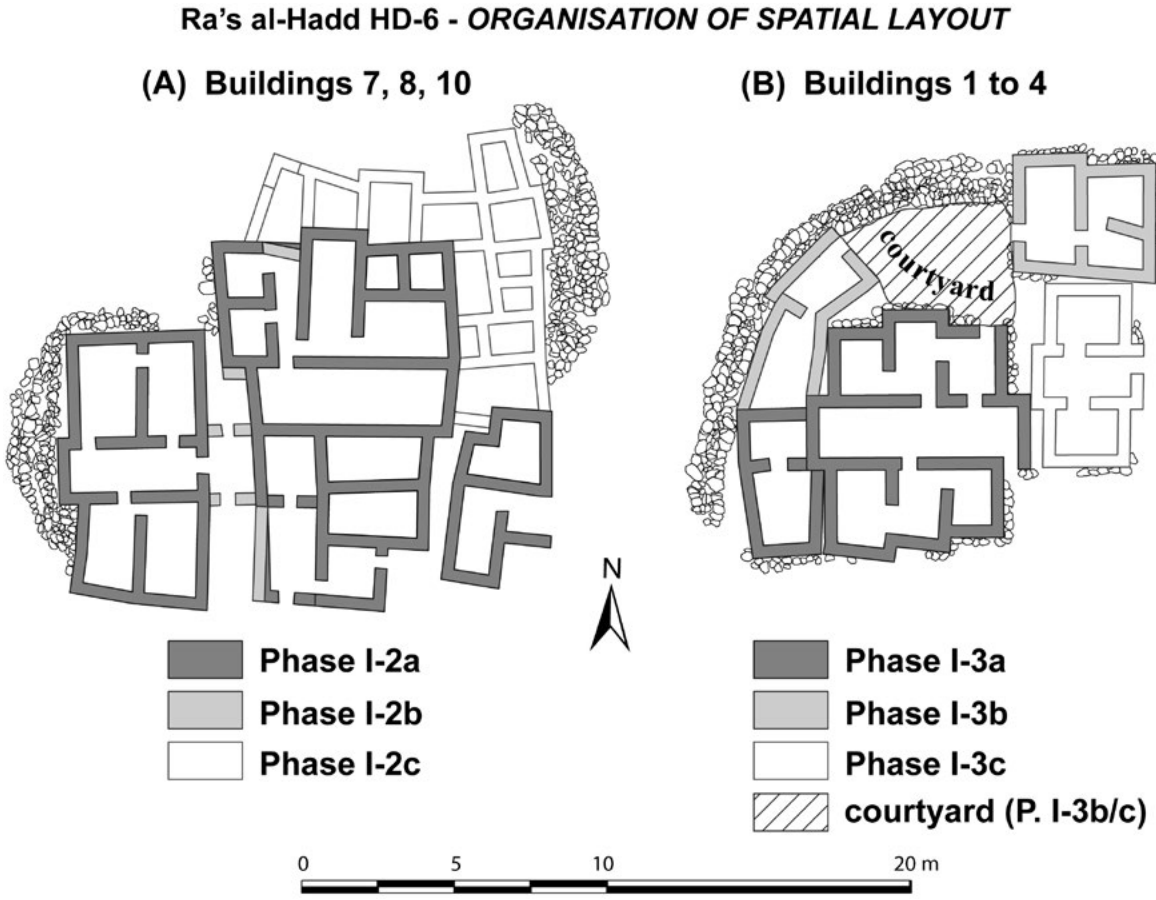

Figure 6. Variation of spatial layout throughout Phases I-2 (A) and I-3 (B) of HD-6, whit the passage from huddled agglomerations to more compact and symmetric structures (plans: V. Azzarà).

end of the occupation, some of the structures were connected by internal doorways. Buildings I and II, namely, formed an integrated complex, most likely related to a single residential group. During Period III, this arrangement was replaced by the construction of a complex progressively organised around a common courtyard, shared by the occupants of the different buildings, and which becomes a closed courtyard at Period IIIc. Period IV somehow represent the 'crystallisation' of this system, with buildings organised along three sides of an internal courtyard, integrated to the dwelling since the construction; each of the two structures excavated for Period IV covers a surface basically comparable to that of the whole compound of Period III, suggesting that most likely they were related to groups of analogous size (Azzarà and De Rorre 2018).

These transformations of spatial layout most likely reflect a reorganisation of cultural nature, concerning namely the relationships within the group (the social unit) and among distinct groups (cf. infra). However, the analysis of plans indicates as well a variation of the siting techniques used for the layout works in the passage from Period III to Period IV of RJ-2, and possibly the existence of a second floor, as suggested by the more massive load-bearing walls of Period IV; besides, this period corresponds to a transformation of building techniques (cf. supra; Azzarà and De Rorre 2018).

In the long term, the passage from the Hafit (HD-6) to the Umm an-Nar period (RJ-2) corresponds to a clear normalisation of building and siting techniques. Spatial layout and technical characteristics of buildings indicate the generation of more standardised models, and the progression of technical skills; this reflects an increasing specialisation of work and of the work force, and hints at the existence of

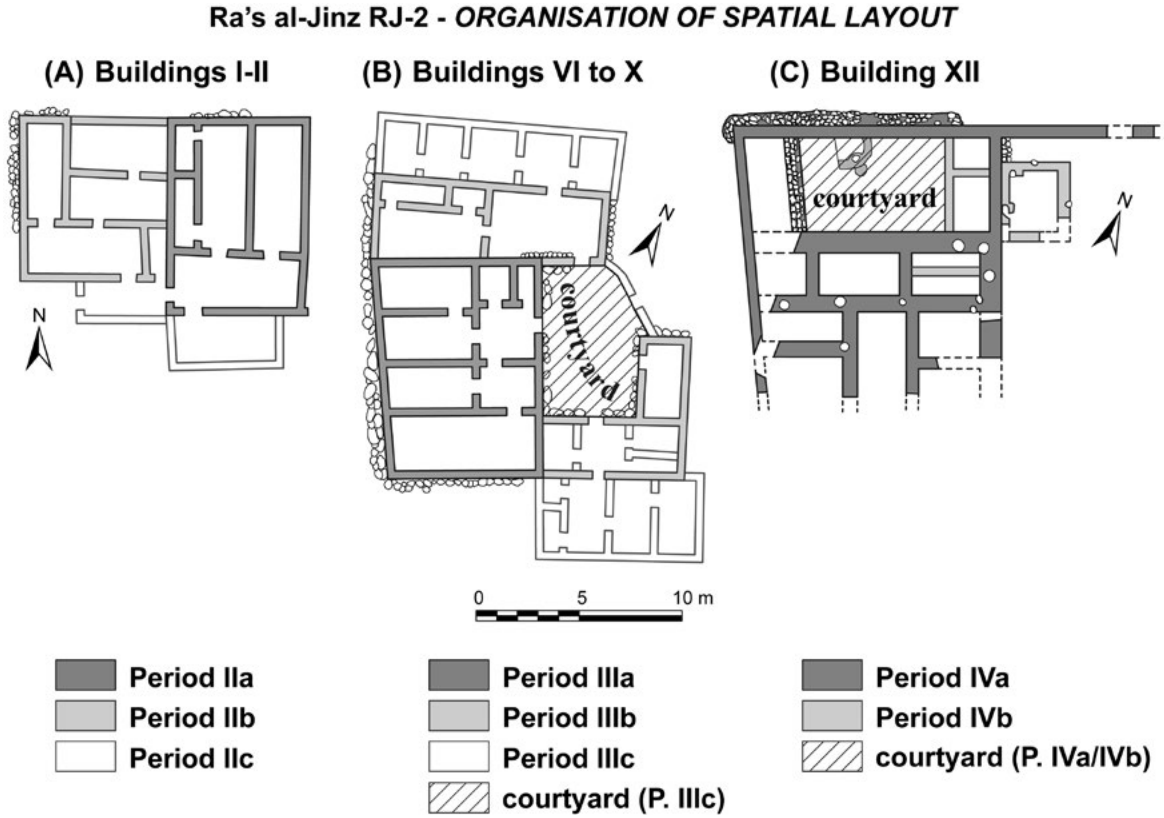

Figure 7. Variation of spatial layout throughout Periods II (A), III (B) and IV (C) of RJ-2, with an evolution towards wide structures having an internal courtyard since the construction (plans: V. Azzarà).

specialised categories of workers originating in the process of gradual specialisation that marks the Hafit period (Azzarà 2015, 2020). Unsurprisingly, the progression concerns funerary architecture as well, as monumental graves reveal concurrent advancements (e.g. Gagnaison *et al.* 2004; Munoz 2015).

5. The semi-fixed-feature elements

The technical breakthrough marking the domain of construction is paired with a reorganisation of the workforce and increased know-how in a series of cottage industries, at both the intrasite and intersite level.

The production of personal ornaments, very characteristic of these settlements, is enlightening. At HD-6, a series of industries on soft-stones and shells characterise the very beginning of the occupation, as indicated by the presence of raw materials, wastes of production, unfinished elements and finished beads (Figure 8a-c). The site, however, presents a true diversification of materials and techniques only from Phase I-3, as stressed in particular by the manufacture of large beads made of hard-stones, whose realisation is costlier both in terms of raw materials and time, as it requires much longer learning process (Figure 8d) (Azzarà 2015; cf. Sela and Roux 2000). The traces of such production, indicated by the presence of raw materials, unfinished elements and finished beads, were only found inside specific rooms within the southern buildings, which attest the more advanced phases of production of soft-stones, shell and mother of pearl ornaments as well (cf. infra). The manufacture of soft stones and shells, on the other hand, is more widely attested throughout the site, and often within the central halls, which displayed a series of different activities; the southern buildings, however, yielded more significant quantities of such remains. A technical evolution is highlighted again by comparing HD-6 and RJ-2, concerning namely the production of rings made of Conidae. At HD-6, the production of such rings implies about ten

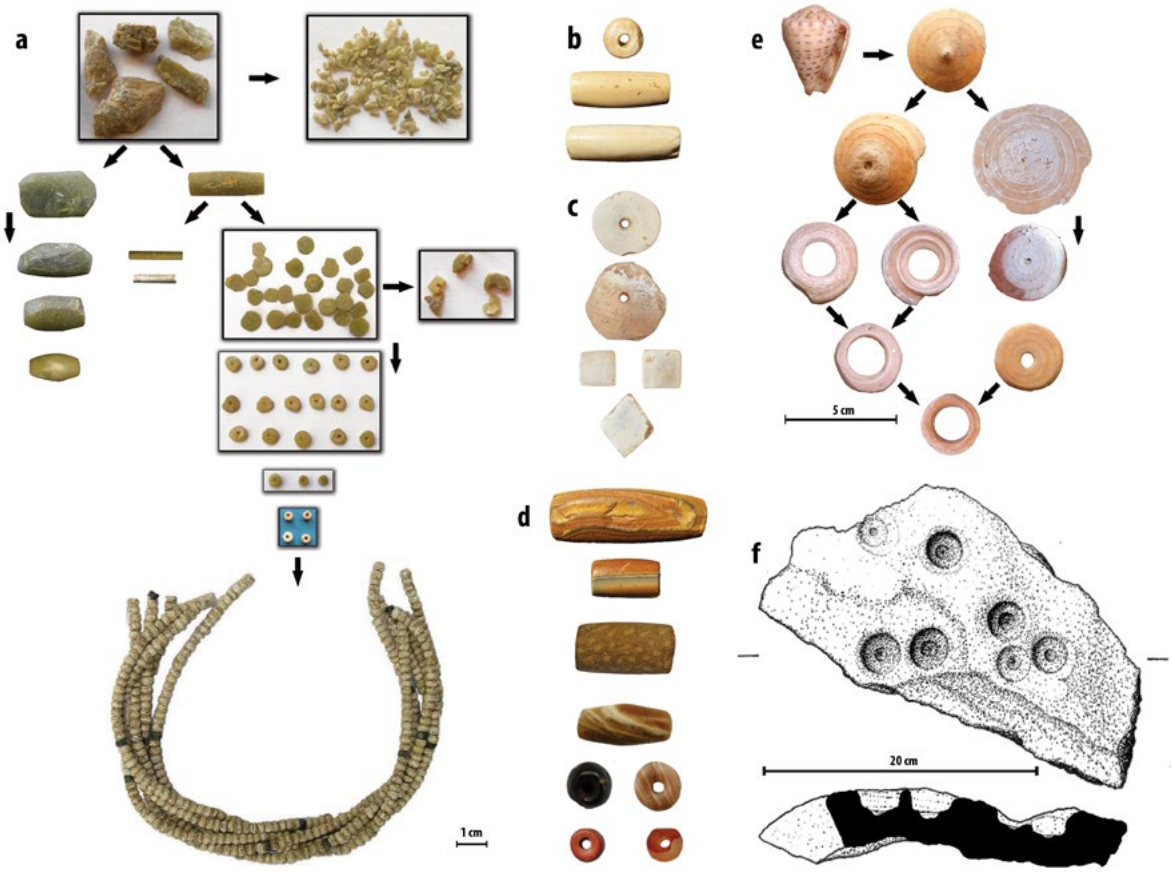

Figure 8. Examples of ornaments production at HD-6 (Hafit period): a) production of soft-stone beads (steatite/baked steatite); b) shell beads; c) mother of pearl pendants and inlays; d) manufacture of hard-stones; e) production of Conus rings, examples of a few variables of an operational sequence including *c.* 10 variables at HD-6. Example of specialised tools at RJ-2 (Umm an-Nar period): f) a Conus slab, a type of groundstone used for the standardised production of Conus rings (plate: V. Azzarà, images: JHP).

