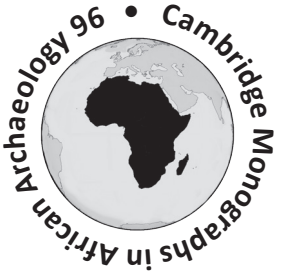
Ceramic manufacturing techniques and cultural traditions in Nubia from the 8th to the 3rd millennium BC.

Examples from Sai Island

Giulia D'Ercole



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To my family and to my grandmother, Elena,
who taught me how to tell a story

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Foreword

'*It often happens that I have to explain to young people why it is good to study. Telling them that it is for the passion of learning is useless, if they do not have the passion of learning*' (U. Eco). These words by Umberto Eco are prophetic, but when students express their interest in one of our subjects, we cannot know their degree, if any, of passion of learning. Such an enthusiasm may not exist in the beginning of their studies as most students usually develop it with time and with the progress of their research; some other students, however, immediately discover their passion of learning. Giulia D'Ercole has been one of the latter and did not take long to convey her passion of learning to me. I do not know when she developed it, but I can certainly say that it was already there when I met her.

I accepted Giulia's invitation to write this Foreword to her book with great pleasure and honour. When this book sees the light, I will have known her for 10 years. I met her in 2007, after her MA supervisor at the University of Rome La Sapienza, Barbara Barich, asked me if I could take a prospective PhD student with a strong desire to study ceramic assemblages. At the time, I had begun to collaborate with Francis Geus, the then director of the Sai Island Archaeological Mission (SIAM) of the University of Lille III-Charles De Gaulle, who in 2004 had entrusted me with the research on the later prehistory of Sai Island, in northern Sudan. My first excavation on Sai was at the Khartoum Variant site, 8-B-10C, and I happened to have quite a considerable sample at hand that I could offer Giulia immediately for a thorough study.

Giulia explained to me that her major interests were in the technological modes of production according to their manufacturing sequences, by observing the macroscopic features (decorations, morphologies, surface treatments, pastes, and tempers), as well as the petrographic, mineralogical, and chemical components. For the former, I introduced her to a database I had specifically created for Saharan and Sudanese pottery and trained her on what I had in turn learnt from my former professor Isabella Caneva on the classification of incised and impressed pottery. However, in spite of my readiness to share my knowledge on the macroscopic systems of pottery classification, I was unable to entirely satisfy Giulia's interests. We then agreed to turn to Italo Muntoni, who at the time was still attached to the University of Rome La Sapienza, and I commended her to him and to his colleague Giacomo Eramo of the Department of Earth and Geoenvironmental Sciences at the University of Bari. All together, we assisted Giulia in crafting her research plan and identifying the most suitable materials and methods.

Once methodological procedures were set in place, it was time for me to prepare my next field season at Sai Island and I proposed to Giulia that she join my team in Sudan. With the enthusiasm and the unconsciousness of a graduate student, she immediately accepted my proposal, and followed me in my expedition. In the field, I had the opportunity to get to know her in depth and discovered a very motivated, determined, persevering, and collaborative person at work, and a sensitive, thoughtful and passionate team member. She also became quickly fond of the awesome beauties of Sudan and the friendly openness of Sudanese people. For Giulia, this was the first of five consecutive field seasons with my research team in Sudan, of which she had become a regular member. Over the years I could see the student Giulia gradually become a trustworthy and responsible colleague. She took part in the excavations of the lower levels at the Khartoum Variant site 8-B-10C, the Abkan deposit at 8-B-76, and the Pre-Kerma site 8-B-10A. These sites cover a long time period spanning from the 8th to the 3rd millennium BC. Beside the excavations, she painstakingly worked on the collected ceramic samples in the laboratory of the SIAM's guest house. In addition, Elisabeth Hildebrand kindly gave her the permission to study the pottery excavated at the Pre-Kerma site 8-B-52A, of which she was in charge, in order to let her have a reliable comparative sample of Pre-Kerma pottery from a well-dated site.

Back in Italy, Giulia spent several months in Bari preparing her samples for the petrographic, mineralogical and chemical analyses, processing the data, and learning to interpret the results under the valuable supervision of Italo Muntoni, Giacomo Eramo, and their collaborators and students in the Department of Earth and Geoenvironmental Sciences. She adopted an integrated approach, combining the macroscopic observations with petrographic analyses of thin section by an optical microscope (MO), mineralogical analyses with powder X-ray diffraction (PXRD), and chemical analyses with X-ray fluorescence (XRF) of major, minor and trace elements of a significant selection of samples from the entire Khartoum Variant, Abkan and Pre-Kerma ceramic assemblages, which she classified in the database.

Giulia defended her thesis in 2012 and it was an easy task for me to present and comment on her successful results, which were fully appreciated by the rest of the jury. The technological approach for the reconstruction of the diachronically varying manufacturing sequences of the ceramic productions from the 8th to the 3rd millennium BC in Sudan that Giulia carried out brought Sudanese pottery into the general debate on the understanding of *chaînes opératoires*. Although this has become a standard essential scientific approach with regard to pottery manufacturing techniques from other parts of the world, it still is in its infancy in Africa.

In the past, different ceramic productions associated with foragers, early pastoralists and agro-pastoralists had been clearly distinguished from a macroscopic point of view. However, this systematic archaeometric analysis cast new light on the modes of pottery production by the diverse human groups and offered a contribution that qualitatively improved our knowledge on pottery production, function, and its social roles during the different periods. For example, it was well-established even with the naked eye that Khartoum Variant and 'Mesolithic' pottery in general was different from later productions. However, these analyses explained why and how they differed in raw material acquisition, clay processing, paste preparation, and use of the vessels. On the other hand, later, Abkan and Pre-Kerma, productions, which show different decorations and surface treatments not only in comparison with earlier assemblages, but also between each other, turned out to be more similar than expected from a mineralogical, petrographic and chemical point of view. These results have allowed to make new and deeper reflections on the makers of these ceramic assemblages, and on their skills, traditions, and concept of pottery as storage, cooking, serving, or ritual vessels. They have also provided insightful suggestions on the ways initial practices of pottery manufacturing were replaced by long-lasting cultural traditions.

This book is not the publication of Giulia D'Ercole's PhD thesis. Four more years of experience with a post-Doc with the ERC Project Across Borders, directed by Julia Budka, at the Austrian Academy of Sciences in Vienna and at the Ludwig Maximilians University in Munich provided her with further experience and professionalism, which she was also able to extend to Egyptian Pharaonic ceramic assemblages. Over the years, Giulia took the time to entirely revise her thesis, cut certain parts, expand others, update all of it, and transform it into a volume for specialists in the international scientific community.

This volume can be appreciated by multiple readers. Colleagues working in Sudan are the most obviously concerned, but certainly not the only ones. Other Africanist archaeologists can have the opportunity to look at a model example of an effective technological approach to African ceramic assemblages; ceramologists working in other parts of the world may be finally relieved to find a systematic and critical discussion on the technological features of 6000 years of pottery production; finally, PhD students, including those who think they will never make it to the end, can be inspired, encouraged, and reassured that a serious work has greater chances to be rewarded.

Elena A. A. Garcea

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The writing of a book is a creative process made up of inspired mornings and miserable days in which it can be a challenge even to put a few words down on the page. Actually, it was mainly in those 'off days' which I spent for the most part walking around with my dog in the park, that I got some of the best ideas and found out the key to get through a controversial section of my research. The good thing is that I have never been alone during this process but indeed could always count on many colleagues and friends who have supported me with generosity and competence in this work.

The first person I would like to thank is Elena Garcea, my PhD supervisor, and the person who first introduced me to the archaeology of Sudan, proposing I take part in her research on the later prehistory of Sai Island and offering me the opportunity to study the ceramic material from the sites where she directed the research. When I first met her in 2007 I had I strong passion for pottery and ceramic technology, but I had never held before in my hands a Khartoum Variant dotted wavy line sherd or studied by myself a ceramic sample. I am sincerely grateful to Elena Garcea for everything she taught me about ceramics and, in general, for sharing with me a speculative method of work and logic of thought, which is rare and precious, and which I hope I have absorbed. I was lucky to have found in her a mentor and a friend.

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Giulia D'Ercole

Introduction

> 'Material objects and technologies are concrete expressions and embodiments of human thought and ideas.' (V.G. Childe 1956: 1)

The invention of pottery and its cultural significance

The invention of pottery is the first case in human history of the manufacture of an artefact by transforming a raw material with particular physical and chemical characteristics – clay – into a product – ceramic – with new and different characteristics (Childe 1936). Because of its own unique properties and for the exceptional versatility of its uses, ceramic has always exercised an undeniable attraction and its study has attracted scholars of all periods. The act of kneading moist clay with water and attentively selecting, initially by trial and error, the most suitable tempering materials; and then again the creative gesture of decoration and, often unrewarded, effort of firing the pot reveal human labour in its whole fragility, strength and greatness. Pottery is also a class of artefacts has changed considerably both in technology and in style over time and space, so that the many stylistic and technological choices adopted in the manufacturing sequence of a vessel do not simply own an aesthetic or functional value, but are primarily of cultural significance (Gosselain 1998, 2000; Sillar and Tite 2000). We could paraphrase the words of Gordon Childe, cited at the beginning, and say that 'the act itself of manufacturing a pot and the final product which results from that act are concrete expressions and embodiments of human thoughts and ideas'.

Another fascinating aspect of pottery is that, in contrast to stone tools which, in a sense, existed since the appearance of the human species, the manufacture of clay objects and the invention of ceramics only occurred hundreds of millennia later, at dates and in ways that varied depending on the different geographic and cultural contexts.

In the Near East, the earliest ceramic containers appeared in approximately 7000 BC, at almost the same time in both Central Anatolia and Upper Mesopotamia (Thissen 2007). From north to south, the functions of this initial pottery could vary (Nieuwenhuyse 2010), but these regions have in common the fact that ceramic was first introduced there when the 'Neolithic process' was well under way and the local populations had already passed through the so-called agricultural 'revolution' (Childe 1936). In fact, although sedentism and agriculture had been precociously adopted in this area at the very beginning of the Holocene and Pre-Pottery Neolithic societies in the Near East already possessed the tools, raw materials and technological knowledge to produce pottery (Hodder 2006; Nieuwenhuyse 2010; Thissen 2007), the invention of ceramic was for them a relatively late phenomenon, apparently independent of the adoption of the new sedentary style of life and of the first control on food production.

Totally different is the case of the African continent and of Sudan. Here the first ceramic containers appeared at the end of the 10th/beginning of the 9th millennium BC, with the earliest dates at *c.* 8700 BC from Sorourab 2, in Central Sudan (Hakem and Khabir 1989; Mohamed and Khabir 2003), and at *c.* 8600 BC from the district of Amara West, in Northern Sudan (northern Upper Nubia), few kilometers north of Sai Island (Garcea *et al.* 2016a), where the present research was carried out. In Sudan, as in other contemporary contexts in north-western Africa (i.e., Huysecom *et al.* 2009; Roset 1982, 1987) – and differently from what can be observed in the Near East – the earliest ceramic productions appeared before and independently of the adoption of a fully productive economy, that is within hunter-fisher-gatherer communities living in permanent or semi-permanent settlements with a 'delayed-return foraging' economy (Garcea 2016b).

