THE MEGALITHS OF NABTA PLAYA

Edited by Romuald Schild
with Agnieszka Czekaj-Zastawny and Halina Królik

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Polish Academy of Sciences

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There are people whose
death is very difficult to accept.

We miss you…

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Preface

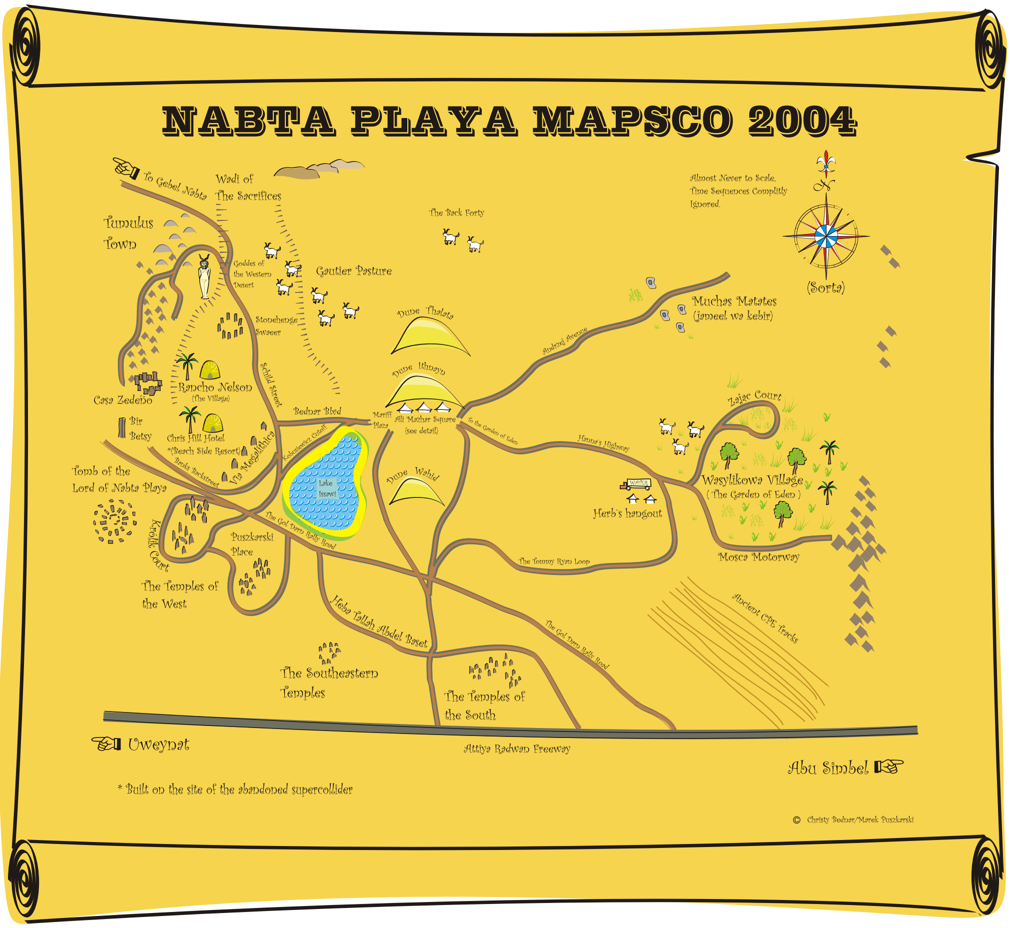
From the Nabta team

This is Professor Romuald Schild's final book. He didn't quite manage to finish it. We never expected him to depart us so suddenly, so prematurely…

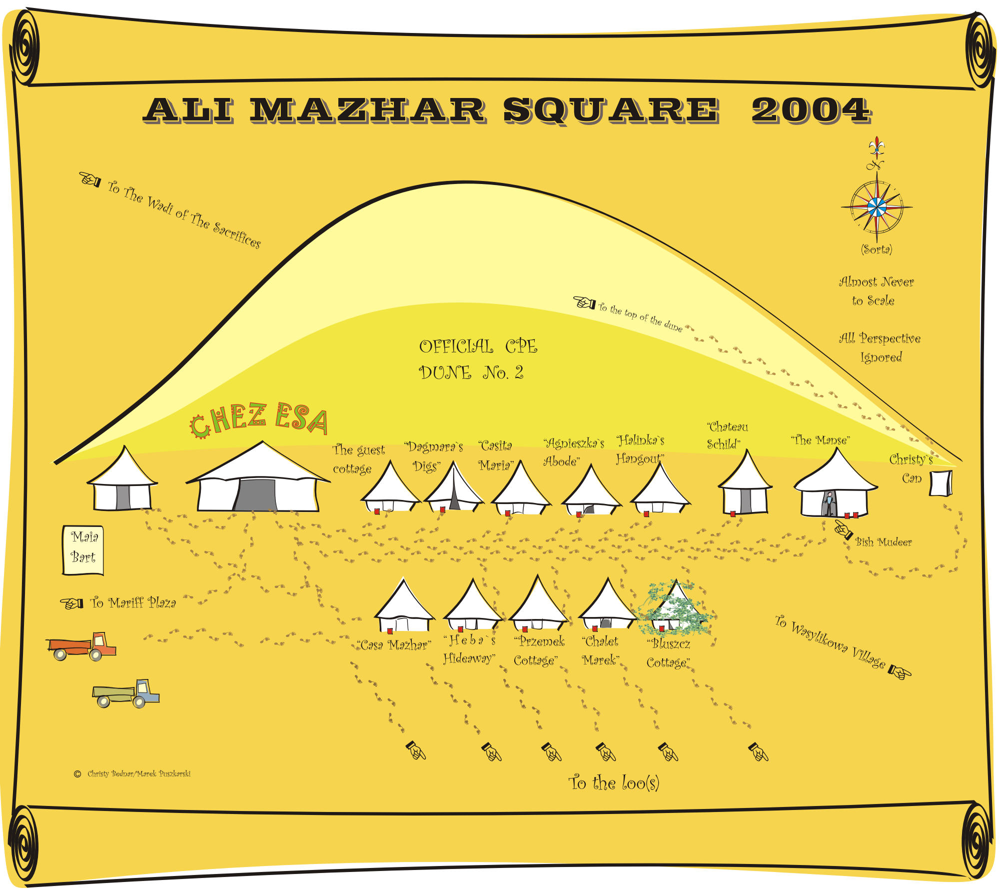
We shall never forget our times together – and not only those working jointly in the field, discovering the desert. For there were also unforgettable evenings of enjoyment, when we laughed at the tales and anecdotes the Professor shared with his inimitable sense of humour. Each season together was magnificent, and so after coming back home we impatiently awaited the next.

Combined Prehistoric Expedition team (Nabta Playa 2008). Romuald Schild third from right. From left: Mirosław Masojć, Halina Królik, Maciej Jórdeczka, Ali Mazhar, Przemysław Bobrowski, HebatAllah A.A. Ibrahim, Maria Lityńska-Zając, Marta Osypińska, Jacek Kabaciński, Betsy Alexander, Agnieszka Czekaj-Zastawny, Tomasz Herbich, Romuald Schild, Marek Puszkarski, Joel D. Irish.

Nabta Playa by Christy Bednar (digital version by M. Puszkarski)



Nabta Playa desert camp by Christy Bednar (digital version by M. Puszkarski)



Alas, it's not to be. But our gratitude for the days we spent together and our myriad discoveries and adventures, for the immeasurable knowledge the Professor gave us, for his warmth and friendship – these shall remain.

About the volume

Over the long years of research in Egypt's Western Desert, members of the Combined Prehistoric Expedition (CPE) discovered unusually rich remnants of settlements from the period when the Sahara was overgrown with savanna, and periodic rivers and lakes existed. Romuald Schild and Fred Wendorf were the main researchers of the area. In addition to numerous articles in professional and popular science journals, there have been several monographic studies, the most important of which are two volumes from the early 21st century. The first, a very comprehensive, multi-author volume, deals with the archaeological sites surveyed between 1972 and 2000, and the second with the comprehensively analyzed ceramics recovered from them. The present monograph, in turn, covers the sites surveyed at Nabta Playa between 2001 and 2008, and thus represents the conclusion of this gigantic project and the culmination of work in the area.

Previous publications covered the results of comprehensive, interdisciplinary studies of settlement sites. The monograph presented here, on the other hand, deals with the most impressive discoveries at Nabta Playa, i.e., the numerous stone structures interpreted as ceremonial. These studies contributed decisively to Professor R. Schild being awarded the most important prize in Polish science: "the Foundation for Polish Science Award". Because of their attractiveness, they are now widely known around the world thanks to the media's steady reporting on the new discoveries. The present work contains those discoveries' expert, interdisciplinary elaboration, prepared by specialists who are part of the CPE.

Thus, the purpose of this volume is to present to a wide audience the accomplishments of almost forty years of research, and thus to complete the comprehensive study of the Nabta Playa area – from its settlement in the period of climatic optimum to the complete desolation of the Sahara. The results of this research are extremely valuable to various scientific fields, i.e., archaeology, anthropology, geology, botany, zoology, climatology, ethnology, as well as to enthusiasts not strictly connected with science. The Nabta Playa area is also part of the cultural heritage of present-day Egypt. The Nubian Museum in Aswan displays relics from this research. Among the most important outdoor exhibits are the stone stelae and "Solar Calendar" (elaborated in this monograph), whose transfer from Nabta Playa fell under the auspices of Egypt's Ministry of Culture and Antiquities.

*

Due to the uniqueness of the area, our research included giving proper names to previously unnamed land formations, such as Nabta Playa, Gebel Nabta, Gebel Ramlah, Bir Nakhlai, Bir Takhlis, Bargat El-Shab, Umm El Akhdar Playa, etc. Generally accepted geographical names and those referring to various geological formations are also used in the text.

This book also contains oft'times specific proper names of archaeological sites or their groupings (e.g., "Elephant Site", "Solar Calendar", "Wadi of the Sacrifices", "Sacred Mountain"). The meaning of these names refers to the interpretation of the stone structures or other spectacular relics discovered. Due to the multinationality of the expedition members, both English and Arabic names were used. They were customarily given during the surveys for the quick identification of sites. They took permanent root during the many years of CPE research. They will also be used in this monograph (in quotation marks), as they are an integral part of the Combined Prehistoric Expedition's history.

All radiocarbon dating was calibrated according to OxCal v4.4.4 Bronk Ramsey (2021); r: Atmospheric data from Reimer *et al.* (2020) and IntCal 20 calibration curve, probability 95.4% (2σ) (calibrated dates in Chapters 4-6, 9, 11-12, 17 have been rounded to decimal digits).

The relative chronology system used for the entire Western Desert was based on a locally developed division relating to specific climatic phases, in conjunction with geological data and traces of human activity (Wendorf and Schild 2001a, 648-651; Schild and Wendorf 2013). It is based on the cultural transformations evident in each of the wet and dry periods. This is because each of the subsequent wet periods was different in terms of precipitation intensity, temperature, type of flora and fauna, and thus was characterized by changes in modes of cultural adaptation to the environment, in lifestyle, and in social organization.

Leading CPE researchers. From the left: Ali Mazhar, Fred Wendorf and Romulad Schild.

Acknowledgments

The United States National Science Foundation supported the work on Megaliths at the Nabta Area until 1999. The later seasons and the installation of the monuments in the Egyptian Museum were funded by the Institute of Archaeology and Ethnology, Polish Academy of Sciences, and the Combined Prehistoric Expedition Foundation, Washington DC.

Poland's National Science Centre has provided the financial funding to prepare this monograph by grant 2014/13B/HS304928 awarded to Romuald Schild. The final preparation of the volume and the printing of the monograph were financed by the Ministry of National Education (MEN), under the grant MONOG/SP/0123/2023/01 (2023-2025).

Dr. Zahi Hawass, Chairman of the Supreme Council of Antiquities, Cairo, kindly awarded Romuald Schild all the necessary permission to install the monuments in the Nubian Museum.

Finally, we wish to express special thanks to Paul Barford and Philip Earl Steele for undertaking the tedious task of revising and improving the language and style of the essays and providing essential editing advice. Philip Earl Steele also proofread the volume just before publication, which helped us avoid many unwanted errors.

Part I. The Nubia Shab Pediplain and the Atmur El Kibeish Peneplain

Chapter 1.

Introduction

Romuald Schild

A seasoned traveler driving west leaves the Nile Valley at the height of Abu Simbel and soon enters a sandstone and sand country covered by a pebbly hamada. He is driving over the Nubia Shab Pediplain, created by the ancient retreat of the Western Desert Eocene Plateau (Issawi *et al.* 2009: 24), the formation of which began in post-Lower Eocene times (Issawi 1971: 91). A few witnesses of these erosional processes remain there to give evidence on this ancient history – namely, the lonely offset mountains of the retreated, backworn Western Desert Plateau. One of them is Gebel Nabta (Fig. 1.1; 1.2), standing high and alone some 160 km due west of Abu Simbel. A rough country surrounds Gebel Nabta's deflational basins: small scarps and faults, igneous rocks intrusions, chains of barchans, as well as Quaternary and Tertiary pediment ridges. Driving is difficult and risky. Among characteristic landmarks of the area is the outstanding depression of Nabta Playa, one of the largest internally drained basins in the South-western Desert of Egypt (Fig. 1.2).

1. Location. Geology and geomorphology of the area

The Nabta Playa basin lies some 130 km west of the Nile and ca. 40 km to the south of the Sin El Kaddab, Eocene scarp. It is oval in outline and extends in the west-east direction. The central and deepest section of the depression is about 20 km long and 11 km wide (Fig. 1.2, 1.3). Its catchment area measures approximately 150 square kilometers. It includes Nubia Formation rocks (Issawi 2009: 205) in the west, east, and south – and igneous rock zones in the north and northeast. Today we see a pebble/shingle hamada with dunes, occasional sand sheets, exposed bedrock in places, and rarely off-layer mountains with their pediments like Nabta and Ramlah to the south and southeast.

The playas, quite frequent in this part of the Western Desert, cluster at the foot of the Kiseiba and Eocene, or Sin El Kaddab, scarp and also appear further to the south of the scarps at Gebel Ramlah, Nabta Playa, Gebel Nabta, Bir Nakhlai, Bir Takhlis, Bargat El-Shab, etc. In all cases, these playas have been formed in shallow, highly deflated basins. Today, the fossil playas are partially filled with aeolian sand, sandy/gravelly alluvial, and sandy, silty, and clayey lacustrine, clastic deposits, all showing more or less abundant traces of prehistoric human occupation.

Figure 1.1. Location of Gebel Nabta and Nabta Playa in the southern part of the Western Desert of Egypt. Drawn by P. Wiktorowicz.

Some of the playas have been studied in the recent past, primarily by the Combined Prehistoric Expedition. Among these are the following loci (Fig. 1.4): Nabta Playa Basin (1974-1975, 1977, 1990-1992, 1994, 1996-2009); the playas at Kiseiba Scarp, El Balaad Playa (1979), Bir Murr Playa (1979), Gebal El Feel Playa (1979) and El Adam Playa (1979, 1980); El Kortein Playa (1977), El Gebal El Beid Playa (1977, 1991); Gebel Nabta Playa (1977, 1994), Gebel Ramlah Playa (2001, 2003, 2009, 2011- 2018); Gebel El Fantas Playa; Bargat El-Shab Playa (2005-2007, 2017, 2018); Umm El Akhdar Playa (Nicoll 1998); also examined by the Combined Prehistoric Expedition in 2004, and Nab El Diep Playa in the immediacy of Nabta Playa (2000-2003).

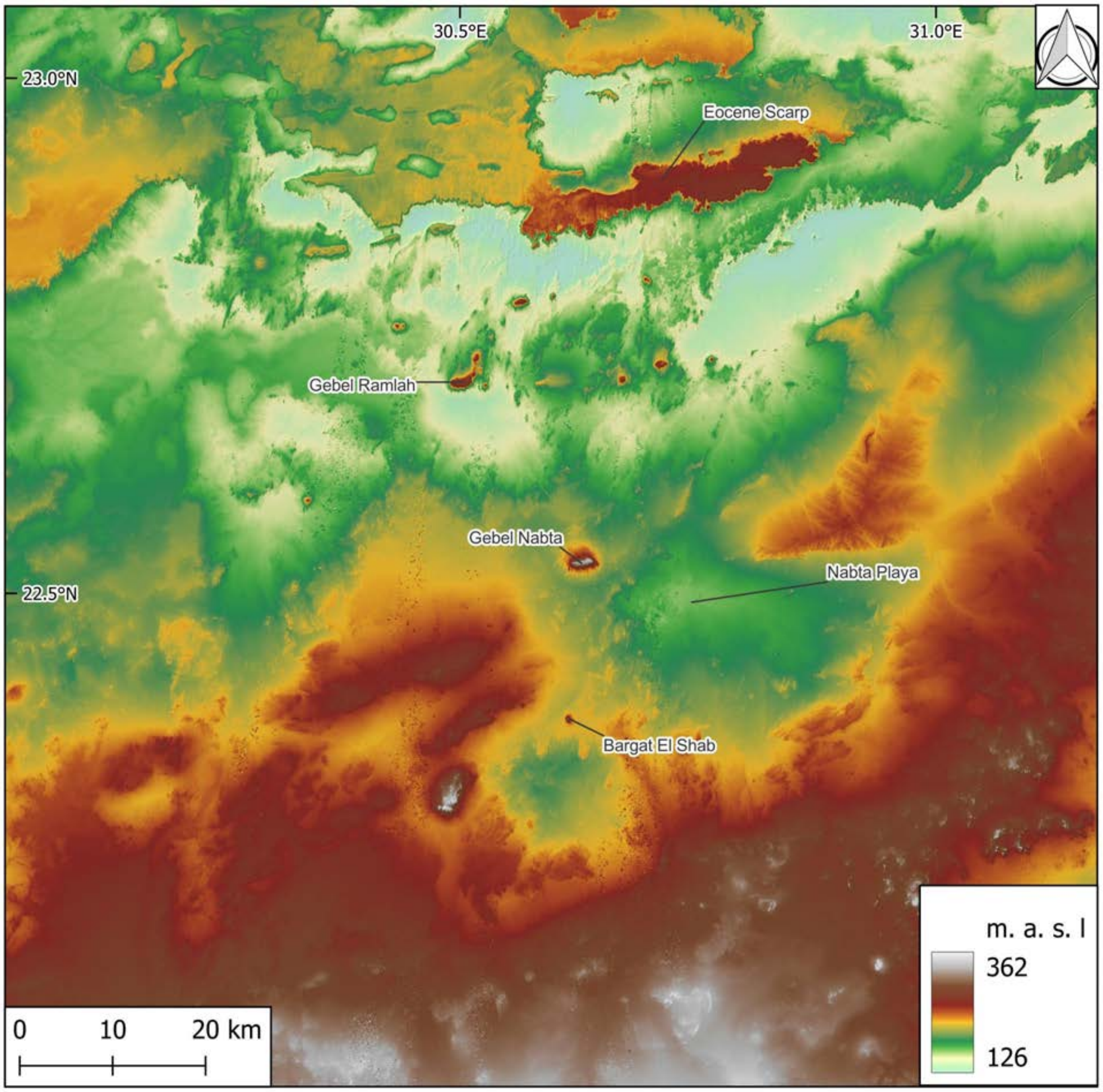


Figure 1.2. Elevation Map of the Kiseiba/ Nabta Playa Area based on Digital Elevation Model (source: Copernicus DEM). Drawn by P. Wiktorowicz.

The playa basins in the Nubia Shab Pediplain were carved in the Cretaceous sandstone and Qusseir shale of the Nubia Formation during the Pleistocene and preceding periods. Various Pleistocene clastic deposits fill the basins, usually capped by Holocene lacustrine, aeolian sediments, and alluvial washes.

A series of OSL age estimates from the trenches and cores at Nabta Playa, Gebel Nabta Playa, Bargat El-Shab Playa, El Adam Playa, and Gebel Ramlah Playa measured on sediments underlying the Final Pleistocene/Holocene aeolian, alluvial and lacustrine beds yielded results indicating various Upper Pleistocene dates, preceding the earliest Final Pleistocene/Holocene wetting events. These results are not surprising in light of the rare occurrences of Middle Palaeolithic and earlier artefacts on the Western Desert floor.

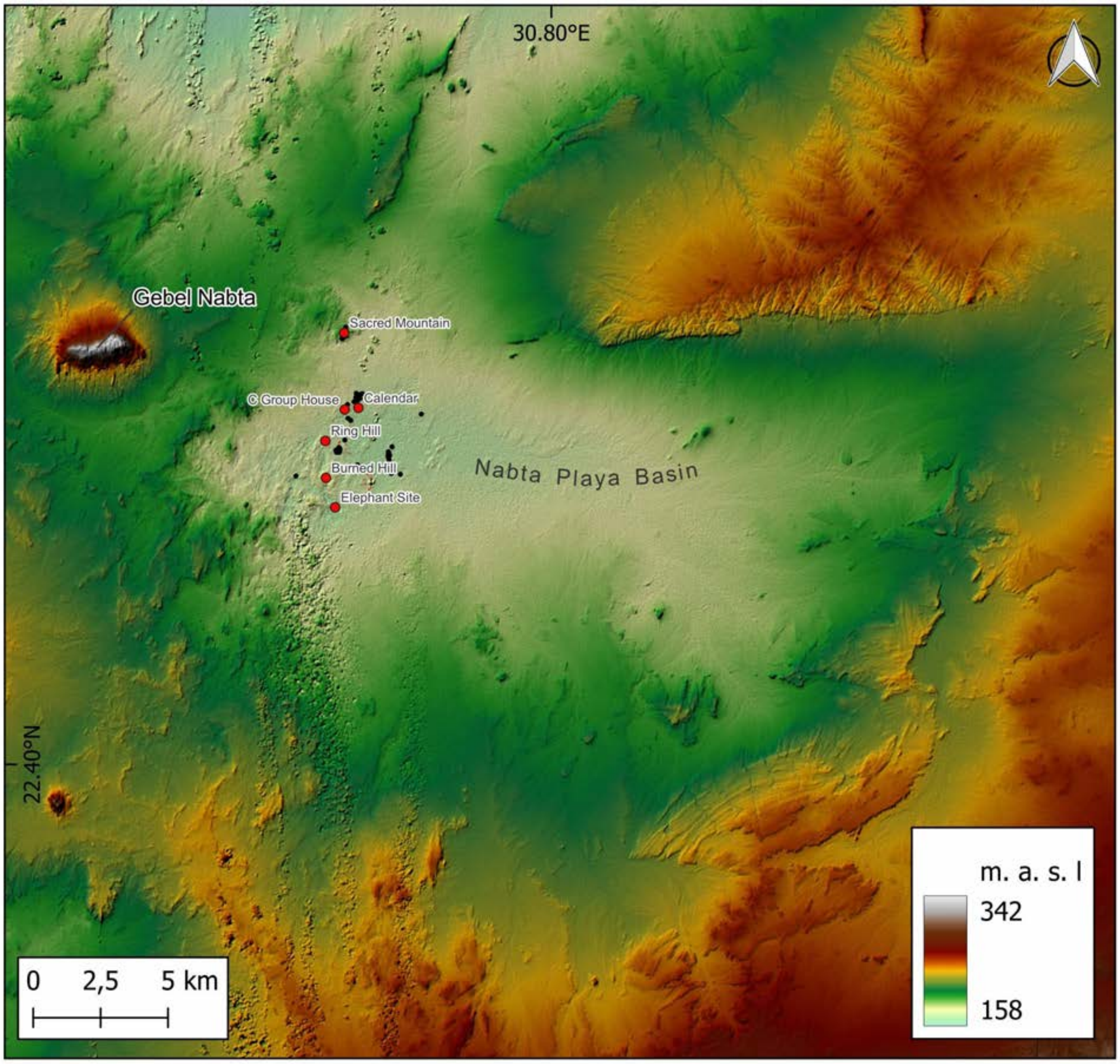


Figure 1.3. Nabta Playa Basin based on Digital Elevation Model (source: Copernicus DEM). Location of some Nabta Playa prehistoric features. Key: Red dots, major sites; black dots, stelae. Drawn by P. Wiktorowicz.

Nabta Playa is one of the areas where this occurs. At "Elephant Site", a well-fossilized, deflated elephant skull cropped up on top of a Holocene archaeological pit. The skull contained no collagen and had been redeposited from another stratigraphic context. A typical Levallois flake found on the surface in the nearest vicinity of the pit (Gautier *et al.* 1994) confirmed the Middle Palaeolithic age of the finds.

Typically, the top Quaternary deposits in the basins are deflated and remodeled (Fig. 1.5). This is why archaeological remains in the lag position often may litter the modern floor of Nabta Playa, on which the truncated clastics make an irregular, multi-coloured, kaleidoscopic pattern.

In the Nabta Playa Basin's central portion, what dominates is a reddish brown (5YR 5/3, 5/4), sandy and clayey surface consolidated to cemented silt of the 8.2 ka event age (Schild and Wendorf 2013). Polygons of old desiccation fissures filled with light brown/reddish sand break the surface of muds. The western, eastern, and northern banks of the basin centre, on the other hand, show exposed, somewhat flat, rarely undulating, truncated sandy shores, yellow in colour, often consolidated. Their littoral sections interfinger with thin beds of lacustrine silts and contain a rich lacustrine malacofauna. Numerous surface runnels enter the central part of the basin, while a few shallow wadis with inconspicuous mouths enter the playa basin from the north. Strings of barchan dunes invade the area from the north, while sizeable recent sand sheets mask the floor of the basin around the centre and its eastern part.

Two important groups of sediments are responsible for most of the Nabta Playa's depositional history. The first is sand trapped by the vegetation of phytogenic dunes and forming beaches in the Playa's shore zones and alluvial surface washes and floors of sandy playas. The second consists of fine-grained clastics washed into the basin and deposited due to the precipitation of suspended matter during inundations and flash flooding in the area.

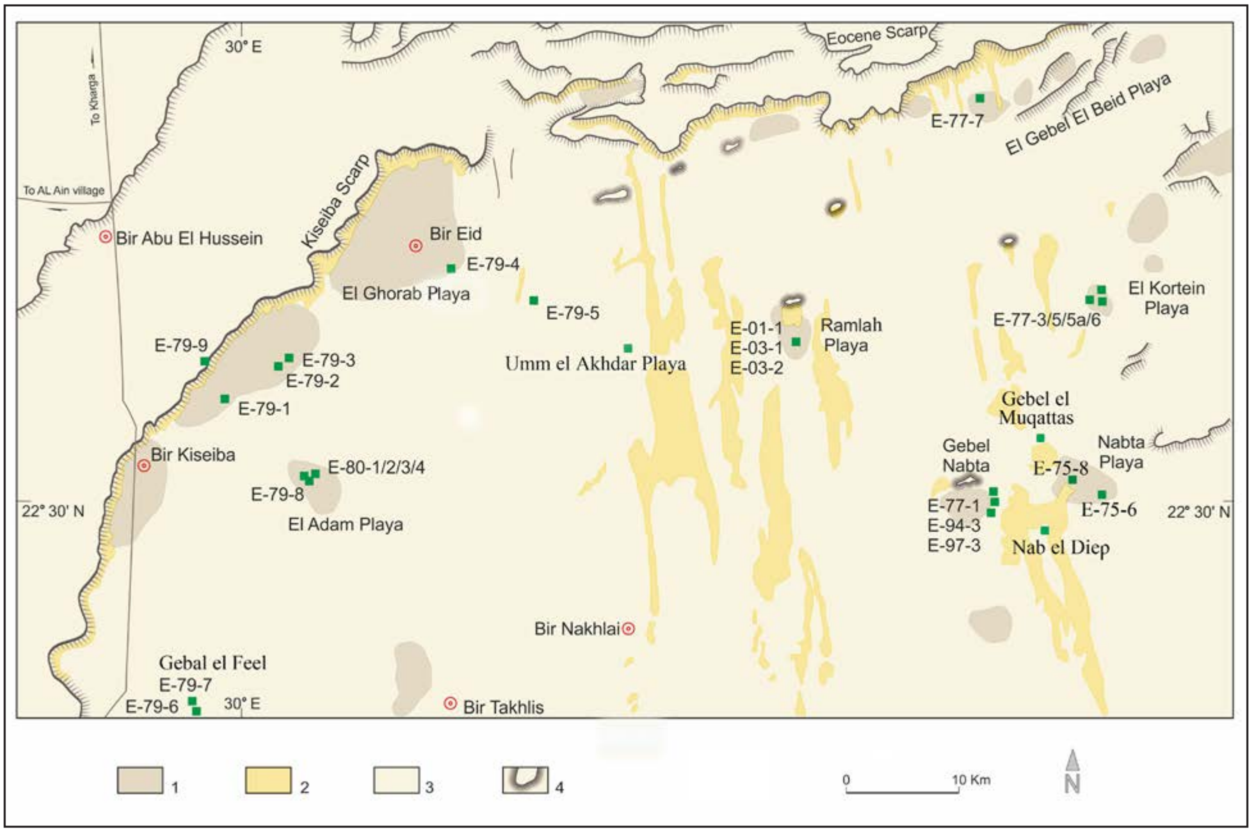
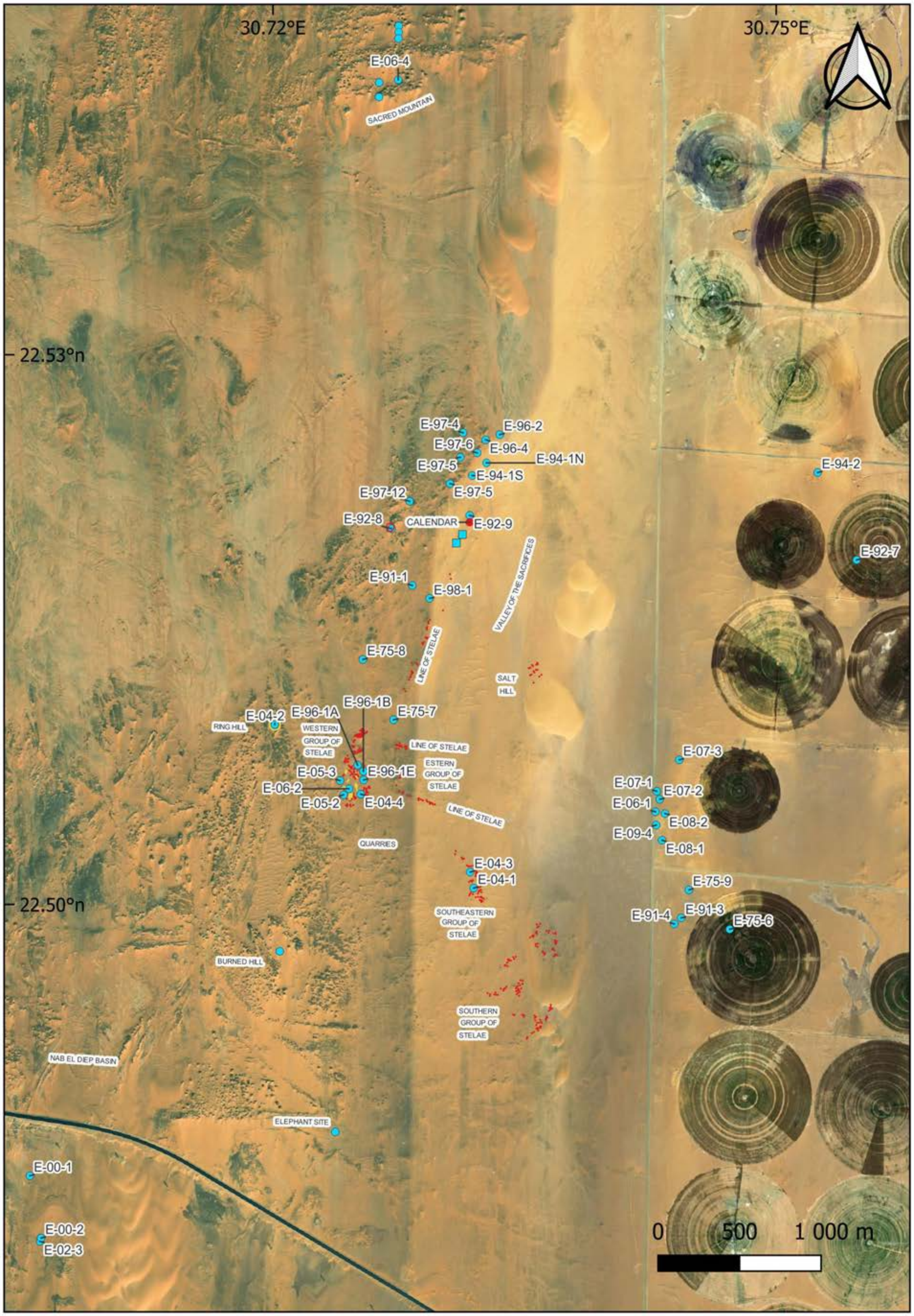


Figure 1.4. Kiseiba/Nabta Playa Areas. Excavated sites, playas, and desert wells. Map by Alex Applegate (Wendorf and Schild 2001a: 3) updated by Halina Królik. Key: 1, Playas; 2, Barchans; 3, Hamadas; 4, Scarps.