variables of the operational sequence (Figure 8e) (Azzarà 2015; Marcucci 2004). At the opposite, the sequence reconstructed by Charpentier (1994) for RJ-2 presents only a few variables, and appears as much more standardised. The higher specialisation of the later productions is also stressed by dedicated tools, such as groundstones bearing multiple cavities and used as a support to maintain the manufactured pieces during their processing (Figure 8f) (cf. Charpentier 1994).

The evolution of metallic productions is substantial as well. While the production consists of simple objects obtained by cold-hammering during the Hafit period (although this might be challenged by recent discoveries, cf. Schmidt and Döpper 2017), the introduction of smelting during the Umm an-Nar period leads to the production of more performant and sophisticated artefacts, in particular towards the end of the 3rd millennium, when refined manufactures characterise the whole Eastern Arabia (e.g. Weeks 2003). This progression can be remarked at the intrasite level at RJ-2; here, the most common classes are represented by simple artefacts (blades, chisels, fish-hooks...) mainly worked by cold-hammering, all along the occupation. From the very end of Period II, the metallic corpus includes much more refined artefacts (axes, 'razors', a hoe-shaped tool, ornaments...), as well as clear traces of melting activities, storage and recycling at relatively significant scale (e.g. Cleuziou and Tosi 2000; De Rorre 2007). From this period onwards, the site displays specific spaces related to metalworking, such as the Building IX within the Northern Compound (Cleuziou and Tosi 2000), or a workshop external to the buildings in the southern area of the site, which has yielded thousands of artefacts at different stages of processing (De Rorre 2007). These elements corroborate the likeliness of a development, both in terms of production and technical skills.

Finally, a major technological and cultural evolution between the Hafit and the Umm an-Nar period is related to the manufacture of pottery that, exceptional at the dawn of the Bronze Age, outspreads in the area from the second half of the 3rd millennium BCE (e.g. Méry 2000; Thornton and Ghazal 2016). RJ-2 itself presents a wide assemblage of local productions, such as Buff and Bicolour Sandy Ware and Fine Red Painted Ware, associated with potteries of Indus and Mesopotamian origins (Azzarà 2018; Cleuziou and Tosi 2000), while pottery is virtually absent at HD-6, which has delivered a total of four sherds from a single Mesopotamian pot (Azzarà 2009).

As a general assessment, the second half of the 3rd millennium BCE is marked by more standardised operational sequences, more specialised tools and more refined artefacts, hinting at increased specialisation in several manufacturing processes. However, this process of specialisation is not distinctive of the Umm an-Nar period, and its prelude can already be detected throughout the first centuries of the millennium.

6. The non-fixed-feature elements (the social actors)

Building on the results of technological studies, I have combined different types of analyses to tackle the aspects more closely related to the socio-economic actors and their behaviours, which, of course, can only be approached through the remains of the material culture they have left.

Space syntax analyses have stressed the dynamics of circulation within the dwellings, as well as the degree of integration or segregation and the measure of control of the different rooms, which reflect the horizontal and vertical relationships among the people occupying those spaces (Table 1, Figures 9a-b, 11a-b). These relationships were verified against the distribution of the indicators of activities as identified by technological studies. Craft activities, in particular, were represented by the various phases of the *chaînes opératoires*, through the presence of raw materials, wastes of production, artefacts at different stages of processing, and finished goods (Figure 10) (Azzarà 2015).

Altogether, these analyses lead to a function-related interpretation of space, allowing to approach the behaviour of social actors, at least from the point of view of the production/consumption dynamics (Azzarà 2015).

At the Hafit period, the buildings of HD-6 are marked by a reiteration of different functions within each architectural unit (Figure 9c); during Phase I-3, in particular, the spatial organisation of activities is quite consistent within the various dwellings. During both Phase I-2 and I-3, each unit presents a room, most often in central position, which constitutes the hearth of the household and, from the syntactic point of view, the most integrated space. This room, frequently displaying large fireplaces, is connected to a series of daily domestic activities, such as food processing (e.g. Azzarà 2009, 2012b); however, it does present traces of craft activities as well, and namely the less complex manufacturing phases of soft-stone, shell and mother of pearl ornaments. Other rooms, always located at the extremity of one of the lateral wings in the tripartite buildings, were clearly intended for storing, as suggested by their size and/or by the arrangement and the association of finds within the space. Such rooms were marked by assemblages of tools, raw materials, large shells used as vessels, etc., neatly placed along the walls, as for instance a series of 17 large perforators all stacked together within a very small space, or series of 20 to 40 spires of Conus arranged in identical piles but not associated with traces of production.

During Phase I-3, the southern buildings present one room bearing the traces of hard-stones manufactures, while attesting also the more advanced phases of production of soft-stones, shell and mother of pearl ornaments (cf. supra). These spaces can be defined as workshop areas, as they seem to be univocally related to crafting throughout the different occupations of the buildings; by the syntactic point of view, these rooms reveal a fair degree of both segregation and control, suggesting that they were related to specific categories of individuals that somehow had a

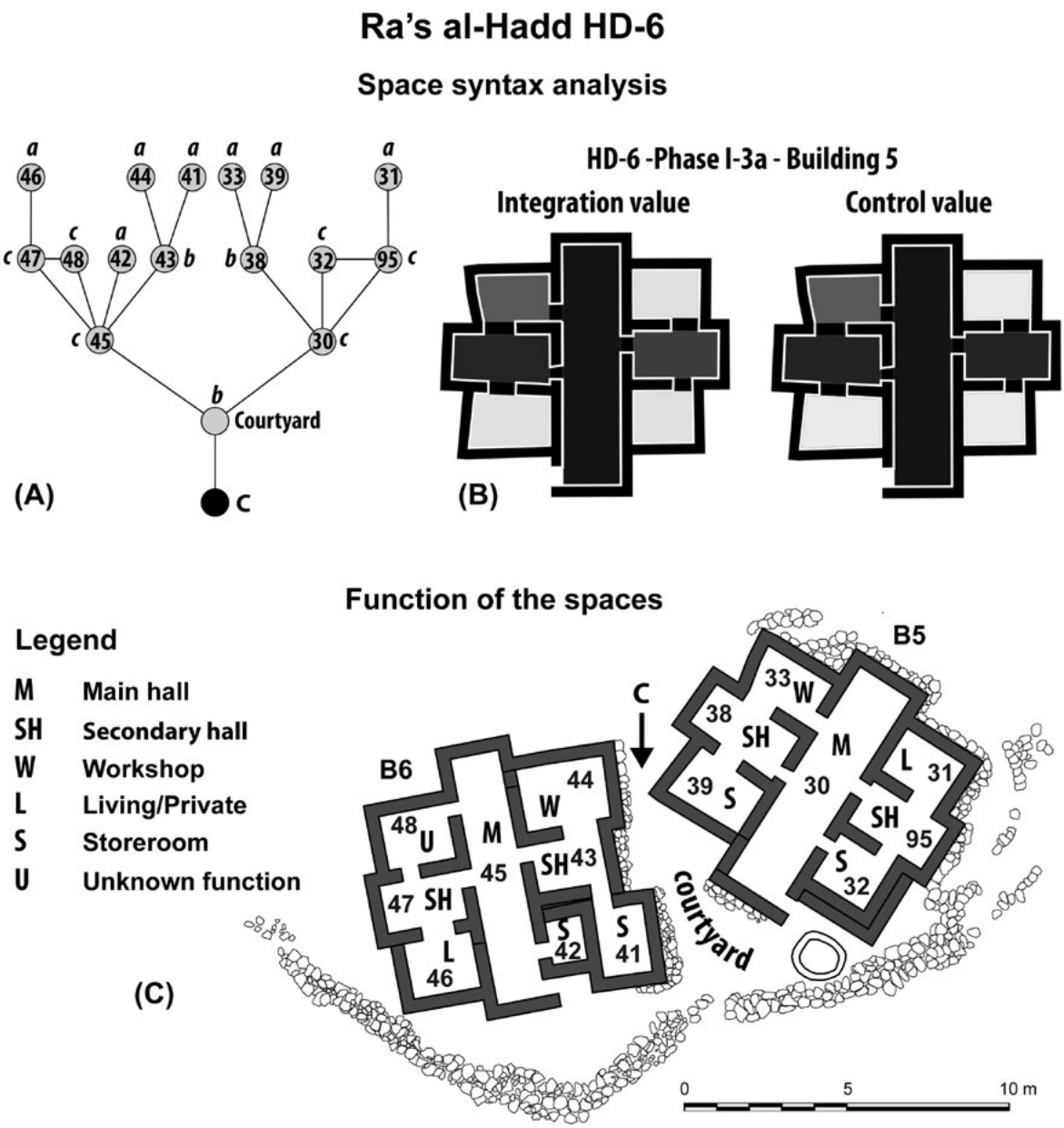

Figure 9. Space syntax analyses at HD-6: a) justiphied graph of the complex formed by Buildings 5 and 6, highlighting the syntactic similarity of building layout, as the two dwellings display almost identical graphs; b) integration and control value of the spaces, the visual example of Building 5 (cf. Table 2) (darker colours indicate high values); c) plan showing the functionalisation of space in the complex formed by Building 5 and 6 (plans and graphs: V. Azzarà)

prominent role in the group. Still, these workshops were integrated to the domestic space, and the site does not present buildings with a specific function-related purpose. Most likely, every building identifies a single household.

RJ-2, at the opposite, displays function-specific buildings, and, more generally, the function-related segmentation of space is more evident, with higher degree of segregation between domestic and manufacturing activities (Figure 11c). Buildings with different functions were related to one single household, which likely consisted of a higher number of individuals, and perhaps more than one nuclear family (Azzarà 2009, 2015, 2018). Besides, starting from the end of Period II, the site yields function-specific areas located outside the buildings, such as a workshop for bronze melting and casting (cf. supra, De Rorre 2007).