In the Near East, sedentism was therefore a prerequisite for agriculture and many scholars consider it the spur that would have triggered such a crucial economic change. However, a direct link between sedentism and pottery does not exist and the adoption of pottery seems rather to respond to the need felt by the new agricultural communities for improved storage facilities and for more efficient ways of processing food (Nieuwenhuyse 2010: 72; cf., also Moore1995; Redman 1978). In the African continent, this paradigm appears to be overturned: sedentism constituted a prerequisite for pottery technology but not necessary for agriculture which was instead introduced only at an advanced stage and only in a few specific areas of the country.

These arguments lead us to review some of the theoretical assumptions accepted until now on the invention of pottery and to reflect in a more critical and problematic way on the functional and cultural reasons behind the emergence of the earliest ceramic technology. Were the initial motivations which led to the invention of pottery potentially different on the African continent compared and in the Near East? Did the economic and social context where such innovation took place influence and, in a certain sense, determine the choices – technological, aesthetic and functional – adopted by the first potters?

Sai Island in northern Upper Nubia (northern Sudan)

The context of the case studies for this research is of exceptional importance for both its location and cultural history – Sai Island, in the Middle Nile Valley. This island is located in a strategic geographic position, on the border between ancient Upper and Lower Nubia, and is a key setting to understand the cultural and political dynamics that led to the emergence of the two most important North African cultures: the Pharaonic kingdom of Egypt and the Nubian kingdom of Kerma.

Sai is also one of the largest islands in the River Nile. Its landscape, varying from a barren, inhospitable interior to a relatively fertile perimeter lapped by the Nile River, appears extraordinarily spectacular and those, like myself, who have had the fortune to go there, could have the feeling they were diving into a past environment that still looks real and vibrant. All its geographic features and natural elements, from water to sand, and to the silt of the Nile, are particularly tangible and the island offers geologically an almost unlimited supply of raw materials.

Sai Island has a very long and continuous occupational history. It was first occupied during the Early Stone Age (*c.* 220,000–150,000 years ago) through recent prehistory and into the Kerma period (*c.* 2450–1480 BC). During the Early New Kingdom (*c.* 1550 BC), it was of prime importance for Egyptian southern expansion, becoming one of the main Pharaonic centres in Upper Nubia (Budka 2014). The island was still occupied in medieval times and the Ottoman period (end of the sixteenth-beginning of the nineteenth century AD) until the present day.

The time frame considered in this study covers about five millennia of later prehistory, extending from the initial appearance of ceramic technology made by sedentary hunters-fisher-gatherer communities of the Early Holocene (local Khartoum Variant horizon: *c.*7600–4800 BC), through the emergence, during the Middle Holocene, of the first 'Neolithic' pastoral societies (Abkan horizon: *c.* 5550–3700 BC), into the flourishing Pre-Kerma Nubian culture (*c.* 3600–2500 BC). The uniqueness of the geographic context and its exceptionally long sequence of occupation provide a first-rate opportunity to widely investigate the cultural and economic significance that the invention of pottery had in the African continent from its earliest appearance within the 'Pre-Neolithic' ('pre-pastoral') communities of the Early Holocene to the first proto-historical cultures of the Late Holocene.

The ceramic sample consists of over 3,000 sherds selected from four sites excavated on Sai Island during successive field seasons starting from January 2009 until February 2013. A thorough analysis

and discussion of these ceramic finds is followed by a comparison across a broader geographical area, including the regions of Lower and Upper Nubia, Central Sudan and the Egyptian Western Desert. The final result of this study suggests an original synthesis and interpretation of the ceramic traditions in Nubia and Sudan.

Methodological approach and research questions: style, traditions and change

The approach adopted for the analysis of the pottery sample was essentially technological and primarily inspired by the concepts of *chaîne opératoire* (Leroi-Gourhan 1964, 1965; Cresswell 1972) and 'technological style' (Lechtman 1977).

The concept of style was for a long time almost solely related to the aesthetic characteristics of an object (i.e., the decorative style of a pot) and so the earliest studies on Saharan and Sudanese pottery were mainly dedicated to the analysis of decoration, elaborating typologies of decorative motifs, styles and design structures (e.g., Camps Fabrer 1966; Bailloud 1969; Nordström 1972). Later, Caneva (1983, 1988, 1995; Caneva and Marks 1990; Caneva *et al.* 1993) developed these earliest typologies into a new system of classification which first linked the decorations with the techniques and tools used by the potters.

Style is however not just an aesthetic concept which relates to 'a specific and characteristic manner of doing something that is always peculiar to a specific time and place' (Sackett 1977: 370). It is above all a powerful communication tool through which people can mark boundaries or, otherwise, convey information between different groups (Wobst 1977).

For this reason, David and Kramer (2001:219) have defined style as 'a relational quality, the potential for which resides in those formal characteristics of an artifact that are acquired in the course of manufacture as the consequence of the exercise of cultural choice'. Central to this definition is the concept of 'technological style', firstly developed by Lechtman (1977), and the insight that the style potentially resides in every phase of the manufacturing sequence (or chaîne opératoire) (Sillar and Tite 2000: 8).

Keeping this in mind, I have chosen to combine a stylistic assessment of the ceramics with a technological analysis, aimed at outlining all stages of the manufacturing processes, i.e., preparation, production, finishing, use, and discard. The whole analysis was structured in two steps: beside a through macroscopic observation of all the potsherds, a selected number of sherds were also submitted to archaeometric petrographic, mineralogical and chemical analyses in order to better investigate specific aspects of the chaîne opératoire.

Archaeometric and technological studies have already been conducted on Nubian and Sudanese prehistoric ceramic assemblages (e.g., Dal Sasso *et al.* 2014; Francaviglia and Palmieri 1983; Hays and Hassan 1974; Khabir 1991; Klein *et al.* 2004; Nordström 1972), however this is the first time that this analysis covers such a remarkably long chronological sequence across different phases which, both economically and culturally, may be considered decisive not just for the history of Sudan but for the whole human past.

The main purpose of this book consists in fact not in the study of the ceramic assemblages from Sai Island and not even in the definition of the evolution of the stylistic and technological traits of the Nubian and Sudanese pottery traditions. I am rather interested in understanding the cultural and functional meaning that ceramics had for ancient people when they first made them and, further, in the perception that those people had of their past environment and of the other populations living nearby.

What were the functions and the social meanings of the earliest Nubian and Sudanese ceramic productions? Did this meaning eventually change over time in the transition from the first hunter-fisher-gatherers communities of the Early Holocene to the Middle Holocene cultures with a productive economy? Did the development of stylistic and decorative aspects of pottery correspond to the technological innovations or were they independent variables? How did people choose the raw materials, technologies and tools for making their pottery? And, moreover, what was the cultural significance of these choices?

This book aims at seeking a meaningful answer to such questions by establishing an ongoing dialogue between the material evidence and the socio-cultural context, starting from the analysis of the ceramic assemblages of Sai Island and ending with a broader evaluation of contemporary Nubian and Sudanese ceramic complexes. Finally, this research wants to offer its contribution to the study of pottery, being of interest not only for Africanists but potentially to scholars also working in the Near East as well as in other cultural and geographical contexts.

Structure of the research

The book consists of six chapters as follows:

The first chapter describes the geographical and cultural area covered by the research project and provides a detailed review of the chronological events which led to the development of Nubian and Sudanese societies in the Nile Valley and in the neighbouring deserts, with particular attention to the development of the local Khartoum Variant, Abkan and Pre-Kerma cultures.

The second chapter is devoted to the specific context of Sai Island and describes the research, the environment and the geomorphological features of the island and of the four sites where the ceramic assemblages originated.

Chapters 3 deals with the classification and with the statistical processing of the ceramic data pertaining to each context which was carried out on a relational data base. Chapter 4 presents the results of the archaeometric characterization conducted on a large sample of artefacts and sediments from the four sites.

Chapter 5 deals with interpretation and discussion. A comparison is made between macroscopic observations and the evidence resulting from archaeometric analyses. In this chapter, the data pertaining to the different ceramic assemblages, which had previously been discussed separately, are compared in terms of style and technology in order to outline a possible chronological variability (or else continuity) across the different local cultural horizons and also within the same cultural complex.

Finally, Chapter 6 compares the evidence collected from Sai Island with the evidence available for the Nubian and Sudanese contexts which are discussed in the opening chapter. In this chapter an attempt is made to provide both a synthesis and an interpretation of the development of ceramic traditions in the Nubian and Sudanese cultures throughout the Holocene period, with reference to the questions raised at the outset.

1. Nubia and its cultural sequences between the 8th and the 3rd millennium BC: Khartoum Variant, Abkan and Pre-Kerma

Introduction

The region of Nubia encompasses a broad geographical territory, extending along the Nile River from the First Cataract, in modern Egypt, to the Sixth Cataract, in modern Sudan and including the desert and semi-desert areas east and west of the Valley. This territory comprehends different ecological niches and cultural entities, which, depending on times, climate and environmental conditions have been variously related to each other, building more or less solid and durable networks.

This chapter describes the chronological development and the geographical distribution of the Early to Late Holocene cultures in Nubia (Middle Nile Valley), locally named Khartoum Variant, Abkan and Pre-Kerma, with particular regard to the evidence from Sai Island.

First, a general description of climatic and environmental conditions in the Nile Valley and in the Egyptian Western Desert and an analysis of the different land occupation strategies is provided for each period, from the Early (*c.* 8000–5000 BC) through the Middle (*c.* 5000–3500 BC) and into the Late Holocene (*c.* 3500–2500 BC). Then follows a discussion of the specific cultural complexes in Nubia (Khartoum Variant, Abkan and Pre-Kerma) and a definition of their chronology and settlement evidence.

In retracing this sequence of developments, the local Khartoum Variant, Abkan and Pre-Kerma cultures have been compared with the other cultures concurrently emerging in Central Sudan, Upper Nubia and in the Egyptian Western Desert. The intention has been to try, as far as possible, to establish a relationship among those regional entities in time and space.

For each chronological horizon, the various cultural complexes are referred to by the names that have become customary in discussion of the region (i.e., Khartoum Variant in Lower and northern Upper Nubia, Mesolithic in the rest of Upper Nubia, Early Khartoum in Central Sudan, and Early Neolithic in the Egyptian Western Desert). A synopsis of the chronological sequences in the different regions during the Holocene is showed in **Figure 1.1**.

Radiocarbon dating for the different cultural contexts is expressed throughout the text in cal BC. When calibrated dates were not available, calibrations were obtained by the author using OxCal v. 4.2.4 Bronk Ramsey (2013), IntCal13 atmospheric curve (Reimer *et al.* 2013).

Climate, environmental conditions and human occupation during the Early Holocene along the Nile Valley and in the Egyptian Western Desert

From about 8300 BC on, a more or less simultaneous return to more humid climatic conditions has been recorded in the different parts of the eastern Sahara from the latitude of Khartoum (around 15°N) up to Egypt **(Figure 1.2)**. This rather unexpected phenomenon, which initiated before the start of the Holocene and lasted until the Late Holocene (12,800–3500 BC), is known as the African Humid Period (AHP) (deMenocal *et al.* 2000; Gasse 2000; McGee *et al.* 2013; Tierney and deMenocal 2013) or the time of the 'Green Sahara' (Drake *et al.* 2011; Dunne *et al.* 2012; Sereno *et al.* 2008), although it underwent a number of dry intervals.