30.72°E
30.75°E
22.53°n
22.50°n
E-06-4
SACRED MOUNTAIN
E-97-4
E-96-2
E-97-6
E-96-4
E-94-1N
E-97-5
E-94-1S
E-94-2
E-97-12
E-97-5
E-92-8
CALENDAR
E-92-9
E-92-7
VALLEY OF THE SACRIFICES
E-91-1
E-98-1
LINE OF STELAE
E-75-8
SALT HILL
E-04-2
RING HILL
E-96-1A
E-96-1B
E-75-7
WESTERN GROUP OF STELAE
LINE OF STELAE
ESTERN GROUP OF STELAE
E-05-3
E-96-1E
E-06-2
E-05-2
E-04-4
LINE OF STELAE
E-07-3
E-07-1
E-07-2
E-06-1
E-08-2
E-09-4
E-08-1
QUARRIES
E-04-3
E-04-1
E-75-9
E-91-4
E-91-3
E-75-6
SOUTHEASTERN GROUP OF STELAE
BURNED HILL
SOUTHERN GROUP OF STELAE
NAB EL DIEP BASIN
ELEPHANT SITE
E-00-1
E-00-2
E-02-3
0
500
1 000 m

◄ **Figure 1.5.** Central Section of Nabta Playa and Nab El Diep Basin according to Bing Maps imagery. Blue dots - major prehistoric sites. Circles on the right side of the map - contemporary destruction. Dots in the western side are located in the Nab El Diep Basin. Drawn by P. Wiktorowicz.

2. A brief chronicle of the CPE study and stone installation research at Nabta Playa

Following the Nubia UNESCO Campaign (Wendorf 1968) in 1967, 1968, and 1995, the Combined Prehistoric Expedition (CPE) mapped and studied the geoarchaeology of the Edfu, Isna, Makhadma, and Dishna Areas in the Middle Nile Valley (Wendorf and Schild 1976; Wendorf *et al.* 1997), followed by similar projects in the northern Fayum (1969) depression (Wendorf and Schild 1976). Then, in the early 1970s, the activity of the expedition switched to the Western Desert, first to Dakhla Oasis (Schild and Wendorf 1977) and the Dyke Area (1972), and later (Wendorf and Schild 1980) to Kharga (1976). Finally, in the field seasons of 1973-1974 (Schild and Wendorf 1981) and in 1986-1988, the lakes in Bir Tarfawi and Bir Sahara East in the Atmur El Kibeish Peneplain were explored and mapped (Wendorf *et al.* 1993).

A very complex and lengthy mission in the Wadi Kubbaniya (1978, 1981-1984), north of Aswan, was devoted to the Final Middle and Late Paleolithic (Wendorf and Schild (Assembled); Close 1980; 1986; 1989a; 1989b). It was partially preceded by a shorter although critical high desert mission in the Bir Kiseiba Area of the Atmur El Kibeish Peneplain (1979-1980), Western Desert (Wendorf and Schild (Assembled) in Close 1984d; Wendorf 2008).

Extensive archaeobotanical research associated with the excavations in the South-Western Desert in the 1990s and the 2000s (Barakat 2001; Butler 2001; Hather 2001; Magid 2001; Wasylikowa 2001; Wasylikowa *et al.* 2001a; 2001b; 2001c; Lityńska-Zając, this volume) form the firm basis of the most recent reconstructions of the Holocene plant communities accompanying human settlement. This task has been greatly aided by the results of independent palynological studies of the biogenic fossil formations in the lakes of northwestern Sudan (Haynes *et al.* 1989; Ritchie *et al.* 1985; Ritchie and Haynes 1987; Ritchie 1994). One should also add to these studies the work of K. Neumann (1989a; 1989b) in the Eastern Sahara and the recent research in the Farafra Oasis Area (Fahmy 2014).

Until the 1991 field season, the megaliths of Nabta Playa were not recognized as prehistoric human installations. Instead, they had been understood and initially mapped as natural geological outcrops of the Nubia (Wendorf and Schild 1980: 90). In 1991, after the return to the area of the CPE in 1990, following a nine-year pause, Fred Wendorf and Angela Close, struck by the presence of large and unusual sandstone outcrops in the form of large blocks along the western shore of Nabta Playa, decided to test these "outcrops". Soon, several test trenches revealed that many of the "outcrops" lay on top of lacustrine silts while the others are set in the same deposits (Wendorf *et al.* 1992-1993; Wendorf and Schild 1995-96). The silts were much later determined as having formed during the 8.2 ka event (Schild and Wendorf 2013).

The tested sandstone blocks have subsequently been identified as part of Alignment A of the megalithic sandstone blocks (Figs. 1.5, 2.1, 2.2). In 1997, John McKim Malville, a paleoastronomer, with the help of Ali Mazhar and Fred Wendorf, proposed further megalithic alignments branded as Alignments B and C and determined their geographic (GPS) positions (Figs. , 2.1, 2.4). In the same season, McKim Malville researched the astronomical arrangement of the possible solar calendar in the "Wadi of the Sacrifices" (Haynie 2015; McKim Malville 2015; McKim Malville *et al.* 1998; 2007; 2008; Wendorf and McKim Malville 2001). Recently, the reliability of Alignment C has been questioned (McKim Malville *et al.* 2007; 2008).

A cromlech resembling a stone installation known as a possible "Solar Calendar" at the Site E-92-9 was first spotted in 1991 (Figs. 1.5; 2.1; 2.2). The device, located on a small hillock on the right bank of the "Wadi of the Sacrifices", was preliminarily mapped by Zedeño and Schild during the 1992 season (Applegate and Zdeños 2001b). McKim Malville studied the installation in 1997 and tabled a hypothesis concerning its use as a time determining appliance (Malville *et al.* 1998).

A shallow wadi, a tributary of the lake, dubbed "Wadi of the Sacrifices", discharges into the playa lake at its northwestern section. It flows from the north, touching the eastern footslope of the Gebel El Muqaddas, or "Sacred Mountain". The two largest tumuli (E-94-1 and E-94-1S) with piled rock superstructures were first spotted in 1991 north of the possible "Solar Calendar" and excavated by Alex Applegate in the "Wadi of the Sacrifices" in 1994. During this and two successive seasons at Nabta Playa, in 1996 and 1997, several other rock tumuli were located in the valley. Alex Applegate excavated two of these (E-96-2 and E-96-4) in the 1996 season, while five others (E-97-4, E-97-5, E-97-6, E-97-12, and E-97-16) were explored in 1997 by Alex Applegate, Achilles Gautier, and Steven Duncan (Applegate *et al*. 2001). In early 2000 a few other tumuli were identified on the rising western slope of the Wadi by Schild (Figs. 1.5; 2.1; 2.2). Finally, in 2007, a brief excavation of a few empty, small tumuli-like structures and cairns in the fuzzy delta of the wadi concluded this chapter of research.

Immediately to the south and southeast of Alignment A are four fields or groups of megalithic structures of the menhir, or stelae class spread along the western shores of the Nabta Playa basin. The installations occupy the 8.2 ka middle Holocene playa silts shaped by desert winds into low hillocks. These groups have been assigned the names Western, Eastern, South-Eastern, and Southern Groups (or Fields) of Stelae (menhirs). In addition, several individual stelae occurred on a small but prominent hill called "Salt Hill", lying to the north of the South-Eastern Group. Clusters of megalithic blocks in the Western and Eastern Fields of Stelae were first recognized in 1994 and schematically mapped by Ali Mazhar and Romuald Schild in the 1996 and 2001 seasons (Figs 1.5; 2.4; 2.5; 2.7).

Two of the clusters in the Western Field known as Structures A and B (Site E-96-1) were excavated by Fred Wendorf, Steven Duncan (Structure A), and Halina Królik (Structure B) in the 1996 season. In 1997, Halina Królik and Sandra Davies opened up a part (Site E-96-1, Structure E) of another cluster (Wendorf and Królik 2001).

While the Western and Eastern groups have been intensively studied since 1996, the last two groups were identified, mapped, and tested by trenching during the 2004 and 2005 seasons. Each group contains several to more than twenty tight clusters of megalithic blocks and slabs and single, isolated, worked stones. It soon became apparent that many, and in some instances all, of the blocks were shaped by crude knapping into stelae-like forms with rounded, ogival, or anthropomorphic tops (head and shoulder) and rounded, pointed, or flat bases.

Today, most slabs lie flat and broken into pieces on the surface of the Early Neolithic, 8.2 ka playa silt, frequently dispersed as the result of *desert creep*, a geo-kinetic phenomenon common in desert environments. However, a dozen or so monuments are still upright, though broken or tilted.

Initially, the blocks were set upright by inserting their bases in previously excavated pits. We had first believed that the physics of desert wind erosion would explain the kinetics of collapse and the reason for the fall of the megaliths. However, the OSL dating of the sediments underlying the fallen stelae pinned the downfall to human action. The OSL age estimates linked the destruction of the monuments to the presence of the C-Group pastoralists in the area at about 2500-2160 BC, almost perfectly fitting Phase Ia of the C-Group dated at around 2500-2160 BC (Hafsaas-Isakos 2010). Over 50 stelae clusters containing several hundred individual menhirs have been recognized so far along the western shores of the ancient Lake Nabta.

Beginning in 2004 and continuing until 2007, Halina Królik, HebatAllah A.A. Ibrahim, Dagmara Mańka, and Maciej Jórdeczka tested four discrete sandstone quarries (Sites E-04-4, E-05-2, E-05-3, and E-06-2), sources of the sandstone blocks used for the stelae shaping (Figs. 1.5; 2.1; 2.4). The quarry area occurs in the southern section of the "Western Field of Stelae". In the 2006 and 2008 seasons, Tomasz Herbich (this volume) conducted an electro-resistivity survey of several broken stelae clusters in the northeastern section of the "Western Field". The survey showed that most individual stelae clusters were set right above erosional table rock bedrock rises covered by lake clays of the 8.2 ka event age, a setting similar to that disclosed at Site E-96-1 A, B, and E.

A double stone ring resting upon a prominent flat-topped hill overlooking Nabta Playa Basin from the west was discovered during the 2002 season by Romuald Schild. The structure (Site E-04-2), the impressive remains of a tumulus truncated by desert winds, rests atop a white Cretaceous shale whose surface had been leveled before the construction was installed. The erosion removed the earthen superstructure leaving the two stony rings of the tumulus exposed (Figs 1.5; 2.1; 2.6). A similar widespread erosional phenomenon has been observed at countless desert burial mounds with earthen superstructures (compare, e.g., cemeteries in the Bayuda Desert, Sudan –Paner and Pudło 2010: 123). Today, the remains of the tumulus are composed of an inner ring of quartzitic sandstone slabs – a sandstone dry masonry chamber surrounding the grave pit, and an outer ring formed by 22 large sandstone slabs. Halina Królik and Dagmara Mańka excavated the tumulus in the spring of 2004.

The author discovered the "Sacred Mountain" (Gebel El Muqaddas) sanctuary in the 2005 field season. This isolated, lonely mountain is about two kilometers north of the "Wadi of Sacrifices" (Figs 1.3; 1.5; 2.1; 2.10). It is a serrated, prominent rocky massif of about one kilometer in diameter (Fig. 2.10) overlooking the flat plain of the north Nabta Playa Basin and slowly rising toward the north, well beyond the fossil shores of the lake. An initial mapping of the individual archaeological features visible on the surface began in 2006, together with a preliminary clearing of the wind deflated installations resting in lag positions. However, the first detailed excavations of the tumuli and other sacred loci dating to around 7000 BC were not carried out until 2007 by Agnieszka Czekaj-Zastawny and Przemysław Bobrowski. Finally, during the 2009 season, a detailed map of the entire mountain, containing very copious Early Neolithic stone installations, was produced.

Over a kilometer to the south of "the Western Group of Stelae" is the Burned Hill (Hearth Mound), a small, erosional isolated hillock formed by wind erosion around a vast surface, stone-lined hearth (Fig.1.5). It is a natural erosional remnant located in desert badlands of an early Holocene dune covered with thousands of stones, mostly burned. A cache of preforms and a polished celt eroding from its slopes suggest the Late or Final Neolithic age for this archaeological feature (Wendorf and Malville 2001: 498). A similar scorched, stone-paved area occurs at the northeastern section of the "Sacred Mountain".

3. Conclusion

The morphing panorama of several cultural, socioeconomic, and demographic transformations over five millennia, as sketched in the following essays, is tightly intertwined with essential climatic and environmental phenomena shaping the prehistory of the Middle and Late Holocene of the Nubia Shab Pediplain and Atmur El Kibeish Peneplain. The Nile Valley is in the background of these events; however, the focus here is on an overview of the Nabta Playa's cultural prehistory. Today, it is predictable that the sacred installations and spiritual monuments of Nabta Playa are not alone in the South-Western Desert. Recent discoveries by research teams of the CPE in the Bargat El-Shab and Gebel Ramlah show that various small-scale sacred installations may be found in many loci in the vast expanses of the South-Western Desert.

The last part of the book contains chapters illustrating denuded surface and subsurface sites as examples of problems often met in the desert. The first (E-04-3), in a lag position and embedded in the topsoil developed in the truncated 8.2 ka event reddish silt, has been subjected to countless cases of soil churning and alluvial surface washes. The second (E-00-2), on the other hand, is a case of aeolian denudation exposing on the surface nearly the entire assemblage of artefacts. The third situation illustrates a homogeneous site (Site E-02-3) still partially covered by sediment with features fully preserved together with its original infilling.

Chapter 2.

Measurements and maps

Romuald Schild and Paweł Wiktorowicz

Mapping the surficial geomorphological features of the Nabta Playa Basin and similar basins in the area was initially an almost impossible task because of the lack of maps, except for large-scale geological charts in which Quaternary features are rarely marked – and never shown in detail. Therefore, our necessary surficial geology mapping was based on aerial photographs taken in the 1960s, which were not corrected for distortion (Schild and Wendorf 2001: Fig. 2.1). On the other hand, the various available satellite imageries almost always have features blurred by dunes and extensive sand sheets. These eliminate the possibility of more detailed observations of the beds and unit boundaries.

The available large-scale geology and topographic maps of the South-Western Desert have no precise elevation contours and only sporadic, dispersed elevation points located on top of a few gebels. Therefore, the Nabta Playa Basin elevations have been related to the Nabta Playa assumed benchmark level datum of 100 m a.s.l. An iron peg on top of a small hillock located about 20 m to the southwest of Site E-75-6 marks the datum point (see Sector G – red cross). An average of 15 GPS (Global Positioning System) readings of the datum in February 1998 gave roughly 215 m a.s.l.

In subsequent years, the availability improved significantly of various types of cartographic imaging sources, as did access to high-quality satellite imagery calibrated in the WGS84 world reference system. Since 2000, after the Selective Availability mechanism was turned off, the quality of GPS measurements has also improved greatly. Moreover, small lightweight receivers quickly appeared, making it possible to work in any terrain. Stations measured with GPS receivers could easily be visualized on satellite imagery and programs embedded in GIS (Geographic Information System) and CAD (Computer Aided Design; see Chapter 1, Fig. 1.5) environments.

Originally, traditional surveying methods in the form of tape measures, levelers, optical theodolites, etc. were used at archaeological sites. The next step in surveying work at Nabta Playa Basin was the advent of precision laser total stations in the early 21st century. The collected data was then processed in Coder's WinKalk and MikroMap software. It was possible not only to make precise measurements, but also to delineate the local geodetic warp of the surveyed space and to perform the detailed planigraphy of various archaeological objects (barrows, tumuli, stelae, foci, etc.). This made it possible to create large, accurate maps, on which the various categories of structures and features were precisely marked, which at a later stage made it possible to study various types of spatial relations. From 2009 to 2011, mapping was conducted on Site E-06-4 (Gebel El Muqaddas), a large landform located on a plateau on the northwestern edge of Nabta Playa. The survey used a local rectangular plane coordinate system, based (the origin of the system) on a point measured in GPS. Using a precision compass (part of the tachymeter set), the north direction of the system's central axis was determined. Over the course of several weeks, nearly six thousand field pickets were acquired with the total station, which allowed the generation of enough data (in the form of a point cloud) to create an accurate contour map and, at a later stage, to create a Numerical Terrain Model (NMT; Fig. 2.11). After completing the field measurements, the first step was to compile a list of all survey points in the form of a TXT file downloaded from the device's memory. In the MicroMap program, using the "contours" module, a base situation and elevation map of the surveyed area was generated on the basis of the reclassified measurement data. All excavations and various categories of megalithic monuments were marked on this base study. This map also served as the basis for large-scale plans (1:1000, 1:500) of individual archaeological sites.

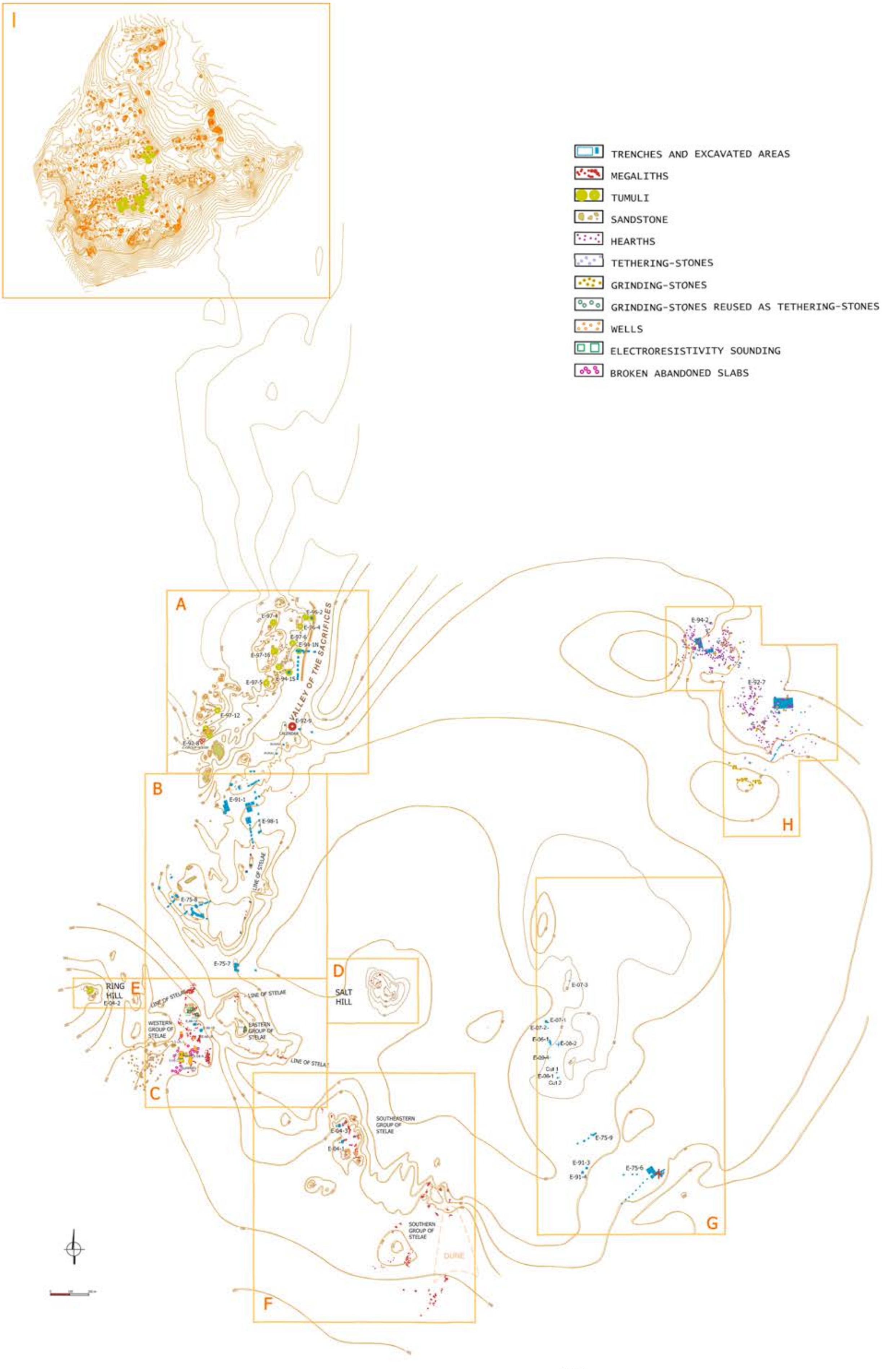
GIS-type software (Qgis), made it possible to convert local coordinates acquired in the field to the necessary form in Egyptian mapping called WGS84/UTM36N (EPSG32636). This is a plane rectangular coordinate system based on the WGS84 ellipsoid and using a meter grid. Since all the data acquired in the field was recorded within a single mapping system (EPSG32636), it was possible to place both the survey excavation grid and the data acquired from the planigraphy of megalithic structures and other features on different map bases, for which advanced GIS software symbolization could be used.

The next stage was the processing of the obtained data, which involved the use of specialized computer programs. The result was a whole series of thematic maps and analyses made in GIS software. At this stage, the primary software used was Coder's MikroMap geodetic program. However, for GIS analyses, the programs used were: QGIS and SAGA GIS, as well as web-based imagery sources such as Google Maps, Esri, and Bing, for example (Szczepanek 2017). Generally available NMT data were also used, such as from NASA's SRTM mission (https://pl.wikipedia.org/wiki/Shuttle_Radar_Topography_Mission) as well as from the data-base of the Japanese Space Agency JAXA (https://www.eorc.jaxa.jp/ALOS/en/aw3d30/data/index.htm), and the project COPERNICUS DEM – Global and European(https://spacedata.copernicus.eu/collections/copernicus-digital-elevation-model).

Nearly two decades (1990-2011) were spent detailing the archaeological mapping of the Nabta Playa Basin, including the Gebel El Muqaddas. The mapping was completed by Romuald Schild, Ali Assad Mazhar, and Paweł Wiktorowicz (Figs 2.1-2.10).

At the same time, the Combined Prehistoric Expedition began the detailed mapping of the Quaternary geology of Nabta Playa. Unfortunately, the project has yet to be fully completed. A series of accurate maps of most of the Nabta Area have nonetheless been drawn, including the small neighbouring basin of the Nab El Diep. These maps created the foundation for the location of sites in the Bing satellite imageries (see Chapter 1, Figs 1.2; 1.3; 1.5).

► **Figure 2.1.** General Map of Nabta Playa Basin showing the location of individual sectors. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.


I
TRENCHES AND EXCAVATED AREAS
MEGALITHS
TUMULI
SANDSTONE
HEARTHS
TETHERING-STONES
GRINDING-STONES
GRINDING-STONES REUSED AS TETHERING-STONES
WELLS
ELECTRORESISTIVITY SOUNDING
BROKEN ABANDONED SLABS
A
VALLEY OF THE SACRIFICES
B
LINE OF STELAE
C
D
SALT HILL
E
RING HILL
LINE OF STELAE
WESTERN GROUP OF STELAE
EASTERN GROUP OF STELAE
F
SOUTHEASTERN GROUP OF STELAE
SOUTHERN GROUP OF STELAE
DUNE
G
H

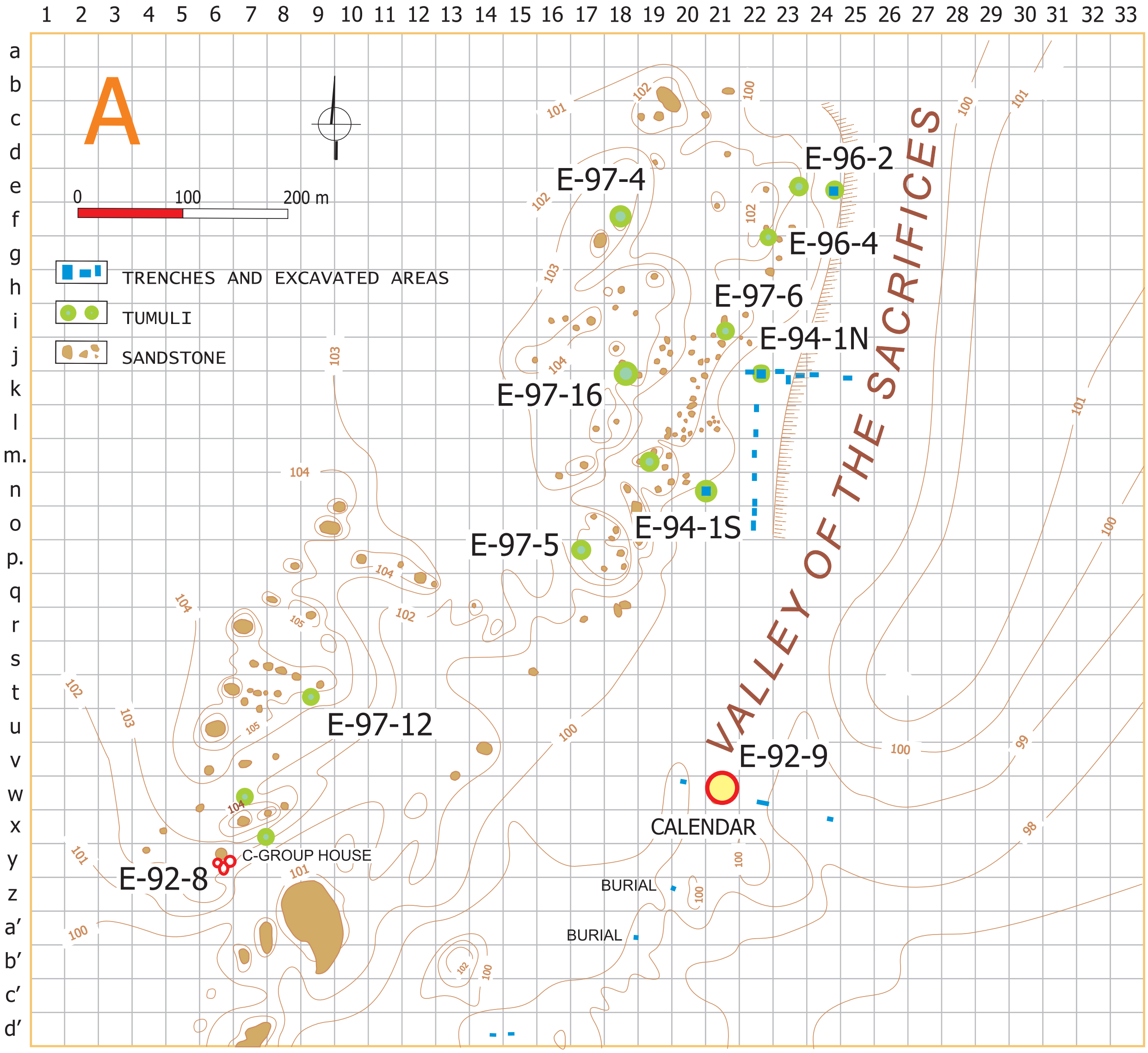


Figure 2.2. Nabta Playa, map of Sector A. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.