HD-6 – Space Syntax – Building 5									
Phase	**Room**	**D** Depth	**MD** Mean Depth	**RA** Relative Asymmetry	**RRA** Integration (Real Relative Asymmetry)	**E** Control	**C** Connec-tivity	**TotD** Total Depth	**MRRA** Mean Integration
I-3a/b	C	0	2.29	0.43	1.31	0.25	1	3	**1.16**
	30	**1**	**1.43**	**0.14**	**0.44**	**2.17**	**4**		
	31	3	2.57	0.52	1.60	0.33	1		
	32	3	2.57	0.52	1.60	0.33	1		
	33	**2**	**2.00**	**0.33**	**1.02**	**0.58**	**2**		
	38	**2**	**1.86**	**0.29**	**0.87**	**1.75**	**3**		
	39	3	2.71	0.57	1.74	0.33	1		
	95	**2**	**1.71**	**0.24**	**0.73**	**2.25**	**3**		
RJ-2 – Space Syntax – Building VII									
Phase	**Room**	**D**	**MD**	**RA**	**RRA**	**E**	**C**	**TotD**	**MRRA**
IIIa/ b/c	C	0	2.20	0.60	1.72	0.33	1	3	**1.10**
	5	**1**	**1.37**	**0.11**	**0.34**	**3.83**	**3**		
	7	2	2.25	0.36	1.13	0.20	1		
	8	2	2.25	0.36	1.13	0.20	1		
	4	**2**	**2.00**	**0.29**	**0.90**	**1.20**	**2**		
	6	3	2.87	0.54	1.69	0.50	1		
	3	**2**	**1.75**	**0.21**	**0.68**	**2.20**	**3**		
	1	3	2.62	0.46	1.47	0.33	1		
	2	3	2.62	0.46	1.47	0.33	1		

Table 1. Figures representing the value of integration, control and connectivity as introduced by Hillier and Hanson (1994), the examples of Building 5 of HD-6 and Building VII of RJ-2.

As a whole, such variations indicate an important transformation of the relationships among the individuals and the way they organise their activities. Buildings at HD-6 reproduce similar functions, suggesting that each building identifies a household, regardless of the composition of the household itself, which cannot be defined, though we may suppose it consisted of a nuclear family. However, the site also presents clusters of connected buildings, non-adjacent but yet organised around an external courtyard, which was likely related to affiliated households (Figure 6b) (Azzarà 2015).

This kind of social organisation evolved during the following Umm an-Nar period, with the rising of tighter bonds within each cluster of affiliated groups and possibly a focus on extended family, as suggested by the evolution of spatial layout and the function-related segmentation of space at RJ-2 (Azzarà 2015, 2018).

The different technical domains indicate increasing levels of technicity and a gradual specialisation of the workforce, already throughout the Hafit period, then more evidently during the Umm an-Nar period. Although the evidence does not allow the definition of gender or age categories, as the archaeological association of artefacts and individuals within the EBA collective burials is virtually impossible, the analyses of settlement evidence stresses the existence of socio-economic categories, that is individuals connected to specific activities (masons, metal-workers, potters, stone and shell craftspeople...). For each of these categories, we can imagine the existence of master-craftspeople, helped by apprentices and, especially in building domain, less skilled work force. Some of these categories probably overlapped with each other, and it is likely that these individuals, who were

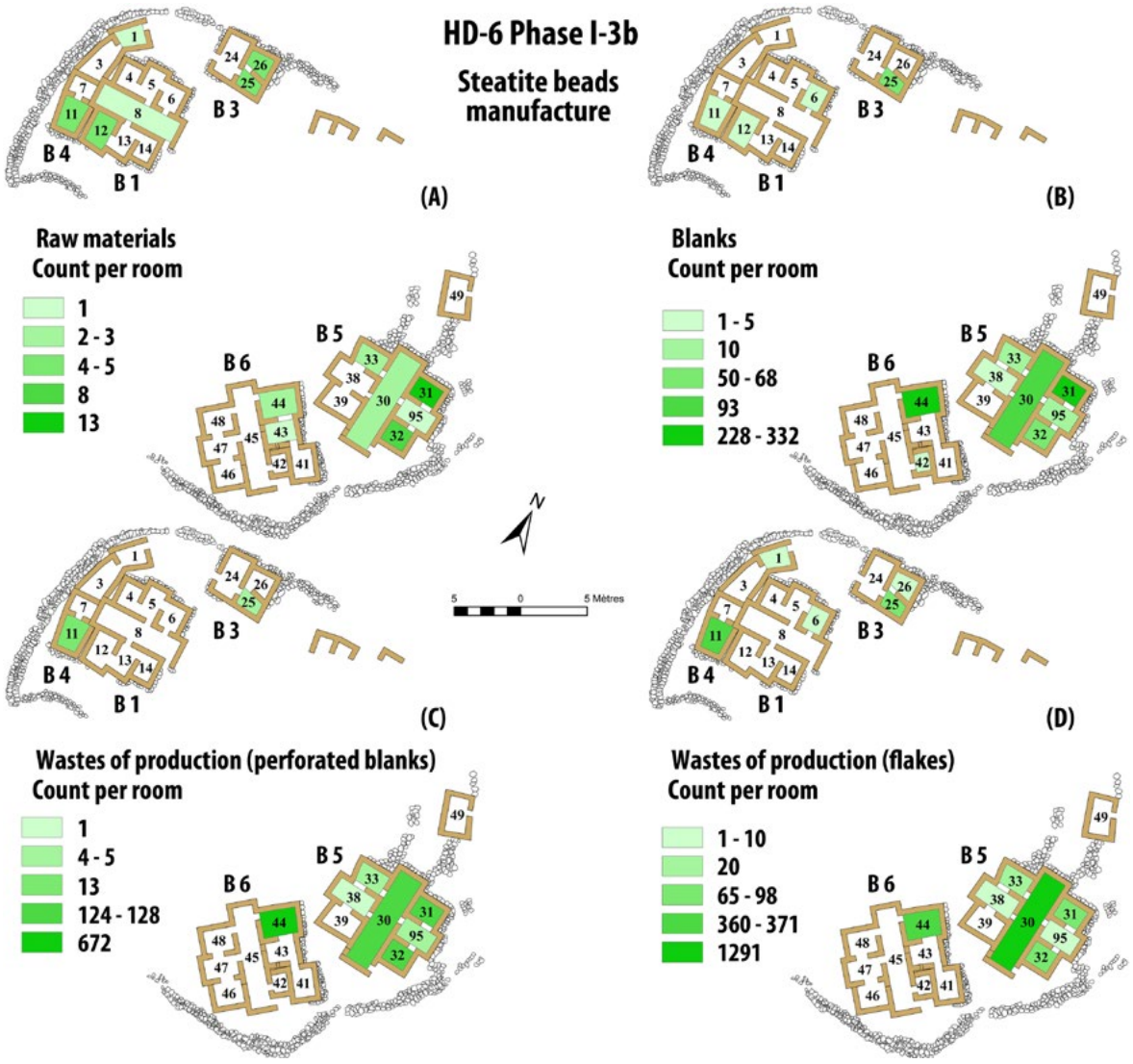

Figure 10. Example of the distribution of finds at HD-6, showing the count per room of some indicators of production for steatite beads (soft-stone): a) raw materials; b) blanks; c) discarded perforated blanks; d) flakes from the first shaping of raw materials. The elements were also counted as total per building, and as total per quadrat following the internal excavation grid of every room (plate: V. Azzarà).

non-attached specialists (cf. Costin 1991), only worked part-time as craftspeople, spending part of their time in activities more related to subsistence, at both periods.

However, the impact of increasing specialisation must not be underestimated. Among other things, distributional analyses highlight a plausible factor of social development at HD-6: while every household produces soft-stone and shell ornaments, a few specific households seem to truly specialise in the production of ornaments, with quantities exceeding the consumption at the household or even at the village level, and including the manufacture of hard-stones (Azzarà 2015). Part of the productions were likely traded to acquire goods unavailable in the catchment area of the site. This would have produced in turn social disparities and amplified the dynamics of hierarchisation. Using an agent-based model, similar dynamics have been suggested for prehistoric Eastern Arabia by Rouse and Weeks (2011).

As for RJ-2, the material culture shows a clear intensification of exchanges at the regional and interregional level, as indicated by imported goods. Whether their acquisition was direct or

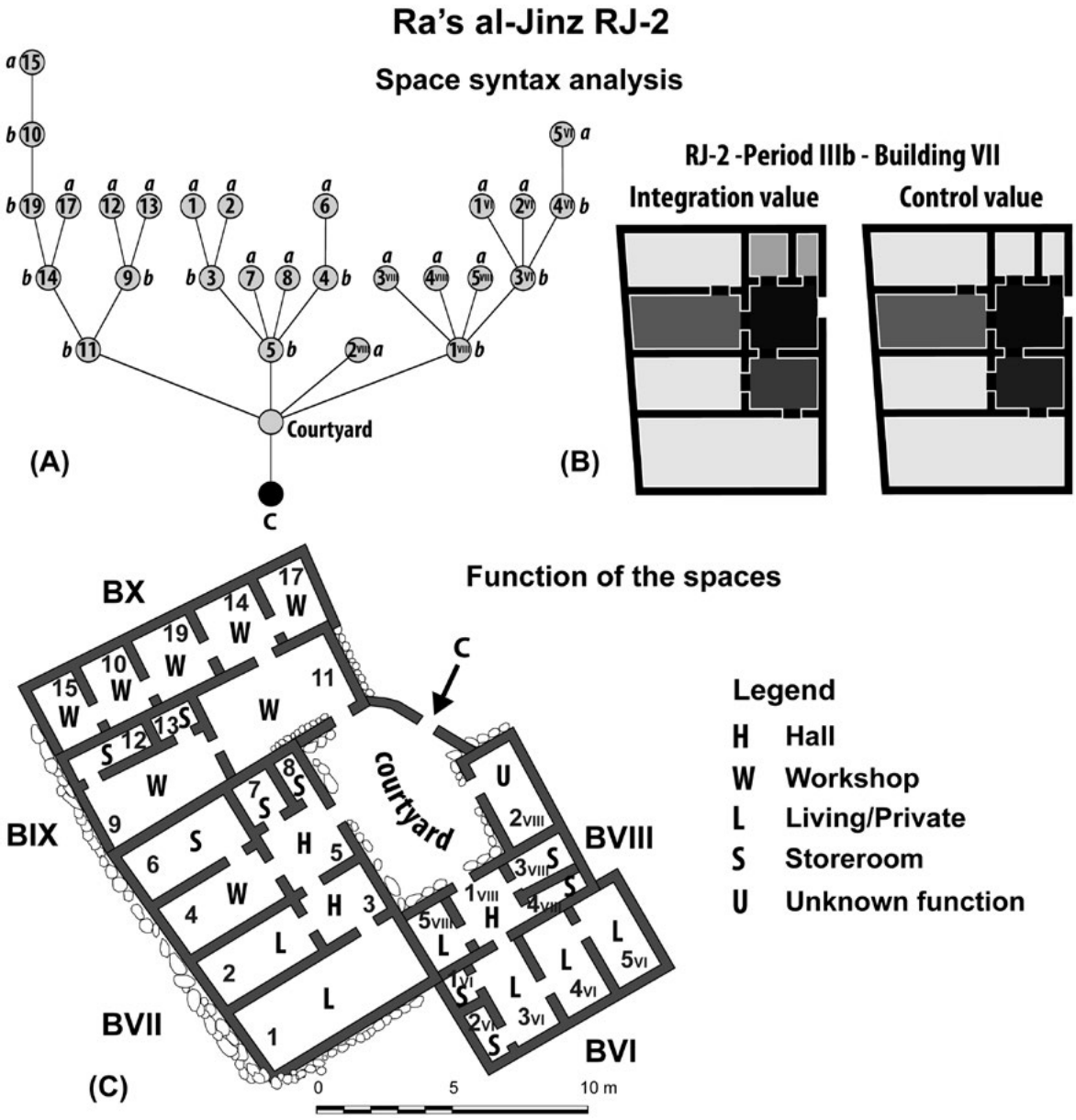

Figure 11. Space syntax analyses at RJ-2: a) justiphied graph of the complex formed by Buildings VI to X, highlighting the differences in building layout, as the graphs of individual buildings are asymmetric; b) integration and control value of the spaces, the visual example of Building VII (cf. Table 2) (darker colours indicate high values); c) plan showing the function of space in the complex formed by Building VI-X (plans and graphs: V. Azzarà).

indirect, their presence suggests different levels of contact with close and far communities, and a sharper hierarchisation, which is reflected by higher craft specialisation and segmentation of activities (cf. Azzarà 2018).