The AHP can be attributed primarily to an increased extension of the monsoon palaeosystem driving the Intertropical Convergence Zone (ITCZ) northwards with a resulting gradual shifting of the summer

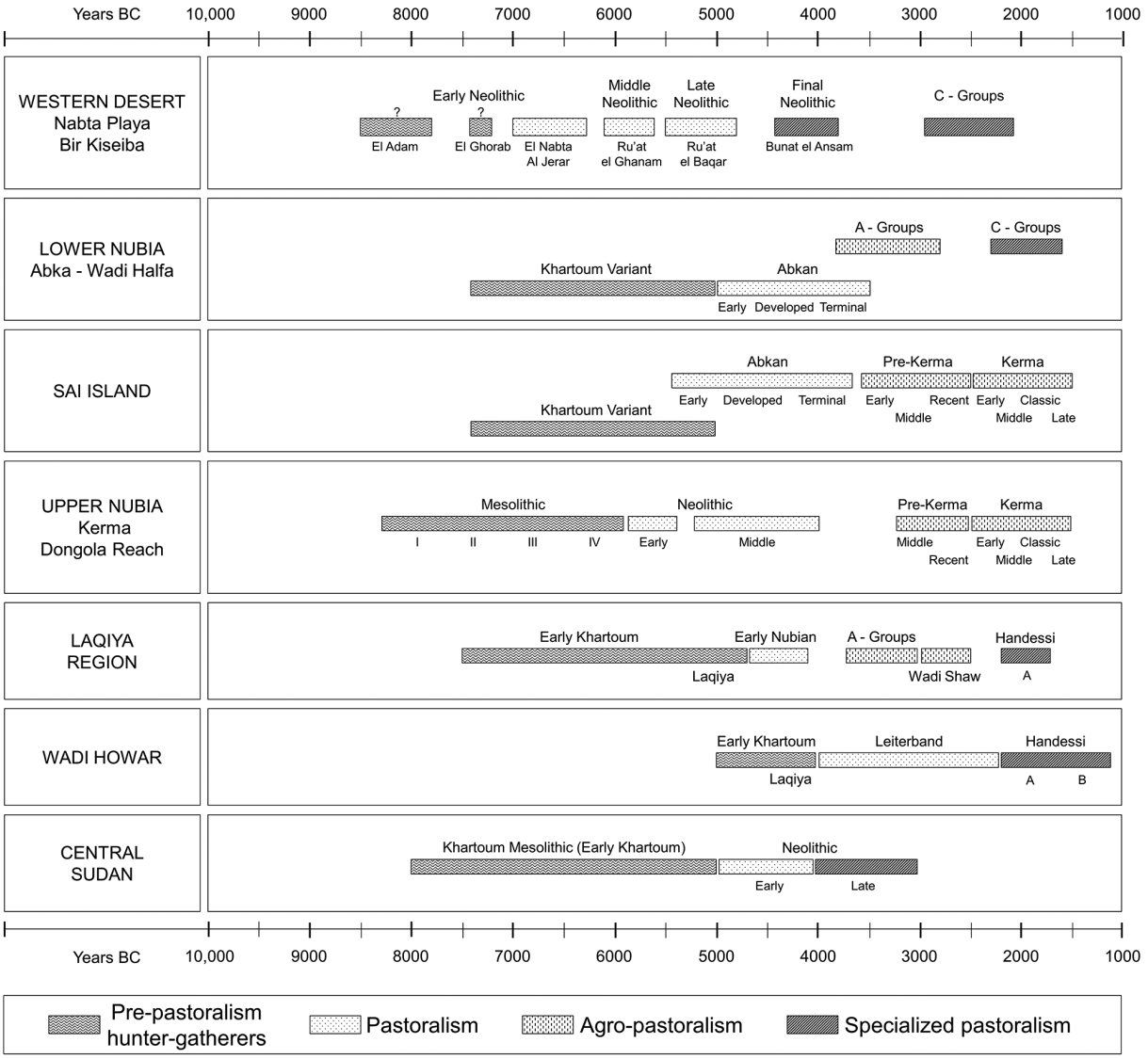

Figure 1.1 A synopsis of the chronological sequences during the Holocene in the regions of Egypt and Sudan mentioned in the text (figure by G. D'Ercole).

tropical rain front towards northern latitudes (Gasse 2000; Maley 1991). The Sahara consequently came out of a hyper-arid phase and began slowly to be re-populated (Manning and Timpson 2014), so that even the Egyptian Western Desert, for a long time an uninhabited and inhospitable area, became suitable for human settlements thanks to the presence of several playa basins fed by seasonal rains (Kuper and Kröpelin 2006; Nicoll 2004).

In spite of these general climatic conditions, during the Early Holocene, the Sudanese and Egyptian Nile Valley appeared as a 'mosaic of habitats' (Florenzano *et al.* 2016: 3) including diverse complementary environments with specific local or regional ecological conditions corresponding to the different latitudes but also to the specific hydro-geological and sedimentological history of the various sectors of the river (see also Honegger and Williams 2015).

Central Sudan at a latitude of 17° North was at that time an area of swamps and lakes (Pachur *et al.* 1990), with shallow lakes reaching as far as west of the Gebel Tageru Highlands (Williams and Adamson

1980). The Nile was directly connected to these western areas of the Erg Ennedi and Gebel Tageru and from those to the Sahara by a network of channels and tributaries including the Wadi Howar, a river, now dried up, which flowed for over 1000km from the Ennedi Mountains to Old Dongola (Kröpelin 2007) **(Figure 1.2)**. These regions on the southern border of the Sahel received plentiful constant rainfall, which supported the growth of wooded savannah vegetation and enabled the survival of several animal species including large mammals and different kinds of fish and shellfish (Gabriel 1976, 1986; Haynes 1985; Neumann 1989; Pachur *et al.* 1990). Remains of *Celtis integrifolia* fruits have been found along the central Nile Valley in the site of Khartoum Hospital together with the remains of gastropods like *Limicolaria caillaudi*, indicating the presence of a humid climate and of rainfall estimated at over 400mm/y, twice as much as the present values for that area (Arkell 1949).

In this part of the Nile Valley, permanent or semi-permanent settlements were created from approx. 8000 BC on by communities of hunter-fisher-gatherers who manufactured pottery and belong to the 'Early Khartoum' (or 'Khartoum Mesolithic') tradition (*c.* 8000–5000 BC) (Arkell 1949; Caneva 1983; Caneva *et al.* 1993).

Further north, along the northern Dongola reach of the Nile (19°N), in Upper Nubia **(Figure 1.2)**, recent archaeological and geological studies, supported by a consistent sequence of OSL and radiocarbon dates (Macklin *et al.* 2013, 2015; Welsby *et al.* 2001, 2002; Woodward *et al.* 2001), testified to the presence during the Early Holocene of extensive alluvial plains, terraces and paleochannels (see also Williams *et al.* 2010).

In Upper Nubia the first evidence of human occupation, at the onset of the Holocene, dates from *c.* 8300 BC and come from the region of Kerma, 40km north of Dongola, on the east bank of the Nile (Honegger 2014; Honegger and Williams 2015). It refers to hunter-gatherer groups producing pottery who, as their southern neighbours in the Khartoum region, also lived in semi-permanent or permanent villages exploiting the various resources offered by the Nilotic environment.

At the latitude of Sai Island (20° 42′ 30″ N), between the Second and the Third Cataract of the Nile **(Figure 1.2)**, the reconstruction of pollen spectra describes 'a regional plant landscape characterized by an open (desert) savannah with a local fresh water habitat covered with riverine vegetation' (Florenzano *et al.* 2016: 12). The pollen data indicate at *c.* 6400–6200 BC (8200 cal BP) a dry environment with only xerophilous vegetation together with seasonal species. The presence of tropical *Acacia* and *Limicolaria* gastropods are testimony approx. one millennium later (*c.* 5050–4800 BC) of a wet, warm phase occurring after the 'cooling and dry 8200 cal BP event' (Florenzano *et al.* 2016).

In this region of northern Upper Nubia, the first Holocene hunter-gatherer settlements with ceramic assemblages are attributied to the Khartoum Variant cultural complex (see below) and appeared slightly later compared to the region of Kerma. The earliest dates from Sai Island are between *c.* 7600–4800 BC and indicate a continuous occupation throughout the 8200 cal years BP dry event (Garcea *et al.* 2016a; Florenzano *et al.* 2016).

As we proceed further north along the Nile, near the present Egyptian border, a drier environment can be imagined, although wet conditions endured in the vicinity of the Nile or in the hinterland where seasonal rains and underground springs offered ecological refuges permitting the establishing of human settlements (Kuper and Kröpelin 2006).

According to Kuper and Kröpelin (2006), this stage corresponds to the 'Early Holocene reoccupation phase' of the Eastern Sahara (8500–7000 BC) and coincides with the beginning of the Holocene humid optimum. During this phase, groups of hunter-gatherers started to settle around the many playas and hilly areas of the Western Desert (Kuper 2002; Wendorf and Schild 2001) **(Figure 1.2)**. In contrast, the

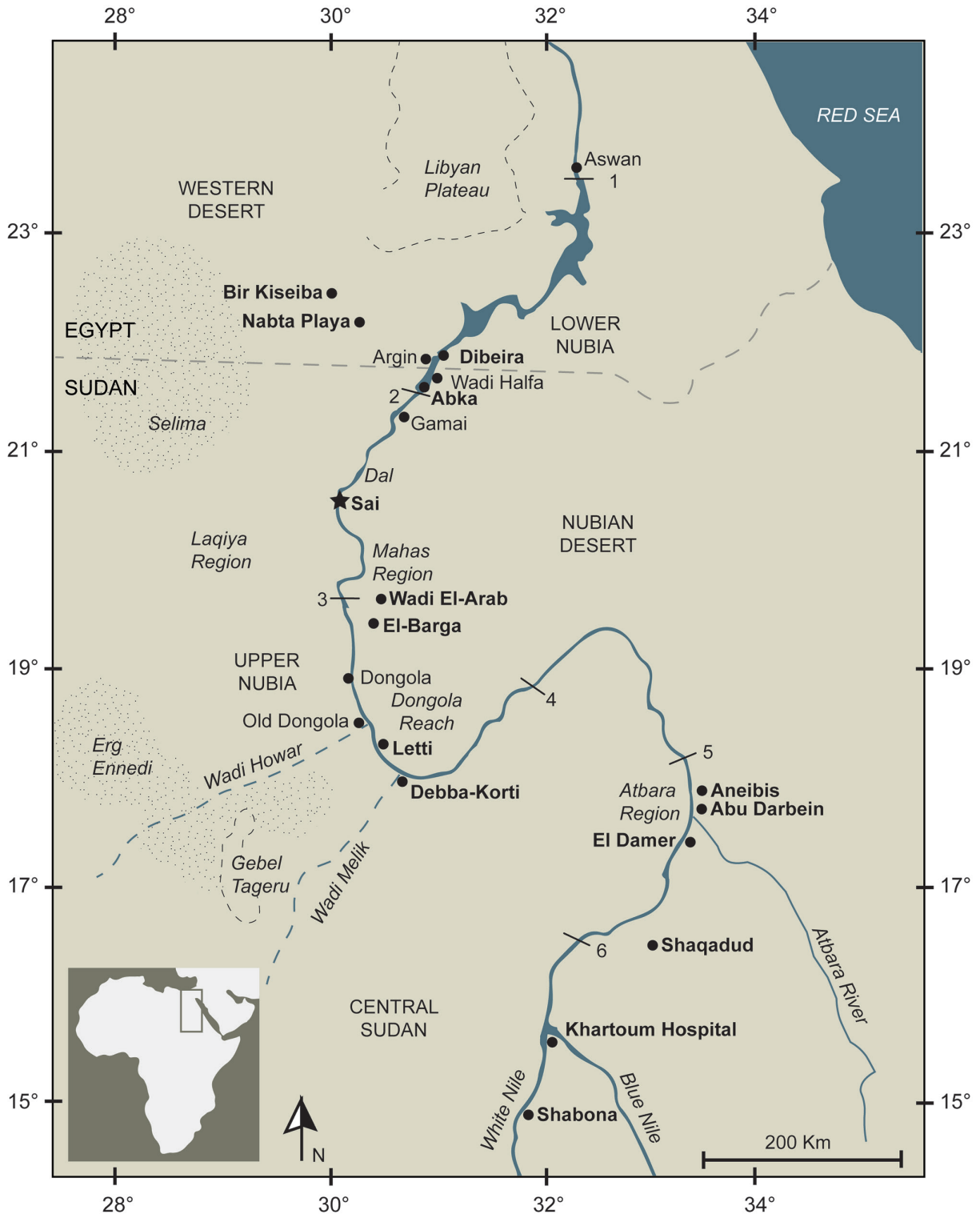

Figure 1.2 Map of Egypt and Sudan during the Early Holocene (c. 8000–5000 BC) with geographical features and sites cited in the text (figure by G. D'Ercole).