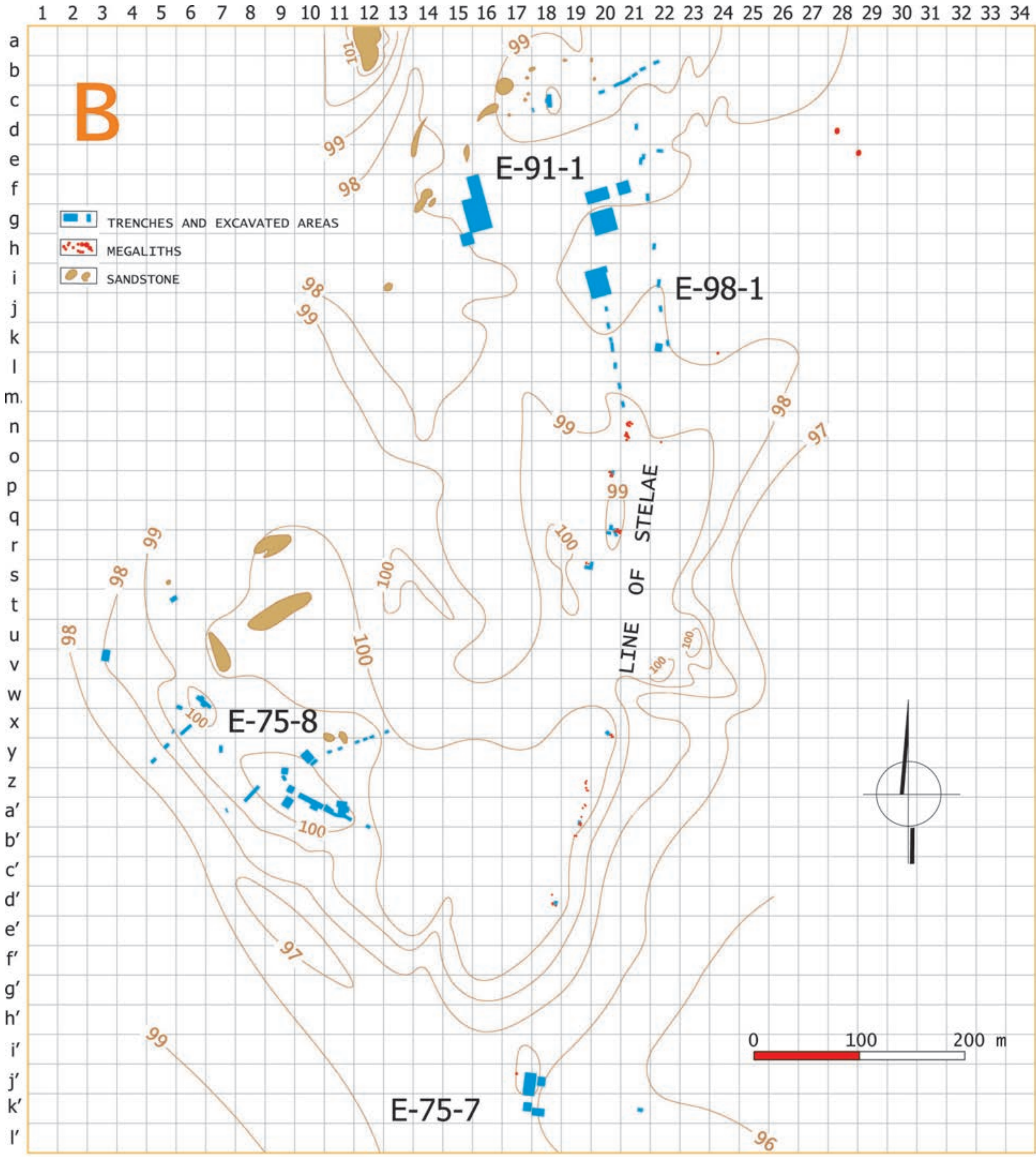


Figure 2.3. Nabta Playa, map of Sector B. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.

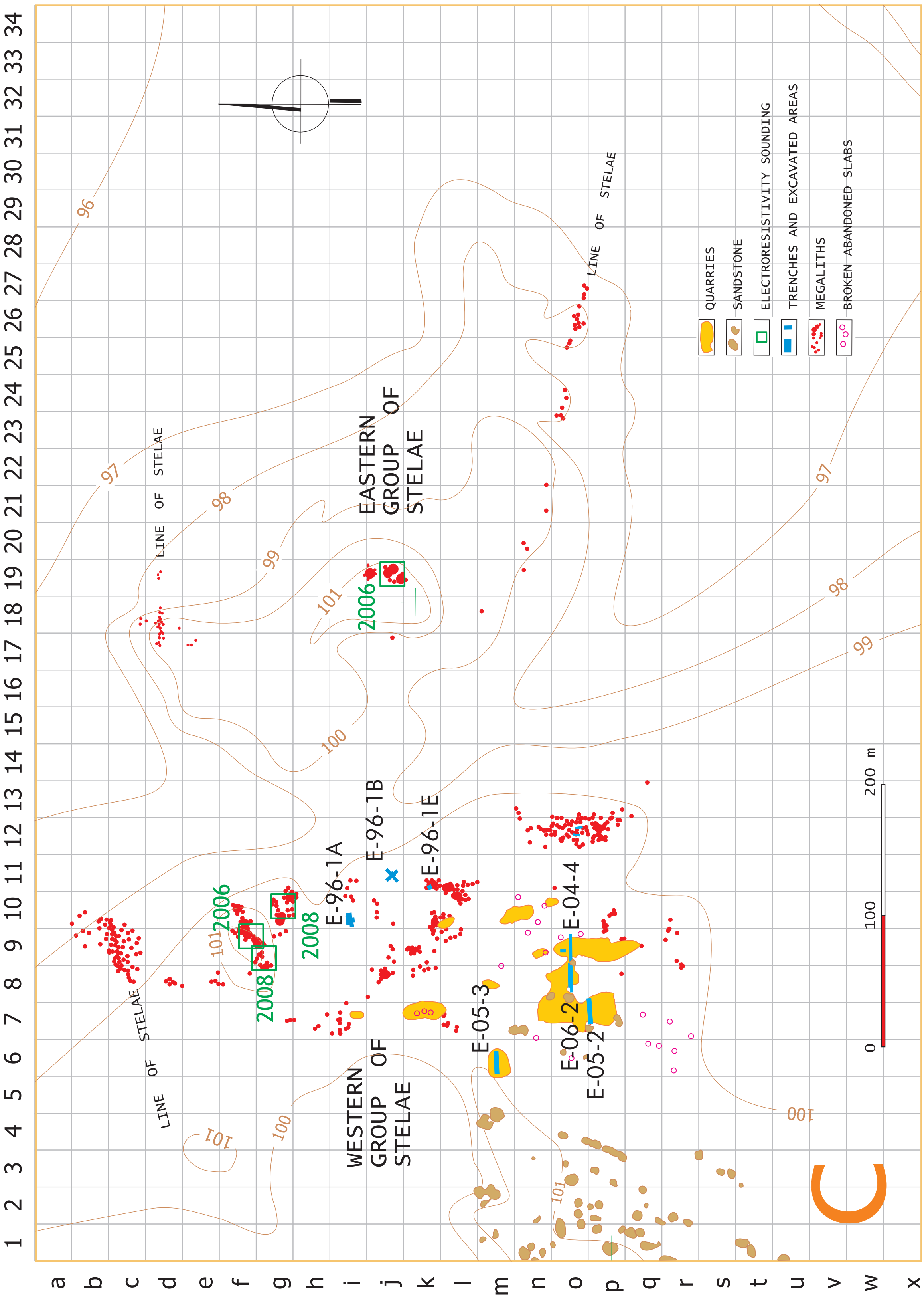


Figure 2.4. Nabta Playa, map of Sector C. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.

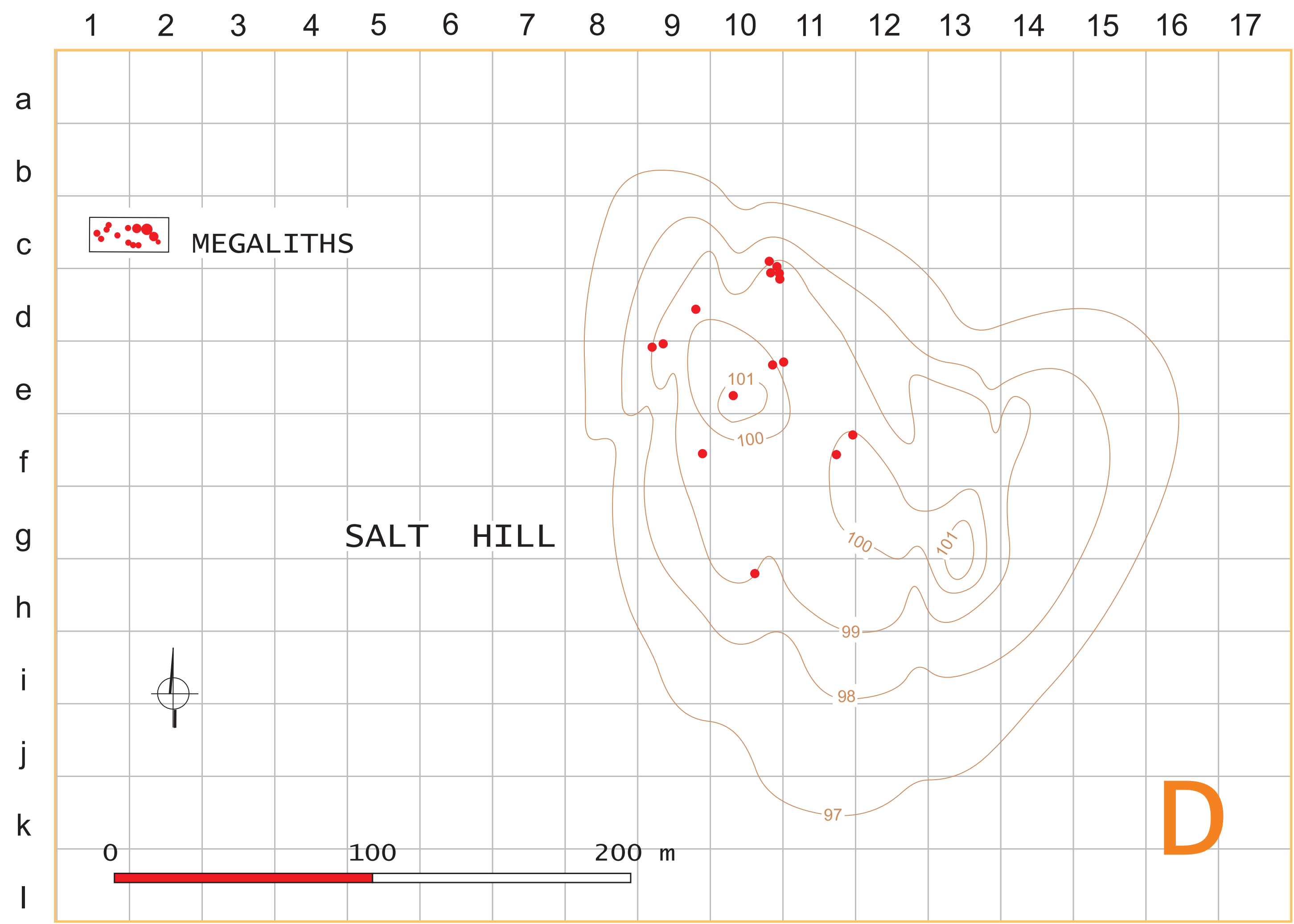


Figure 2.5. Nabta Playa, map of Sector D. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.

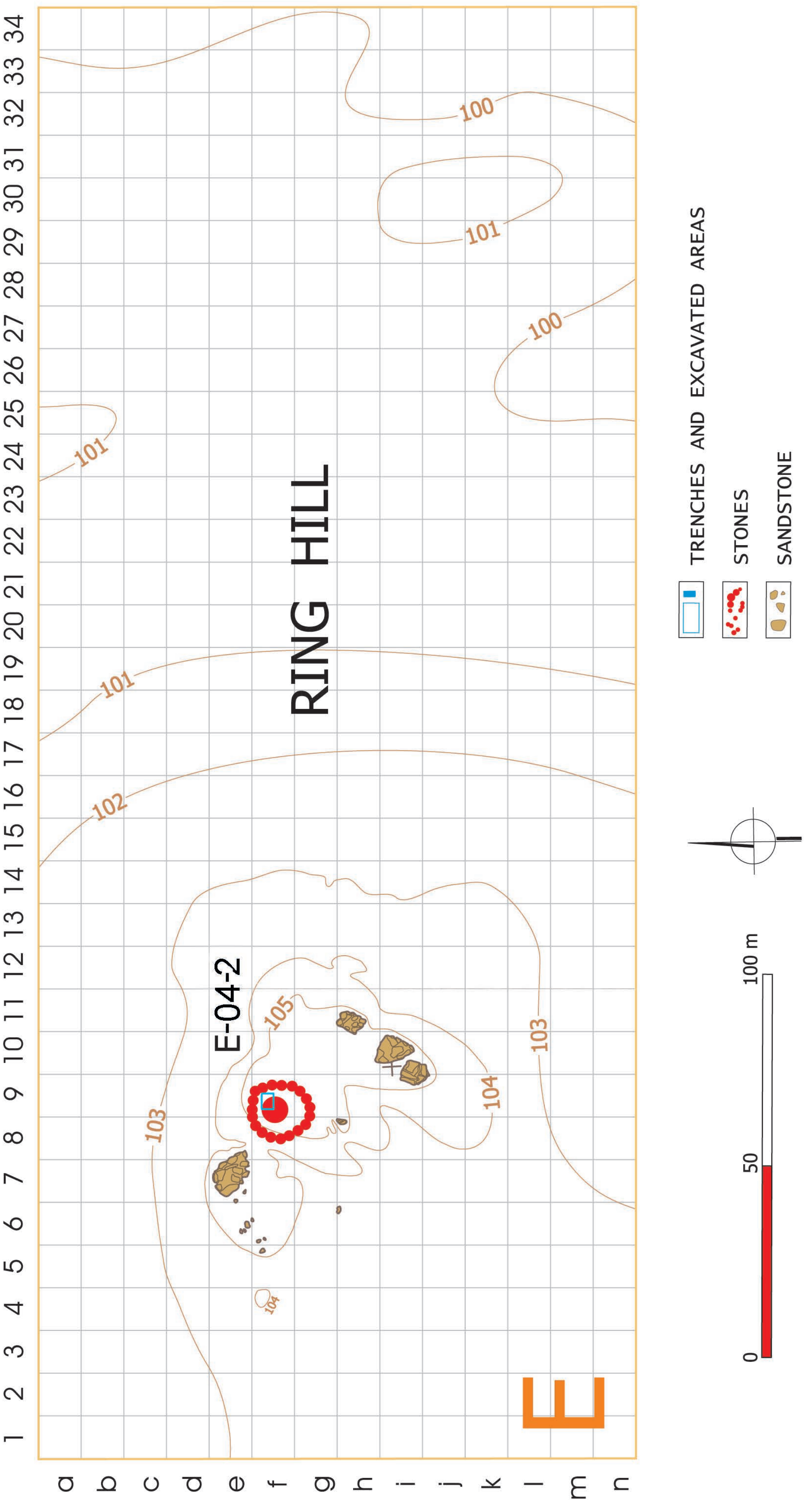


Figure 2.6. Nabta Playa, map of Sector E. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.

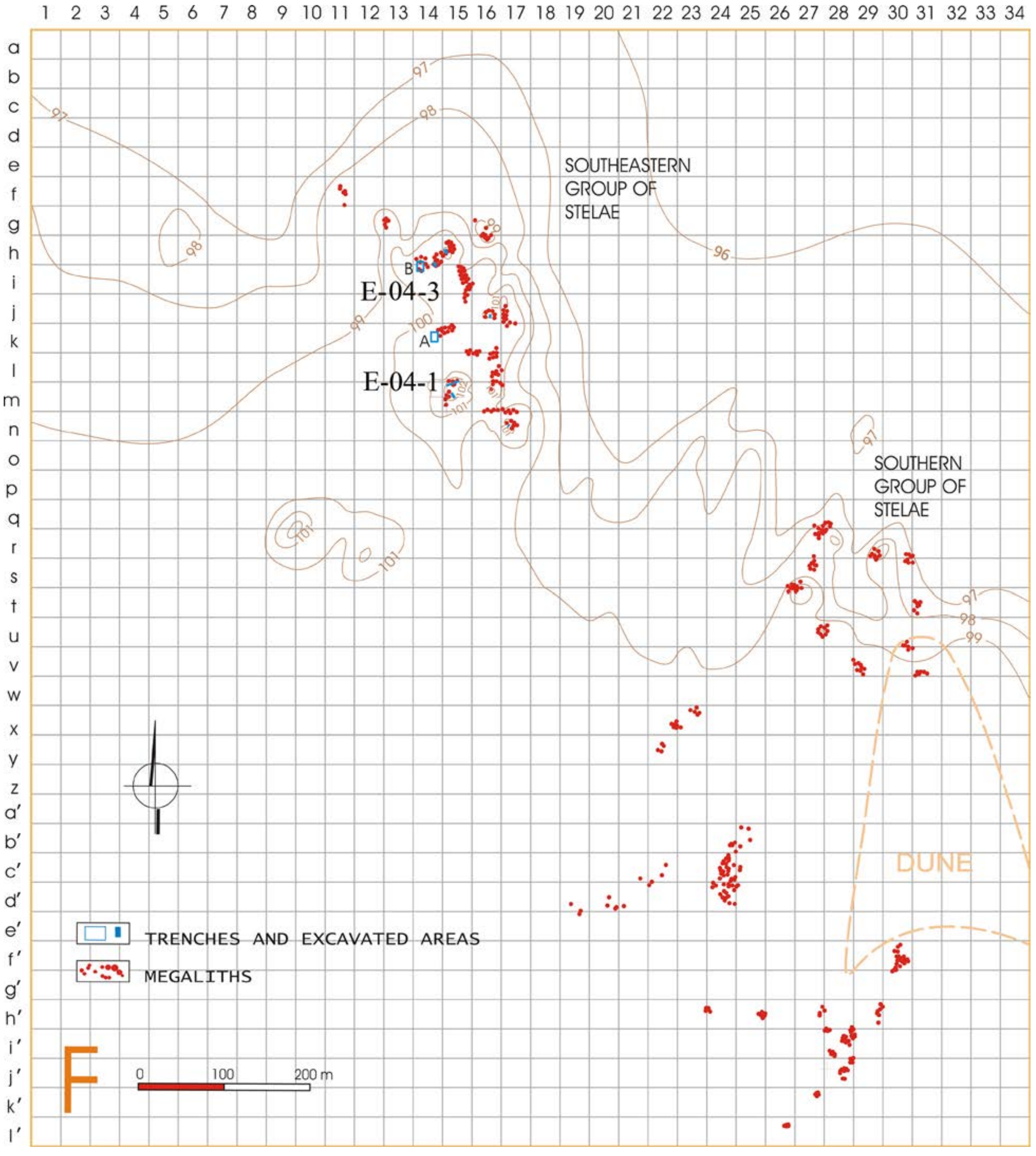
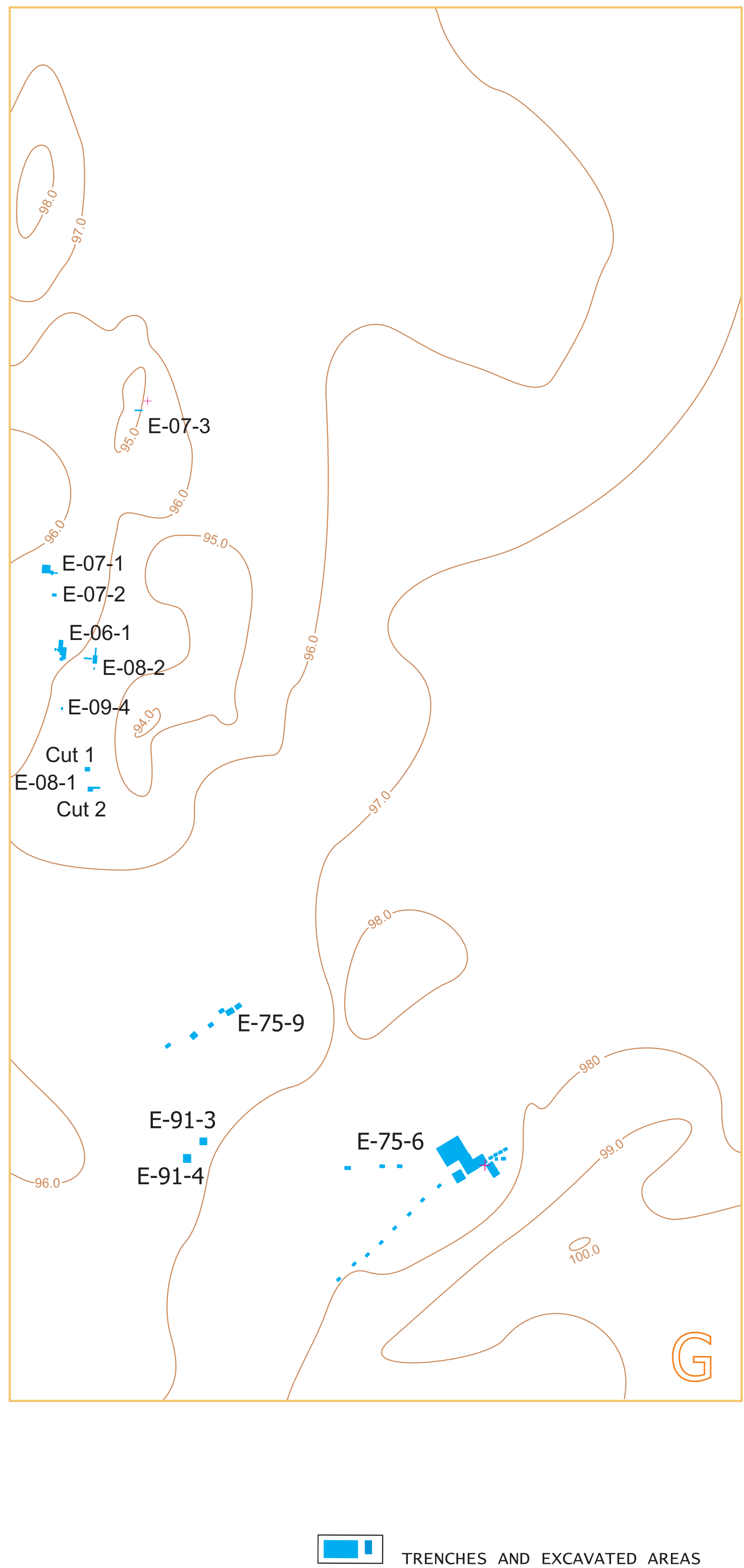
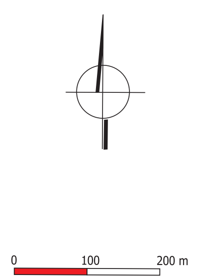


Figure 2.7. Nabta Playa, map of Sector F. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.

Figure 2.8. Nabta Playa, map of Sector G. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.





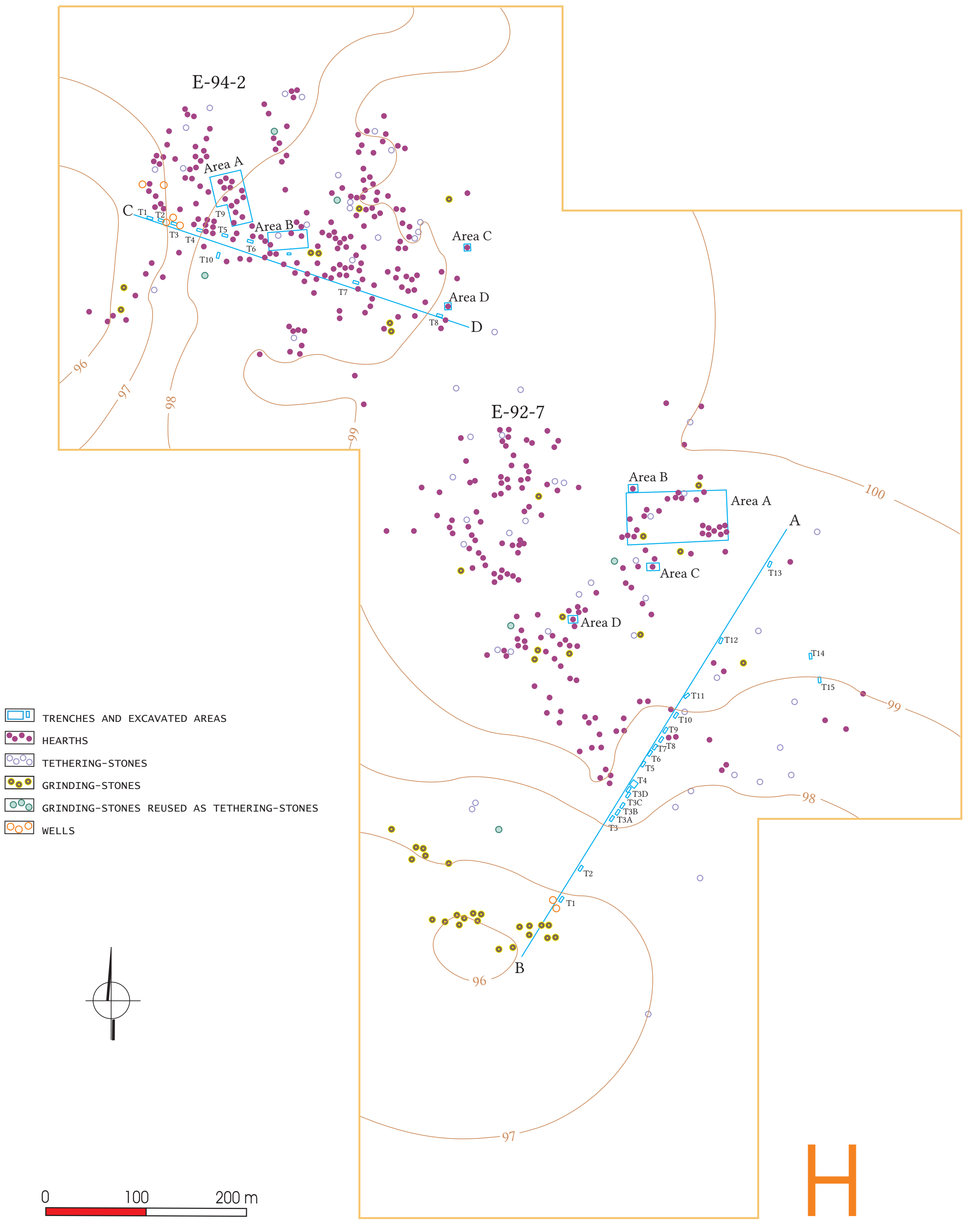


Figure 2.9. Nabta Playa, map of Sector H. Map by R. Schild and A. Mazhar. Drawn by M. Puszkarski.

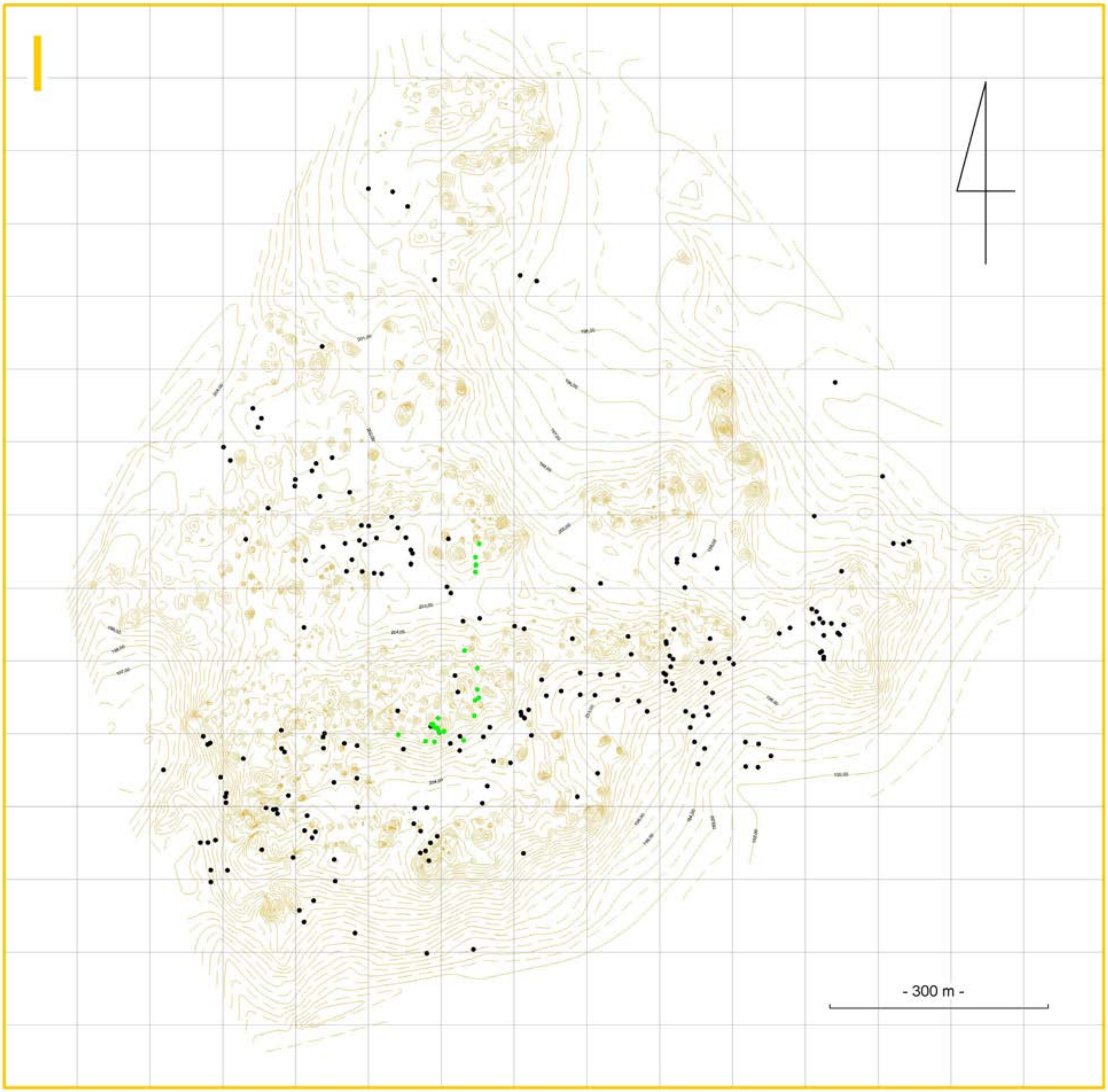


Figure 2.10. Nabta Playa, map of Sector I. Map by P. Bobrowski, A. Czekaj-Zastawny, P. Wiktorowicz. Drawn by. P. Wiktorowicz.