7. The rise of socio-economic complexity: the perspective of the household and of the community in EBA Eastern Arabia

A diachronic analysis of the evidence detected at HD-6 and RJ-2 allows drawing an elaborated picture of Eastern Arabian communities and their process of socio-economic complexification. The arrangement of architectural units at HD-6 and RJ-2 hints at the existence of different clusters of affiliated groups, whose system of relationships evolved through time. While at the beginning of

the social evolutionary path each group probably constituted a household, towards the end of this path the household corresponded more likely to a cluster of groups, as suggested by the increasing integration of adjacent structures; such integration, first displayed by the utilisation of shared external spaces, and then by internal circuits of circulation, culminates in the construction of large unitary buildings, which occupy the surface previously allotted to several contiguous dwellings (cf. Figure 6-7). The separation between internal and external space is more defined, as suggested by the building layout of Period IV at RJ-2, originally designed to represent the preferential relationships among the members of the group and symbolising group affiliation. By the end of the 3rd millennium BCE, connections among the members of the household are stronger – regardless of the composition of the EBA 'Omani' household (polygamous families, siblings, etc.) (Azzarà 2009, 2012a, 2015; Azzarà and De Rorre 2018).

The characteristics of buildings and building materials highlight as well increasing levels of technicity throughout the whole 3rd millennium BCE; likewise, increasing specialisation emerges from the analysis of local manufactures. As a whole, the analysis of the domestic built environment and the activities within it shows that, although we cannot talk of full specialisation of work and rigid social hierarchisation, we are far from the completely egalitarian society evoked by the monumental, collective graves, hinting at principles of equality and affiliation, and interpreted as a powerful symbol of community bonds. Indeed, as it has already been argued, the funerary evidence rather conceals tangible socio-economic diversification and the existence of inequalities (e.g. Azzarà and De Rorre 2018; Cleuziou 2002; Munoz 2015; Rouse and Weeks 2011). Yet, although this complexity is widely recognised by now for the Umm an-Nar period, it is interpreted as the outcome of external influences, and mostly attributed only to the second half of the 3rd millennium. However, the analysis of domestic evidence not only highlights the existence of different socio-economic categories, and a substantial socio-economic disparity within Eastern-Arabian societies, but shows as well that the process of diversification is already operating at least from the beginning of the Bronze Age. Most likely, the complexification acknowledged for the Umm an-Nar period, originates in the economic disparity fostered by local production and consumption strategies from the end of the Neolithic onwards.

Of course, there is much still to be done to fully identify the triggering factors of these socio-economic process, and to understand how the interaction of different groups and of individuals within the groups shaped prehistoric societies of Eastern Arabia. Still, the case of Eastern Arabian communities, even at a micro-regional level, shows well how the analysis of settings and activities as integrated systems is a powerful means to tackle social complexity and socio-economic structures of past populations.

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Interpreting long-lived-in dwelling spaces: integrated spatial analysis of a Late Bronze Age area at Coppa Nevigata (south-eastern Italy)

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Abstract

Spatial analyses have been increasingly used to investigate behavioural patterns and human activities in archaeological and ethnoarchaeological studies. For the Bronze Age in the central Mediterranean spatial analyses integrating various ranges of data, from artefacts to ecofacts, still remain limited in number. Moreover, studies have mainly focussed on well-preserved contexts affected by sudden destructions; spaces inhabited over long periods and so subjected to dynamic depositional processes, are more challenging to interpret as to their function(s). Yet, these latter are commonly encountered archaeological contexts. Representing palimpsests of repeated activities, they are valuable case studies for investigating the spatial organisation of activities.

This paper presents an integrated spatial analysis of a long-occupied area of the Coppa Nevigata settlement from the Late Bronze Age. It is a trial, aimed at both building a viable methodology to deal with 'dynamic' deposits and verifying the potential of the observed record in terms of activity areas and fossilised patterns of behaviour.

Keywords: Spatial Analysis, Activity Areas, Interdisciplinary Approach, Bronze Age, Coppa Nevigata

Résumé

Les analyses spatiales sont de plus en plus utilisées pour étudier les modèles comportementaux et les activités humaines dans les études archéologiques et ethnoarchéologiques. Pour l'âge du bronze en Méditerranée centrale, les analyses spatiales intégrant diverses gammes de données, des artefacts aux écofacts, restent encore limitées. De plus, les études ont principalement porté sur des contextes bien préservés affectés par des destructions soudaines; les espaces habités pendant de longues périodes et soumis à des processus de dépôt dynamiques sont plus difficiles à interpréter quant à leur fonction. Cependant, ces derniers sont des

contextes archéologiques couramment rencontrés. Représentant des palimpsestes d'activités répétées, ils constituent des études de cas utiles pour étudier l'organisation spatiale des activités.

Cet article présente une analyse spatiale intégrée d'une zone occupée depuis longtemps dans le site de Coppa Nevigata depuis la fin de l'âge du bronze. Il s'agit d'un essai visant à mettre au point une méthodologie viable pour traiter les dépôts «dynamiques» et à vérifier le potentiel des données observées en termes de zones d'activité et de comportements fossilisés.

Mots-cles : analyse spatiale, aires d'activité, approche interdisciplinaire, âge du Bronze, Coppa Nevigata

1. Introduction

Spatial analyses have been increasingly used to investigate patterns of behaviour and human activities in archaeological and ethnoarchaeological studies (Carrer 2015; Lancelotti *et al.* 2017; Rondelli *et al.* 2014). These are even more telling if they combine different sources of data, from portable artefacts and ecofacts, to structures, to depositional processes. GIS-based analyses and statistical elaborations allow for correlating of different sets of data, placing both functionally characterised artefacts and by-products of activities (i.e. ecofacts) within a spatial dimension (Achino and Barceló 2019; Barceló 2002; Blankholm 1991; Djindjian 1999; Domínguez-Rodrigo and Cobo-Sánchez 2017; Hietala and Larson 1984; Merrill and Read 2010). An interdisciplinary integrated approach is vital to achieve an in-depth understanding of activity areas as proxies for cultural patterns of behaviour and the social organisation of activities.

In recent years our knowledge about Bronze Age settlements in Italy has expanded. More and more varied, evidence is now available to explore the socio-economic organisation of these communities. In so doing, the characterisation of the spatial configuration and functional variability of the spaces in settlement areas represents a key step. However, though spatial studies have indeed increased (Achino and Barceló 2019; Alberti 2017; Aquino *et al.* 2016; Cantisani 2015; Moroni *et al.* 2020; Peinetti *et al.* 2015; Vullo *et al.* 1999), holistic analyses integrating various ranges of data, particularly the bio-archaeological ones, still remain limited (Speciale *et al.* 2016). Moreover, studies have mainly focussed on well-preserved contexts, such as those affected by sudden destructions and collapses (Cazzella *et al.* 2002; Malorgio and Maggiulli 2011; Scarano 2011; Vullo *et al.* 1999). Long-lived-in spaces and activity areas, on the other hand, more affected by occupational disturbances and dynamic depositional processes, yield apparently chaotic records that are challenging to interpret concerning their function(s). Yet, not only are these types of deposits very common among archaeological contexts, but they also represent the palimpsests of repeated activities and thus are good candidates for the identification of socially accepted patterns of behaviour (Childe 1956, ch. 3).

This paper presents an integrated spatial analysis of an area of the settlement of Coppa Nevigata dating to the Late Bronze Age. It is a trial study, aimed at both building a viable methodology to deal with 'dynamic' deposits, possibly resulting from repeated activities, and verifying the potential of the observed record and reliability of portable-finds distributions in terms of activity areas and fossilised patterns of behaviour. (G.R., E.L., G.F., C.M., M.P., V.M., G.S., M.V.)

2. The archaeological context

2.1. The settlement of Coppa Nevigata

The Bronze Age settlement of Coppa Nevigata, in north Apulia (Figure 1), is one of the most extensively excavated sites in Italy (Cazzella and Recchia 2012). It was located on the shore of an ancient lagoon, now reclaimed, which connected the village to the sea. A very long-lasting settlement, it was continuously occupied for over one millennium (from the 18th to the 8th centuries BC) and was well integrated into the maritime exchange networks operating in the

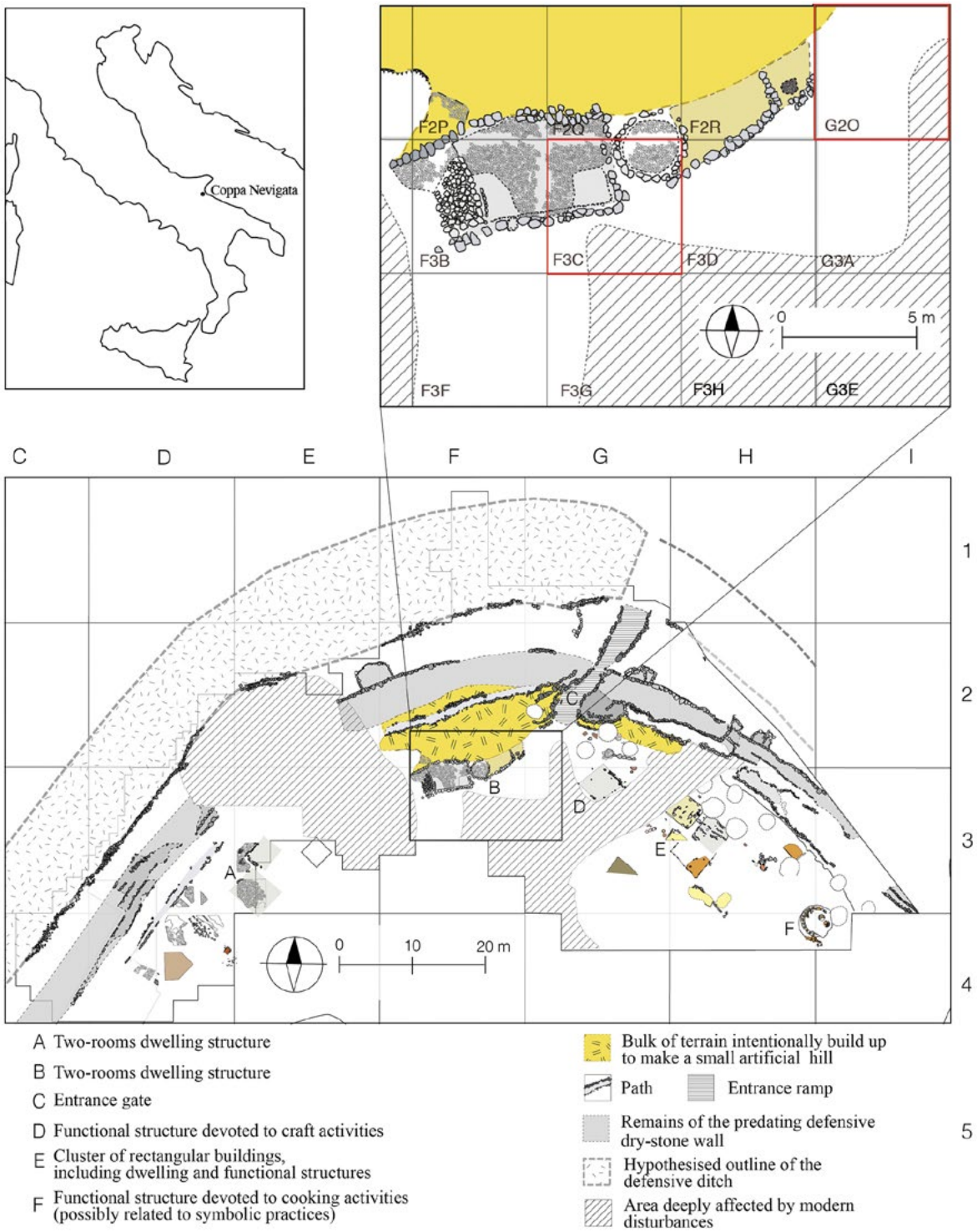

Figure 1. Bottom: map of the Coppa Nevigata settlement showing the features pertaining to the Late Bronze Age (12th century BC). The black rectangle marks the area under scrutiny. Top: the area under scrutiny: the red squares mark the grids analysed in detail.

eastern Adriatic and the Aegean (Cazzella and Recchia 2009). A distinct feature of the settlement is the complex defensive system that was rebuilt and reshaped several times. The spatial organisation of the habitation also changed significantly through time due to socio-economic transformations of the resident community, but the settlement always remained in the same physical position despite the changes in the surrounding environment (Caldara and Simone 2012). A notable reorganisation of the spatial arrangement of both domestic architecture and

the management of goods occurred in the Late Bronze Age (13th-12th centuries BC). At the same time, the level of craft activities increased considerably, probably owing to the rise of elite groups (Cazzella and Recchia 2013).