Egyptian Nile Valley at that time was almost completely lacking in human settlements (Vermeesch 2002). A similar scenario characterizes also the following period ('Mid-Holocene formation phase') (7000–5300 BC). Human groups became well established and increasingly sedentary at Nabta Playa as in

the northern oases (Kuper and Kröpelin 2006), while in the Egyptian Nile Valley only a few sites have been documented (Vermeesch 2002).

The intense and repeated flooding registered during the Early-Mid Holocene in the Egyptian sector of the Nile Valley most probably limited the human capacity to exploit the territory being responsible for a prolonged hiatus in occupation, something which is not recorded in the Sudanese Nile Valley. Further, the frequent floods of the Nile possibly obliterated part of the evidence of the Early Holocene settlements in Egypt (Honegger and Williams 2015; see also Vermeesch 2002).

The Khartoum Variant culture: definition, chronology and settlements

The definition of the Khartoum Variant culture dates back to the 1960's when, less than ten years after the publication of Arkell's volume 'Early Khartoum' (1949), Myers (1958, 1960) excavated a group of sites in the vicinity of Abka – close to the border between modern Egypt and Sudan **(Figure 1.2)**. These sites appeared to have some aspects of material culture in common with the sites in the central Nile Valley, which form part of the Early Khartoum tradition.

A few years later, Shiner (1968a) attributed the archaeological evidence found in the Abka – Wadi Halfa region to a new cultural phase, which he called 'Khartoum Variant'. According to the author, the Khartoum Variant was the result of technological knowledge and of cultural options introduced from outside (Shiner 1968a). In the opinion of Shiner (1968a), this culture appeared however less developed and less rich in terms of the production of material objects than the Early Khartoum culture in the central Nile Valley, hence its definition as a varying northern development (i.e., 'Variant') of the original Early Khartoum (see also Garcea and Hildebrand 2009).

Similarly, Nordström (1972: 10–11) described the Khartoum Variant horizon as being 'a secondary phase of the Khartoum techno-complex', suggesting for this culture of Lower Nubia a chronological position younger than the Early Khartoum, that is between *c.* 5500 and 4500 BC, whereas the Early Khartoum is dated between *c.* 8000–5000 BC (Arkell 1949; Caneva 1983; Caneva *et al.* 1993).

During the 1960's, a number of intensive surveys and excavations were carried out on the occasion of the rescue operations in Lower Nubia, from the First to the Second Cataract, connected with the construction of the Aswan High Dam. The results were published by the Combined Prehistoric Expedition (CPE) (Wendorf 1968) and by the Scandinavian Joint Expedition (SJE) (Nordström 1972).

The CPE investigated eight Khartoum Variant sites, five in the vicinity of Abka (277, 1022, 2016, 2006, 1045), one (Dibeira West 5) north of Argin and two (626 and 628) in the desert, at about one kilometer north-west of Wadi Halfa (Shiner 1968a). The SJE identified four additional sites, two in the vicinity of the Second Cataract (423 and 428 = CPE 1045) and two north of the Egyptian border (89 and 18A) (Nordström 1972). Between 1963 and 1966, new settlements attributable to the same culture were discovered in the Abka district between Gamai and Dal (Mills 1965, 1968; Mills and Nordström 1966) and in the portion of the valley south of the Dal Cataract (Vila 1975–1979) **(Figure 1.2)**.

Khartoum Variant sites in the region of Abka – Wadi Halfa (Lower Nubia)

The sites located around the Second Cataract in Lower Nubia represent the core area of distribution of the Khartoum Variant culture. Shiner (1968a) and Nordström (1972) describe them as small 'open-air camps' mostly located a few hundred metres from the river, not directly on the river bank but rather upon Precambrian hills or on gentle slopes, probably to ensure protection from the frequent floods. These open-air sites have been for the most part destroyed by erosion and have left shallow deposits containing clusters of lithic and ceramic artefacts.

Based on material data, it was suggested that these settlements might have been used only seasonally either as workshops or as stopover stations by mobile groups which seasonally engaged in gathering, hunting and fishing activities (cf., Shiner 1968a).

Two cave shelters attributed to this cultural horizon have also been identified in the Abka district: sites Abka V and Abka IX (Myers 1958, 1960). These shelters are located at different levels along the river: the 'Upper Site' and the 'Low Site' to be used when the Nile flow was lower (Myers 1960).

None of these sites around the Second Cataract provided radiocarbon dates except for Abka IX, which provided a date from level 6 (M–804) of 8260 ± 400 uncal years bp (*c.* 8291–6396 BC) (Myers 1960), and Dibeira West 5 which provided a date of 6540±110 uncal years bp (*c.* 5667–5306 BC) (Hays 1984; Shiner 1960) **(Table 1.1)**. Further, older dates come from this area from the two 'Shamarkian' sites of Dibeira West 51 and 53 (Schild *et al.* 1968), which are nearly contemporary with Abka level 7 (cf., Usai 2004: 23) **(Table 1.1)**.

To-day it is possible to extend the sphere of influence of the Khartoum Variant horizon farther from its original core area around the Second Cataract. Its social and economic identity is being more clearly defined as well as its position in the chronology of the Early-Mid Holocene cultures.

Khartoum Variant sites at Sai Island (northern Upper Nubia)

New evidence pertaining to the Khartoum Variant complex has been detected on Sai Island **(Figure 1.2)**. On the island were identified several Khartoum Variant sites of which two (sites 8-B-10C and 8-B-76) were extensively excavated (Garcea 2006–2007, 2011–2012, 2016a; Garcea and Hildebrand 2009; Garcea *et al.* 2016a).

Both sites 8-B-10C and 8-B-76 are located in a formerly vegetated floodplain habitat (Garcea 2016b) and both provided a long stratified sequence of occupation indicating a repeated use of the site by human groups at different times (for a detailed description of these sites, see Chapter 2).

At site 8-B-10C, level 1 is dated between *c.* 5050 and 4800 BC, while level 2 revealed an earlier phase of occupation, dating between *c.* 7600 and 7200 BC (Garcea *et al.* 2016a) **(Table 1.2)**.

Site 8-B-76 provided both horizontal and vertical stratigraphy (Garcea 2016a). The Khartoum Variant materials appear concentrated in the northeasternmost units – towards the inland – while the south-

Site	Period	# Sample	Context	Material	14C yr bp	References	Years BC 95.4% Probability range
Dibeira West 5	KV	TX–1155	settlement	charcoal	6540±110	Hays 1984	5667–5306
Dibeira West 51	SHK	SMU–585	settlement	charcoal	8860±90	Schild et al. 1968; Wendorf et al. 1979	8256–7684
		WSU–176		charcoal	7700±120		7023–6263
Dibeira West 53	SHK	SMU–4	settlement	charcoal	7910±120	Schild et al. 1968	7083–6483
Abka IX Level 6, bottom	KV	M–804	settlement	shell	8260±400	Myers 1960	8291–6396

Table 1.1 Radiocarbon dates from Khartoum Variant (KV) and Shamarkian (SHK) sites in the Abka-Wadi Halfa region (Lower Nubia). Calibrations were obtained by the author using OxCal v. 4.2.4 Bronk Ramsey (2013); IntCal13 atmospheric curve (Reimer et al. 2013).

Site	Period	# Sample	Context	Material	14C yr bp	Cal BP	Years BC	References
8-B-10C	KV		settlement					Garcea et al. 2016a
Level 2, 102N/106E		ISGS–A2745		Pila shell	8505±25	9515±15	7550–7580	
Level 2, 95N/106E		ISGS–A2744		ostrich eggshell	8280±25	9275±120	7205–7450	
Level 1, Hearth 1D		KIA–24463		charcoal	6080±35	6810±90	4945–5040	
Level 1, Hearth 1D		ISGS–A2737		charcoal	6030±25	6865±60	4855–4975	
Level 1, Hearth 1A		ISGS–A2736		charcoal	5995±25	6835±45	4840–4930	
Level 1, Hearth 1A		KIA–24464		charcoal	5980±40	6935±85	4800–4930	
8-B-76								
Level 2, 11-13m	KV	ISGS–A2308	settlement	charcoal	7460±30	8275±65	6260–6390	

Table 1.2 Radiocarbon dates from Khartoum Variant (KV) sites on Sai Island (northern Upper Nubia). Calibrations in Garcea et al. (2016a) based on Riemer et al. (2013).

westernmost unit – closer to the present course of the Nile – only includes later Abkan materials. In the vertical stratigraphy, the Khartoum Variant occupation lies below the Abkan deposit with a date to 6260–6390 BC (Garcea *et al.* 2016a) **(Table 1.2)**.

Overall, this suggests a more stable and structured occupation strategy in comparison with the Khartoum Variant sites around the Second Cataract. Both the Khartoum Variant people in the region of Abka – Wadi Halfa and those settled on Sai Island were Nilotic hunter-fisher-gathers with a similar economic strategy ('delayed-return foraging') (Garcea 2016b; see also Garcea 2006a; Woodburn 1982, 1988) and comparable ceramic and lithic assemblages. However, the settlement pattern of the former ('small-open air sites' with absence of stratigraphic deposit, except for Abka IX, and scanty evidences of domestic features) hint at a mobile or semi-mobile occupation strategy, with possible short-distance seasonal displacement of part of the group or of the entire community. In contrast, the archaeological evidence from Sai Island (sites with thick stratigraphic sequence, hut floors and other domestic features) indicates a sedentary or near-sedentary occupation strategy, with sites that were 'either permanently occupied or systematically reoccupied in the same spot' (Garcea 2016b: 40). If we consider the geographical distribution of the Khartoum Variant culture, from the Second towards the Third Cataract, these differences in settlement pattern could be explained taking into account the different morphological and hydro-geological history of the various sectors of the river (i.e., severe erosion at the sites around Abka – Wadi Halfa) as well as the peculiarity of each habitat, either island or mainland (cf., Garcea 2016b).

From a chronological perspective, the earliest radiocarbon dates from Sai Island (*c.* 7600 BC) would appear to overlap with the dates of the Early Khartoum sites in the central Nile Valley. This indicates the possibility that these two cultures developed simultaneously and independently of each other (cf., Garcea and Hildebrand 2009). The Khartoum Variant and Early Khartoum cultures also differ in their ceramic traditions (Garcea and Hildebrand 2009; Jesse 2002; see for details Chapter 6).