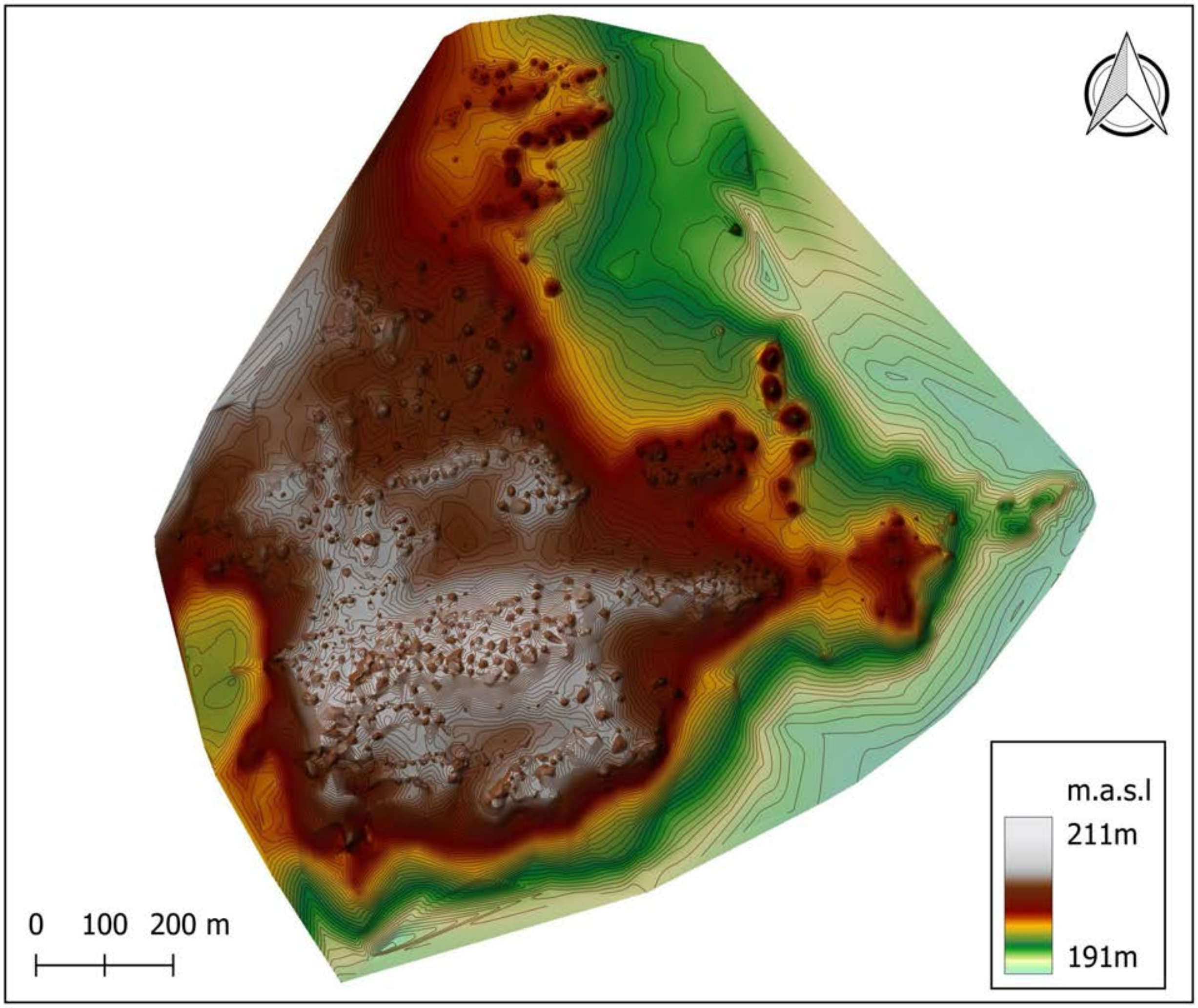


Figure 2.11. Nabta Playa, Site E-06-4 (Gebel El Muqaddas). Digital Terrain Model with colour scale. Additionally, visible layers generated automatically from DTM. Drawn P. Bobrowski.

Part II. The Groups of Tumuli

Chapter 3.

The Early Neolithic tumuli from Gebel El Muqaddas, Site E-06-4

Przemysław Bobrowski and Agnieszka Czekaj-Zastawny

1. Introduction

Site E-06-4 at Gebel El Muqaddas ("Sacred Mountain") is on the northernmost edge of the "ceremonial complex" of Nabta Playa, and is its earliest component (Wendorf and Schild 2001a); (Fig. 3.1). It was discovered in 2005 during surface surveys conducted by R. Schild along the wadi channel running towards the area of the paleo-lake. This had been a seasonal river that drained towards the Nabta reservoir at the beginning of the Holocene. In the upper section of the wadi, a small rock mass dominated over the sand-gravel surface of the valley (Fig. 3.2). On its culmination, slopes, and internal depressions were observed numerous stone mounds of a character that may be described as tumuli. This term was applied for the first constructions discovered in the Nabta Playa Basin which appeared to be round cairns built over a pit with a cattle burial (Applegate *et al.* 2001), and the label has therefore been used for similar features described in this chapter. In addition to this, the term "structure" was used in relation to other constructions in the complex – for example, areas covered with flat stone pavements. In 2006, Dagmara Mańka and Marek Puszkarski began documenting the largest and most compact concentration of these features in the southwestern part of the area. At the same time, one of the structures located there was also tested by excavation (Tumulus 1).

Systematic excavations conducted by Agnieszka Czekaj-Zastawny and Przemysław Bobrowski began in 2007. The work was primarily focused on one of the most visible forms in this part of the site – Tumulus No. 2 and the complex of smaller stone structures that accompany it. Further features located in the vicinity of this tumulus were numbered from 2/1 to 2/4. Tumulus No. 19, located several dozen metres to the southeast of the above-mentioned concentration and Structure 21 located at the southern edge of the massif, was also examined. Work was also carried out in the area of a large hearth complex occupying a large depression in the centre of the hill. Here one large campfire site (no. 1) was examined and at the same time a 20-metre geological section was excavated. In the next research season, in 2008, studies of stone structures 2/5, 2/6, 2/7 located in the area of Tumulus No. 2 were continued. Other features previously registered on the surface were also examined, including Tumulus No. 9, 18, 26, 28, 30, 31, 40 and stone structures No. 23, 24, 25, 27, 29, located in the southern and central part of the site and the remains of two hearths (No. 2, 3). In 2009, a team composed of Agnieszka Czekaj-Zastawny, Jacek Kabaciński, and Paweł Wiktorowicz, made a series of several hundred measurements of features throughout the entire site using a total station. Thanks to this, it was possible to make a detailed plan for the distribution of all the structures visible on the surface (Fig. 3.3). During this work, the remains of further features were discovered (including the so-called house of group C and a circular feature provisionally identified as a well).

Figure 3.1. Location of the Site E-06-4 (Gebel El Muqaddas) in Nabta Playa basin.

Figure 3.2. Nabta Playa. A, B – view at the Site E-06-4. Photo by R. Schild, P. Bobrowski.

2. Location of the Site E-06-4.

The Gebel El Muqaddas is located on the north outskirts of the area interpreted as the "ceremonial space" mentioned above (about 2.5 km to the N), and about 6 kilometers to the NW from the dense zone of the Neolithic settlements situated along the western edge of the Nabta Playa (cf. Fig. 3.1, 3.2). It is a serrated, prominent massif with an area of about 1.5 km^2 rising above the flat plain of the North Nabta Playa Basin, well beyond the fossil shores of the lake. It is built of sandstones of the Nubian Formation, at its base it has an irregular rectangular plan and on the NS axis it is about 1.2 km across; on the WE one, it measures about 1.4 km. From the south and west, its slopes drop steeply down several dozen metres, but on the north and east sides the slope runs down less steeply to the surface of the plain built from various alluvial deposits grading into playa silts (Schild and Wendorf 2001a: fig 2.1). On the east, the massif abuts a wide, but shallow *wadi*. On the south, over a wide area at the foot of the massif are the readily visible, preserved remains of an ancient forest of the Cretaceous period in the form of numerous fossilized tree trunks (Fig. 3.4). The mount is dissected by a few small valleys and deflation basins, several of which form large, sandy cirques. Over the whole area are clearly visible, even prominent hills consisting of raised sandstone deposits with many small knolls topped by a dark brown to black ferruginous quartzitic sandstone (Fig. 3.5).

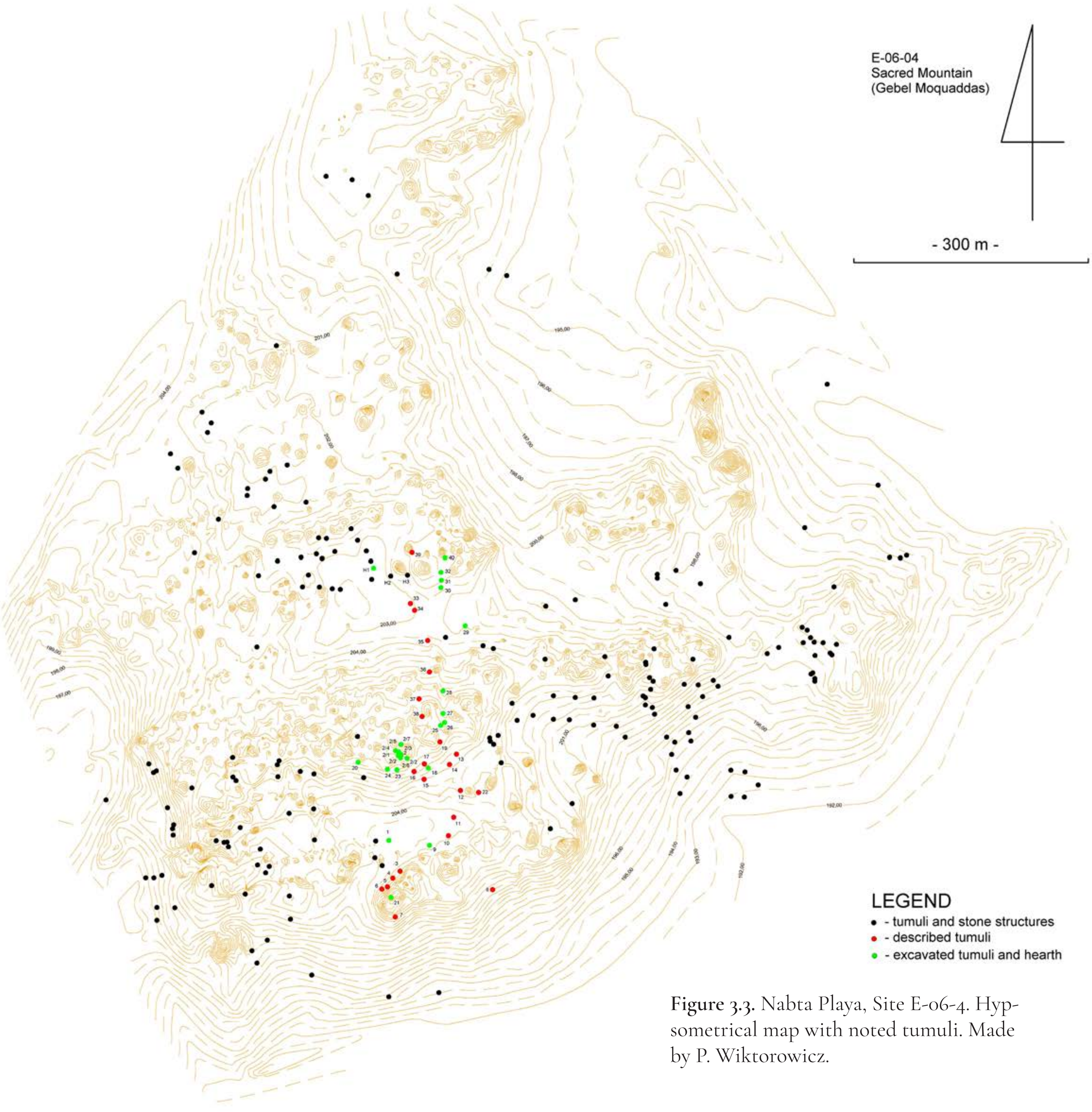


Figure 3.3. Nabta Playa, Site E-06-4. Hypsometrical map with noted tumuli. Made by P. Wiktorowicz.

Figure 3.4. Nabta Playa, Site E-06-4. A, B – petrified forest at the foot of the Gebel El Muqaddas. Photo by A. Czekaj--Zastawny.

3. Characteristics of the Site.

A total of 224 stone structures have been noted across this whole area within the last few years (cf. Fig. 3.3, Fig. 3.7). These structures include tumuli, slab pavements, and a gigantic hearth area (Fig. 3.6).

These stone monuments occurred primarily in the southern, western, and central parts of the massif, forming clusters of several to a dozen or so sites. In the northern and eastern part of the massif, their number clearly decreased. The tumuli and other structures were mostly situated on prominent hills. A few occurred on the hillsides and inside the deflation basins. In the centre of the Gebel El Muqaddas massif, in the largest deflation depression, a large complex of overlapping hearths was registered. In the western part of the massif there are remains of a feature similar to the so-called group C house from Site E-92-8 in Nabta (Applegate and Zedeño 2001a). At the eastern foot of the massif, a circular feature was recorded that was provisionally identified as a well.

Figure 3.5. Nabta Playa, Site E-06-4. View at one of the tumuli. Gebel Nabta visible in the background. Photo by P. Bobrowski.

Figure 3.6. Nabta Playa, Site E-06-4. View at the Hearth Area from the East. Photo by P. Bobrowski.

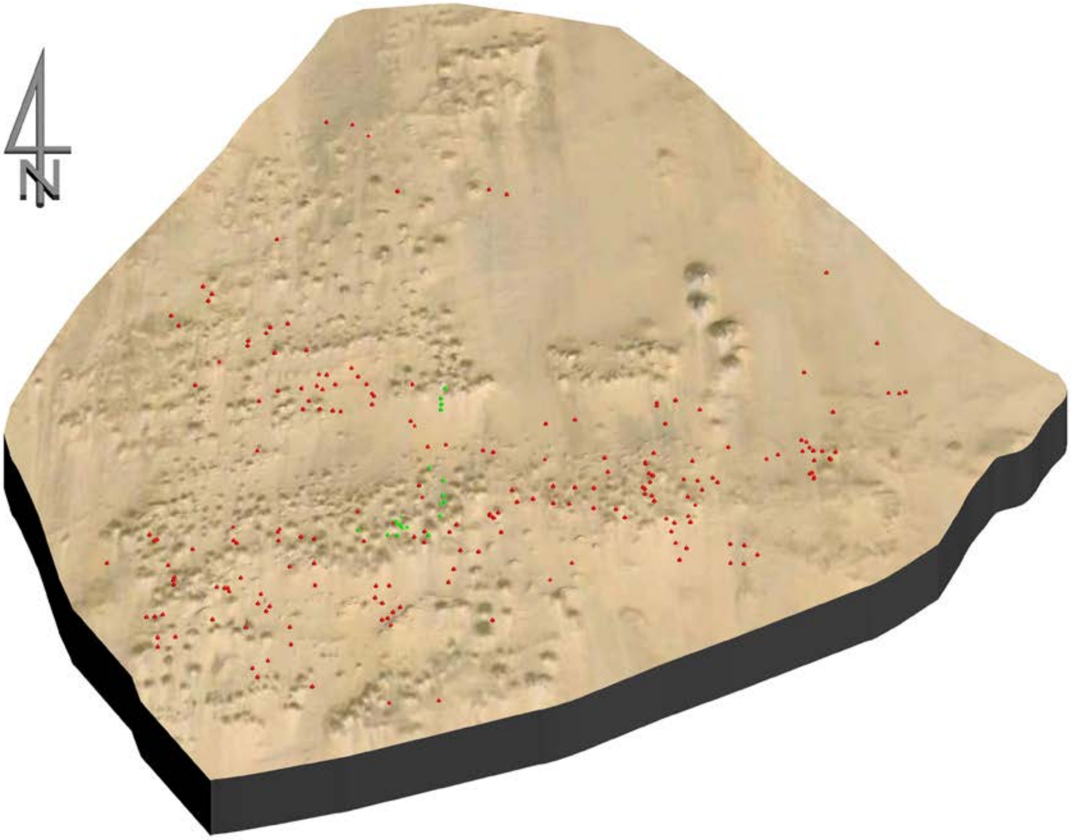


Figure 3.7. Nabta Playa, Site E-06-4. Three-dimensional map with noted tumuli: red dots - tumuli and stone structures, green dots - studied tumuli. Made by K. Juszczyk, P. Wiktorowicz.

Within a few seasons, the excavation of 24 sites had been undertaken, and another 22 were described and documented in detail (Table 3.1, Fig. 3.8-3.16). Stone structures formed as low stacks of stones or pavements of sandstone slabs were placed directly on the level of the fossil dune sands or a slightly consolidated layer of weathered quartzite sandstone. Some stones showed traces of intentional working. Most of the tumuli had a circular shape. The diameter of the smallest (Tumulus 16) was about 200 cm, and the largest (Tumulus 1) about 750 cm. Most of the surviving examples had mounds with a diameter of 400 to 500 cm (cf. Table 3.1). Their height ranged from about 30 to 60 cm. In the case of some tumuli, an outer kerb, made of larger plates or flat stones (e.g., Tumuli 1, 4, 10, 17) was noticeable. Structures with mounds being irregular in plan (e.g., Tumuli 3, 4) were rarer, and their size, in the vast majority of cases, occupied an area of 300 x 400 cm.

The smaller stone structures were both circular in shape (e.g., Structures 2/1, 2/2, 2/4) and irregular (Structures 23, 24, 25). The diameter of the former was in the range of 100-200 cm, while the structures with irregular projections had a maximum dimension not exceeding 200 cm. Some of them consisted of only a few larger stone slabs. The height of the features ranged from approx. 10 to 50 cm.

Table 3.1. Nabta Playa, Site E-06-4 – Gebel El Muqaddas. The characteristics of the tumuli and structures.

No.	Form of feature	Shape	Size (cm)			Excavated	Shaft	Figure
			Length	Width	Height			
1.	Tumulus 1	circular	750	750	30	yes	no	Fig. 3.9
2.	Tumulus 2	circular	400	400	60	yes	yes	Fig. 3.18, 3.19
3.	Structure 2/1	circular	140	140	40	yes	yes	Fig. 3.18, 3.19, 3.21
4.	Structure 2/2	circular	100	100	10	yes	no	Fig. 3.18
5.	Structure 2/3	irregular	200	150	20	yes	yes	Fig. 3.18, 3.22
6.	Structure 2/4	circular	100	100	10	yes	no	Fig. 3.18
7.	Structure 2/5	elongated	250	250	50	yes	yes	Fig. 3.18, 3.23, 3.24
8.	Structure 2/6	elongated	250	100	20	yes	no	Fig. 3.18
9.	Structure 2/7	oval	300	180	30	yes	yes	Fig. 3.18, 3.25, 3.26
10.	Tumulus 3	irregular	400	300	30	no	?	Fig. 3.9
11.	Tumulus 4	irregular	400	300	20	no	?	Fig. 3.9
12.	Tumulus 5	irregular	700	350	30	no	?	Fig. 3.9
13.	Tumulus 6	irregular	300	250	30	no	?	Fig. 3.10
14.	Tumulus 7	circular	350	350	30	no	?	Fig. 3.10
15.	Tumulus 8	circular	280	280	30	no	?	Fig. 3.10
16.	Tumulus 9	circular	500	500	30	yes	no	Fig. 3.10
17.	Tumulus 10	circular	500	500	30	no	?	Fig. 3.10
18.	Tumulus 11	circular	400	400	30	no	?	Fig. 3.10
19.	Tumulus 12	circular	420	420	30	no	?	Fig. 3.11
20.	Tumulus 13	circular	360	360	20	no	?	Fig. 3.11
21.	Tumulus 14	irregular	400	300	20	no	?	Fig. 3.11
22.	Tumulus 15	oval	400	300	30	no	?	Fig. 3.11
23.	Tumulus 16	circular	200	200	30	no	?	Fig. 3.11
24.	Tumulus 17	circular	420	420	30	no	?	Fig. 3.11
25.	Tumulus 18	circular	300	300	40	yes	no	Fig. 3.12
26.	Tumulus 19	circular	400	400	30	yes	no	Fig. 3.13
27.	Tumulus 20	irregular (scattered)	?	?	?	no	?	-
28.	Feature 21	recess of the natural stone block	-	-	-	yes	no	Fig. 3.31-3.33
29.	Tumulus 22	circular	500	500	50	no	?	Fig. 3.12
30.	Structure 23	irregular	150	70	20	yes	no	Fig. 3.12
31.	Structure 24	irregular	220	90	30	yes	no	Fig. 3.12
32.	Structure 25	irregular	150	80	20	yes	no	Fig. 3.12

33.	Tumulus 26	irregular	400	250	30	yes	yes	Fig. 3.27
34.	Tumulus 27	irregular	400	350	40	yes	no	Fig. 3.12
35.	Tumulus 28	circular	350	350	40	yes	yes	Fig. 3.27
36.	Tumulus 29	irregular	350	300	30	yes	no	Fig. 3.12
37.	Tumulus 30	circular	200	200	50	yes	no	Fig. 3.14
38.	Tumulus 31	circular	450	450	30	yes	no	Fig. 3.15
39.	Structure 32	irregular	400	300	20	yes	no	Fig. 3.15
40.	Structure 33	oval	300	200	30	no	?	Fig. 3.15
41.	Tumulus 34	circular	200	200	25	no	?	Fig. 3.15
42.	Tumulus 35	circular	280	280	30	no	?	Fig. 3.15
43.	Structure 36	circular	280	280	20	no	?	Fig. 3.16
44.	Structure 37	irregular	200	200	20	no	?	Fig. 3.16
45.	Structure 38	circular	270	270	20	no	?	Fig. 3.16
46.	Tumulus 40	circular	400	400	35	yes	yes	Fig. 3.28-3.30

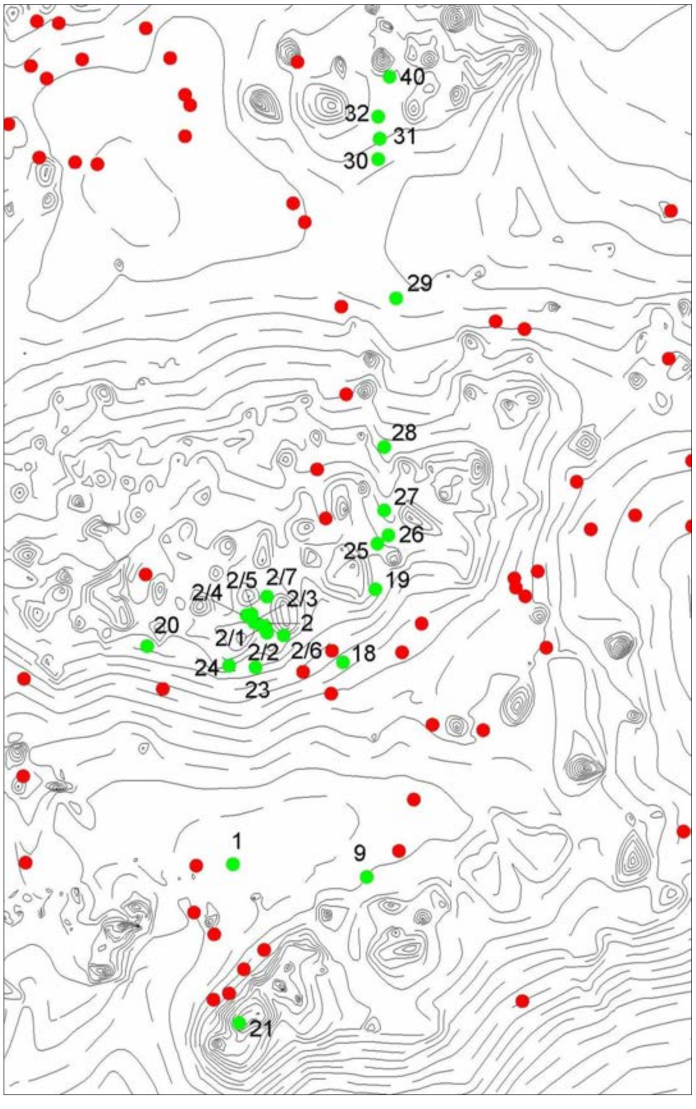


Figure 3.8. Nabta Playa, Site E-06-4. Fragment of hypsometrical map with excavated tumuli. Made by P. Wiktorowicz.

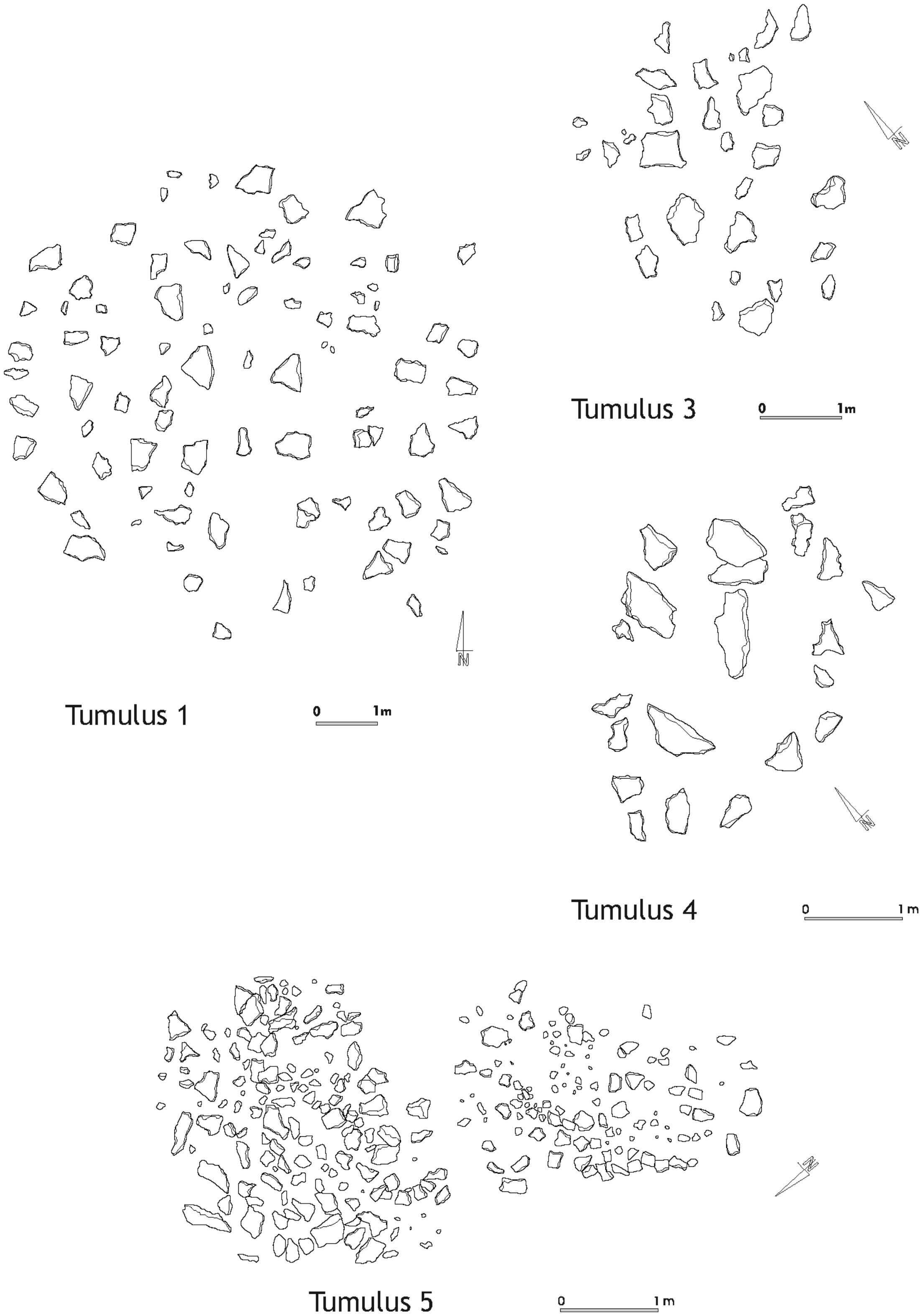


Figure 3.9. Nabta Playa, Site E-06-4. Tumuli 1, 3-5. Drawn by M. Puszkarski, J. Mugaj.