Interdisciplinary studies have shed light on different socio-economic aspects of Coppa Nevigata and the dynamics of the surrounding environment(s), from subsistence economy strategies to the technology and organisation of productions and the development of specialised activities (Fiorentino and D'Oronzo 2012; Jones and Levi 2012; Levi *et al.* 1994; Minniti 2012; Siracusano 2012). Since the late 1990s spatial distribution analyses integrating diverse sources of data (artefacts, ecofacts, characteristics of the deposits etc.) have been carried out in order to explore the patterns of use of the spaces at the settlement (Cazzella *et al.* 2002; Moscoloni *et al.* 2002). The research has included organic residues analyses on pottery samples, which have provided evidence for an early production of olive oil at the site (Evans and Recchia 2001-2003).

2.2. Case study area

In this paper, we discuss a new integrated spatial analysis of a distinct area of the settlement dating to a late phase of the Late Bronze Age (12th century BC). Located on the north-eastern side of the village, on the slope of a small artificial mound that overlooks both the settlement's entrance gate (or one of the entrances) and a large open space (Cazzella and Recchia 2015), this area was possibly the residency of an elite group. It is characterised by a domestic building consisting of two adjoined rectangular rooms: the west one is provided with a small cobbled patio, while the east one includes a cobbled circular structure (Figure 1). No hearths/cooking structures were preserved inside these rooms, but an external hearth adjoined the eastern one. This building and the surrounding spaces have yielded thousands of ecofacts and artefacts (including pottery, metal objects and scrap metals, stone and bone artefacts). Moreover, a substantial amount of fine wheel-made Mycenaean-type sherds occur, which may well indicate a distinctive status of the residents and/or activities with specific symbolic and social meanings (Bettelli *et al.* 2017).

Unlike the areas that have been previously analysed from a functional spatial distribution perspective (§2.1), mostly characterised by undisturbed primary deposits sealed by collapse layers, the area under scrutiny was occupied over a certain span of time without significant episodes of fire and/or collapse. Thus, a danger exists that the incidence of occupational disturbances was so high as to ultimately interfere with any attempt to use data drawn from portable artefacts/ecofacts to ascertain activities and space function. Nonetheless, as we shall see below (§3), spatial distribution analyses may provide evidence to test the nature of the deposits and the impact of occupational disturbances. Therefore, two specific zones (falling into two grid-squares: F3C and G2O respectively; Figure 1) that are representative of diverse activity-spaces related to the building have been selected as trial case studies for the spatial analysis. The first zone (F3C) encompasses: a portion of each of the building's rooms (west and east) and the area just outside them to the south. The second one (G2O) corresponds to an open area, neither too close not yet too far from the building, in the proximity of a hearth adjoining the east room. All the deposits from the life-span of the structure have been taken into consideration. A positive result showing but a moderate impact of disturbances and fair reliability of observed portable-artefact/ecofact distributions, will encourage the extension of the analytical process to the entire area.

2.3. Strategies of collecting finds and sampling of archaeobotanical remains

The strategies adopted during the excavations for collecting finds allow for their quite accurate positioning on GIS maps. With particular reference to this area, finds (including faunal remains) have been collected, either with exact spatial coordinates or in grids of 1 x 1 m. (G.R.)

Area	Sample	Litres	% of sampling	n. of remains	Concentration (n. of remains per litre)
Room west (F3C)	89/011	8	100%	132	17
Room west (F3C)	89/015	7	20%	142	20
Room west (F3C)	90/002	21	20%	60	3
Room west (F3C)	90/009	14	20%	21	2
Room west (F3C)	90/012	14	20%	1487	106
Room west (F3C)	90/013	7	20%	17	2
Room west (F3C)	90/015	14	20%	142	10
Room west (F3C)	90/018	7	20%	77	11
Room west (F3C)	90/028	4,6	100%	767	167
Room west (F3C)	90/030	4,2	100%	6	1
Room west (F3C)	90/031	2,6	100%	1390	535
Room west (F3C)	90/032	1,6	100%	56	35
Entrance/outside (F3C)	89/010	7	20%	206	29
Entrance/outside (F3C)	89/012	7	20%	821	117
Entrance/outside (F3C)	89/014	7	20%	216	31
Room east (F3C)	90/020	7	20%	222	32
Total		**133**		**5762**	

Table 1. Soil samples for the collection of archaeobotanical remains from grid F3C. The quantity (in litres) of sampled soil and the sampled percentage of removed soil is indicated, as well as the amount of detected remains and their incidence per litre of soil.

Each layer on the site is sampled for the collection of archaeobotanical remains. Each sample, usually comprising a minimum of 20% of the whole soil removed, is wet sieved using two different mesh (0.5 and 2.0 mm). Depending on the nature of the deposits and the visible concentration of plant remains, up to the 100% of the removed soil was sampled (Hastorf and Popper 1988; Marston *et al.* 2014). This latter course was followed for most of the samples taken in room west of the analysed area (Table 1). (M.P.)

3. Understanding depositional processes

The record under scrutiny is far removed from the 'Pompeii premise' (Binford 1981). In fact, the evidence results from the repeated use of the area over a certain span of time, without significant gaps or episodes of collapse. Thus, the first step is to evaluate the deposit formation and the impact of anthropic disturbances on the primary deposition of artefacts/ecofacts. According to Michael Shiffer and Martin Kuna's categories of refuse (Kuna 2015; Schiffer 1972, 1983), 'primary refuse' deposits are the best candidates for the study of activity areas.

3.1. Hypotheses on the nature of the deposits

On the basis both of the nature of the strata and the spatial organisation of this area we have put forward three working hypotheses to consider: 1) the deposit is a midden, mainly resulting from the discard of waste from the closest dwelling structures; 2) it is a midden, mainly constituted by the waste of activities carried out in other areas and then discarded there; 3) it is waste, mainly resulting from repeated activities carried out on the spot. Obviously, each of these different actions could have contributed to the deposit formation, but the main point to be assessed is: to what extent does the observed distribution of artefacts/ecofacts tell us about the various activities performed in these spaces? Is the deposit under scrutiny chiefly a 'primary-refuse' one or a 'secondary-refuse' one?

Another important aspect to be weighted is the extent to which the deposit has been affected by post-depositional disturbances, such as trampling effects. For this particular factor, the degree of pottery fragmentation and the size-distribution of sherds is widely considered a valuable proxy. Generally speaking, the smaller (and more non-matching) the fragments are, the higher the possibility that the deposit underwent trampling and disturbances. Yet the fragmentation ratio *per se* it is not decisive for achieving an understanding as to whether the deposit is a primary or a secondary, since even this latter may contain fairly-well preserved pots. A more viable approach is to combine different types of data, such as the fragmentation ratio and the consistency in the spatial distribution of artefacts judged by types/style and function. In fact, a high rate of entropy results from (repeated) dislocations of finds/deposits and/or repeated disturbances. Therefore, the spatial distribution analysis itself helps reveal the nature of the deposits and the reliability of the assemblages under scrutiny as records of the social organisation of activities inside the settlement. Whatever the nature of the deposit, a high fragmentation rate hampers one's ability to recognise the overall shape and functional attributes of the vessels. This means that in areas where the fragmentation index is very high the patterns of performed activities will be hardly readable.

3.2. Fragmentation ratio of pottery

In order to assess the fragmentation ratio, all the ceramic sherds (diagnostic and non-diagnostic, approximately 7300 in total) recovered not just from the two selected zones but from the entire area, have been measured and divided into size-groups and thickness-groups whose parameters have been fixed on the basis of statistical analyses of the characteristics of the pottery assemblage (Recchia *et al.* 2018; Lucci in press).

For the observed area as a whole, the chart of Figure 2.A shows that the overwhelming majority of fragments are small, while their number proportionally decreases as their size increases. Yet, if we divide up and consider the data space by space, (Figure 2.B), it becomes clear that the sherd fragmentation ratios tend to differ. Medium-size sherds outnumber small-size fragments in both inner spaces and the areas closer to the building. Conversely, moving away from the building small-size sherds become the vast majority. The spatial distribution of fairly-preserved vessels is partially comparable with that of the sherds, but it tells us something more too: the best-preserved vessels chiefly occur outside the building, although close by it, with a notable cluster beside the hearth (G20). Thus, one can declare that open areas, especially those further from the structures, were indeed affected by agents such as trampling. This action could have altered the deposit, but not necessarily so dramatically as to affect a spatial distribution analysis. (E.L.)

4. Criteria of functional classification

4.1. Functional classification of artefacts

In developing functional analyses and functional classifications some general issues should be taken into account: pottery and tools are multifunctional, especially in societies whose level of productions is neither highly specialised nor standardised (Van der Leeuw 1984); the intended (or potential) function and actual function of a given object may differ (Skibo 1993). Use-wear analyses and organic analyses of trapped residues to detect the vessels' content(s) are indeed crucial to assess the actual function of tools and pots.

Use-wear analyses on stone and bone/antler artefacts and organic analyses on pottery samples from the assemblage under scrutiny are ongoing. In the present study, however, the practical function of artefacts has been inferred also by using the results from analyses carried out on other assemblages from the site as a basis for comparisons (§ 2.1). Moreover, this study