On the other hand, a review of the lithic (Usai 2004, 2005) and ceramic (Gatto 2002a, 2006a) assemblages has provided elements for a comparison between the Khartoum Variant in the Nile Valley and the Early

Site	Period	# Sample	Context	Material	14C yr bp	References	Years BC 95.4% Probability range
Nabta Playa E-75-6	Early Neolithic El Nabta phase	Gd–6260	settlement	charcoal	8260±100	Schild & Wendorf 2001	7516–7069
		Gd–6257		charcoal	7770±110		7028–6434
Nabta Playa E-91-1	Early Neolithic Al Jerar phase	DRI–3526	settlement	charcoal	7740±115		7027–6399
		Gd–12188		charcoal	7360±90		6414–6059
Nabta Playa E-75-6	Early Neolithic Al Jerar phase	Gd–6507	settlement	charcoal	7610±120		6742–6219
		Gd–6510		charcoal	7330±100		6400–6020

Table 1.3 Radiocarbon dates from Early Neolithic (El Nabta/Al Jerar phases) sites in the Nabta-Kiseiba region (Western Desert). For periods when several dates are available, only the earliest and the most recent are provided. Calibrations were obtained by the author using OxCal v. 4.2.4 Bronk Ramsey (2013); IntCal13 atmospheric curve (Reimer et al. 2013).

Neolithic cultures in the Egyptian Western Desert (Nabta Playa and Bir Kiseiba region) **(Figure 1.2)**. Both the Khartoum Variant ceramics and the Early Neolithic production from Nabta-Kiseiba are decorated with typical rocker impressions mostly in bands of dotted wavy lines of the type 'short waves' (Jesse 2002: 80). Another peculiar feature which these productions have in common are some decorations on the vessels rims, known as 'milled' and 'notched impressions' (Gatto 2002a). At Nabta Playa, dotted wavy line decorations firstly appeared within the El Nabta/Al Jerar phase (*c.* 7100–6200 BC) (Nelson 2002a) **(Table 1.3)**. In Lower Nubia, a dotted wavy line sherd was found in the Khartoum Variant site of Abka IX (level 6) in association with a date (8260±400 uncal bp or 8291–6396 BC) which corresponds to the El Nabta sequence (Gatto 2006a: 65). At Sai Island ceramics decorated with dotted wavy line motifs first appeared at site 8-B-10C, level 2 (see Chapters 3 and 6).

Additional comparisons were also made between the Khartoum Variant and the Early Holocene hunter-gatherer cultures from the region of Kerma (northern Dongola Reach) (Garcea 2011–2012; Garcea and Hildebrand 2009). These groups, ascribable to the Mesolithic of Sudan (Honegger 2014; Honegger and Williams 2015), lived in semi-permanent villages and produced ceramics in a style comparable with the Khartoum Variant tradition. The sites of this period show indistinctly the same distribution being all located outside of the alluvial plain, safe from the Nile floods (Honegger and Williams 2015). This topographical choice found a comparison with the Khartoum Variant sites around Abka – Wadi Halfa (Lower Nubia); however, these sites in the Kerma region are more extended and, similarly to sites 8-B-10C and 8-B-76 at Sai Island, yielded thick stratigraphic deposits. The two most relevant are El-Barga and Wadi El-Arab **(Figure 1.2)**.

The site of El-Barga consists of a habitation structure, with traces of a semi-underground floor dug directly into the Nubian sandstone, which dated from *c.* 7500 BC (Honegger 2006, 2010, 2014; Honegger and Williams 2015). Further, several graves have been identified both within and close to the hut. Overall, approximately 50 inhumations were detected with dates between *c.* 7800–7000 BC (Honegger 2004a, 2005, 2014; Honegger and Williams 2015). No grave goods were found with the exception of two graves with bivalve Nile shells (Honegger 2004a, 2005, 2014) **(Table 1.4)**.

The site of Wadi el-Arab extends for more than four hectares with a stratigraphic sequence dated between *c.* 8300 and 6300 BC **(Table 1.4)**. The excavations yielded one oval habitation structure similar to the one from El-Barga and at least three other structures of which two were also dug into the ground and one, pertaining to a second phase, delimited by stones used to sustain posts for a superstructure (Honegger 2014). In the site were also discovered hearths, pits and 'some ten tombs disseminated within the habitations' (Honegger and Williams 2015: 6).

Site	Period	# Sample	Context	Material	14C yr bp	Cal BP	Years BC	References
Wadi El-Arab	Mesolithic I	ETH–31788	settlement	ostrich eggshell	8990±65	10,250–9910	8300–7960	Honegger & Williams 2015
		ETH–40941		ostrich eggshell	8820±40	10,500–9700	8200–7750	
	Mesolithic II	ETH–40949	settlement	ostrich eggshell	8795±40	10,300–9630	8180–7680	
		ETH–31787		ostrich eggshell	8140±65	9300–8790	7350–6840	
	Mesolithic III	ETH–40946	settlement	ostrich eggshell	8135±40	9250–9000	7300–7050	
		ETH–40524		ostrich eggshell	7590±40	8450–8340	6500–6390	
	Mesolithic IV	ETH–40526	settlement	ostrich eggshell	7400±40	8340–8070	6390–6120	
		ETH–51610		ostrich eggshell	7365±35	8310–8050	6360–6100	
El-Barga	Mesolithic II	ETH–27205	settlement	ostrich eggshell	8730±70	10,20–9540	8170–7590	
		ETH–31779		ostrich eggshell	8180±65	9400–9000	7450–7050	
	Mesolithic III	ETH–27206	grave 33	Nile shell	8020±65	9080–8640	7130–6690	

Table 1.4 Radiocarbon dates from Mesolithic sites in the Kerma region (Upper Nubia). For periods when several dates are available, only the earliest and the most recent are provided. Calibrations in Honegger and Williams (2015) based on Riemer et al. (2013).

Finally, settlements dated to the Early Holocene and possibly related to the Khartoum Variant complex have also recently been discovered in the region of Mahas – Third Cataract on both banks of the Nile (Herbst 2008; Edwards and Osman 2012) **(Figure 1.2)**. The distribution of these sites, a few kilometres from the present course of the Nile, reflects the hydrological regime of the river during the Early-to-Mid Holocene so that the sites may be expected to lie above the high flood level of the period (cf., Edwards *et al.* 2012). They did not yield domestic features but are characterized by clusters of lithic artefacts, shells, bones and ceramic sherds whose style can be attributed, in my opinion, to the Khartoum Variant tradition (see Edwards and Osman 2012: 42–44).

A comparison between the Khartoum Variant ceramics from Sai Island and the other contemporary sites mentioned above from Lower Nubia, Upper Nubia and the Western Desert is provided in detail in Chapter 6.

Climate, environmental conditions and human occupation during the Middle Holocene along the Nile Valley and in the Egyptian Western Desert

Climatic and environmental conditions in northern Sudan and southern Egypt began to deteriorate in the second half of the Holocene. From approx. 5300 BC, levels of humidity dropped considerably and seasonal rainfall became less frequent over a large part of the region, turning the climate to semi-arid and marking the return of drier conditions especially in the Western Desert (Kuper and Kröpelin 2006). This process followed different patterns in the Egyptian and Sudanese portions of the valley and in the hinterland, east and west of the Nile.

Botanical and faunal data from the Khartoum region provide a picture not unlike the one reconstructed for the Early Holocene sites. Seeds of *Celtis integrifolia* were found in the Neolithic site of esh-Shaheinab **(Figure 1.3)** together with remains of gastropods of *Limicolaria caillaudi* and remains of thirty-two

species of mammals, of which buffalo, giraffe and hippopotamus were the most plentifully represented among the wild animals (Arkell 1953: 12). This indicates the persistence of a humid climate and rainfall levels above 400mm/y (Wickens 1975).

The esh-Shaheinab Neolithic (*c.* 4800–4500 BC), represented by a number of sites located on the west bank of the Nile around Khartoum and its immediate hinterland, is essentially still a Nile based culture, with a mixed hunting-fishing-gathering and herding economy (Arkell 1953; Garcea 2006b; Haaland 1987). In contrast, due to dissimilar geomorphologic conditions, in the sites east of Khartoum on the opposite bank of the Nile, herding almost totally replaced the earlier hunting-fishing-gathering economy (Garcea 2006b; Peters 1986). The site of Umm Direiwa, on the eastern bank **(Figure 1.3)**, provided some of the earliest evidence for domestic cattle from this area with dates from around 5050–4790 BC (Haaland 1987).

A hiatus in human occupation to be possibly linked to the decline of the Nile flow at this time is registered in the region of Kerma (Upper Nubia) between approx. 5500 and 5000 BC (Macklin *et al.* 2015). From 5300 BC on, due to the drier conditions, the region is re-occupied with new settlements located on the alluvial plain (Honegger and Williams 2015). This phase corresponds to the development of Neolithic pastoral societies (Chaix and Honegger 2015; Honegger 2014).

At Sai Island **(Figure 1.3)**, local seasonally wet conditions persist between 5000 and 4300 BC as witnessed by the presence of the terrestrial gastropod *Limicolaria* sp. (Florenzano *et al.* 2016). Here, there are no gaps in the human occupation and the new pastoral Abkan groups (see below) settle on the same site as the previous Khartoum Variant foragers (Garcea 2016a).

Farther from the Nile Valley, the environment must have been less hospitable. According to Nicoll (2004), the Sudanese/Sahelian vegetation typical of the Selima region, west of Sai Island **(Figure 1.3)**, did not change until approx. 5000 BC. There followed a gradual desiccation which can be reconstructed based on the levels of the local lake. At first (6000–5000 BC), levels started to fall as water evaporated and eventually the lake dried up completely around 3000 BC (Ritchie and Haynes 1987).

The desiccation process was perhaps more rapid and more intense in the Egyptian territory. With the exception of a few sheltered areas, all other locations in the Western Desert started to become depopulated. This process began around approx. 5000 BC just as the series of humid phases came to an end and local playa basins disappeared, often silted up by the new phenomenon of wind-blown sand (Nicoll 2004).

This period corresponds to the 'Mid-Holocene regionalization phase' of human occupation in the Eastern Sahara (5300 to 3500 BC) (Kuper and Kröpelin 2006). It is associated with the establishment of specialized fully pastoral societies with cattle, of either local or Near East origin (Gautier 2001, 2002) in addition to domesticated caprines imported from the Near East (cf. Gifford-Gonzalez and Hanotte 2011; Linseele 2010; Linseele *et al.* 2014).

In the same period (toward the end of the 6th millennium BC), Near East domesticated cereals firstly appeared in Nubia (Garcea *et al.* 2016b). The earliest evidence comes from cemetery R12, south of Kadruka, in Upper Nubia **(Figure 1.3)**, and consist of phytoliths of *Hordeum* sp. and/or *Triticum* sp., (Madella *et al.* 2014). These cereals were possibly used as both food but also as a funerary offering or they may have served for some ritual function within the burials (cf. Out *et al.* 2016). In spite of this initial evidence, regular crop cultivation would appear in Nubia only much later, around 2700 BC, that is during the Pre-Kerma horizon (Hildebrand 2006–2007) (see below).