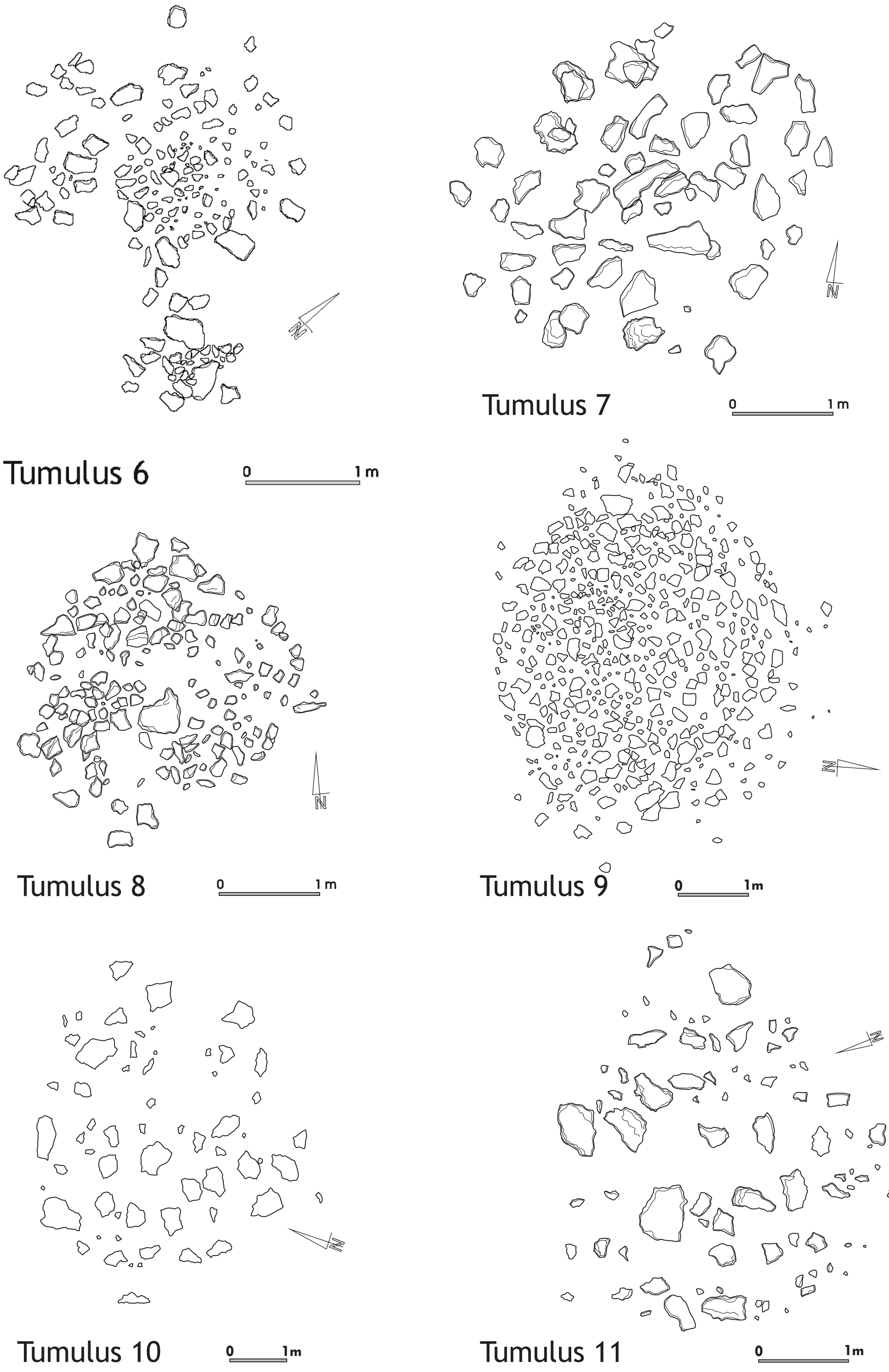


Figure 3.10. Nabta Playa, Site E-06-4. Tumuli 6-11. Drawn by M. Puszkarski, J. Mugaj.

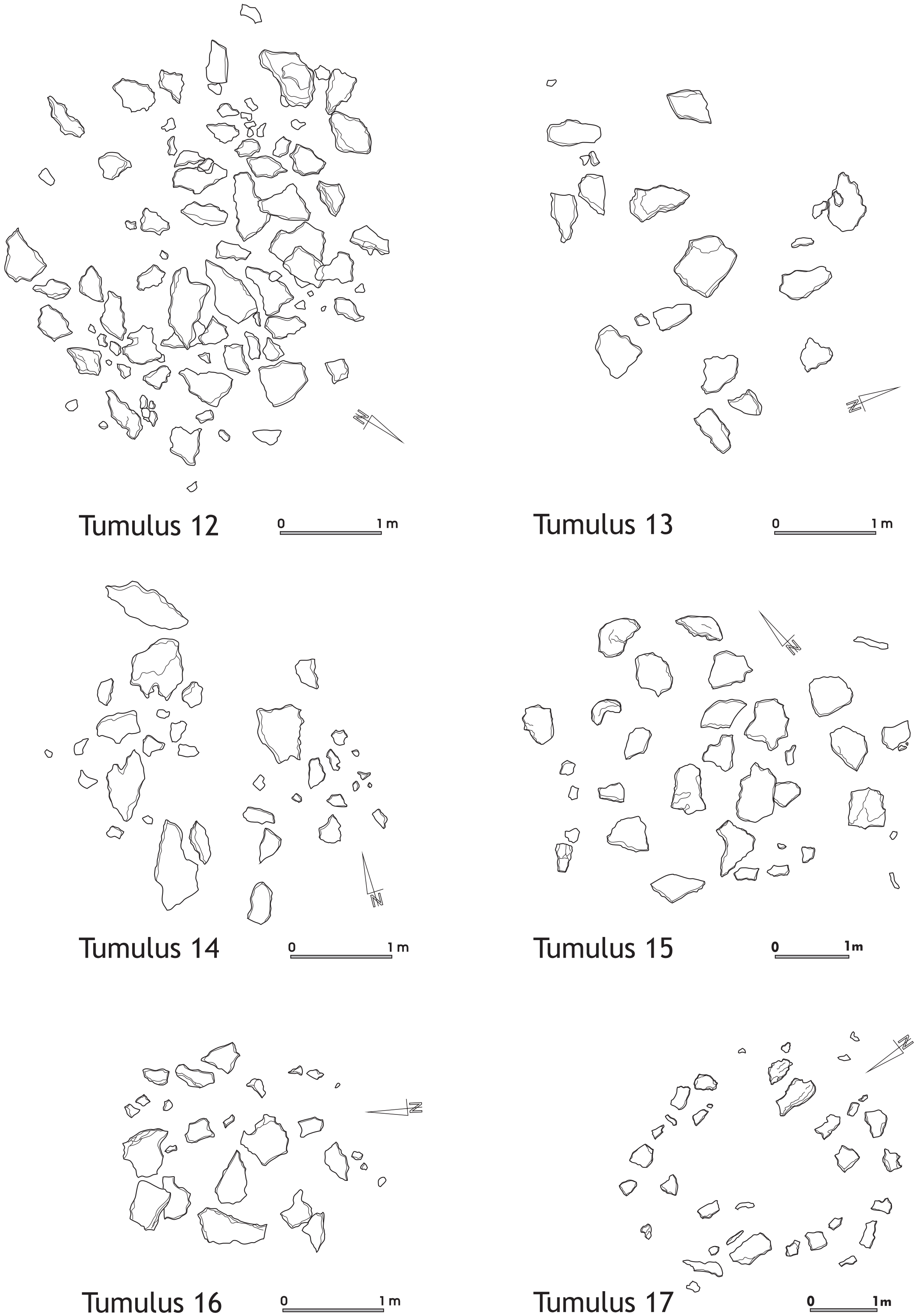


Figure 3.11. Nabta Playa, Site E-06-4. Tumuli 12-17. Drawn by M. Puszkarski, J. Mugaj.

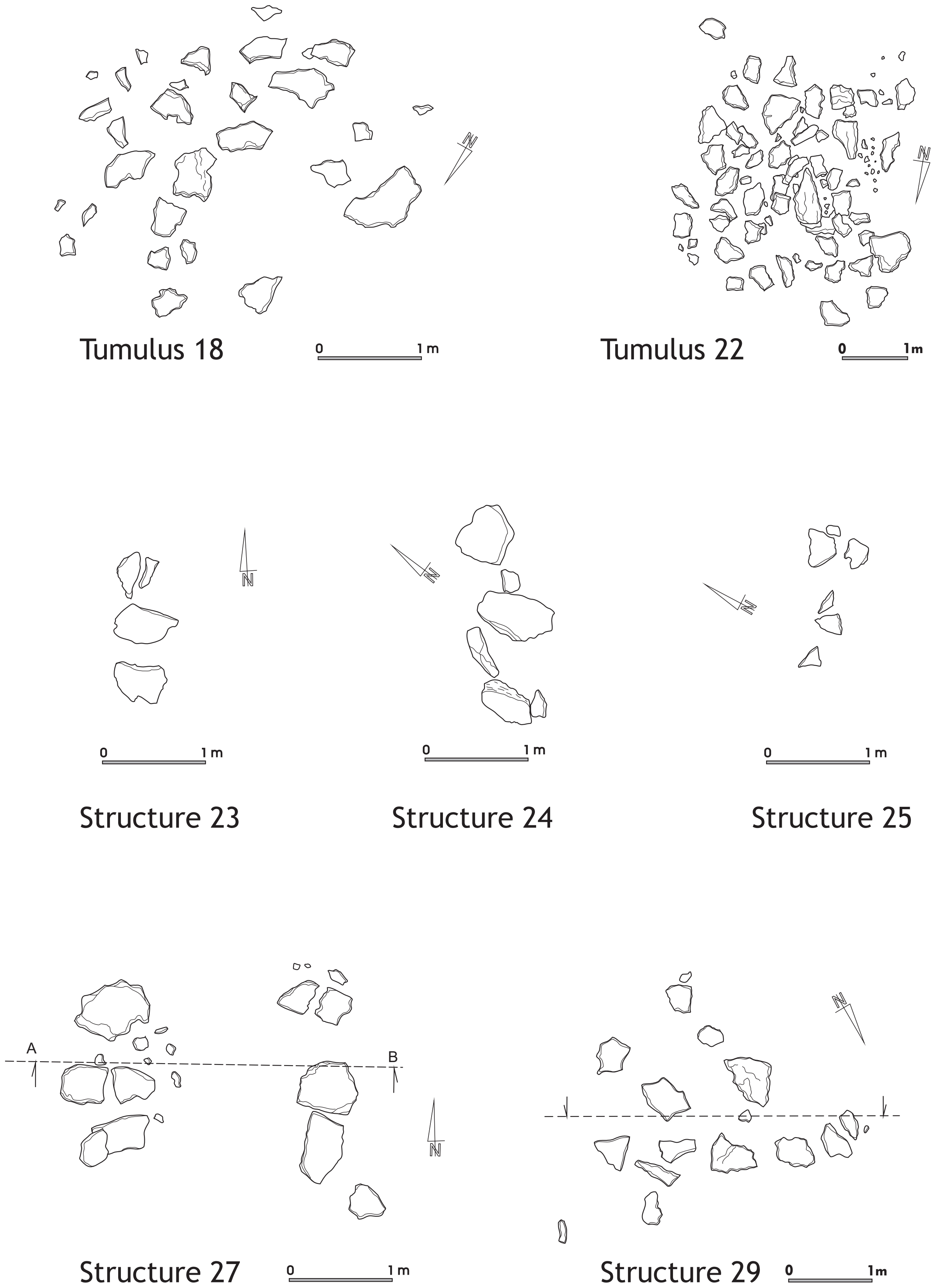


Figure 3.12. Nabta Playa, Site E-06-4. Tumuli 18, 22 and stone structures 23-25, 27, 29. Drawn by M. Puszkarski, J. Mugaj.

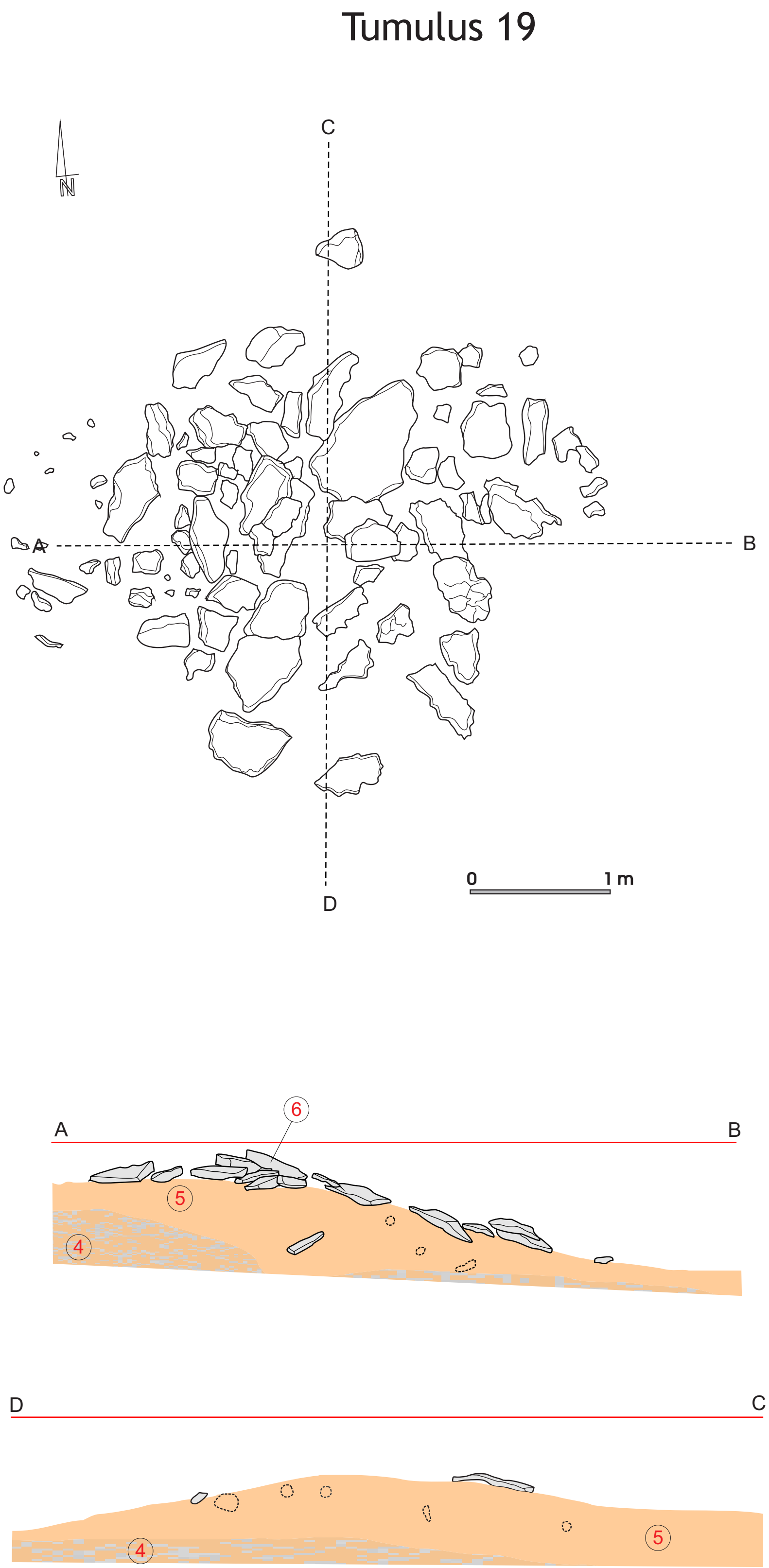


Figure 3.13. Nabta Playa, Site E-06-4. Tumulus 19. 1, 3 - layer of consolidateted, eroded quartzitic sandstone, 2- layer of limonite, 4 - layer of alluval rubble of quartzitic sandstone, 5 - dune sand, 5a - consolidated dune sand, 6 - quartzitic sandstone stone slabs. 7 - animal bones, 8 - berning with charcoals. Drawn by Agnieszka Czekaj-Zastawny, J. Mugaj.

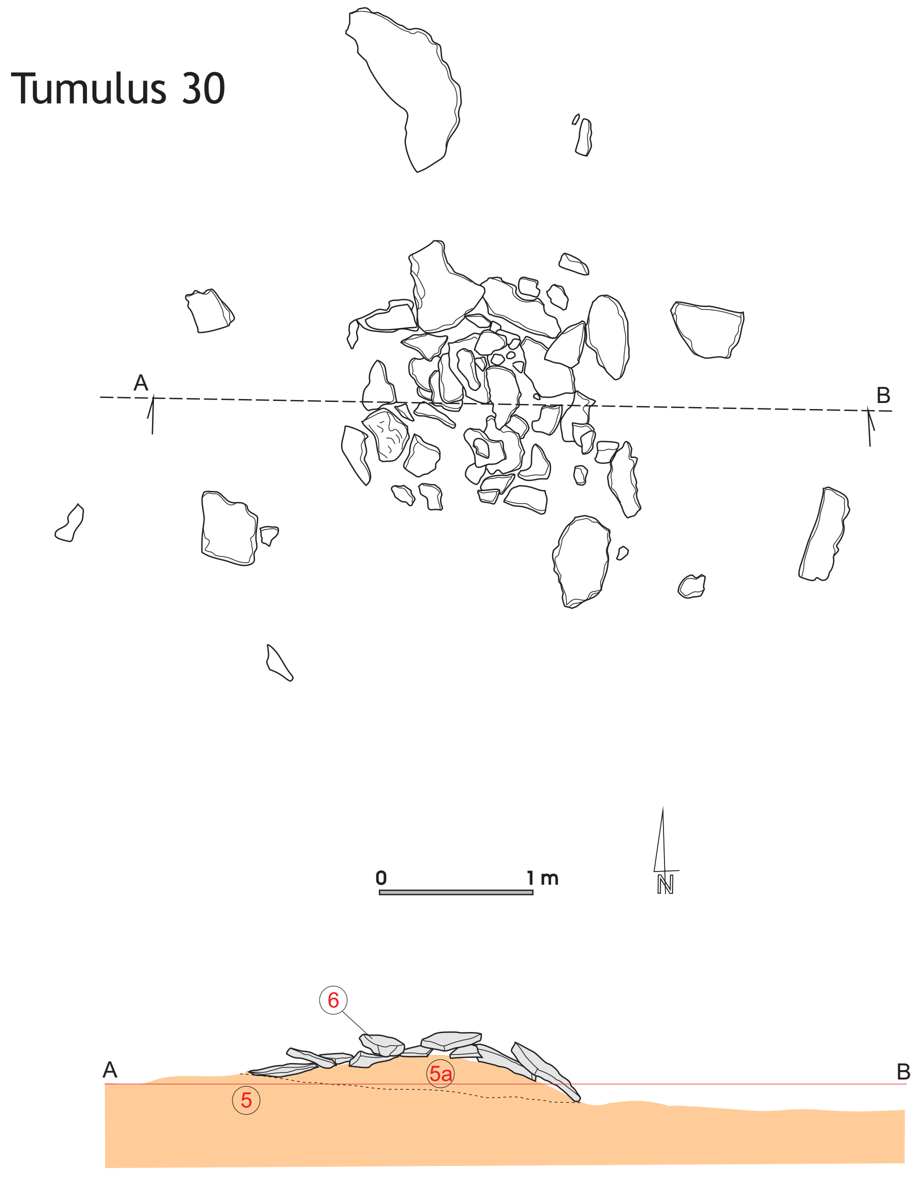


Figure 3.14. Nabta Playa, Site E-06-4. Tumulus 30. Key see figure 3.13. Drawn by A. Czekaj-Zastawny, J. Mugaj.

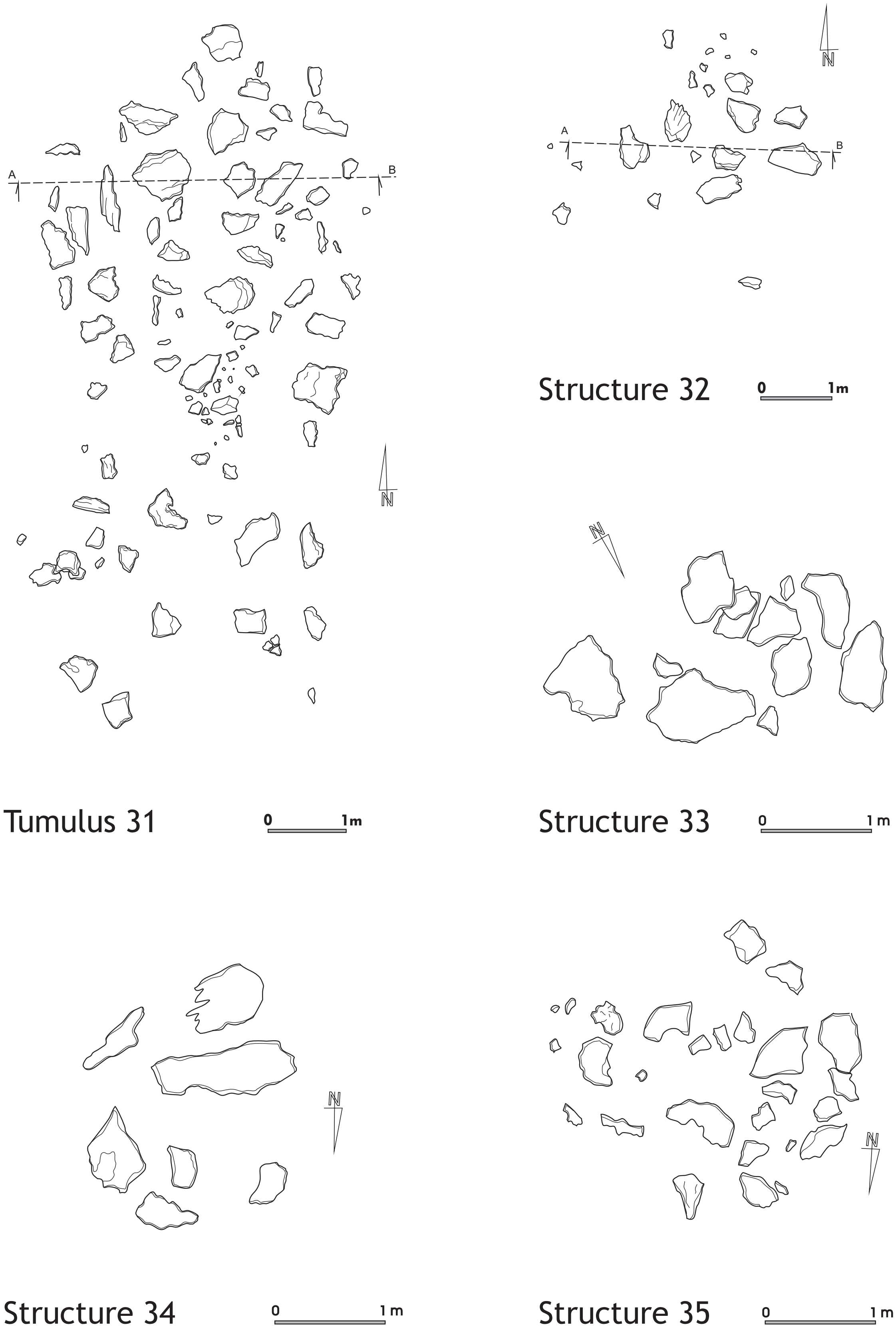


Figure 3.15. Nabta Playa, Site E-06-4. Tumulus 31 and Structures 33- 35. Drawn by. M. Puszkarski, J. Mugaj.

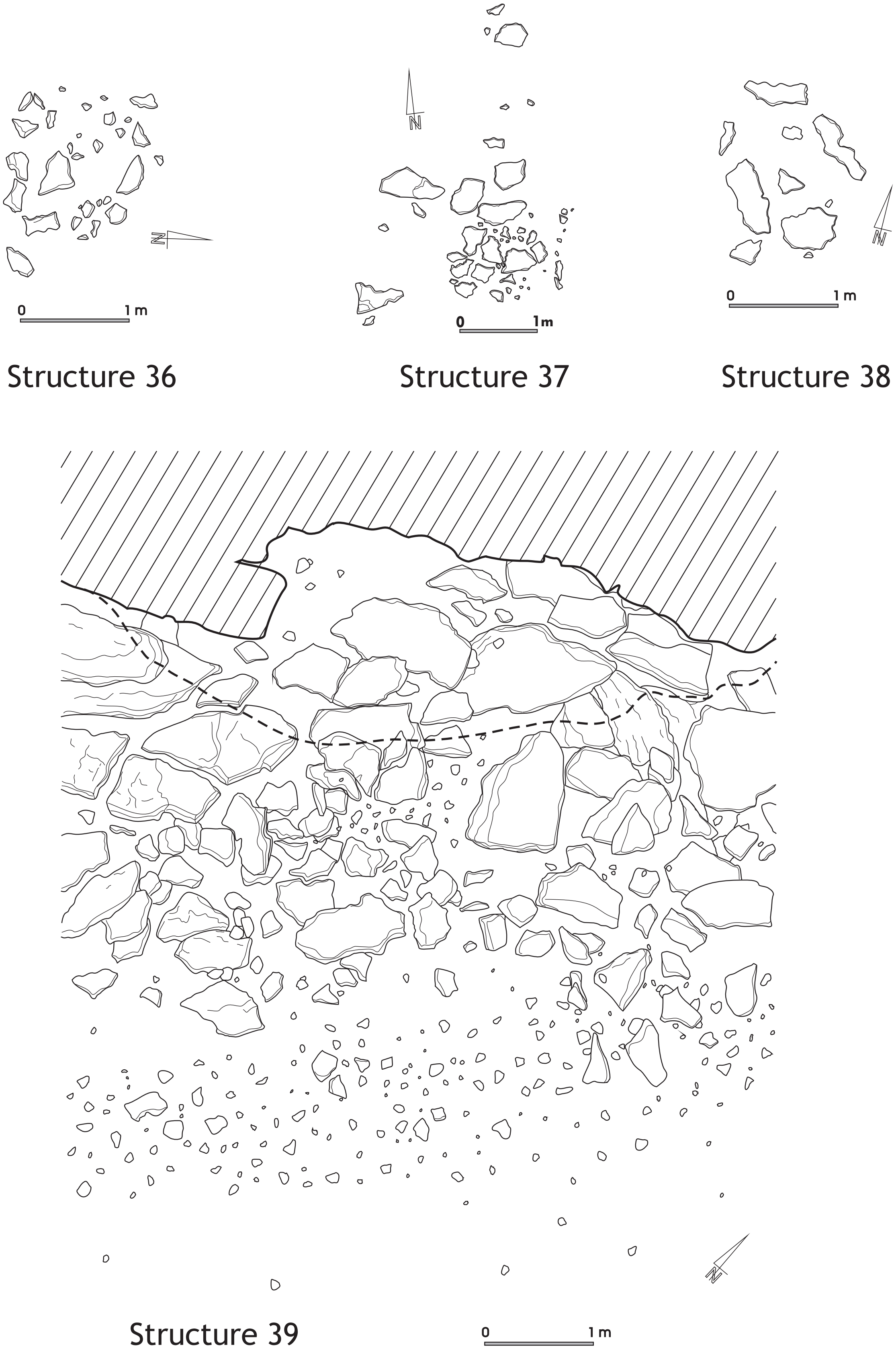


Figure 3.16. Nabta Playa, Site E-06-4. Structures 36-38 and Feature 39. Drawn by M. Puszkarski, J. Mugaj.

4. Excavated tumuli and structures.

During two seasons (2007-2008), 24 stone structures were excavated (Bobrowski *et al.* 2011; 2012; 2014; cf. Fig. 3.8). They were generally located in the middle of the whole zone with stone constructions. Some of them (feature 30-40) were situated somewhat further to the north, in the central part of the plateau, on the hills surrounding the central deflation basin on the east. Pits were found underneath some stone structures (these features will be described in detail below; Table 3.2), but only two of them had artefacts in their fills. On excavation, no pits were found under the majority of the structures examined, nor were any artefacts found (e.g., Tumuli 1, 9, 18, 19, 27, 30, 31, Structure 32; Fig. 3.17). The most interesting of the structures that had no pit underneath was Tumulus 9. This was a mound with a regular circular plan and a diameter of about 500 cm that had been built of a dense concentration of sandstone slabs and heavily burnt irregular stones. Exploration of the feature to a depth of about 40 cm below the surface showed a complete lack of any traces of burnt material and burning of the soil. It is clear that this feature, due to its diameter, regular shape, arrangement of stones, and no traces of burning was not caused by the erosion of a campfire site, but was an intentional construction made of slabs and stones brought from nearby fireplaces.