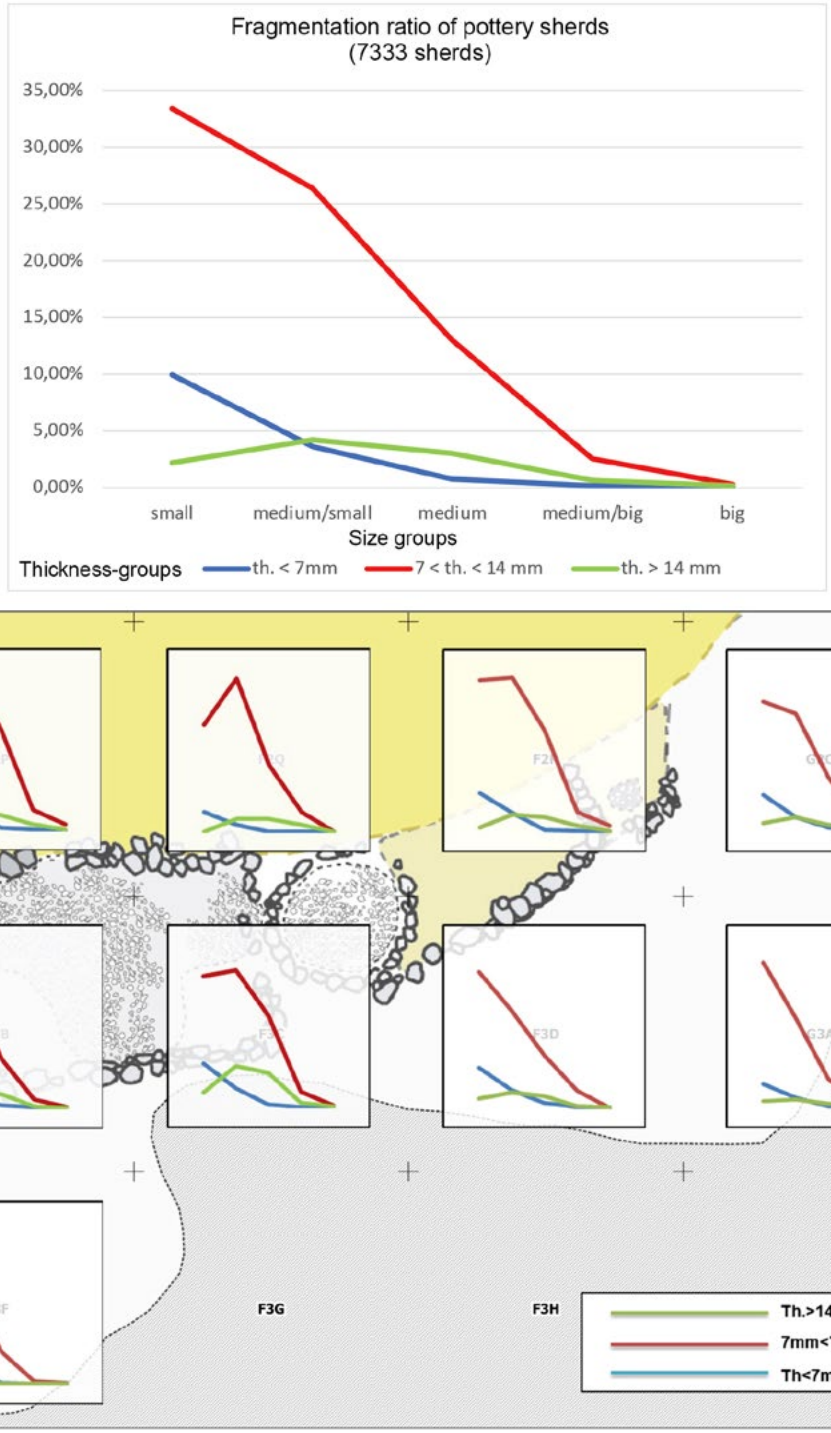

Figure 2. Fragmentation ratio of pottery. A: incidence of ceramic sherds per size-groups and thickness groups – all diagnostic and non-diagnostic sherds from the entire area have been considered; B: fragmentation ratio data space by space.

adopts a multiscale approach that ranges from the functional classification of each find to the analysis of depositional contexts and associations between different types of remains and structures. This process helps to both reduce the number of hypotheses put forward to explain the pattern(s) of potential use of the artefacts and figure out the main types of activities performed. A further element considered is the condition of each find (complete, half preserved and fragment). Broken vessels (especially large portions or specific parts) or tools might well have been recycled or reutilised for different purposes than their original function.

4.2. Pottery

Our functional classification of pottery (Recchia 1997) is based on the observation of the vessels in terms of technological factors (chiefly pottery fabric and finishing; Recchia and Levi 1999), ergonomic factors and the range of actions allowed or prevented by its morphology (pouring, closing, manipulating the content, holding, thermal-shock resistance etc.). Any recurrent sets of technological and morpho-functional attributes detected have then been related to more general practical functions (consuming, preparing/transforming, cooking, storing, transporting) according to specific ways of use and in relation to distinct types of substances being handled (dry, liquid, semi liquid, semi-solid). Thus, each sherd/vessel has been categorised according to the range of practical functions it can (easily) perform (Figure 3.1-6).

4.3. Other artefacts

Non-vessel ceramic artefacts, stone, bone/antler and bronze artefacts have been first classified according to categories of practical intended functions (i.e. knives, daggers, axes, arrowheads, awls, spatulas, pins, brooches, grips etc.). Then they have been assigned to broad functional categories, such as tools/implements, ornaments, weapons, blanks, non-finished pieces and waste debris. The three latter, in particular, are good pointers for the occurrence of processing activities in a specific area. Tools/implements may well represent either the artefacts that were utilised in processing materials or artefacts that were being processed/just finished. Similarly, ornaments may occur in a given deposit either as lost/hidden objects or, especially when found in clusters, as artefacts that were being processed/assembled. Moreover, as with multi-purpose vessels, some types of artefacts can be used for different purposes: telling examples are axes, that are both tools and weapons. (G.R.)

4.4. Functional classification of ecofacts

Botanical and animal remains, mainly those from domestic contexts, are proxies for a wide range of human activities, from economic strategies and dietary habits, social patterns of processing and storing food, to carpentry and the production of tools/implements and commodities of various kinds. Therefore, they have been classified in categories that are specifically designed to cover and interpret all their potential range of usage in specific contexts.

Charcoals for instance can be mainly related to both fuel and carpentry. The choice of taxon depends on various factors, from the environment through the advantageousness of specific plants for a given use to specific cultural choices and traditions. Charred seeds and fruit-remains in particular have been classified according to the main type of crops and elements indicative of harvesting patterns, storage patterns and crop processing patterns (i.e. grains, chaff and weeds).

Animal bones can be related to two main spheres of activities: that pertaining to food (butchery, storage and consumption) and that connected to further use of by-products (leather and animal skins working, exploitation of raw material such as tendons, bones and antlers). Therefore, in addition to the analysis of species frequency, the remains belonging to the major edible species have been classified according to meat-yielding categories following Barker (1982). (C.M., M.P.)

5. Spatial distribution analysis

5.1. Pottery

Ceramic sherds (*impasto* pottery, 2902 in total) represent the vast majority of both the ceramic assemblage and of all the artefacts found in these spaces. However, the overwhelming portion

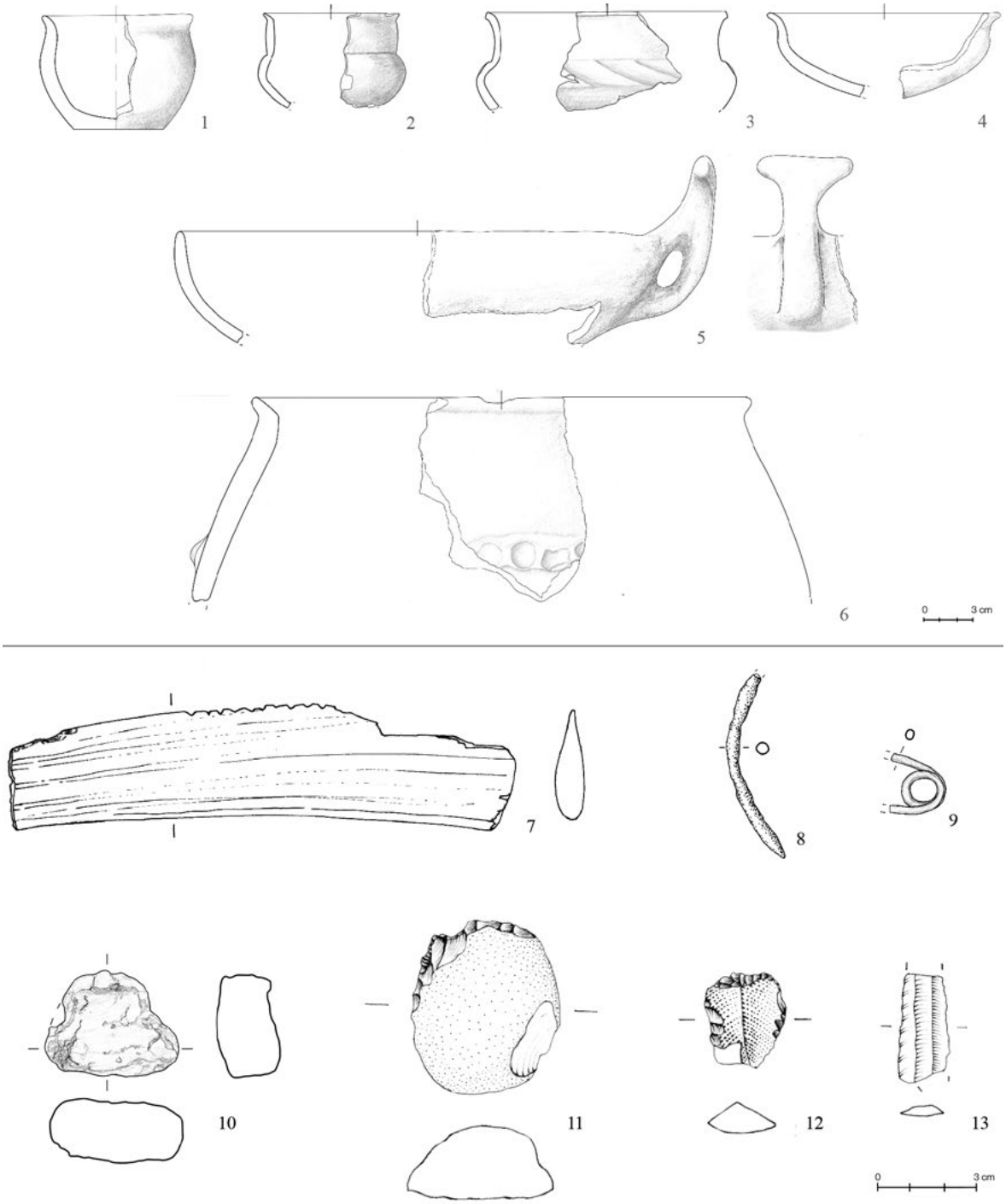

Figure 3. Coppa Nevigata, examples of artefacts from the area under scrutiny.
1-2: Individual-consuming vessels (storing of small quantities?); 3-4: Individual-consuming vessels; 5: collective-consuming/preparing vessel; 6: cooking/storing vessel; 7: bone notched implement; 8: bronze ornament/tool; 9: bronze ornament (*fibula*); 10: bronze thick trapezoidal-shaped object; 11-12 flint tools (scrapers); 13: flint tool (blade).

is quite small and/or non-diagnostic and therefore unviable for functional classification (§ 3.1). Functionally recognisable sherds/ fairly preserved vessels amount to only 132 (Table 2). Functional categories that have a notable incidence are those for consuming and consuming/preparing (approximately the 60%) and those for cooking/storing and storing (approximately the 25%), while potentially multifunctional vessels tend to be rarer. Among the better attested classes, individual-consumption vessels represent the vast majority (29% out of the total functionally recognisable

General intended functions	Ind. cons.	Coll. cons.	Preparing	Cooking	Storing	> two functions
Individual consumption	38					
Collective consumption		9				
Preparing		30	8			
Cooking		3	2	1		
Storing	1		2	22	12	
More than two functions						4

Table 2. Number of sherds/vessels per functional categories. Grey shadowed cells highlight the cases that are mainly suitable for a specific function.

sherds), followed by collective-consumption/preparing vessels (23%), then by cooking/storing vessels (17%), storing vessels (9%) and collective-consumption vessels (7%).

The spatial distribution of both sherds and fairly preserved vessels is not random, but rather it reflects repeated pattern(s) of use of each area for specific purposes (Figure 4). Sherds belonging to cooking/storing and storing vessels (Figure 3.6; yellow and brown dots) chiefly occur in the south-east corner of the west room (F3C). Conversely, collective-consumption and preparation/transformation vessels/sherds (Figure 3.5; sky blue and green dots) are significantly concentrated in the open space near the hearth (G2O). On the other hand, individual-consumption vessel/sherds are scattered broad scale across the various areas, with no notable clusters. In this assessment, though, it needs to be taken into account that: 1) sherds from small-vessel (such as the individual-consumption sorts; Figure 3.1-4) tend to be generally diagnostic (especially in comparison with large-container shards, among which walls fragments have an high incidence) and thus are likely to be overrepresented; 2) small bowls, which represent the majority of the recognised individual-consumption pottery, might have been used not only for eating/dinking but also for other purposes, possibly related to storing practices (i.e. covering other containers, drawing up liquids from large-mouth containers etc.). Therefore, their ubiquitous presence might be, to some extent, related to their functional versatility. On the other hand, the occurrence of well-preserved individual-consumption pottery in G2O sits well with the concentration of collective-consumption and preparation/transformation vessel and sherds in the same area, giving weight to the functional consistency of this cluster.

The pattern of fragmentation of the Mycenaean-type vessels reflects that of *impasto* pottery: sherds tend to be larger inside and near the structure. The repertoire includes both bowls and jars, yet all of them are likely to have been used in consuming activities, possibly carrying a symbolic meaning. We can assume that these were kept inside the structure and used both there and in the open space near the hearth (G2O).