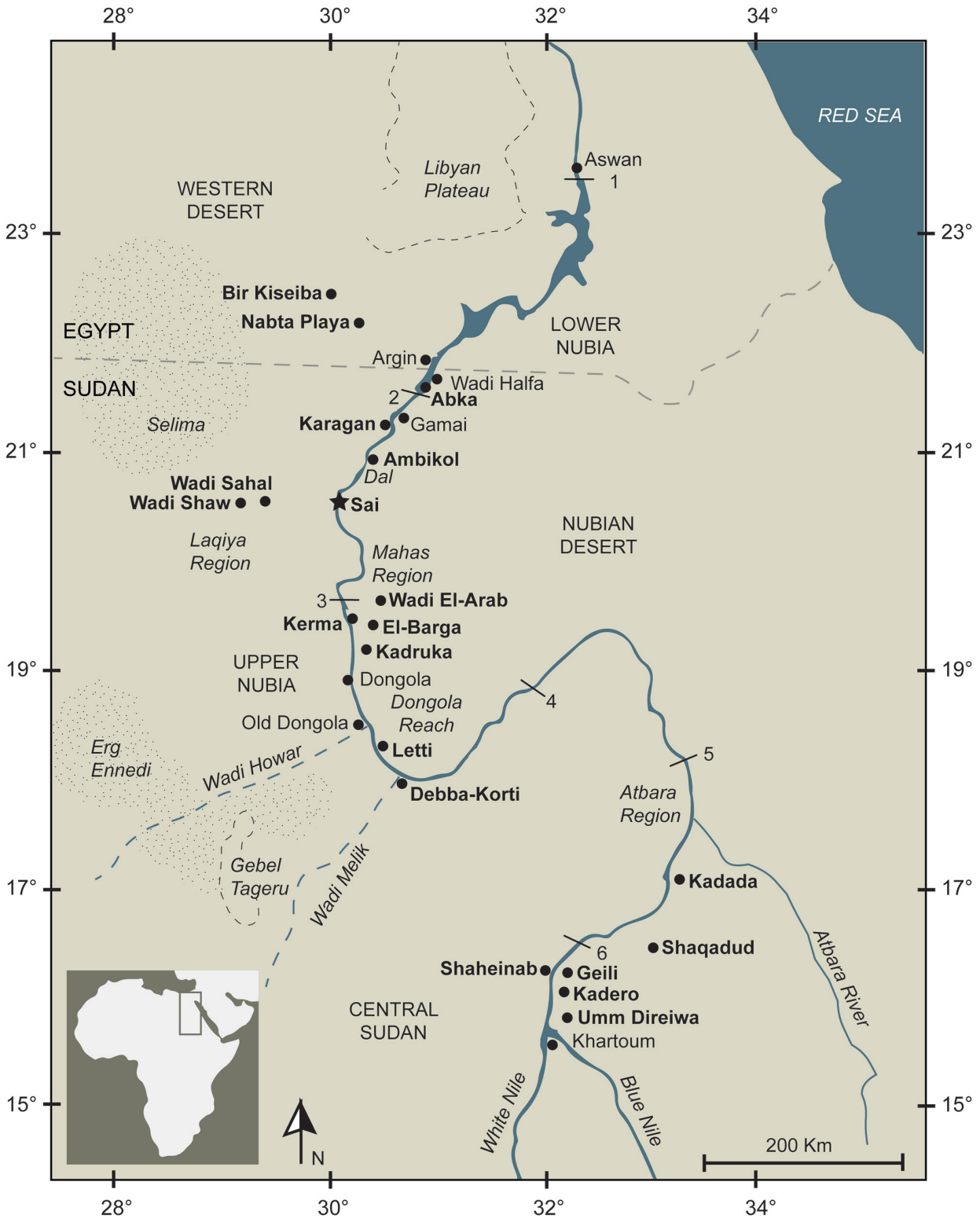

Figure 1.3 Map of Egypt and Sudan during the Middle Holocene (c. 5000-3500 BC) with geographical features and sites cited in the text (figure by G. D'Ercole).

The Abkan culture: definition, chronology and settlements

The term 'Abkan' was proposed by Shiner (1968b) to indicate a group of sites (no. 94, 604, 629, 1001, 1029, 2002 and 2007) concentrated along the Nile Valley in the area of Abka – Wadi Halfa. These sites are distinguished by a lithic industry, which appears to have developed out of the local Qadan tradition (Wendorf 1968), but by ceramics which are completely innovative in style and technology, in comparison with Khartoum Variant ceramics (Nordström 1972: 80).

Shiner (1968b) believed that Abkan and Khartoum Variant sites were partially contemporary – and this is the case indeed of the two sites 8-B-10C and 8-B-76 investigated on Sai Island (see below). The material production of these cultures is different, yet they overlap geographically and share the same settlement patterns and economic strategies, though Shiner implied that it was still to be demonstrated that the Abkan group had adopted certain characteristics of a pastoral way of life.

The Abkan horizon was initially divided into two phases: 'Early Abkan' (5000–4500 BC) and 'Developed Abkan' (4500–4000 BC) (Shiner 1968b). Nordström (1972) added a third phase: 'Terminal Abkan' (4000–3500 BC). He also suggested a revision of the entire chronological sequence for this culture. According to him, the final phase of the Abkan horizon overlaps with the first evidence available for the A-Group ('Early A-Group'), known from northern locations in Lower Nubia, which it had direct links with. The Terminal Abkan would thus constitute 'the starting point of a trajectory which led to the emergence of the A-Group proper in the southern part of Lower Nubia' (Nordström 2006: 37).

Several sites, which were described as being Abkan, were discovered in the Second Cataract and Batn-el-Hagar region **(Figure 1.3)** during the salvage work promoted by UNESCO in response to the construction of the Aswan dam (Adams and Nordström 1963; Carlson 1966; Mills and Nordström 1966; Nordström 1962, 1972; Verwers 1962; Williams 1989).

Abkan sites in the region of Abka – Wadi Halfa (Lower Nubia)

Similarly, to the Khartoum Variant, also the Abkan sites in Lower Nubia are open-air settlements, which have been considerably damaged as a result of severe erosion and possess very few typical structural features except for clusters of burned stones sometimes associated with layers of ash and concentrations of lithic and ceramic artefacts. The location of Abkan settlements is however slightly different from that of earlier Khartoum Variant sites. Rather than choosing hillsides or slopes, the settlers generally preferred the floodplain, river terraces or even the mouth of former, now dried up, tributaries of the Nile.

At site 1001, described by Shiner (1968b), copious fish remains have been found together with a smaller quantity of mammal bones. It would seem, therefore, that it was actually a fishing camp even though no formal fishing tools have been identified.

Site 5-S-25, on the island of Shagir – in the centre of the Second Cataract – is another fishing camp possibly belonging to the Abkan horizon[1]. The site yielded remains of different fish species over a layer of ash associated with a few ceramic sherds. In all probability, this area was repeatedly used by human groups at particular times of year possibly to smoke fish caught in the rapids close by (Adams and Nordström 1963).

Nordström (1972) dated CPE sites 1029, 2002 and SJE 414 in the district of Abka to the Early Abkan phase (*c.* 5000–4500 BC). Sites SJE 365, 369 and 371 as well as sites CPE 604 and 629 are attributed to the Developed Abkan (*c.* 4500–4000 BC) and are only slightly larger, without any trace of huts.

[1] This site, together with Site 5-T-38 on the island of Matuga (Second Cataract), is mentioned among the *'Early A-Group'* contexts of the region although both sites possibly belong to an earlier cultural phase. According to the authors, these sites *'presumably form an older part of a continuous development during this Nubian period'* (Adams and Nordström 1963: 18 footnote 18).

Levels 5 and 4 at the Abka IX shelter might also belong to the Abkan horizon **(Table 1.5)**. The ceramics found in those levels are different from those from level 6 and are described by Myers (1960: 176–177) as being 'made of sandy Nile mud ware with the surface very crudely combed or perhaps wiped with grass'. Gatto (2006a: 64) has included however the pottery of Abka IX, level 5 ('Ware C') still within the scope of the Khartoum Variant tradition.

South of the Second Cataract, in the locality of Wadi Karagàn **(Figure 1.3)**, site 11-I-16 provided one of the most recent dates for this area: 4935 ± 130 uncal bp (4032–3377 BC) (Carlson 1966) **(Table 1.5)**. Two further dates come from Ambikol East **(Figure 1.3)** site 16-S-10 to 5730 ± 160 uncal bp (4991–4263 BC) and 5330 ± 80 uncal BP (4332–3991 BC) (Hays 1984) **(Table 1.5)**.

Abkan sites at Sai Island (northern Upper Nubia)

Evidence of the Abkan culture has also been recently found on Sai Island (Geus 1998, 2000, 2002, Garcea 2006–2007, 2011–2012, 2016a; Garcea *et al.* 2016a) **(Figure 1.3)**.

These sites are located in the vicinity of the area occupied by the earlier Khartoum Variant settlements that is, near the former course of the Nile River, along the pediment, which at that time it should also correspond to the maximum extension of the island (Geus 2000) (for a detailed description of these sites, see Chapter 2).

At site 8-B-76, including both Khartoum Variant and Abkan materials, the Abkan occupation was closer to the river, following the accretion of sediment around the island. Material from the Abkan deposit – where ceramics analysed in this work were collected (see Chapter 3 and 4) – has been attributed to several dates stretching from approx. 5500 to 3700 BC (Garcea et al. 2016a) **(Table 1.6).**

Another Abkan site, which includes exclusively Abkan artefacts, is site 8-B-81. This site is located on the same western side of the island, north of 8-B-76, and dates to between approx. 5000 and 4300 BC (Garcea *et al.* 2016a) **(Table 1.6)**.

Site	Period	# Sample	Context	Material	14C yr bp	References	Years BC 95.4% Probability range
Dibeira West 4	Post-SHK	WUS–103	settlement	charcoal	5220±50	Schild et al. 1968; Wendorf et al. 1979	4230–3955
Dibeira West 50	Post-SHK	SMU–2	settlement	charcoal	5880±150	Schild et al. 1968; Wendorf et al. 1979	5207–4406
		SMU–1		charcoal	5410±150		4586–3944
Abka IX	ABK		settlement			Myers 1960; Stuckenrath & Ralph 1965	
Level 5		M–803		shell	5960±400		5666–3995
Level 4		M–802		ostrich eggshell	4470±300		3946–2351
Level 4		M–801		charcoal	4500±350		4041–2235
CPE 605	ABK	WSU–190	settlement	charcoal	6430±200	Hays 1984	5734–4911
Wadi Karagan 11-I-16	Terminal ABK	GXO.423	settlement	charcoal	4935±130	Carlson 1966	4032–3377
Ambikol East 16-S-10		U–820		charcoal	5730±160		4991–4263
		U–2490		charcoal	5330±80		4332–3991

Table 1.5 Radiocarbon dates from Abkan (ABK) and Post-Shamarkian (Post-SHK) sites in the Abka-Wadi Halfa region (Lower Nubia). For periods when several dates are available, only the earliest and the most recent are provided. Calibrations were obtained by the author using OxCal v. 4.2.4 Bronk Ramsey (2013); IntCal13 atmospheric curve (Reimer et al. 2013).