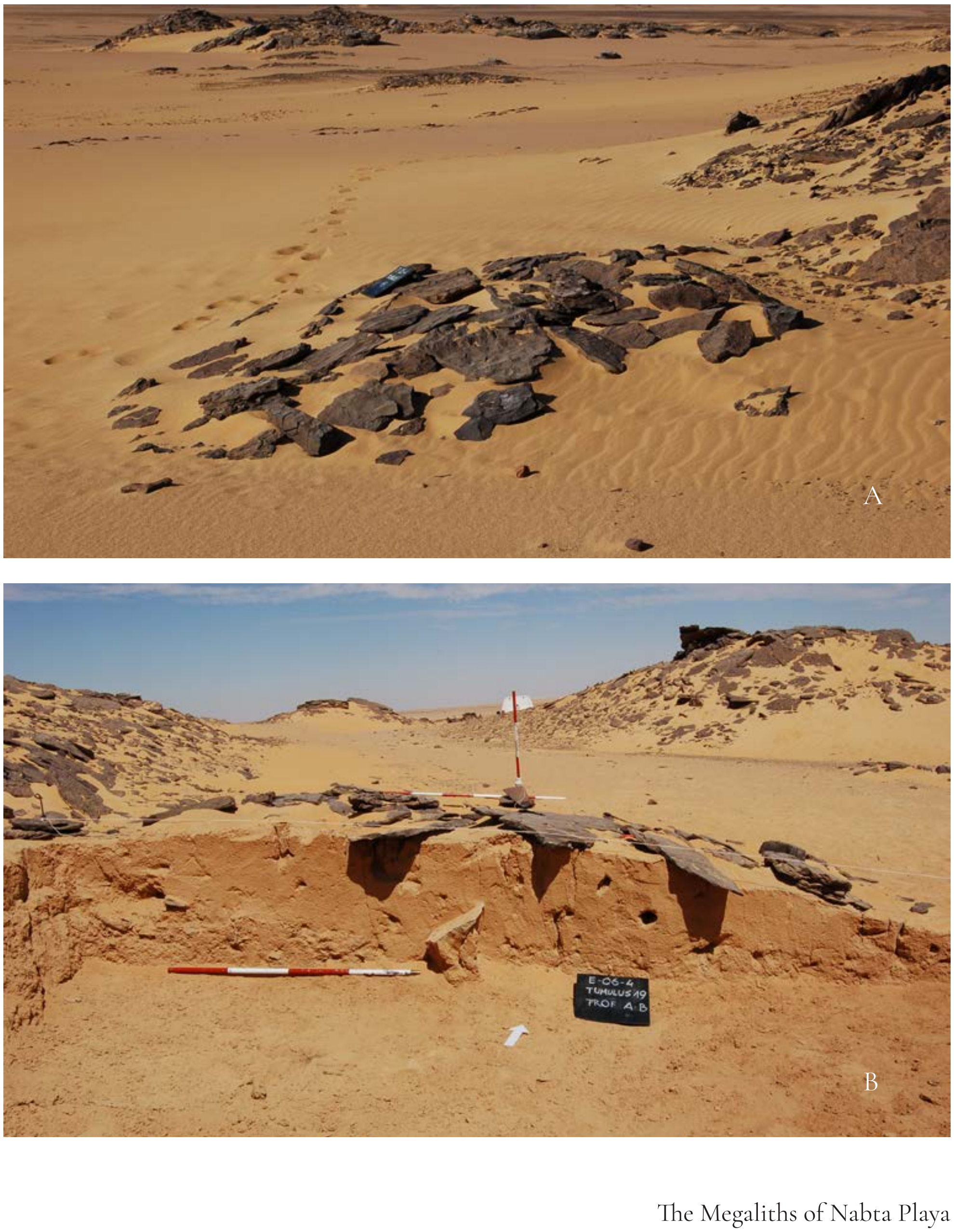


Figure 3.17. Nabta Playa, Site E-06-4. Tumulus 19: A – before exploration, B – profile view. Photo by A. Czekaj-Zastawny.

The main aim of this chapter is to present the most interesting of the excavated features, that is Tumulus 2 and the concentration of several slab-built structures (nos. 2/1, 2/2, 2/3, 2/4, 2/5, 2/6, 2/7) in its immediate surrounding. All are situated on the southern slopes of the southern deflation hollow near the top of the hill, between two small sandstone ridges forming a part of the embayment of the deflation hollow. The structures were formed by low piles and/or pavements of quartzitic sandstone slabs deposited immediately on fossil dune sand. Four of them, 2/1, 2/3, 2/5, 2/7, as well as Tumulus 2, revealed pits under the stones. Several of the slabs, particularly those in the pits or immediately above, had been shaped by knapping.

Tumulus 2

Tumulus 2 had a nearly circular shape and measured about 4 m in diameter. It was some 60 cm high, although its original height could have been considerably greater. It was built of irregular quartzitic sandstone blocks piled on top of and around a pit. Most of the stones were deposited over the central part of the pit. Some of these had collapsed into the pit to rest in the topmost infill at various angles after a presumed original cover had disintegrated. The tumulus was excavated in four quadrants. Two cross-sections have been recorded, along the NS (C-D) and WE (A-B) axes (Fig. 3.18, 3.19; cf. Table 3.1).

An oval pit, measuring 110 x 90 cm, and about 130 cm deep, had been cut through the slightly consolidated dune sand, and a shingle bed consolidated to cemented sandstone (alluvial slope wash), into the underlying weathered, whitish sandstone. The walls are vertical. The pit was filled with weakly consolidated dune sand. There was one sandstone slab, in a diagonal position, in the centre of the shaft. Near the bottom (in the eastern part of the shaft), two microlithic tools occurred; a small short side triangle and a backed bladelet, both made from the Eocene Egyptian flint (Fig. 3.20: 1-2; cf. Table 3.2). From the fill also came one fragment of the shell of a Nile oyster (*Etheria nilotica*) and 18 *Tamarix* charcoal fragments. the latter supplied radiocarbon dates of 6882 ± 113 BC (Poz-20288: 7960 ± 50 BP).

Seven small concentrations of stone slabs were located close to Tumulus 2. One (Structure 2/2) occurred about 2 m to the south of the tumulus. The remaining four were placed along a straight line to the west of the tumulus at a distance of 1 m (Structure 2/1), at about 3 m (Structure **2/3)**, and at about 8 m (Structure **2/4** and **2/5)** from the tumulus. About 5 m to the east was located Structure 2/6, and about 10 m to the north – Structure **2/7** (cf. Fig. 3.4, 3.5).

Structure 2/1

Structure 2/1 consisted of a concentration of quartzitic sandstone slabs laid in an approximately circular arrangement with a diameter of 140 cm and a height of 40 cm (cf. Fig. 3.18, 3.19; Fig. 3.21; cf. Table 3.1). The structure was dissected along the A-B cross-section line of Tumulus 2 (cf. Fig. 3.6). Under the pavement of sandstone slabs, a regular pit appeared, sunk into the sandstone shingle bed. The pit was oval in shape, measuring 85 x 70 cm, and reached about 100 cm in depth; the walls were vertical. It contained weakly consolidated dune sand and two levels of thin sandstone slabs arranged in box-like structures, whose sides had been placed at an angle to the horizontal stone slabs forming their bases. At the bottom of the pit, four microlithic tools were found; two triangles with a small short side and two backed bladelets (Fig. 3.20: 3-6; cf. Table 3.2). In the fill were also found 12 fragments of long bones of a ruminant (antelope/gazelle?) and 12 charcoal fragments (*Tamarix*). From the animal bone (carbonate) were obtained radiocarbon dates – 6053 ± 27 BC (Poz-20665: 7190 ± 40 BP).

Figure 3.18. Nabta Playa, Site E-06-4. Tumulus 2 and Structures 2/1-2/7. General view of excavated features. Drawn by M. Puszkarski, K. Sawicki.

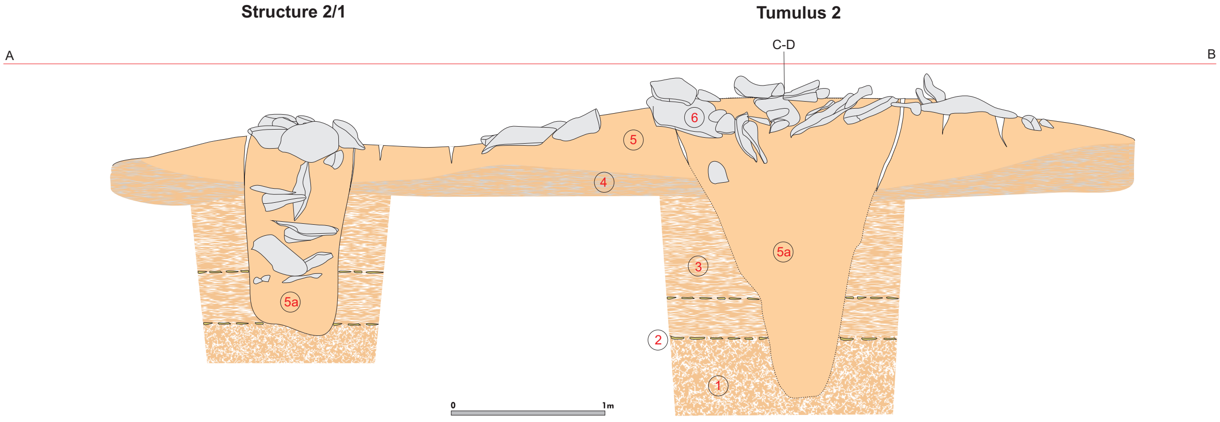


Figure 3.19. Nabta Playa, Site E-06-4. Profile of Tumulus 2 and Structure 2/1. Key see figure 3.13. Drawn by A. Czekaj-Zastawny, K. Sawicki.

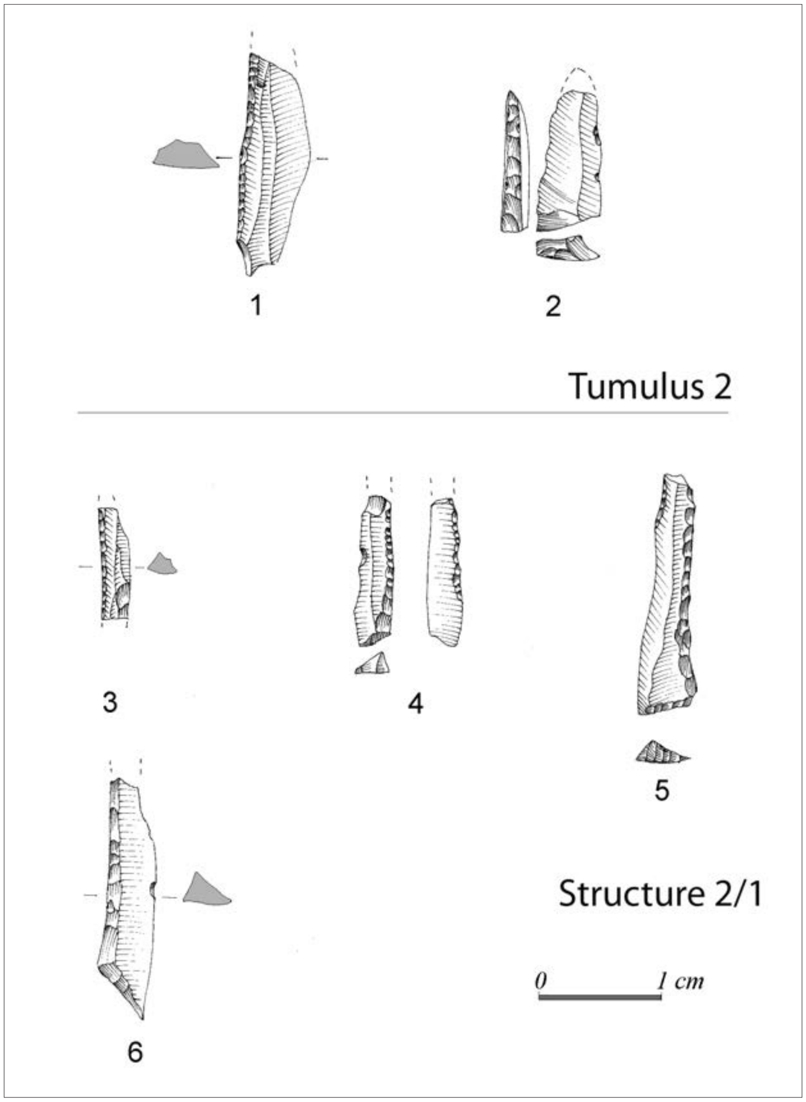


Figure 3.20. Nabta Playa, Site E-06-4. Microlithic tools from Tumulus 2 (1, 2) and Structure 2/1 (3-6). Drawn by M. Puszkarski.

Structure 2/3

This is a concentration of quartzitic sandstone slabs positioned in an irregular feature, approximately oval in plan and measuring about 200 x 150 cm (cf. Fig. 3.18; cf. Table 3.1). There was a pit under the slabs, oval in shape, measuring 90 x 70 cm. The pit was covered by a single, horizontal stone slab (Fig. 3.22). In the cross section along the west-east line, the pit has a vertical wall and an irregular one. It was filled with weakly consolidated dune sand. About 20 cm below its top, two diagonal stone slabs were placed. At a depth of 120 cm, a vertical, thin slab divided the pit into two parts. A small cavity was observed in the northern part of the flat bottom of the pit, at about 125 cm from its top. It had a lens-like shape and measured 25 x 10 cm, with a depth of about 25 cm. No artifacts were found. However, in the feature fill were found three ruminant tooth fragments (*Gazella dorcas*) and 5 charcoal fragments (*Tamarix*). Radiocarbon dates were obtained from the charcoal – 6922 ± 89 BC (Poz-20315: 7990 ± 40 BP; cf. Table 2).

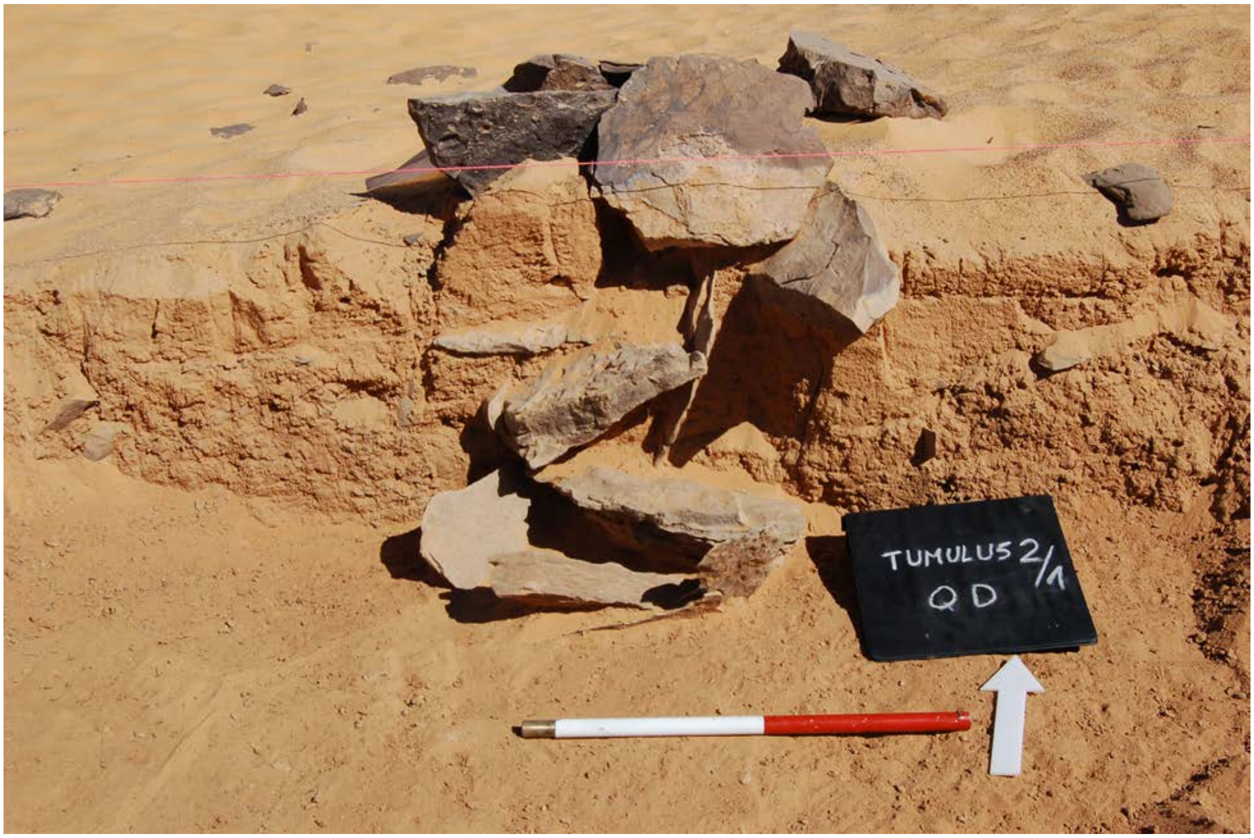


Figure 3.21. Nabta Playa, Site E-06-4. Profile of Structure 2/1. Photo by A. Czekaj-Zastawny.

Structure 2/5

Structure 2/5 was made of quartzitic sandstone. On the surface it had an elongated shape, with slabs in a diagonal position, creating a sloping roof measuring about 2.5 m long, and about 50 cm high (cf. Fig. 3.18; cf. Table 3.1). The mound of the tumulus contained yellowish dune sand, quartzitic sandstone slab constructions, and two levels of stone slabs. The arrangement of these slabs created container-like forms, both covered by a single stone slab that lay in a horizontal position. Under the surface stones the top of the pit was observed (Fig. 3.23, 3.24). In plan, the feature was oval in shape (110 x 80 cm). The pit contained weakly consolidated dune sand. A small cavity was observed in the northern part of the feature in the flat bottom of the pit (about 120 cm from the top of the feature). It had a lens shape and measured 15 x 10 cm, with a depth of about 20 cm. No stone artifacts were found – just six fragments of gazelle teeth (*Gazella dorcas*); (cf. Table 3.2).

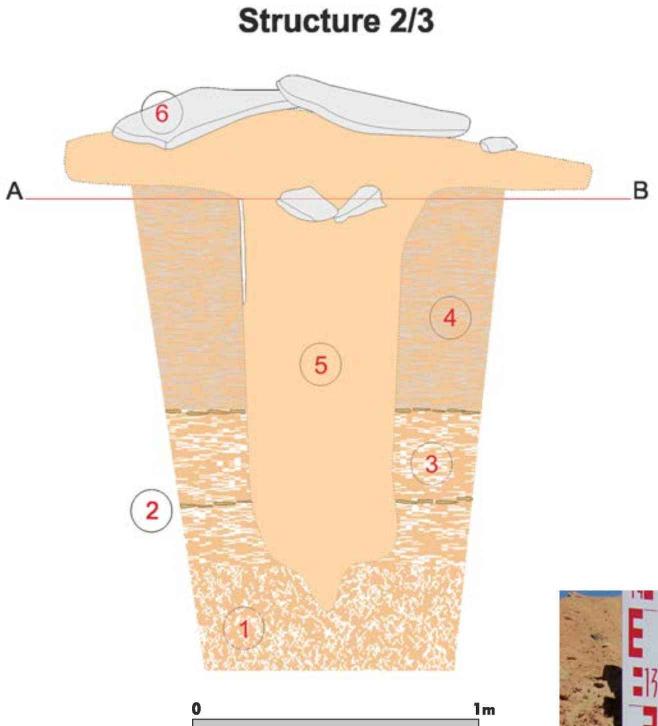


Figure 3.22. Nabta Playa, site E-06-4. Profile of Structure 2/3. Key see figure 3.13. Drawn by A. Czekaj-Zastawny, K. Sawicki.

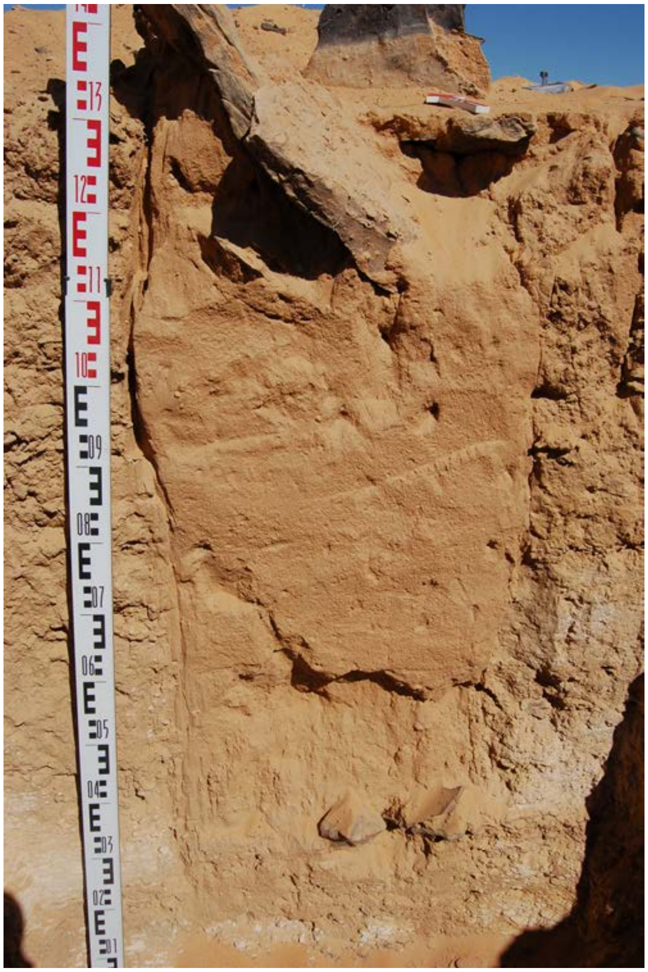


Figure 3.23. Nabta Playa, Site E-06-4. Profile of Structure 2/5. Photo by P. Bobrowski.

Table 3.2. Nabta Playa, Site E-06-4 – Gebel El Muqaddas. The characteristics of the more interesting features examined archaeologically.

E-06-4, Tumulus 2 with associated Structures and Tumuli 26, 28, 40											
Units	Tumulus 2	Structure 2/1	Structure 2/2	Structure 2/3	Structure 2/4	Structure 2/5	Structure 2/6	Structure 2/7	Tumulus 26	Tumulus 28	Tumulus 40
Stone cover	X	X	X	X	X	X	X	X	X	X	X
Pit	X	X	-	X	-	X	-	X	X	X	X
Slab construction inside pit	-	X	-	X	-	X	-	-	X	-	X
Lithics	1 triangle and 1 backed bladelet)	2 triangles and 2 backed bladelets	-	-	-	-	-	-	-	-	-
Animal remains	1 fragment of a shell of Nile oyster (*Etheria nilotica*)*	12 fragments of long bones of a ruminant (antelope/ gazelle?)*	-	3 tooth fragments of a ruminant (*Gazella dorcas*)*	-	6 tooth fragments of a ruminant (*Gazella dorcas*)*	-	-	-	-	-
Plant remains	18 charcoal fgts (*Tamarix*)**	12 charcoal fgts (*Tamarix*)**	-	5 charcoal fgts (*Tamarix*)**	-	-	-	-	-	-	-
^{14}C dates	7960 ± 50 BP (Poz-20288) (carbon)	7190 ± 40 BP (Poz-20665) (carbonate)	-	7990 ± 40 BP (Poz-20315) (carbon)	-	-	-	-	-	-	-

* Analyses by M. Osypińska; ** Analyses by M. Lityńska-Zając

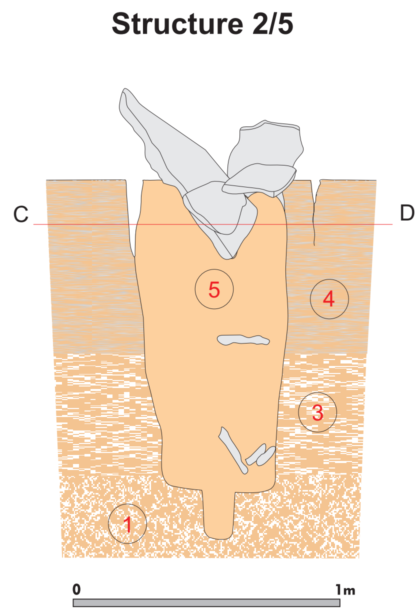


Figure 3.24. Nabta Playa, Site E-06-4. Profile of Structure 2/5. Key see figure 3.13. Drawn by A. Czekaj-Zastawny, K. Sawicki.

Structure 2/7

Structure 2/7 was made of quartzitic sandstone slabs forming an oval shape measuring about 300x180 cm in diameter and about 30 cm in height (cf. Fig. 3.18; Table 3.2; cf. Table 3.1). Visible under the mound (slope wash sandstone) was a shaft (Fig. 3.25, 3.26). It was oval in plan, measuring 70 x 50 cm in diameter and just about 25 cm in depth. In cross section the pit had a basin-shaped form. No stone artifacts were found.

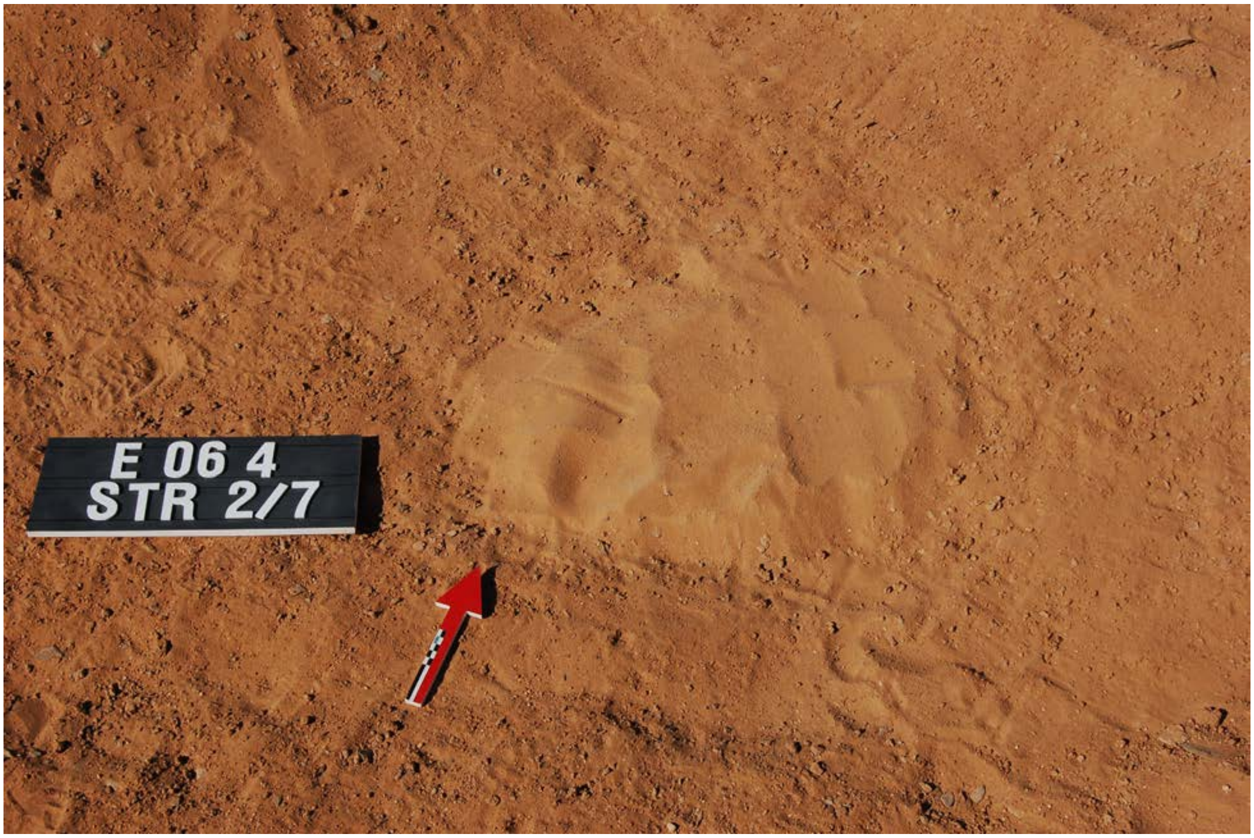


Figure 3.25. Nabta Playa, Site E-06-4. Profile of Structure 2/7. Photo by P. Bobrowski.

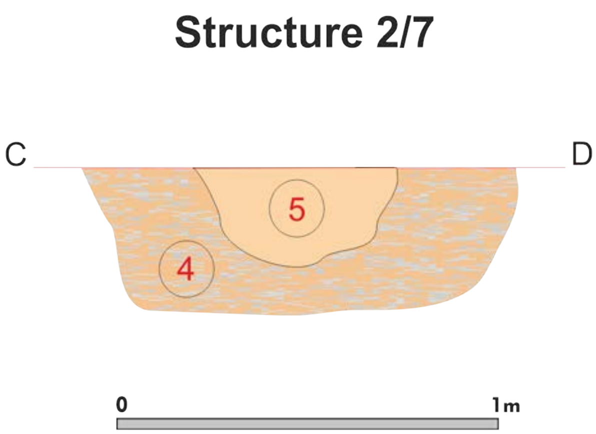


Figure 3.26. Nabta Playa, Site E-06-4. Profile of Structure 2/7. Key see figure 3.13. Drawn by A. Czekaj-Zastawny, K. Sawicki.

Structures 2/2, 2/4 and 2/6 (cf. Fig. 3.18, Table 3.1, 3.2)

Under the stones forming two separate slab pavements, no traces of pits were found at the level of the slope wash, perhaps suggesting that the slab pavements were already in a flat position. Structure 2/2 had a circular shape, measuring about 100 cm in diameter and was about 10 cm high, Structure 2/4 was of about 100 cm in diameter and measured some 10 cm in height, while Structure 2/6 had an elongated shape, 250 cm x 100 cm.

Features of analogical construction, consisting of a pile of stone slabs covering a pit (Tumuli 26, 28 and 40), were recorded north and northeast of the complex of structures associated with Tumulus 2.