5.2. Metal, bone/antler and ceramic objects

Despite being quite few in number (four), metal artefacts show an interesting distribution (Figure 5.A). Only one item has been found in grid F3C, just outside the building. This is a thick trapezoidal-shaped object whose use is difficult to ascertain (Figure 3.10; a possible weight?). By contrast, all the metals in the open area to the east (G2O) are fragmented ornaments or ornaments/tools (Figure 3.8-9). Bone/antler artefacts are five in total. Just outside the building lay a notched implement of bone that was possibly used in wool processing (Figure 3.7; Cristiani and Lemorini 2006). The remaining four items were scattered in the open area to the east (G2O). These include two awls (one of which is fragmented), one broken pin/awl and one half-processed antler item. Deer antler blanks are mostly located inside room west (four, while only two in the open area -G20).

Ceramic tools involve two spindle-whorls (both from room west) and nine disc-shaped objects (fashioned from recycles sherds): one was inside room west, while eight were clustered in the

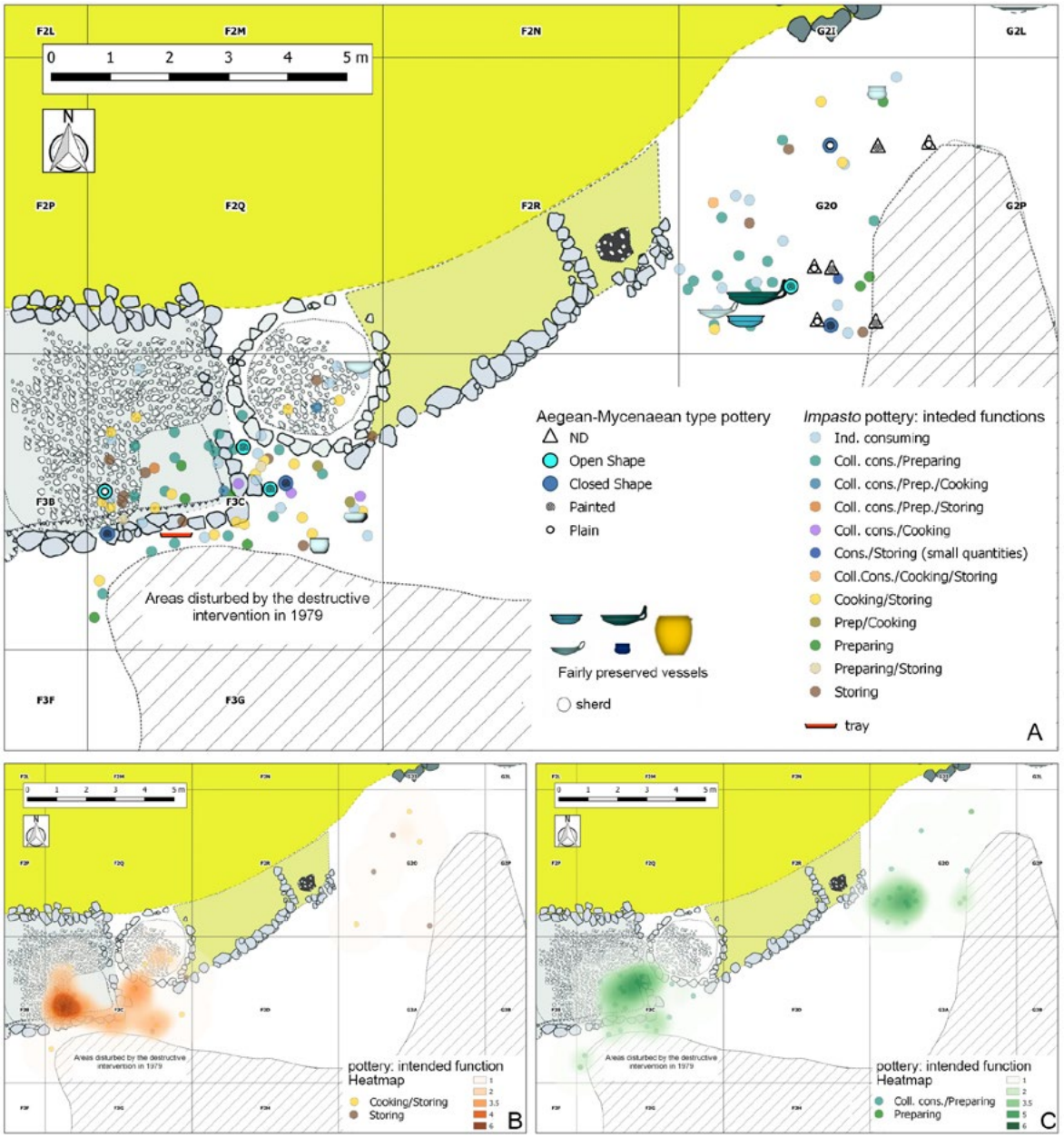

Figure 4. A: Spatial distribution of *impasto* and Mycenaean-type pottery. B: Kernel Density Estimation of cooking/storing vessels/sherds distribution. C: Kernel Density Estimation of collective-consuming/preparing vessels/sherds distribution.

eastern part of the open space (G2O; this is the largest collection in the entire settlement, see Recchia 2012). Their function is puzzling indeed. Similar yet smaller objects have been interpreted as tokens (Mammina *et al.* 1999), but they might have served a range of purposes from that of game-pieces to functional tools.

Generally speaking, there is a clear difference between the distribution of items in the various zones, both on a quantitative and qualitative basis. Virtually none occur just outside the building in F3C (apart from the thick metal item), while inside the building, tools related to textile productions chiefly occur. Antler blanks also appear to be kept inside the room. Conversely, the open space (G2O) has yielded a different array of objects, mostly including tools (often fragmented) but also blanks and semi-processed pieces, besides fragments of bronze ornaments. (E.L.)

Type of tool	F3C (room west)	F3C (entrance/outside)	G2O (open space)	Total
Retouched flake	0	1	1	2
End-scraper	1	3	0	4
Side-scraper	0	0	1	1
Notch	1	0	1	2
Denticulate	1	0	0	1
Total	**3**	**4**	**3**	**10**

Table 3. Number of stone artefacts per types across the various zones.

5.3. Stone artefacts

During the Late Bronze Age, the production and use of stone tools, especially knapped flint tools, was gradually decreasing in Italy until it virtually ceased in the Final Bronze Age/Early Iron Age. Most of the products at the site in this period were indeed expedient (Mironti 2018; Mironti and Moscoloni 2016, 2014). The knapped stone assemblage from the analysed spaces consists of 107 items (Table 3). Of these some 20% have fractures that hamper the observation of specific features and their correct classification. All the objects are made of flint and the vast majority (approximately 95%) are obtained from flint pebbles, which are the commonly exploited raw materials at the site. The overwhelming majority of artefacts (87) are unretouched, with retouched tools (Figure 3.11-13) and cores numbering but 10 respectively. The considerable number of cores possibly testifies of knapping activity in this area. On the other hand, refitting has proven fruitless, which fact argues for the flakes being obtained from different cores, which seem not to have been preserved in this area. Nonetheless, the pebble nature of the exploited raw materials indeed hampers the refitting procedure. It is very likely then that the entire process of knapping, use and discard took place in this general area. Retouched tools mostly include implements suitable for bidirectional longitudinal movements (van Gijn 2010), i.e. end-scrapers, side-scrapers and notches. Two of the retouched tools (an end-scraper and a denticulate) show traces of re-use, such as the removal of the patina: re-use of stone tools was a common practice at the site throughout the Bronze Age. (V.M.)

The distribution of stone artefacts across the various areas is uneven, in terms of both quantity and functionality (Figure 5.A). Only a few items were preserved inside room west (F3C), while the vast majority appear to be clustered in between the entrance area of room east and the open space just outside it (F3C), which we consider as a single zone. A certain number of artefacts occur in the open area near the hearth (G2O). The core/flakes ratio in the west room is quite low (1 core for every 18 flakes) and it is even lower in the area near the hearth (1 core for every 23 flakes), while in the entrance/outside area of the building it tends to increase (1 core for every 6 flakes). Conversely, the ratio between tools and flakes in the west room and in the space near the hearth is similar (1 tool for every 8 flakes), but this drops very slightly in the entrance/outside area (1 tool for every 9 flakes). The observed differences speak in favour of diverse activities having been performed at the various zones. Knapping in all likelihood took place in the entrance/outside area of the building: this was well-lit (a pattern similar to what has been observed at the other Late Bronze Age building analysed in the site: Moscoloni *et al.* 2002). The stone assemblage in the open area (G2O) may well be related to craft activities and/or butchering: this would fit quite well with the distribution of both semi-processed/blanks and animal remains (§5.5). (M.V.)

5.4. Plant macro- remains

Plant remains retrieved from the analysed samples (6782 in total, grid F3C) reveal a rich assemblage (more than 50 taxa) dominated by charred cereal grains. Since the quantity of sediment per samples differ (Table 1), values of remains have been standardised based on the concentration of

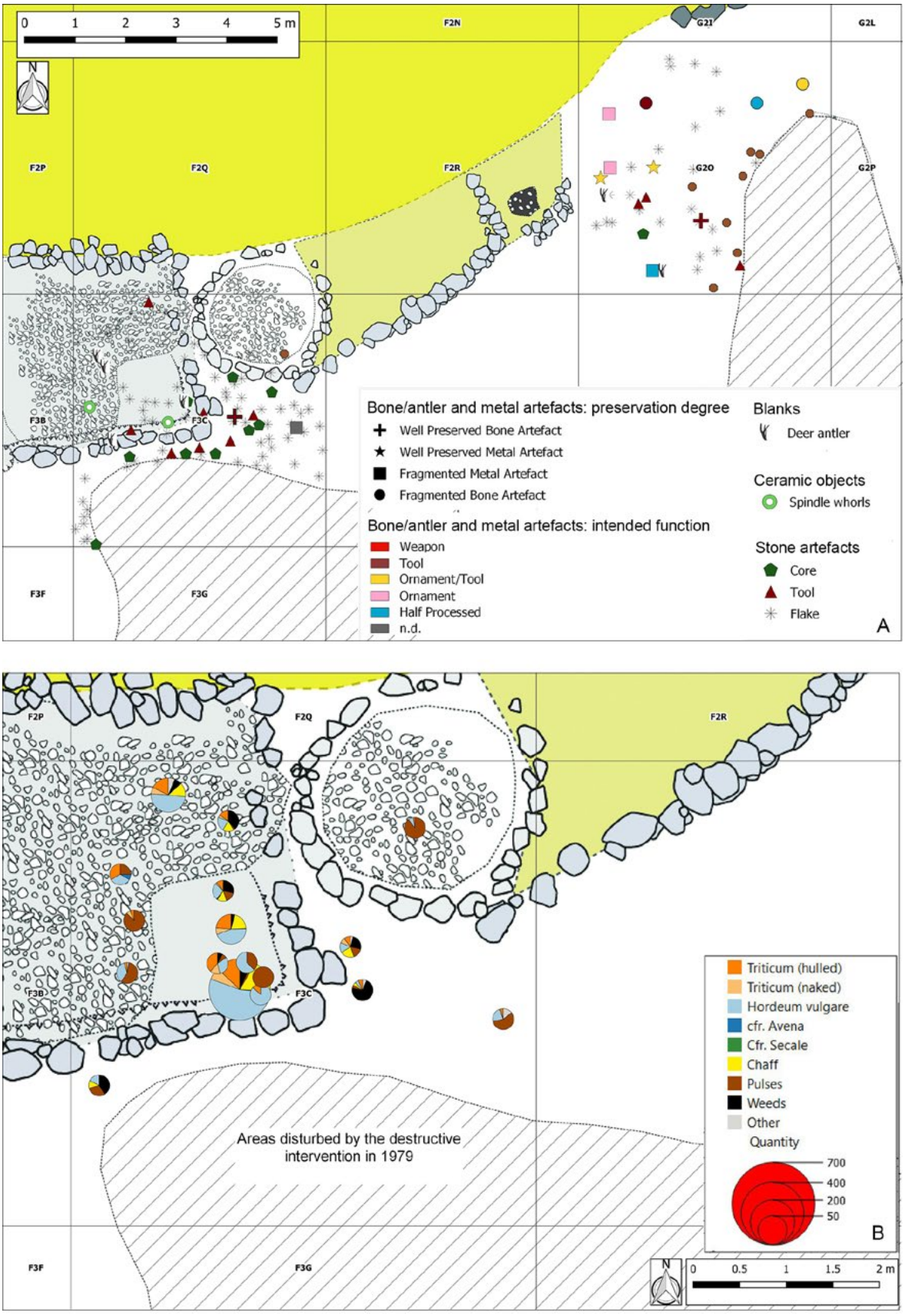

Figure 5. A: Spatial distribution of stone artefacts and metal, bone/antler and ceramic objects. B: Localisation and assemblage pattern of botanical samples from grid F3C.

plant remains per litre of soil. Among the cereals, barley (*Hordeum vulgare*, *H. vulgare* var. *nudum)* and hulled wheat (*Triticum monococcum, T. dicoccum, T. spelta*) have the highest incidence, with chaff elements very common and characteristic (spikelet fork, glume bases, rachis fragments). Charred remains of weeds are also well attested (such as *Chenopodium*, *Medicago*, *Malva*, *Lithospermum*, *Stellaria*, *Fumaria*, etc), followed by naked wheat (*T. aestivum/durum/compactum*), pulses (especially *Vicia faba* var. *minor*) and other wild species, including those typical of marsh environment (*Cladium mariscus, Carex, Suaeda*).