Site	Period	# Sample	Context	Material	14C yr bp	Cal BP	Years BC	References
8-B-76								Garcea et al. 2016a
Level 1, 13-14m		ISGS–A2750		pottery	6500±20	7425±10	5465–5485	
Level 1, 11-13m		ISGS–A2749		pottery	6345±20	7275±20	5305–5345	
Level 1, 9-11m		ISGS–A2748		pottery	6210±20	7100±70	5080–5220	
Level 2, 25-27m	ABK	ISGS–A2751	settlement	pottery	6205±20	7095±70	5075–5215	
Level 9, TU 1-2		ISGS–A2752		pottery	6195±25	7095±70	5075–5215	
Level 4, 25-27m		ISGS–A2309		charcoal	5710±25	6490±40	4500–4580	
Level 7, TU 1-2		ISGS–A2307		charcoal	5395±25	6230±40	4240–4320	
Level 6, TU 1-2		ISGS–A2306		charcoal	5005±25	5755±90	3715–3895	
8-B-81								
Level 3, 1-2m		ISGS–A2755		charcoal	6060±25	6920±35	4935–5005	
Level 2, 3-4m	ABK	ISGS–A2759	settlement	charcoal	6020±25	6845±50	4845–4945	
Level 2, 1-2m		ISGS–A2754		charcoal	5475±25	6260±40	4270–4350	

Table 1.6 Radiocarbon dates from Abkan (ABK) sites on Sai Island (northern Upper Nubia). Calibrations in Garcea et al. (2016a) based on Riemer et al. (2013).

'Abkan-related' sites with shared technological and stylistic options – especially in pottery production – were also observed in the Laqiya region **(Figure 1.3)**, south-west of Sai Island ('Early Nubian' sites at Wadi Shaw and Wadi Sahal) (Lange and Nordström 2006) and in the Egyptian Western Desert (Middle-Late Neolithic sites in the Nabta-Kiseiba region) (Nelson 2002a) **(Tables 1.7 and 1.8)**.

Along the Nile Valley, south of Sai Island, ceramic traditions which show an affinity with Abkan productions have been detected in the region of Kerma, (Honegger 2006, 2014), in the Wadi el-Khowi area (Reinold 2000, 2001, 2004) and as far south as Debba and Korti in the Dongola Reach, close to the Fourth Cataract. The latter belong to the so-called 'Karat Group' (Marks and Ferring 1971) where Gatto (2002b) has observed the presence of a ceramic style with affinities with Abkan sites. Similarly fashioned ceramic sherds were also found in the Letti Basin (Usai 1998) **(Figure 1.3)**.

Site	Period	# Sample	Context	Material	14C yr bp	Years BC	References
Wadi Shaw							Lange & Nordström 2006
82/82-2		KN–3080		charcoal	5730±160	4587±170	
		KN–3877		charcoal	5680±130	4535±139	
	Early Nubian		settlement				
82/66		KN–3331		charcoal	5530±180	4354±208	
		KN–3180		charcoal	5410±65	4218±98	

Table 1.7 Radiocarbon dates from Early Nubian sites in the Laqiya region (Northwest Sudan). For periods when several dates are available, only the earliest and the most recent are provided. Calibrations in Lange and Nordström (2006).

Site	Period	# Sample	Context	Material	14C yr bp	References	Years BC 95.4% Probability range
Nabta Playa E-75-8	El Ghanam Middle Neolithic	SMU–2745	settlement	charcoal	7220±75	Schild & Wendorf 2001	6236–5928
		SMU–368		charcoal	6500±90		5618–5316
Nabta Playa E-75-8	Ru'at El Baqar Late Neolithic	SMU–487	settlement	charcoal	6550±80		5633–5362
		SMU–473		charcoal	5810±80		4842–4466

Table 1.8 Radiocarbon dates from Middle and Late Neolithic (El Ghanam, Ru'at El Baqar phases) sites in the Nabta-Kiseiba region (Western Desert). For periods when several dates are available, only the earliest and the most recent are provided. Calibrations were obtained by the author using OxCal v. 4.2.4 Bronk Ramsey (2013); IntCal13 atmospheric curve (Reimer et al. 2013).

The earliest evidence of an Early Neolithic necropolis (site El-Barga, dating between *c*. 6000 and 5500 BC) comes from Kerma (Honegger 2006, 2014) **(Table 1.9)**. This necropolis provided also the first indication of a domesticated bovine from the region, whose skull was deposited on top of a tomb (Chaix and Honegger 2015; Honegger 2014).

After the abandonment of the El-Barga necropolis in about 5500 BC, the occupations moved to the alluvial plain. Beneath the Eastern Cemetery of Kerma, a large Middle Neolithic settlement dating between approx. 5000 and 4000 BC was discovered (Honegger and Williams 2015) **(Table 1.9)**. Several post holes have been identified at this site, marking the position of oval huts, together with outdoor hearths and fire pits. Remains of fences and palisades indicate the location of livestock enclosures within the perimeter of the settlement. The faunal remains, except for a few fish vertebrae, are all from domesticated cattle and goats (Honegger 2006, Honegger 2014). The general impression is of a large settlement, which was not only used on a seasonal basis but was probably occupied by a numerous population who lived by herding and fishing (Honegger 2003).

Lange and Nordström have proposed the definition of 'Abkan Culture Group' to describe 'different regional cultures related in different ways to the Abkan, combining clear affinities as regards pottery, lithic traits, settlement pattern and economic structure' (Lange and Nordström 2006: 310). This seems to be an effective way to reflect the idea of a cultural complex with a Nubian matrix inherently consistent, yet split into increasingly limited regional areas.

A comparison between the Abkan ceramics from Sai Island and the other contemporary sites mentioned above from Lower Nubia, Upper Nubia and the Western Desert is provided in detail in Chapter 6.

Site	Period	# Sample	Context	Material	14C yr bp	Cal BP	Years BC	References
Wadi El-Arab	Neolithic I	ETH–51609	settlement	ostrich eggshell	7006±36	7940–7750	5990–5800	Honegger & Williams 2015
		ETH–47148		ostrich eggshell	6526±33	7510–7330	5560–5380	
El-Barga	Early Neolithic	ETH–27208	grave 16	ostrich eggshell	7045±70	8000–7720	6050–5770	
		ETH–28405	grave 70	ostrich eggshell	6605±60	7580–7430	5630–5480	
Cemetery of Kerma	Middle Neolithic	ETH–18827	settlement	charcoal	5815±60	6770–6470	4820–4520	
		ETH–51603		charcoal	5458±30	6300–6210	4350–4260	

Table 1.9 Radiocarbon dates from Neolithic sites in the Kerma region (Upper Nubia). For periods when several dates are available, only the earliest and the most recent are provided. Calibrations in Honegger and Williams (2015) based on Riemer et al. (2013).

Climate, environmental conditions and human occupation during the Late Holocene along the Nile Valley and in the Egyptian Western Desert

The end of the African Humid Period (*c.* 3500 BC) marks definitively the shift to arid and hyper-arid conditions in Egypt and northern Sudan. Kuper and Kröpelin (2006) define the period between 3500 and 1500 BC as a phase of marginalization of human occupation ('Late Holocene marginalization phase'). During that period, the human groups in the Eastern Sahara were forced to leave the inhospitable interior and to 'migrate' either towards the Nile Valley or to the few areas that could still offer a more hospitable environment and sufficient resources.

By the Late Mid-Holocene, along the length of the 'Saharan Nile', the vegetation dwindled progressively and aeolian sands advanced (Woodward *et al.* 2015). Rainfall decreased or ceased altogether even in areas which until a few centuries earlier had provided ecological 'refuges' and had been selected by groups of humans as favoured settlement sites (Kuper and Kröpelin 2006).

Between *c.* 3000 and 2500 BC, the lake of Selima, west of Sai Island, and, further south, the depressions of El 'Atrun and Gebel Tageru **(Figure 1.4)** in rapid succession dried up completely (Pachur *et al.* 1990; Ritchie and Haynes 1987). As the climate became drier, also most of the tributary wadis of the Nile (such as Wadi Howar and Wadi Melik), which were active during the AHP, progressively dried up (Nicoll 2004; cf. also Woodward *et al.* 2001, 2015).

The strip of land along the Nile was at that time the only green area. At the latitude of Khartoum, rainfall stabilized at 100–200mm/y (approx. half of the value recorded during the Early Holocene) and a vegetation typical of the Sahelian band replaced the former wooded savannah (Sadig 2010).

In Central Sudan, a hiatus in occupation of more than two millennia followed the end of the Neolithic period (around 3500 BC) (Honegger and Williams 2015; Usai 2014). During this phase, the necropolis at Kadada **(Figure 1.4)** is the only site known from the area (Reinold 2007; see also Salvatori and Usai 2006–2007).

A similar picture comes from Kerma and most of the regions in Upper Nubia. Within the shift to the drier climate of the Late Mid-Holocene, the local Neolithic cultures collapsed and no new sites were established in the area before the emergence, at *c.* 3400 BC, of the Pre-Kerma culture (Honegger 2014; Honegger and Williams 2015).

In the region of Batn-el-Hagar, 30km north of Sai Island, a drop of the Nile flow was recorded *c.* 4200 BC (de Heinzelin 1968). These episodes of drops in river levels were responsible for narrowing the floodplains on Sai's western margins. However, large floodplains and productive environments endured on the eastern side of the island (cf. Garcea and Hildebrand 2009).

Between *c.* 3600 and 2500 BC, different sites ascribable to the Pre-Kerma culture are documented on Sai Island (Garcea and Hildebrand 2009; Geus 1998; Hildebrand 2006–2007; Hildebrand and Shilling 2016) (see below). This period corresponds to the development in Nubia of agro-pastoral societies.

North of Sai Island, in the Egyptian Western Desert, the cultural sequence of Nabta-Kiseiba, terminates around 3800 BC at the end of the last wet phase of the 'Bunat El Ansam Final Neolithic.' The following centuries are characterized by growing aridity interrupted briefly during the 3rd millennium BC by wetter periods, when areas associated with the pastoral culture of the C-Groups were occupied on a temporary basis (Applegate and Zedeňo 2001). In the Egyptian sector of the Nile Valley, the period between *c.* 3800 and 3000 BC, corresponds to the flowering of the Pre-Dynastic and A-Groups cultures (Gatto 2006b).