Tumulus 26

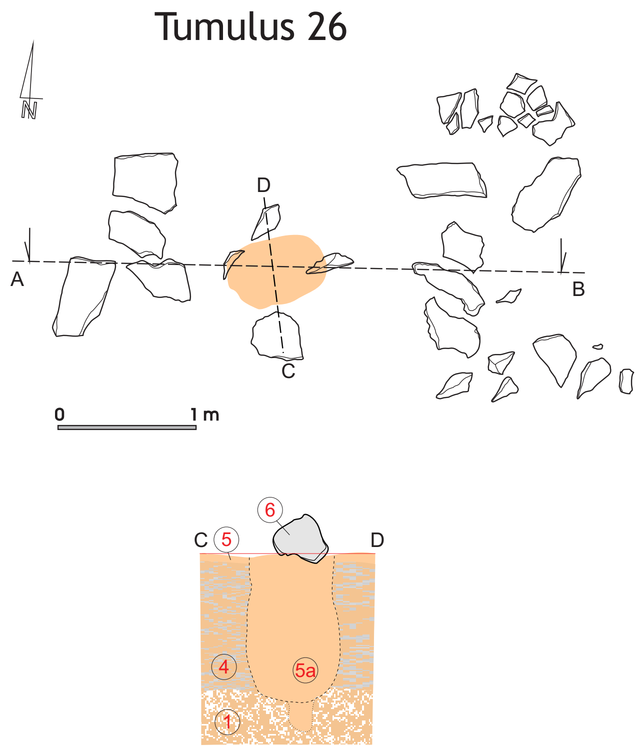
The feature is located about 100 m to the NE of the previously described complex around Tumulus 2. The stone structure visible on the surface, made of a dozen or so quartzite sandstone plates, had a very irregular, elongated shape with dimensions of approximately 400 x 250 cm and a height of 30 cm (Fig. 3.27; cf. Table 3.1, 3.2). This is certainly associated with the erosion of the mound, which probably originally had a compact, circular shape. Under the stone outer layer in the centre of the feature, a pit with an oval outline, measuring 75 x 55 cm, was found cut into the underlying layer of moderately consolidated, weathered quartzite sandstone. A single sandstone slab stood in the upper part of the fill of the pit in an upright position. In the vertical section, the cavity had a baggy shape and a depth of about 105 cm. The feature fill was weakly consolidated dune sand. In the flat bottom of the pit was observed a small depression lenticular in plan, with dimensions of 20 x 15 cm and a depth of 35 cm. No artifacts were found in the feature.

Tumulus 28

The feature was located about 50 m north of Tumulus 26. The surface of the stone mound had a regular circular shape about 350 cm in diameter and 40 cm in height (Fig. 3.27; cf. Table 3.1, 3.2). The pit was found under the stone mound and a layer of consolidated dune sand with a thickness of 20 cm. It was dug into a layer of weathered quartzite sandstone. The top of the pit had a circular plan of with a diameter of 60 cm. In profile the feature had the shape of a deep basin and a depth of 40 cm. The pit contained weakly consolidated dune sand. No stone artifacts were found.

Tumulus 40

Tumulus 40 is located at the foot of a small quartzite sandstone outcrop located in the central part of Gebel El Muqaddas. In plan it was of circular shape and had a diameter of about 400 cm and a height of about 35 cm (Fig. 3.28-3.30; cf. Table 3.1, 3.2). The mound of the tumulus contained yellowish dune sand and quartzitic sandstone slabs. Most of the stones were centred on top of the mound. Some of the stone slabs had fallen into the pits and were resting at an angle to the ground surface embedded in the pit fill. Under the mound, at the level of the slope wash and sandstone the shaft was visible. It was circular in shape, measuring 65 cm in diameter. In profile, the shaft had vertical sides and was about 70 cm deep in the main part. At the flat bottom of the pit (in the central part) there was a small cavity. It had an almost circular shape and measured 20 cm in diameter, with a depth of about 30 cm. The top of this hole was covered by few stone slabs. The shaft contained weakly consolidated dune sand. No artifacts were found.



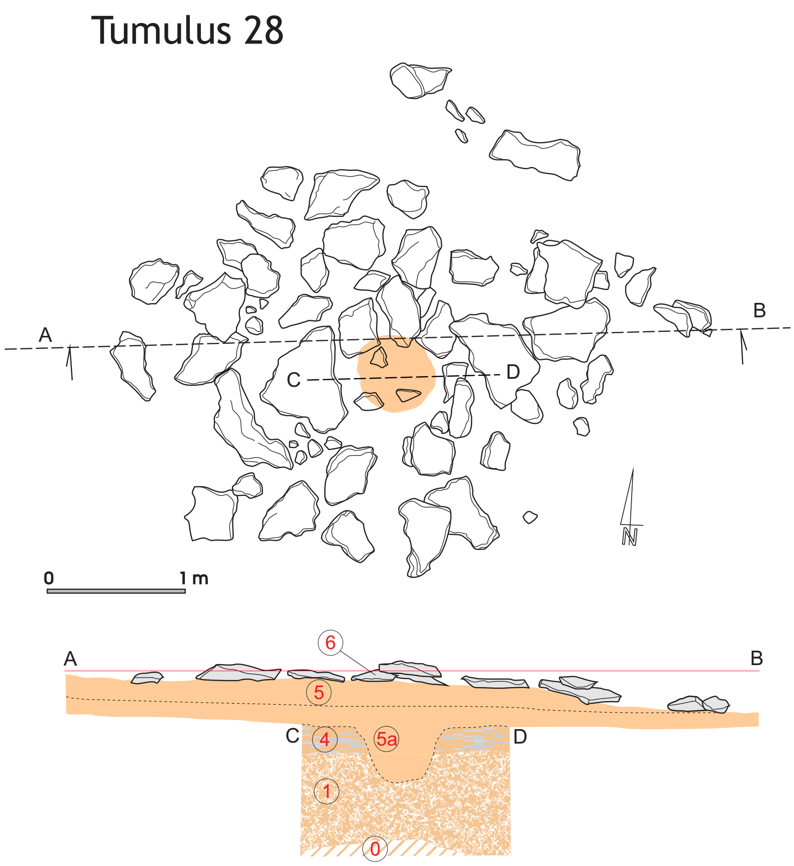


Figure 3.27. Nabta Playa, Site E-06-4. Tumuli 26, 28. Key see figure 3.13. Drawn by A. Czekaj-Zastawny, J. Mugaj.

Generally, eight structures (nos. 2, 2/1, 2/3, 2/5, 2/7, 26, 28, 40) included relatively deep pits, similar to shafts cut into the cemented layer of quartzitic sandstone, filled with consolidated dune sand and covered by sandstone slabs (cf. Table 3.2). Features nos. 2/1, 2/3 and 2/5 contained constructions made of stone slabs, dividing the interior into smaller parts. Animal remains (fragments of long bones and gazelle teeth) and charcoal (*Tamarix* L.) were found in four pits. In two cases (Tumulus 2 and Structure 2/1) the pits contained microlithic tools – functional arrowheads. Moreover, half of a Nile oyster was found in one of the pits.

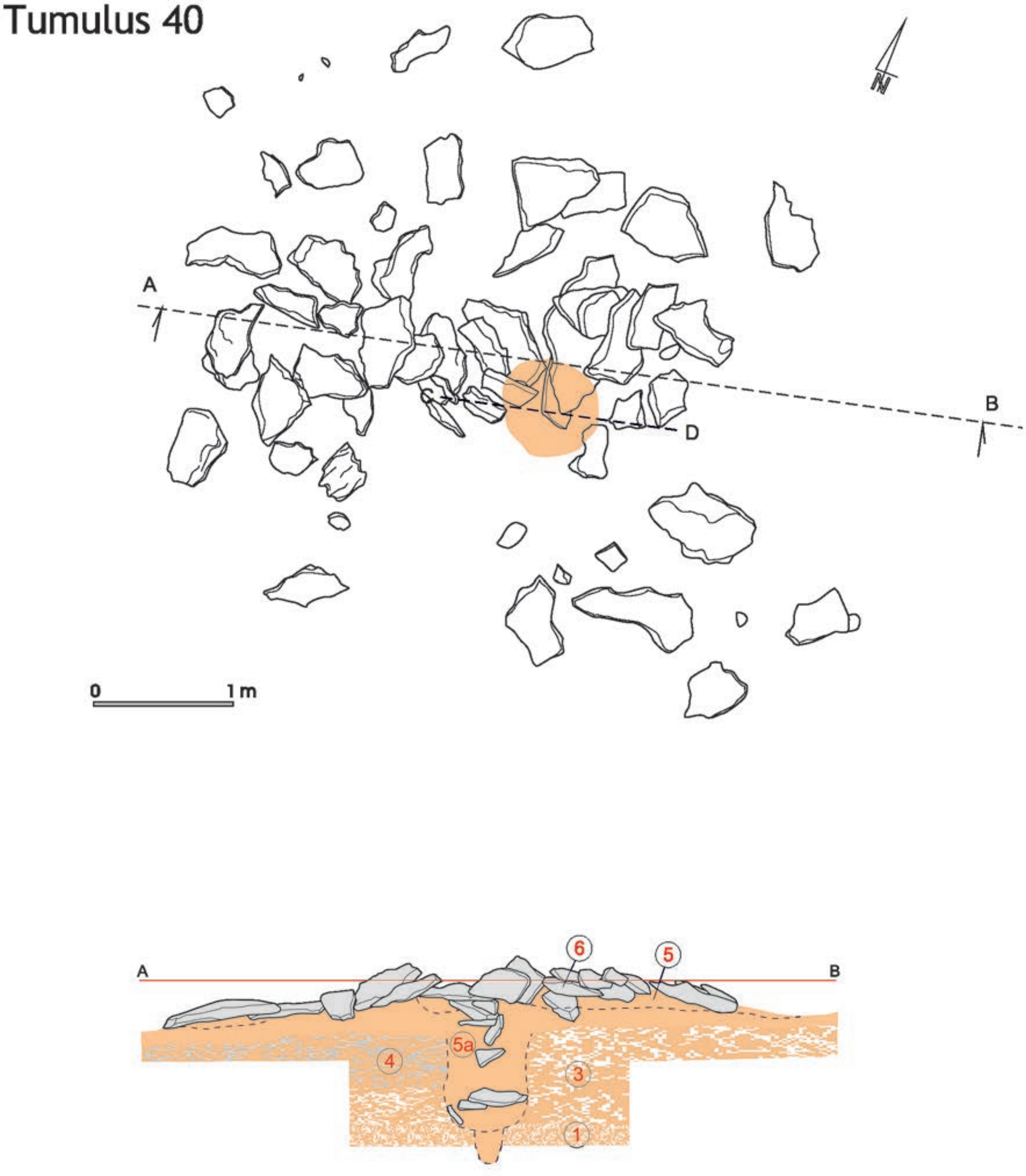


Figure 3.28. Nabta Playa, Site E-06-4. Tumulus 40. Key see figure 3.13. Drawn by A. Czekaj-Zastawny, J. Mugaj.

▲ **Figure 3.29.** Nabta Playa, Site E-06-4. Tumulus 40. Top of the pit. Photo by P. Bobrowski.

◄ **Figure 30.** Nabta Playa, Site E-06-4. Tumulus 40. Small cavity on the bottom of the pit. Photo by P. Bobrowski.

6. Other features in the area of the site.

Feature 21

The summit of the most exposed elevation forming the southern edge of Gebel El Muqaddas was a solid block of quartzite sandstone topped with a flat slab (Fig. 3.31). In the middle of the slab, in a small hollow formed in the place of internal cracks, fossilized fragments of long bones of gazelles (*Gazella dorcas*; Fig. 3.32, 3.33) were found. They were covered with several larger plates and stones, which indicates the intentional deposition of a fragment of a hunted animal. The radiocarbon date made on the basis of the carbonate fraction of these bones is 5204 ± 80 BC (Poz 20418: 6240 ± 40 BP).

Figure 3.31. Nabta Playa, Site E-06-4. Feature 21. The sandstone hill, topped by flat slab with fossilized bones: A – view from a distance, B – the arrow indicates the location of the gazelle's bones. Photo by P. Bobrowski.

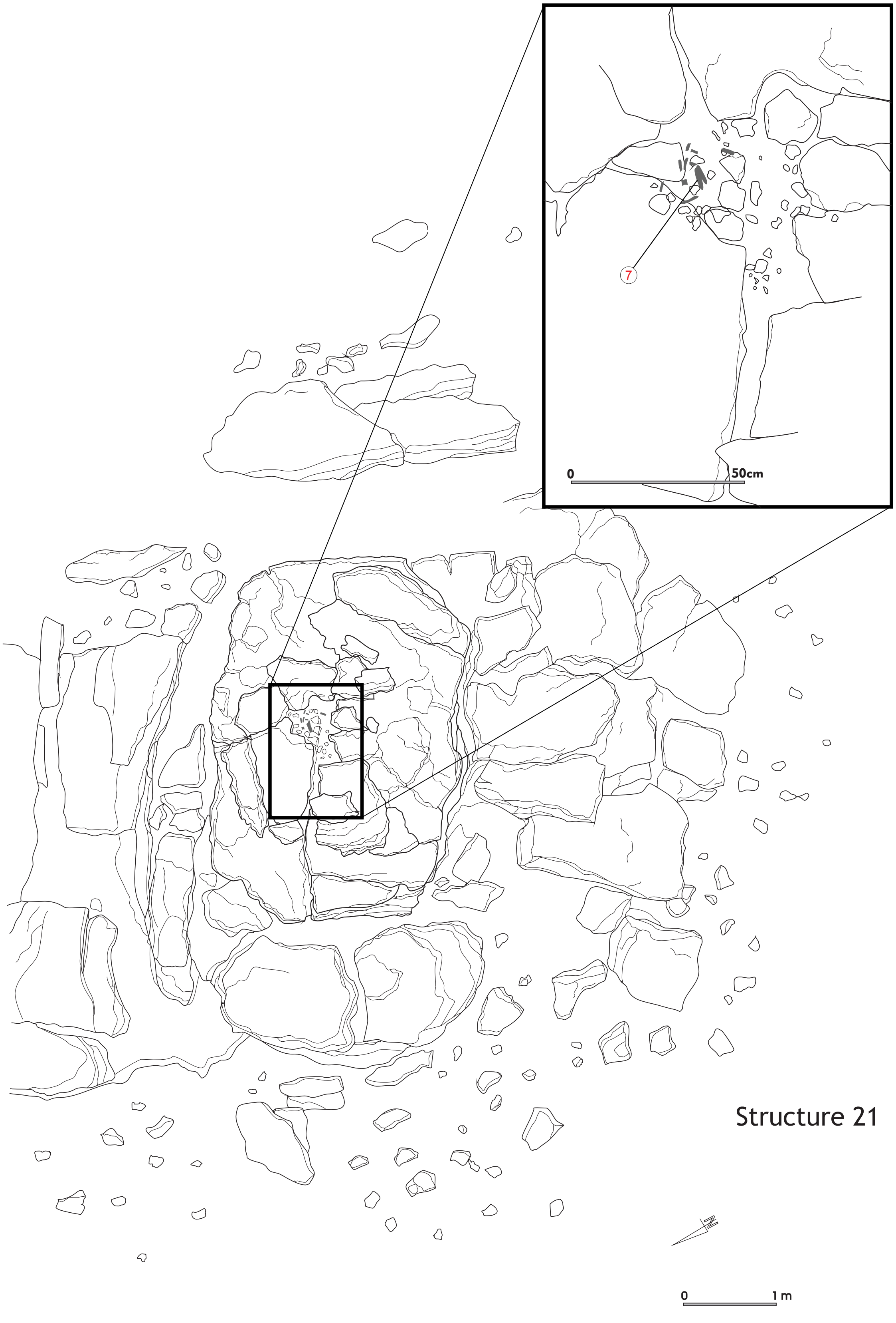


Figure 3.32 Nabta Playa, Site E-06-4. Feature 21. Small depression with fossilized bones of gazelle. Drawn by A. Czekaj-Zastawny, J. Mugaj.

Figure 3.33. Nabta Playa, Site E-06-4. Feature 21. Zoom in on the small depression with fossilized bones of gazelle. Photo by A. Czekaj-Zastawny.

Concentration of hearths

As mentioned earlier, in the centre of Gebel El Muqaddas, in the southern part of the largest deflation basin (with an area of nearly 4 ha), numerous overlapping hearths have been observed (Fig. 3.34). All these features were strongly eroded and in most cases devoid of organic debris (charcoal). On the surface they appear as slightly elevated clusters of strongly-burnt stones with the gaps between them filled with dune sand; the cracked stones and sandstone slabs form regular circular structures. Most were about 2-3 meters in diameter. One such fireplace (Hearth 1/07) was explored. In this feature, which was an area about 220 cm in diameter, the stones were arranged densely, forming a circular outline. In the vertical section, the feature had the shape of a small mound about 40 cm high. Under the layer of stones, in the central part, a very thin but distinct layer of burning with charcoal was observed (Fig. 3.35, 3.36). From the sample taken, the date 5783±42 BC (Poz 20316: 6890±40 BP) was obtained. Two more possible fireplaces (Hearth 2/07 and 3/07), spaced respectively about 20 and 50 m to the east, had a similar form and size on the surface. However, no traces of burned soil, charcoal, or artifacts were recorded during their investigation.

In the central part of the largest campfire complex, a geological section – Trench 1/07 was also established. The excavation had the dimensions of 9 x 1 m. In the northern profile the following layering was observed: The bedrock was made of solid quartzite sandstone (0), above it there were eroded sandstone layers with different consolidation (1, 3) and alluvial quartz sandstone debris layer (4). The top layer was made of sand dune. There were fragments of burned stones and sandstone slabs associated with the hearths on the surface (Fig. 3.37, 3.38).

Three tools made of Egyptian flint were found (in various places) on the surface or around the hearths. These were pieces with continuous retouch that had been flaked from single-striking platform cores (Fig. 3.39).

Figure 3.34. Nabta Playa, Site E-06-4. The Hearths Area. Drawn by M. Puszkarski, J. Mugaj.

Figure 3.35. Nabta Playa, Site E-06-4. Hearth 1/07. Photo by A. Czekaj-Zastawny.

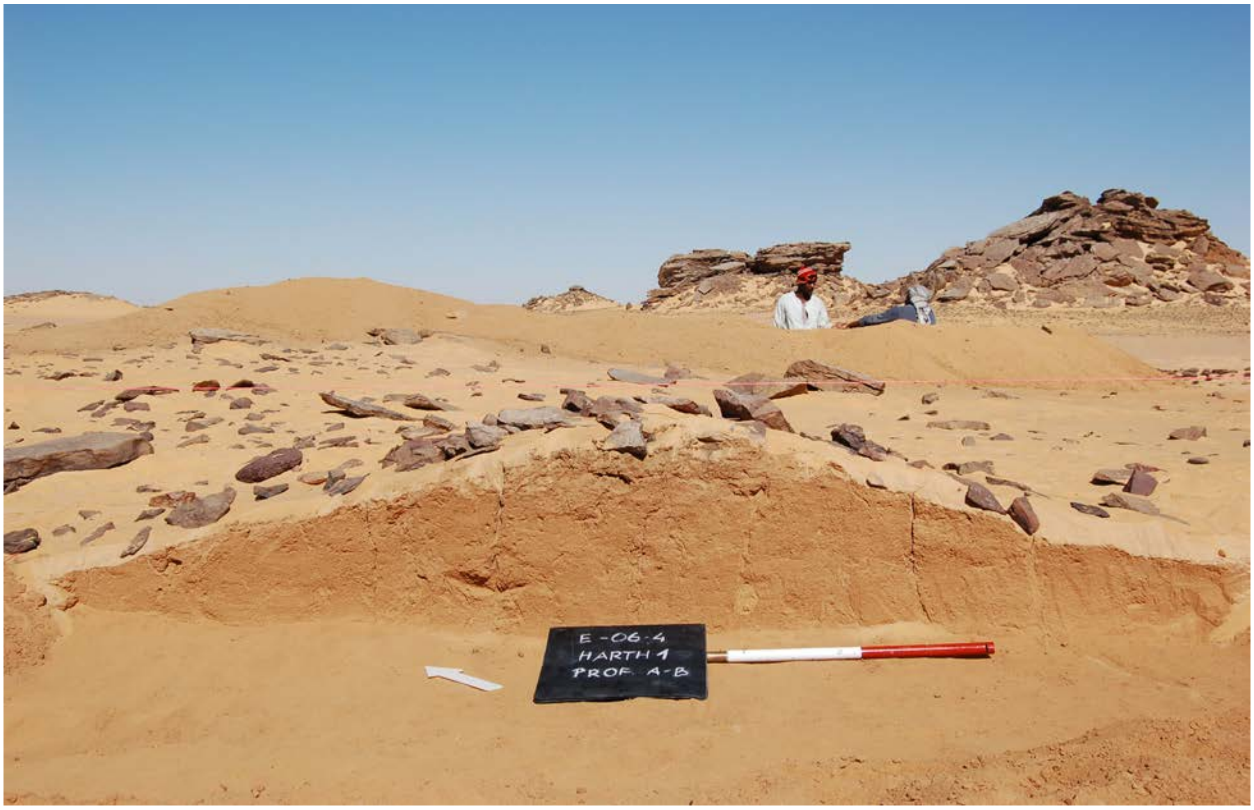


Figure 3.36. Nabta Playa, Site E-06-4. Profile of Hearth 1/07. Photo by A. Czekaj-Zastawny.

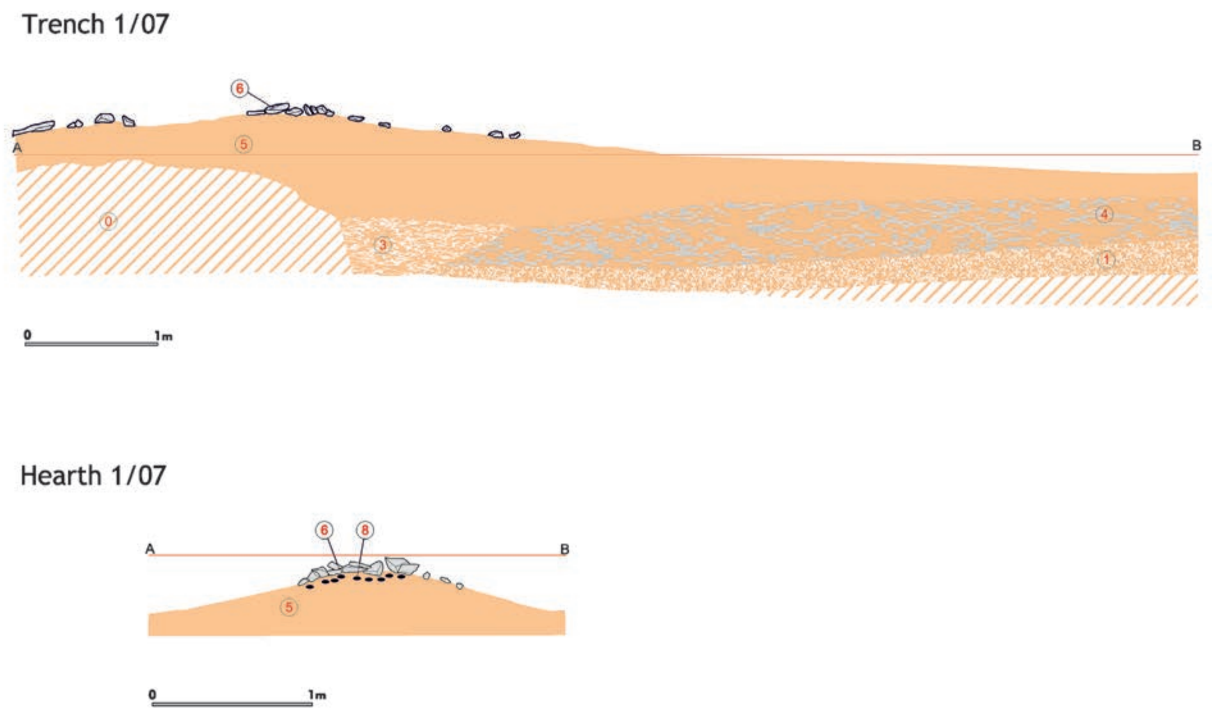


Figure 3.37. Nabta Playa, Site E-06-4. Profile of Geological Trench 1/07 and Hearth 1. Key see figure 3.13. Drawn by R. Schild, A. Czekaj-Zastawny, J. Mugaj.

Figure 3.38. Nabta Playa, Site E-06-4. Geological Trench 1/07. Photo by P. Bobrowski.

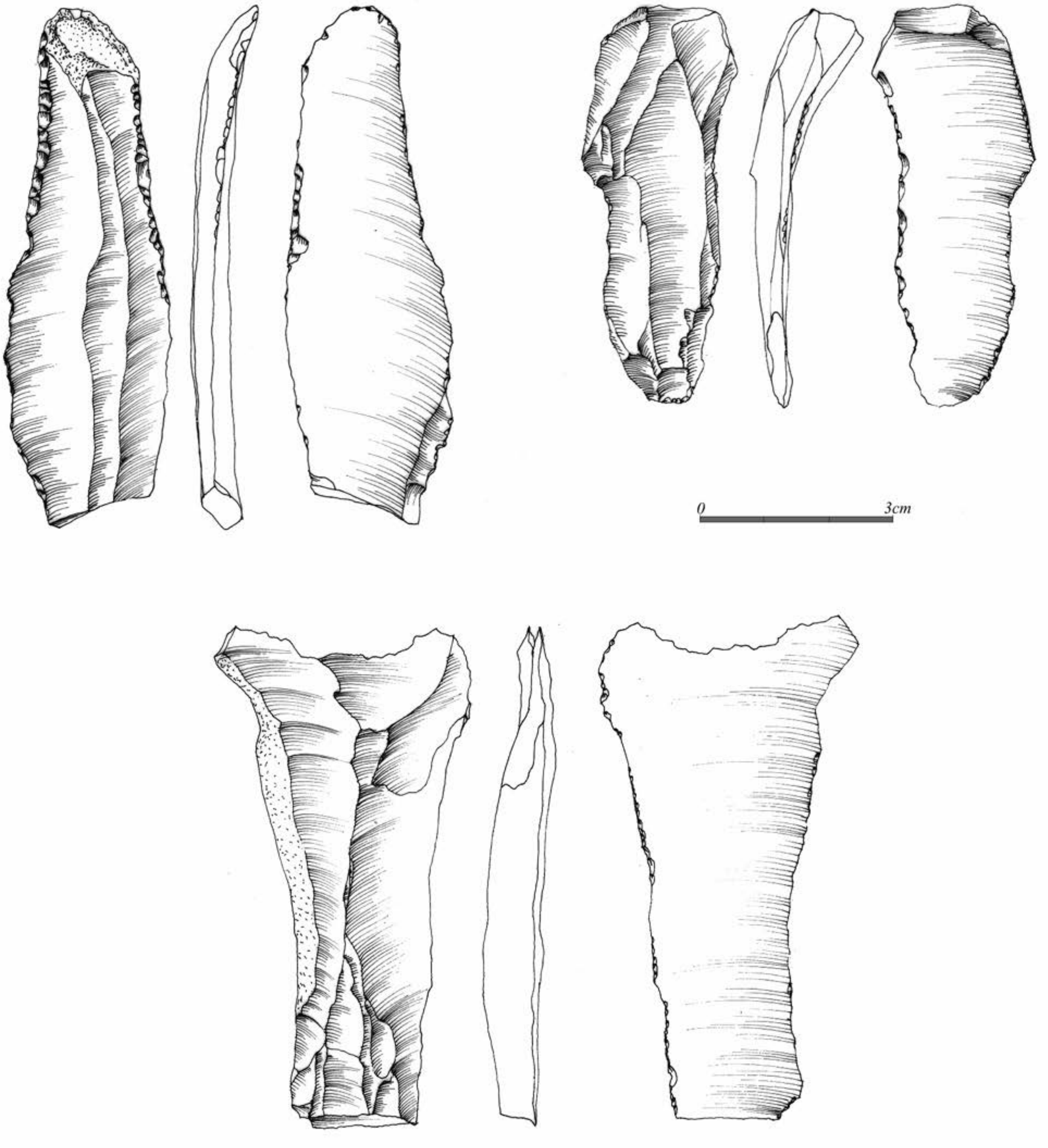


Figure 3.39. Nabta Playa, Site E-06-4. Artefacts form the Hearths Area. Drawn by J. Mugaj.

The “house” of C-group

In the western part of the massif there is the remnant of a feature similar to the so-called cottage (actually a kind of shelter) of group C from the Site E-92-8 in Nabta (Applegate and Zedeño 2001). The outline of the structure (approximately 2 x 1.8 m) has been preserved, visible in the form of vertically closely adjoining flat stone slabs, from which the bases of two “walls” – eastern and western (Fig. 3.40) had been built. They lean on the large sandstone block, which is also the rear (northern) “wall”. This feature can be generally dated to the period of development of the pastoral C-Group (2400-1500 BC; Applegate and Zedeño 2001a; Czekaj-Zastawny, Irish *et al.* 2018). This is the latest feature at the site and ends the settlement period in the Western Desert. This feature has not yet been excavated.

Figure 3.40. Nabta Playa, Site E-06-4. A, B – "House" of the C-Group. Photo by A. Czekaj-Zastawny.

The well

At the eastern foot of the massif, in the depression located near the wide wadi leading to the Nabta palaeolake, a circular feature has been registered that can be preliminarily interpreted as the remains of a well. It has yet to be excavated, but the assumptions about its original function can be based on quite a number of analogies from neighboring areas – Nabta Playa, Bir Kiseiba, and Bargat El-Shab. This feature is clearly visible on the surface, and the most characteristic elements are: a regular, circular outline, about 170 cm in diameter, marked with a circle built of flat, vertically-placed sandstone slabs (Fig. 3.41). The feature is probably related to the Neolithic period – the other wells known so far are dated to the early Neolithic (explored in Site E-79-8 in Bir Kiseiba, sites E-75-6, E-75-9, E-91-1 and E- 92-7 in Nabta Playa and in the Bargat El-Shab region - site E-05-1/well, E-05-1/5; Connor 1984a; Schild and Wendorf 2001a; Wendorf and Schild 2001b; Wendorf *et al.* 2001; Królik and Fiedorczuk 2001). On all the listed sites, the wells are located in the lowest parts of the terrain, near a wadi or palaeolake. They can occur individually, or in pairs (e.g., E-92-7), as well as in groups of several together – in groups clustering along the edge of a water body (Bargat El-Shab; Bobrowski *et al.* 2020; 2021).