The spatial distribution of plant remains across the two rooms and the adjacent open space falling in grid F3C (Figure 5.B) significantly differ, showing distinctive patterns (grains *vs* chaff and weed ratio) in the recovered assemblages. Samples from the south-east corner of the west room have the highest concentration of cereal grains and a large proportion of chaff that is always accompanied by a few weed seeds. This combination has been often interpreted as the result of crops storage practices in which cereals were preserved as spikelets, before being subjected to the final steps of the processing (Hillman 1984; Jones 1984). The samples recovered in the zone of the entrance and in the adjacent open area are marked by a notable percentage of weed seeds and moderate percentage of chaff and fragmented cereal grains. According to the ethnobotanical literature this evidence can be interpreted as the residual by-products (deliberately charred) of the processing activities (winnowing and sieving) that possibly took place in nearby areas. The plant macro-remain assemblage in the sample from the east room significantly differs: the concentration per litre is low and is dominated by charred pulses. Since no traces of burning have been detected in the west room (nor anywhere in the entire area), the high concentration of charred cereal grains, chaff and weeds there possibly represents a secondary (deliberate?) dumping of refuse (*sensu* Schiffer). We must assume, in fact, that already burnt crops were brought into the room on purpose, but what was this purpose is very difficult to figure out. As this assemblage includes small-size remains and its nature reflects that of stored crops, the original storing place (that got burnt) must have been close by. (G.F., M.P.)

5.5. Animal remains

A total of 2,212 animal remains are recorded in the two analysed grids (F3C and G2O). The animal bone assemblage follows the general pattern already observed at the settlement during the Late Bronze Age (Minniti in press; Siracusano 2012). It is dominated by the remains of the main domestic animals – cattle, sheep, goats and pigs – totalling 74% of the material recovered. Sheep and goat are the most common species, according to the number of identified specimens (NISP) with 64%; cattle and pigs are less represented respectively with 20 and 15%. The remains of wild animals are less in number, but a certain variety of species can be observed. Red deer is the main one represented, followed by roe deer and wild boar; badger, wolf, fox and hare are added to them. Wild birds, tortoise and fish should have also contributed to the diet of the inhabitants, although in a very minor role.

The representation of body parts suggest that red and roe deer were mainly hunted for meat, although antlers (§ 5.2) were certainly worked. Cattle were mainly slaughtered as adults. This suggests an economy probably geared towards the use of cattle as traction animals for ploughing. Sheep and goats were kept for mixed purpose, both meat and secondary products. All pigs were slaughtered before reaching two years of age; a certain consumption of suckling pigs is also documented.

The 50% circa of animal remains in the areas under scrutiny is made up of small fragments that were not identified as species and body part. These are far more abundant in the open space, which echoes the pattern seen in the pottery fragmentation. Looking at the spatial distribution (Figure 6), species frequency across areas differs greatly in term of meat yield. The red deer sample is characterised by a strong bias towards certain body parts, such as limb extremities; these are

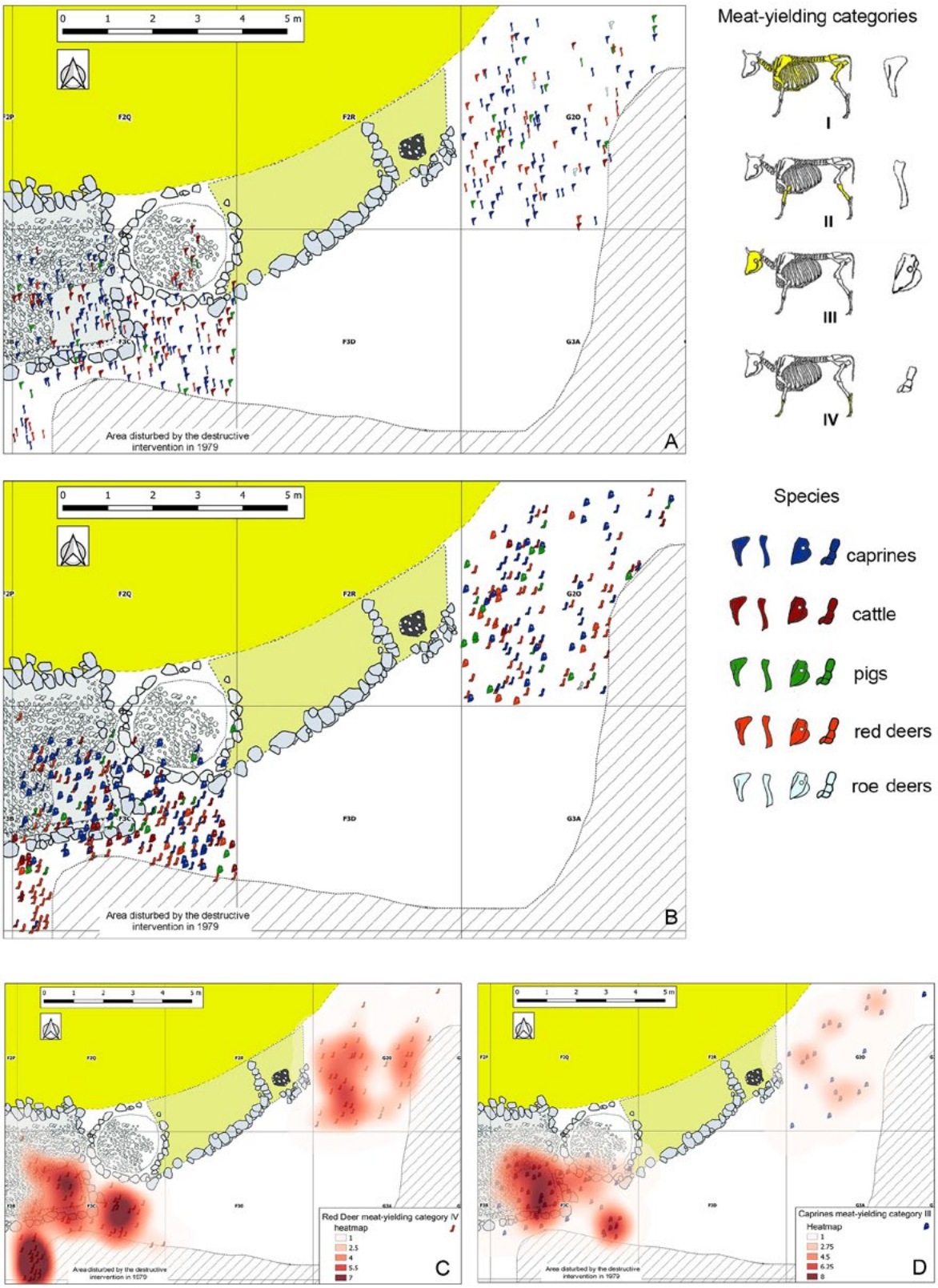

Figure 6. Spatial distribution of animal remains according to meat-yielding categories. A: distribution of high-meat-yielding elements (all species); B: distribution of low-meat-yielding elements (all species); C: Kernel Density Estimation of red deer limb extremities (4th meat-yielding category); D: Kernel Density Estimation of caprine skull bones (3th meat-yielding category).

particularly met with in the western room (F3C), the outside adjoining space, and the open space near the hearth (G2O), suggesting evidence of either leather working or the occurrence of processed animal skins. High-meat-yielding elements of all main domesticates, cattle, caprines and pigs, are clustered in the west room. This may reflect the storage of animal food. Bones yielding high-quality meat also occur in large number in the open area close to the hearth. As these are associated with elements with little or no meat, it is most likely that carcasses where processed in this space and/or entire animals were cooked and/or consumed. This latter hypothesis fits quite well with the distribution of pottery (mostly collective consumption/preparation vessels) and lithics. In the western room the concentration of low-meat-yielding elements, mainly represented by caprine mandibles with their teeth well preserved, is particularly high. If their collection here inside the structure was deliberate, they might represent raw material for producing smoothing tools. (C.M.)

6. Concluding remarks

The statistics and spatial distribution analyses have proven fruitful; they suggest that the observed depositional set, despite being affected by anthropic agents, falls into the category of 'primary refuse', chiefly resulting from repeated activities carried out on the spot. In particular, the integrated analysis of artefacts and ecofacts has revealed specific patterns of management, processing and consumption of primary goods.

The analysed area is thought to be the residency of an emerging kin-group (§ 2.2). Various pieces of evidence prompt this opinion: these include the distinctive location of the building and the occurrence of a number of Aegean-Mycenaean-type sherds. Some of the recognised activities are indeed consistent with a differentiated role of the group using the area, yet other activities appear to be more ordinary.

In the open area close to the hearth (G2O) animal bones reveal activities of butchering and/or consumption of the entire animal. This coupled with the evidence of pottery, suggesting possible practices of consumption with symbolic meaning, such as feasting (Cazzella and Recchia 2013). This would fit well with the hypothesis of the group that occupied this area having an emerging social position and role. In the same open area (G2O), the occurrence of blanks/half-processed antler/bone items and stone tools/flakes plus some bronze ornaments/tools can be related to craft activities and possibly jewellery making. These items were probably connected with the existence of a kind of atelier located just to the east of this area (Cazzella and Recchia 2015). Was this latter – and the performed craft activities, controlled by the kin-group occupying the analysed building?

The interpretation of evidence from the west room is not straightforward. The pottery assemblage dominated by storing/cooking vessels and the occurrence of high-meat-yielding animal bones suggest that this part of the building could have been devoted to storage purposes, which would have included that of blanks/animal raw materials. On the other hand, the conspicuous assemblage of plant macro-remains is the result of a deliberate action of discard from a (close) burnt crop-storage structure. Nonetheless, we cannot rule out that crops were actually kept there, but have vanished from the archaeological record (as might other organic remains) in the absence of fire events. Every day activities, such as those related to textile manufacture and stone knapping were probably carried out in the zone of the building's entrance and the adjacent open area.

The positive results obtained from the zones here studied are such as to encourage one to expand the spatial distribution analysis to the entire area and furthermore to the adjacent sectors. Despite this part of the Late Bronze Age settlement not having been subjected to sudden collapse/destructive events, deposits recovered there are not dramatically altered by post-depositional agents. The relation between artefacts and ecofacts appear to be telling about past activities and differentiated pattern of uses of the spaces. Comparisons with both other areas of the Coppa Nevigata settlement and further coeval contexts will produce a deeper understanding of the social organisation of

both management/consumption of primary goods and craft activities; it will further highlight similarities and differences within and between communities. (G.R., E.L., G.F., C.M., M.P., V.M., G.S., M.V.)

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