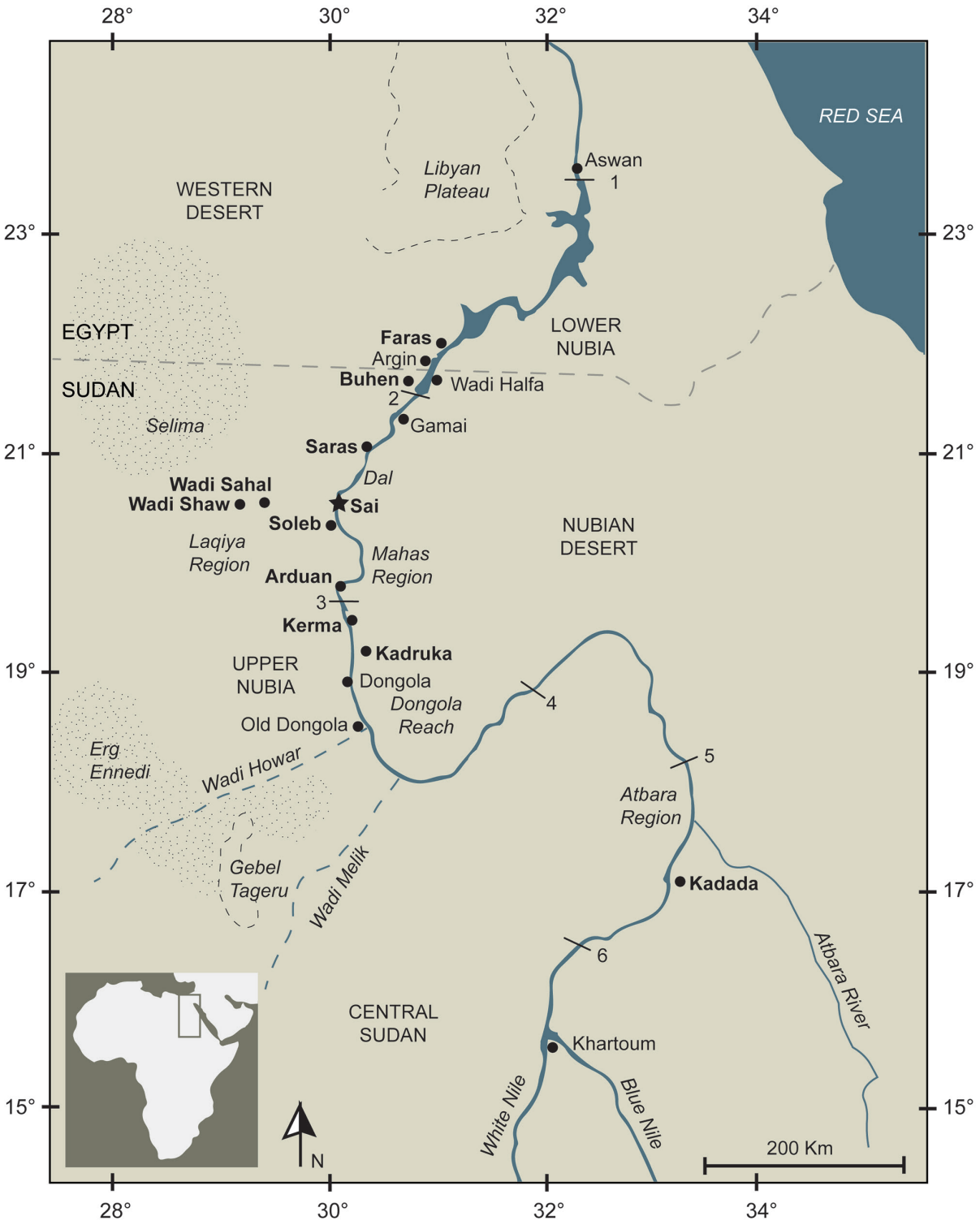

Figure 1.4 Map of Egypt and Sudan during the Late Holocene (c. 3500–2500 BC) with geographical features and sites cited in the text (figure by G. D'Ercole).

Overall, from Central Sudan to Upper Nubia up to the Egyptian territory, the Late Holocene period sees a cohabitation between fully nomadic pastoralists (*sensu* Garcea 2016a), in the desert, and emerging 'state-level' agro-pastoral or farmer societies, along the Nile Valley.

The Pre-Kerma culture: definition, chronology and settlements

This cultural horizon was first described in the 1980's with the discovery of an extensive settlement area in the vicinity of the Eastern Cemetery of the Kerma kingdom **(Figure 1.4)**, directly beneath later Kerma burials (Bonnet 1988).

In chronological terms, two separate cultural phases have been identified within this horizon: a 'Middle phase' dated to approx. 3000 BC (Eastern cemetery of Kerma) and a 'Recent phase' (approx. between 2700 and 2600 BC) represented at the site of Boucharia II (Honegger 2014; Honegger and Williams 2015) **(Table 1.10)**. The earliest phase has not yet been fully documented, but presumably dates to the mid-4th millennium BC.

The 'Middle Pre-Kerma' is mainly known in the area of Kerma and in the Third Cataract while the 'Recent Pre-Kerma' shows a larger geographical extent, from the Second to the Fourth Cataract. In Lower Nubia, north of the Batn-el-Hagar, the Pre-Kerma horizon appears to overlap with the last phases of development of the A-Groups. Ceramics similar to Pre-Kerma products have been found at Saras and Faras as well as at the site of Buhen (Honegger 2004b) **(Figure 1.4)**.

Pre-Kerma sites at Kerma (Upper Nubia)

The most extensive and best documented site pertaining to the Pre-Kerma culture is the settlement discovered by Bonnet (1988) beneath the Eastern Cemetery of Kerma, which has been investigated since 1995 by the 'Mission Archéologique Suisse au Soudan' (Honegger 1995, 1997, 1999, 2003, 2004b, 2004c, 2004d, 2006c).

This settlement is located over an earlier Neolithic site, on the alluvial plain (Honegger and Williams 2015). It covered a surface of some five to six hectares stretching along the bank of the Nile, and has been excavated over a surface area of two hectares (Honegger 2004c, 2014).

The settlement shows a certain structural complexity and a coherent, articulated layout. The storage area located in the north-western part consists of almost 300 pits (originally at least 500), which were most probably used for the storage of cereals (Honegger 2004c, 2014, Honegger and Williams 2015). The remains of many huts, on the other hand, seem to be distributed over the southern and eastern parts of the settlement and constitute a residential nucleus clearly separated from the storage pits. Some smaller pits discovered close to the huts might have been used to store grain for individual households whereas the larger silos, in the western part of the site, would probably have been used communally for different functions (Honegger 2004c).

The huts were circular and on average 4m wide. It has been proposed that a different function was reserved for larger structures which might have been meeting places, the huts of leading members of the community, workshops or stables for domesticated animals (Honegger 2004c). The size of the post holes and the remnants of fences identified close to the structures suggest a rather sturdy and durable construction technique. The walls and roofs were probably supported by a frame of wooden poles covered with interlaced branches and sealed with a layer of mud (Honegger 2006). Rectangular buildings, probably intended for purposes other than domestic use, were also discovered, together with large fortifications, with several parallel rows of fences (Honegger 2004c, 2014).

This settlement, in its internal layout and the characteristics of the structures it contained, is reminiscent of villages of certain agro-pastoral peoples such as the Teso of Uganda or the Zulu in South Africa (cf., Honegger 2003).

Only four graves have been discovered in the vicinity of this site (the only Pre-Kerma burials known so far). Two of them have yielded a few grave goods. These objects are associated with the burial of a female and are similar to typical grave goods from A-Group cemeteries (Honegger 2004d).

Site	Period	# Sample	Context	Material	14C yr bp	Cal BP	Years BC	References
Busharia II	Middle PK	LY–1662–(OXA)	settlement	charcoal	4470±45	5300–4900	3350–2950	Honegger & Williams 2015
	Recent PK	LY–11146	settlement	charcoal	4345±65	5280–4830	3330–2880	
		ETH–20839		charcoal	4085±50	4820–4440	2870–2490	
Cemetery of Kerma	Middle PK	ETH–188828	settlement	charcoal	4400±55	5280–4850	3330–2900	
		ETH–188829		charcoal	4365±55	5270–4840	3320–2890	
	Recent PK	ETH–47154	grave 463	blades of grass	4079±31	4810–4440	2860–2490	
		ETH–47157	grave 442	blades of grass	3920±31	4440–4240	2490–2290	
	Early Kerma I	ETH–27203	grave 321	ostrich eggshell	4050±55	4810–4420	2860–2470	
		ETH–40519	chapel	charcoal	3810±35	4400–4090	2450–2140	

Table 1.10 Radiocarbon dates from Pre-Kerma (PK)/Kerma sites in the Kerma region (Upper Nubia). For periods when several dates are available, only the earliest and the most recent are provided. Calibrations in Honegger and Williams (2015) based on Riemer et al. (2013).

Pre-Kerma sites at Sai Island (northern Upper Nubia)

On Sai Island, the Pre-Kerma culture is represented by sites 8-B-10A and 8-B-52A, which are respectively a habitation site (8-B-10A), and a storage site (8-B-52A) with no indication of habitation, but over 100 pits used as storage facilities for local wild plants and Asian domesticated cereals (Geus 1998; Hildebrand 2006–2007; Hildebrand and Schilling 2016) (for a detailed description of these sites, see Chapter 2). Site 8-B-52A has provided a sequence of radiocarbon dates spanning the period between *c.* 3600 and 2500 BC, which demonstrates an initial phase of construction and use of the site earlier than at the sites around Kerma, already during the 'Early Pre-Kerma' phase; while preliminary dating at site 8-B-10A indicates a later phase of occupation (Hildebrand and Schilling 2016) **(Table 1.11)**. Both sites yielded ceramics typical of the Pre-Kerma tradition (Garcea and Hildebrand 2009) (see Chapters 3 and 6).

Further evidence for the Pre-Kerma culture was provided by surveys and excavations carried out on the island of Arduan, in the region of Mahas, in the Third Cataract (Edwards and Osman 1992, 1993, 2000, 2012) **(Figure 1.4)**. The most important find in this region is site ARD001, identified in 2000 on the island of Arduan, a few kilometers south of the village of Arduan. Nine pits of more or less circular shape were identified in an area of approx. 0.5 hectares. Four of the five pits excavated were larger and are thought to have been used for storage (Edwards and Osman 2012).

Outside the valley, in the regions west of the Nile, a continuity in cultural traditions can be observed, as shown by the technological and stylistic characteristics of pottery from the so-called 'dune habitats' in the Lower Wadi Howar dating from the Middle Holocene (*c.* 4000–2200 BC) (Jesse 2006, 2008). In the region of Laqiya at site 82/52 in the Wadi Shaw **(Figure 1.4)**, dating to *c.* 2500 BC (Lange 2006), the ceramics have many common features with the pottery traditions of the A-Group culture, but have additional characteristics, which indicate also possible links to the Pre-Kerma complex **(Table 1.12)**.

A comparison between the Pre-Kerma ceramics from Sai Island and the other contemporary sites mentioned above from Lower Nubia, Upper Nubia and the Western Desert is provided in detail in Chapter 6.

Site	Period	# Sample	Context	Material	14C yr bp	Years BC	References
8-B-52A	PK		grain storage site				Geus 1998; Hildebrand & Schilling 2016
silo 70, daub seal		ISGS A1741		chaff	4865±20	3696–3637	
silo 26, daub seal		ISGS A1764		chaff	4730±20	3632–3380	
silo 10, daub seal		ISGS A1742		chaff	4300±25	3010–2881	
silo 11		UtC 5295		barley	4151±44	2881–2587	
silo 1		UtC 5294		barley	4142±48	2878–2581	
silo 39, daub seal		ISGS A1763		charcoal	4140±20	2871–2626	
silo 11, daub seal		ISGS A1743		charcoal	4070±20	2836–2496	
8-B-10A	PK - Kerma		settlement				
bag 94, lower deposits		ISGS A1740		charcoal	3485±20	1182–1748	
bag 64, middle deposits		ISGS A1739		charcoal	3420±20	1861–1659	
bag 31, upper deposits		ISGS A1738		charcoal	3465±20	1880–1697	

Table 1.11 Radiocarbon dates from Pre-Kerma (PK)/Kerma sites on Sai Island (northern Upper Nubia). Calibrations in Hildebrand and Schilling (2016) by OxCal v. 4.2.4 Bronk Ramsey (2013); IntCal13 atmospheric curve (Reimer et al. 2013).

Site	Period	# Sample	Context	Material	14C yr bp	Years BC	References
Wadi Sahal	A-Group						Lange 2003
82/38-1		KN–3013	settlement	charcoal	5000±170	3801±171	
82/38-2		KN–3014		bone	4350±320	2973±423	
82/38-3		KN–3177		charcoal	4390±160	3074±224	
82/38-4		KN–3144		charcoal	4990±150	3794±148	
82/38-6		KN–3083		charcoal	4470±50	3173±120	
Wadi Shaw	A-Group		settlement				
82/33-41		KN–3091		charcoal	4320±60	2960±67	
82/59		KN–3145		charcoal	4410±130	3110±82	
83/120		KN–3415		charcoal	4400±400	3013±511	

Table 1.12 Radiocarbon dates from A-Groups sites in the Laqiya region (Northwest Sudan). Calibrations in Lange (2003).