Figure 3.41. Nabta Playa, Site E-06-4. A, B – the stone structure over the well (?) visible on a surface. Photo by A. Czekaj-Zastawny.

7. Chronology

Two features of the complex gave almost identical radiocarbon dates: 7990 ± 40 BP (Poz-20315) and 7960 ± 50 BP (Poz-20288), calibrated to ca. 7000-6800 BC. They fall into the *El Nabta/Al Jerar* Humid Interphase and the Holocene climatic optimum in the Western Desert (Table 3.3; Fig. 3.42; Schild and Wendorf 2013). Also the discovered flint artifacts are typologically linked with the material from the second half of the Early Neolithic. They have the closest analogies on Site E-75-6 (Królik and Schild 2001; Mugaj 2016), located 4 km to the SE of Gebel El Muqaddas, where almost identical microlithic tools appeared in a habitation context, in layers of domestic huts.

Apart from the 14 C dates listed in the description of the excavated structures, we also have dates from a few other features from Gebel El Muqaddas, among them from gazelle bones found in a depression in a stone slab (feature 21), and from a hearth (1/07). The first one, obtained from a carbonate fraction of a bone – 5204±80 BC (6240±40 BP; Poz-20418), as well as a date from a charcoal sample – 5783±42 BC (6890±40 BP; Poz-20316) suggest a connection with the Middle- and Late Neolithic settlement phases in the Nabta Playa Basin (cf. Table 3.3). Together with the dates from Tumulus 2 and Structure 2/3, they indicate that the site as a whole was used from the second half of the Early Neolithic to the first half of the Late Neolithic, i.e., from ca. 7000 to 5200 BC. Considering the chronology and location of the site in question and the symbolic interpretation of the stone construction, we assume that Gebel El Muqaddas was the earliest part of the Nabta Playa "ceremonial space".

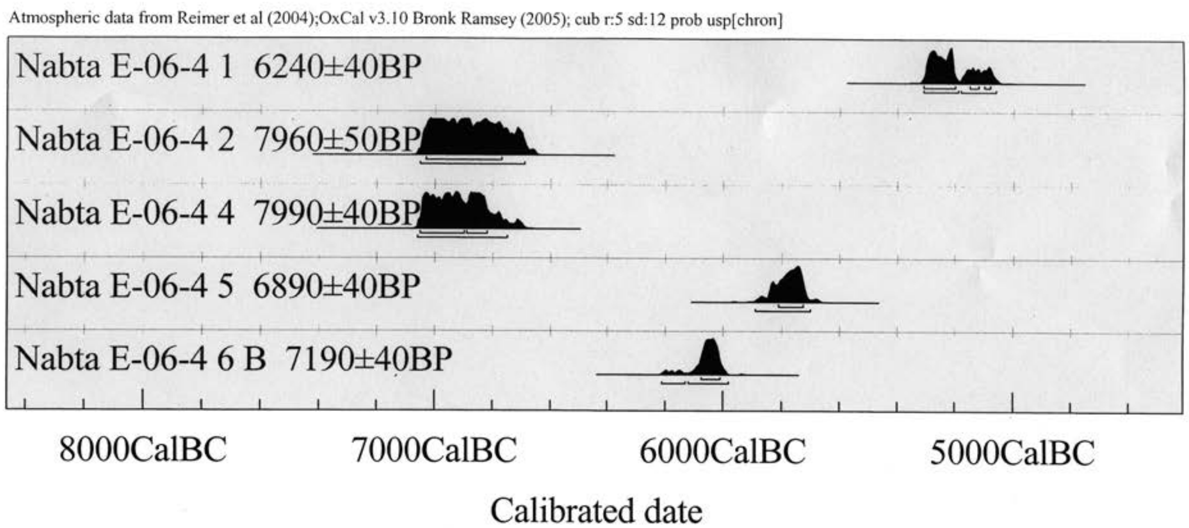


Figure 3.42. Nabta Playa, Site E-06-4. Sequence of radiocarbon dates from the Site E-06-4 and the period of occupation of Gebel El Muqaddas (Bobrowski *et al.* 2011; 2012; 2014).

Table 3.3. Scheme of terminal Pleistocene and Holocene climatic and cultural changes in the Western Desert in Egypt (Schild and Wendorf 2013) and radiocarbon dates associated with Site E-06-4 Calibration with the help of OxCal v 4.4.4 and IntCal 20 calibration curve (at 1σ)..

CLIMATIC AND CULTURAL PHASES		C14 DATES FROM E-06-4	CALIBRATION BC at 1σ
3900-3150 BP **2400-1450 BC**	Group-C Humid Interphase	-	-
4200-3900 BP **2900-2400 BC**	Arid Phase	-	-
4800-4200 BP **3600-2900 BC**	Early Post-Neolithic sites	-	-
5750-4800 BP **4600-3600 BC**	Final Neolithic Humid Interphase *Bunat el Asnam* (*Megaliths Builders*)	-	-
5800-5750 BP **4650-4600 BC**	Post-Late Neolithic Arid Phase	-	-
6500-5800 BP **5500-4650 BC**	Late Neolithic Humid Interphase *Ru'at El Baqar* (*Cattle Keepers*)	6240 ± 40 BP (Poz-20418)	**5302-5079 BC**
6600- 6500 BP **5550-5500 BC**	Post-Middle Neolithic Arid Phase	-	-
7100-6600 BP **6050-5550 BC**	Middle Neolithic Humid Interphase *Ru'at el Ghanam* (*Mixed Pastoralist*)	6890 ± 40 BP (Poz-20316) 7190 ± 40 BP (Poz-20665)	**5827-5725 BC** **6073-6016 BC**
7300-7100 BP **6150-6050 BC**	Post-Early Neolithic Arid Phase	-	-
8050-7300 BP **7050-6150 BC**	Early Neolithic *El Nabta/ Al Jerar* Humid Interphase /local Holocene Maximum/	7960 ± 50 BP (Poz-20288) 7990 ± 40 BP (Poz-20315)	**6073-6016 BC** **7042-6828 BC**
8200-8050 BP **7200-7050 BC**	Post-*El Ghorab* Arid Phase	-	-
8500-8200 BP **7550-7200 BC**	Early Neolithic *El Ghorab* Humid Interphase	-	-
8850-8500 BP **8050-7550 BC**	Post-*El Adam* Arid Phase	-	-
9800-8850 BP **9300-8050 BC**	Early Neolithic *El Adam* Humid Interphase	-	-

8. Discussion

Interpreting the constructions described is not an easy task. In most cases, the attribution of a "cult function" to archaeological features is very problematic. Nevertheless, the characteristics of the structures rather preclude their strictly utilitarian use. We do not know any storage pits with such a construction, located so far from a habitation zone.

The stone-covered shafts cut into the virgin sediment and the accompanying assemblages of animal remains and flint artefacts are very interesting. Multiple utilization levels within the constructions and the presence of charcoal suggest that the pits had been opened several times. It should be noticed that the other 20 features discovered at Site E-06-4 (not presented here) did not contained any artifacts.

The constructional elements of the structures described here allow them to be assigned to the category of tumuli. The absence of human remains suggests that these were some form of symbolic constructions. If our interpretation is correct, the excavated features would be the earliest finds of this kind in the world (Krzak 2001; Wendorf and Schild 2001a; Schild and Wendorf 2004).

As already noted, more than 200 similar stone constructions were registered at the site, together with a fireplace complex in one of the inner depressions of the plateau, but no settlement structures. Across the whole area of the site (ca. 150 hectares) only three flint tools (retouched blades) were found. Moreover, the site is located at a distance of 3-4 km to the SE from the site of an intensive settlement on the eastern and western limits of the Nabta Playa Basin.

*

Concentrations of megalithic structures are known from various regions of Africa. Among the hundreds of thousands of megaliths recorded, two distinct zones can be distinguished – one in West Africa (northern Morocco), the other in East Africa with large cemeteries with thousands of features. Among the typological lists created for megalithic constructions of Africa (Camps 1962, and also typologies by: L. Frobenius, J. Fergusson, E.O. Tillner, H. Müller-Karpe; Krzak 2001), there are no parallels to the tumuli from the site discussed here. Each of them, however, presents only megalithic tombs but neglects to take into account other structures of a non-funerary nature. In the case of similar forms, they are always considered in the category of barrows and burial mounds, and these are considered the most commonly-known forms of the tomb in North Africa (Krzak 2001: 101). In some cases, the mounds cover chambers, but the simplest type is a mound without a pit underneath, where the deceased was laid on the original ground. Among the various types of funerary structures, dolmens are also mentioned, and interestingly, among such features from Algeria the examples without human remains are quite numerous (Krzak 2001:112). The tumuli from E-06-04 have no analogy or, due to the lack of human remains, have not aroused the sufficient interest of researchers. It is possible to point out only distant similarities to some of the tumuli from the E-06-4 site, as the above-mentioned burial mounds without pits under them and the dolmens that do not contain human remains; however, they are much later than the features from Gebel El Muqaddas (Krzak 2001: 114).

In addition to the two main zones of occurrence of sepulchral structures in Africa, the area of the Sahara (Milburn 1988) should be mentioned. There is a large variety of stone constructions dated mainly to the fourth to second millennia BC (Krzak 2001: 133). About 10 sites from the whole region of the Sahara can be identified that are among the close or further analogies (Applegate *et al.* 2001: fig. 15.11); however, they are closer chronologically to the late Neolithic features from Nabta Playa (see below), dated to around 5300-4300 BC (Schild and Wendorf 2001b) than the earlier tumuli from Gebel El Muqaddas. These sites have produced various types of stone mounds covering remains (skeletons, fragments, or single bones) of cattle and (rarely) goats. Geographically, the nearest analogy is 'Feature y' from the site of Bir Murr 1, located about 110 km northwest of Nabta, dated to ca. 5300 BC

(Connor 1984b: 391). Three tumuli were found there, each with a diameter of approx. 2-3 m, made of stone slabs, of a size of 30-50 cm.

Some similar constructions can be found in the area of Nabta Playa, in the immediate vicinity of the Site E-06-4, but it should be remembered that the tumuli from Gebel El Muqaddas are the oldest part of the complex. Later, in the Late Neolithic, in Nabta Playa there are almost exclusively stone constructions or single stele of a non-funerary character, representing rather some other kind of symbolism. Only two features were human burials (Site E-97-5 and E-04-2; Applegate *et al.* 2001; Schild and Wendorf 2014). However, in a few cases (within the North Tumuli group), remains of domestic animals were found in the pits under the mounds. At the E-91-1n site, this was the skeleton (burial) of a cow. At five consecutive other sites (E-94-1s, E-96-4, E-97-4, E-97-6, E-97-16, Applegate *et al.* 2001), fragments of cattle bones (*Bos primigenius*) were found in the pits, and at Site E-94-1s, sheep remains (*Ovis ammon*) were found. No flint objects or internal stone structures like those at Gebel El Muqaddas were found in any of the pits under the stone mound.

In recent years, stone structures, most probably from late and final Neolithic period, have also been discovered at the sites (E 17-11, E-18-3B, E18-2B, E19-1B, E-18-4B) at Bargat El- Shab a dozen kilometers southwest of Nabta Playa. These evince circular features with a diameter of about 1-5 m built of quartzitic sandstone. Part of these stone structures were excavatede (Bobrowski et all 2021).

It seems, therefore, that there are later counterparts of Gebel El Muqaddas within the North Tumuli of Nabta. Thus, the development between ca. 7000 and 4300 BC of the idea of sacrificial tumuli can be observed running from the features with a stone embankment covering a narrow, deeply cut pit (or without an underlying pit) from E-06-4, with remains of wild animals (gazelles), dated to the second half of the Early Neolithic, to the Late Neolithic tumuli among the North Tumuli of Nabta, containing the remains of domesticated animals. The tumuli of Gebel El Muqaddas (ca. 7000-6800 BC) would therefore be the oldest features of this type from the Sahara, and probably in all of Africa.

Chapter 4.

Tumuli from the right bank of the large wadi – "Wadi of the Sacrifices"

Romuald Schild

1. Introduction

A significant, structural tributary wadi system draining the Eocene scarp and its foot in the north of Nabta Playa discharges into the Nabta Basin in its northwestern corner after passing through a granite gorge formed by two huge uplifted igneous masses and washing the eastern edge of the Site E-06-4 at Gebel El Muqaddas. It is the dominant provider of rainwater to Nabta Playa. Over a dozen rock tumuli of various sizes dot the smooth right bank of the wadi mouth and rugged eastern slopes of the elongated flattish sandstone ridge bordering the watercourse on the west (cf. Fig. 2.1, 2.2).

Nine rock tumuli were excavated in the 1994, 1996, and 1997 field seasons by Alex Applegate, Achilles Gautier, and Steven Duncan (2001) and four similar ones were identified in Sector A in the wadi or along its rocky west bank (Squares: e/23; m/19; w/7 and x/7). Additionally, a dozen or so very small stone tumuli and/or cairns located to the southeast of the C-Group Houses (Square y/6) were tested by a group of students led by Nelson in the 2007 season; none of these, however, yielded artefacts and/or subsurface structures (Typescript on file in IAE, PAS).

An unusual stone installation regarded here as a possible "Solar Calendar" (E-92-9), occurs at the northern end of the elongated sand hillock (Sector A, Square w/21). The first detailed field study of the construction took place in the 1994 season (Applegate and Zedeño 2001b). Interpretation of the object elicited several questions as to the age and function of the feature. Sadly, the feature also provoked non-scientific interest among adherents of *New Age* religion, and hence the installation suffered damage. In order to mitigate this, a new study of the installation took place in 2008-2009 as part of a salvage project of transfer and reconstruction of the object to the Nubia Museum in Aswan (Schild and Wendorf 2012).

The entire area around the right bank of the valley shows isolated places with evidence of human presence mainly in the form of deflated small stone hearths and rare, but perceptible bi-notched tethering stones, usually made of sandstone plates, indicating the occasional use of the sandy bank as grazing land. In stark contrast to the sparse presence of human traces on the right bank, however, is the density of artefacts on the surface of the elongated sand hillock immediately to the south of and around the possible solar calendar where burnt stones derived from countless hearths cover the expanse. The radiocarbon date associated with a partially deflated hearth placed near the installation (Applegate and Zedeño 2001b: 464) of 6000 ± 60 (CAMS-17287) years uncalBP (6990-6670 calBP or 5040-4720 calBC at 2σ) suggests the association of the hearth with the Late Neolithic (the *Ru'at E1 Baqar* phase), although its link with any of the tumuli or the "Solar Calendar" installation has not been firmly demonstrated**.**

2. Tumulus with a young cow's skeleton – Site E-94-1N

Perhaps the most spectacular tumulus in the "Valley of the Sacrifices" is the tumulus containing the burial of a young cow, probably a heifer, at Site E-94-1N (Sector A, Square k/22). It occurs slightly to the east of north of the "Solar Calendar". It is an unassuming tumulus measuring some 6.4 x 0.6 metres with a roundish superstructure made of loosely dumped sandstone blocks.

The pit underneath was sunk about 0.5 m. Its infills' thick suite of alluvial beds was made up of:

a. Laminated silty sand (Bed 4) that grades up into a sandy, gravely light yellowish-brown (10YR 6/4) silt;

b. Laminated, friable, reddish yellow (7.5YR 6/8) alluvial sand (Bed 3);

c. Gravelly, bedded wadi sand (Bed 2). This short, alluvial series rests upon the Qusseir Shale bedrock (Bwd 1).

The pit was filled with a settled structureless and collapsed alluvial, sandy infill derived of Bed 3 containing the nearly complete articulated skeleton of a domesticated bovid (Fig. 4.1) resting on the left side with its head pointing south (Bed 5). A decayed tamarisk stick, probably remains of a roof made of sticks, was placed on top of the deposit (Applegate *et al.* 2001: 469). It gave a radiocarbon date of 6470 ± 270 (CAMS-17289) uncal. years BP (7920-6750 calBP , or 5980-4800 calBC at two σ). The pit was sealed with a plaster made of a fine consolidated sandy silt, light brown (10YR 6/4) in colour (Bed 6), continuously placed over the pit and abutting a layer, some 25 cm thick, curving round in a C-shape (Bed 8) covering the southern, western, and northern edges of the pit. It was made of consolidated, beaten, and daubed gravelly wadi sand. Bed 7, or the upper fill of the pit, was made from the dumped wadi sand from Bed 2 washed into the pit after Bed 5 and 6 had settled up (Applegate *et al.* 2001: 470). Bed 8, in turn, was overlaid by the friable fine sand of a surface wash or wadi deposit (Bed 3) that also penetrated the empty spaces between the collapsed sandstone blocks in the upper portion of the subsided pit. A layer of surface and slope wash tops the entire sequence seemingly grading up into a light yellowish brown (10YR 7/4) redeposited sandy silt.

About two dozen bones of a small ruminant, a subadult of dorcas gazelle or a sheep or goat, were found among the lower slabs of the stony superstructure of the tumulus.

As to the articulating *Bos* skeleton, the horncores, postcranial remains, and dental growth indicate that the recovered remains represent "a female and barely an adult" that can be cautiously regarded as a "moderate longhorn" (Applegate *et al.* 2001: 472).

3. Tumuli with disarticulated cattle remains – Sites E-94-1S, E-96-4, E-97-4 and E-97-16

In total, four tumuli containing disarticulated cattle remains have also been excavated: E-94-1S (Sector A, Square n/21), E-96-4 (Sector A, Square g/22), E-97-4, Sector A, Square f/18), and E-97-16, Sector A, Square k/18).

Directly north of the "Solar Calendar", and to the southwest of Site E-94-1N is the tumulus labelled E-94-1S. This was built of quarried sandstone blocks dumped over scattered bones resting directly on the dune with sparse, thin, silty lamination and underlain by a thin layer of a pinkish brown, sandy silt playa deposit immediately resting on the Nubia sandstone bedrock. The blocks were piled up in the form of a dome some 4 x 5 meters in size and partially covered by a new sandsheet.

Figure 4.1. Nabta Playa, Site E-94-1N. Tumulus with a young cow's skeleton. Photo by R. Schild.

Cattle bones of at least three individuals, including a possible sub-adult cow, dominated the assemblage among which the remains of two legs of a sheep and small ruminant bones were also present. The spiral green fractures of some bones may suggest that no heating was applied preceding the breaks and that the flesh was removed before depositing the offering (Applegate *et al.* 2001: 474). Two flakes were found within the scatter of bones.

Tumulus E-96-4 occurs on the edge of the elongated sandstone hillock, close to a low wadi terrace bank. It is again a hemispherical tumulus, about 4 m in diameter, built with dumped sandstone blocks. It contained fragments of cattle teeth and bones dispersed between the blocks overlapped by a loose, recent sandsheet. A bed of loose, light orange-brown sandy silt, reaching a thickness of about 40 cm at places with alluvial, wadi pebbles lies beneath the sand sheet and rests upon the sandstone. The bones and teeth that were found most probably represent one juvenile, one sub-adult, and two adults. A few postcranial elements of a canid suggest the presence of a jackal or a larger dog (Applegate *et al.* 2001: 475).

A sandstone bedrock knoll, about 7 x 8 m in size in the northwestern section of the ridge is one of the highest points in the entire area rising nearly 5 m above the wadi floor. The rocky tumulus of Site E-97-4 four metres in diameter, rests on the flat top of the sandstone bedrock. It is covered in places with a reddish yellow aeolian sand. The bone assemblage, found between the rocks, consists mainly of cattle remains, apparently two individuals – a juvenile and a sub-adult, as well as late intrusive bones of birds and two fragments of ostrich eggshells.

The fourth tumulus (Site E-97-16) containing disarticulated cattle remains occurs in the midst of the ridge. It is built of dumped sandstone blocks on Nubia sandstone bedrock and is the smallest of the group, being about 3 m in diameter. Its top is covered with a relatively thin bed of loose, yellow, recent, and conspicuously laminated sandsheet covering a noticeably laminated, reddish yellow, slightly consolidated colluvial sand masking the sandstone blocks and being present in the empty spaces between them. It rests unconformably on the underlying layer; a colluvium made up of conspicuously laminated silty sand with gravel and pebbles resting on the weathered sandstone bedrock. The tumulus has yielded a small series of bones and teeth of a single sub-adult *Bos* (Applegate *et al.* 2001: 481).

4. Tumulus containing cattle and ovicaprid remains – Site E-97-6

Low on the eastern slope of the ridge is the slightly hemispherical tumulus of Site E-97-6 (Sector A, Square i/21) made of a discontinuous structure of sandstone slabs measuring about 4 m in diameter, placed in a small depression. The slabs are partially covered with a recent laminated sandsheet overlapping a reddish yellow (7.5 YR 6/8), inconspicuously laminated fine, alluvial sand resting unconformably over a reddish yellow (7.5 YR 6/6) colluvial fine silty sand with sandstone gravel and shingle covering a rough surface of weathered, whitish sandstone.

A very small assemblage of bones was recovered from between the sandstone plates in the alluvial sand of Bed 3. Of interest are some splinters of cattle bone and a bone flake derived from an ovicaprid. A small hearth buried in Bed 3 gave (Applegate *et al.* 2001: 478) a radiocarbon date on charcoal of 5500 ± 160 BP (DRI-3354) uncal years BP (at 2σ: 6640-5930 calBP , or 4690-3980 calBC and around 4350 BC of modal value). Because of the high standard deviation of the date the assay overlaps with the *Bunat El Asnam* time span.

5. Tumulus containing human remains – Site E-97-5.

In the middle of the elongated hillock, on a minor isolated and weathered sandstone knoll rising about 4 m above the floor of the wadi is an incomplete tumulus about 4 m in diameter built with dispersed sandstone blocks (Sector A, Square p/17). The human remains were found in a small, shallow depression in the highly weathered sandstone and covered with the slabs overlain by aeolian sandy silt. The burial yielded the remains of a healthy young male in a flexed position resting on the right side with the spine to the east and the head toward the north (Applegate *et al* 2001: Fig. 15.6). The cranium, mandible, and teeth were not present, leading to the presumption that the cranium had been separated before the burial (Applegate *et al.* 2001: 477-478).

6. Empty tumuli

Two tumuli, E-96-2 (Sector A, Square e/24) and E-97-12 (Sector A, Square t/9), both built with sandstone blocks, did not yield bones. The first, placed at the northern entrance to the wadi's mouth, had only 18 separate blocks of sandstone clustered in a shallow depression, 2 m in diameter. The latter tumulus is placed near the flattish top of the highest and relatively large knoll of the hillock in the southwestern section of the low sandstone ridge. It is a round, domed tumulus some 4 m in diameter showing the most massive sandstone blocks at the base and reaching a total height of 85 cm (Applegate *et al.* 2001: 479). This and the elevation of the knoll makes it the highest situated tumulus of the entire area of Sector A. Two denticulates on flakes were associated with the tumulus.

Four unexcavated tumuli have also been recorded in the vicinity of the "Valley of the Sacrifices". One (Sector A, Square e/23) occurs about 30 metres west of Site E-96-2, the second is c. 60 m to the northwest of Site E-94-1S (Sector A, Square m/19) and two are placed on a hillock (105 m a.s.l.) northeast of the C-Group houses (Sector A, Squares x/8 and w/7).

7. Burials at the mouth of the wadi

The dunes on the right bank of the mouth of the wadi of the same complex as the one on which the calendar had been built yielded two burials at Site E-97-17 in Squares z/20 and a'/18 of Sector A. The human burials were profoundly affected by deflation and weathering. They contained two seemingly flexed human skeletons, of which only 13 teeth have been recovered from one of the burials. The recovered teeth tentatively indicated an older adult probably of Sub-Saharan affinity (Irish 2001: 525).

8. Conclusions

Two available ^{14}C ages directly associated with the tumuli of the area give no definite answer as to the age of the barrows because of the considerable standard deviations of the counts.

Both the date of the young cow tumulus and the radiocarbon assay of the tumulus at Site E-97-6 are within 2 σ of the Late Neolithic (the *Ru'at El Baqar* age). However, this younger date is also inside the range of the Final Neolithic (the *Bunat El Asnam* period) at Nabta Playa (cf. Table 3.3).

The entire area at the mouth of the "Wadi of the Sacrifices", some 300 m south of the Site E-94-1N, and around the possible "Solar Calendar", is particularly abundant in lag gravel and burned chunks of quartzitic sandstone – both witnesses to the presence of a multitude of hearths that had once glowed on top of the elongated sandy hillock. A well-preserved example of such a hearth is the one near the "Calendar" stone circle, which gave a calibrated date of about 5040-4720 BC at 2σ (see above) as well as embedded fragments of burnished pottery suggesting a *Ru'at El Baqar* (the Late Neolithic) presence. On the other hand, the location and the very expressive occurrence of burned stones suggest a ceremonial character of the fires rather than that of a household situation.

Part III. The Menhirs

Chapter 5.

Quartzitic Nubia Sandstone Quarries and the Duration of the Final Neolithic Occupation

Halina Królik, Romuald Schild, Maciej Jórdeczka, Dagmara Mańka
and HebatAllah A.A. Ibrahim

1. Introduction

Assessing the date of the activities at Nabta Playa of the *Bunat El Asnam* desert dwellers is difficult as there is precious little direct dating evidence associated with the stelae monuments present in the field. The astronomical alignments, although suggestive, are often ambiguous. An important source of information is therefore the dating evidence recovered from the quarries from which the quartzite blocks were obtained for the construction of the alignments and putative place of temporary camps of their users.

The shallow pits of ancient quartzitic sandstone quarries described here lie in a zone from a few to 100 m to the west and southwest of the Western Field of stelae (cf. Fig. 2.4). They appear on the surface as numerous very shallow depressions that stand out by being bold, yellow sandy patches on the reddish playa silt mantle topped by a shingle hamada. The biggest of these features is in Section C Squares o-q/7-9, while the smaller ones, measuring less than 30 m in length, are in Squares m/6, i/7, k/7, m/8, n/9, o, n/10 and l/10. To the southwest, behind the quarries, extends a broad expanse of Nubian sandstone hillocks. Over a dozen broken, abandoned, large slabs dot the area around the quarries. Two of the quarries were investigated in the 2004-2006 field seasons by Halina Królik, Dagmara Mańka, Romuald Schild, Maciej Jórdeczka, and HebatAllah A.A. Ibrahim.

2. The Largest Quarry (Squares o-q/7-9), Sites E-04-4, E-05-2, and E-06-2

Four trenches were laid out in the largest of the quarries (Fig. 2.4). Two of these, termed Site E-04-4, are in the narrow, elongated eastern arm of the quarry. One (Site E-06-2) is a continuation to the west of Trench 1 at Site E-04-4, separated from Trench 1 by a sandstone remnant, and one (Site E-05-2) was located in the western part of the feature.

The stratigraphy of the quarry sites is very simple and includes natural and mixed anthropogenic and natural strata. At the base are the Cretaceous rocks composed of shale and fine sand topped by the quartzitic sandstone of the Qusseir Clastic Member (Issawi *et al.*, 2009: 205), the middle member of the Nubia Formation (Stratum 1, Bedrock). The deposits of Stratum 1 are, in turn, unconformably overlain by the 8.2 ka event reddish silt of the playa

(Stratum 2, Unit 2). In the quarry pits, the floor formed at the top of the shale is littered with sandstone shingle waste in a sand matrix showing traces of working and burning. The bed also contains chipped artefacts, potsherds, and faunal remains together with traces of hearths, often with charcoal (Stratum 3, Unit 3a, Sandstone Shingle in alluvial sand matrix). It is stratigraphically followed by a thin aeolian sand lens (Unit 4) and alluvial silty sand infills of the quarry pits (Stratum 3, Units 5 and 6), and the topmost aeolian sand of recent sand sheet (Stratum 4, Unit 7).

Site E-04-4

Trench 1, 20.5 m long and 2 m wide, was excavated across the width of the eastern branch of the quarry pit and nearly abuts to the west, where there is a small quartzitic sandstone remnant. The second trench, a short one, measuring 5 m by 2m, was perpendicular to Trench 1 and placed one metre to the north of it.

Of all the trenches excavated in this quarry, Trench 1 (Fig. 5.1, 5.2) and its continuation to the west at Site E-06-2 (cf. Fig. 5.6), revealed the most information about the quarry's exploitation and the dynamics of the deposition of the fill. The eastern, elongated mining pit, seen in Trench 1 of Site E-04-4 and Site E-06-2, is nearly 70 m long and 18 m wide in its northern section. The mining procedure consisted of removing the capping deposit, the reddish playa silt (Stratum 2, Unit 2), to expose the sandstone bedrock and then quarry out the visible quartzitic sandstone (Stratum 1, Unit 1c). First, the eroded sandstone remnants were exposed on the surface by an earlier deflation and then extended down to the underlying sandstone beds until reaching the shale. The sandstone in the trench area is characterized by a breakage along the beds and relatively easy separation of platy blocks facilitating the work.

The limit of mining activity stops at the top of the white or pinkish shale that forms the floor of the mine, except for the eastern section of the trench, where it ends confronted with a thick wall (base unexposed) of reddish (5YR 5/4-5/6) playa silt, deposited during the 8.2 ka event (Stratum 2, Unit 2). The silt shows a blocky structure, slickensides, and many deep desiccation cracks. In addition, a few relatively small, abandoned sandstone blocks separated from its original bed are resting on the top of the silt.

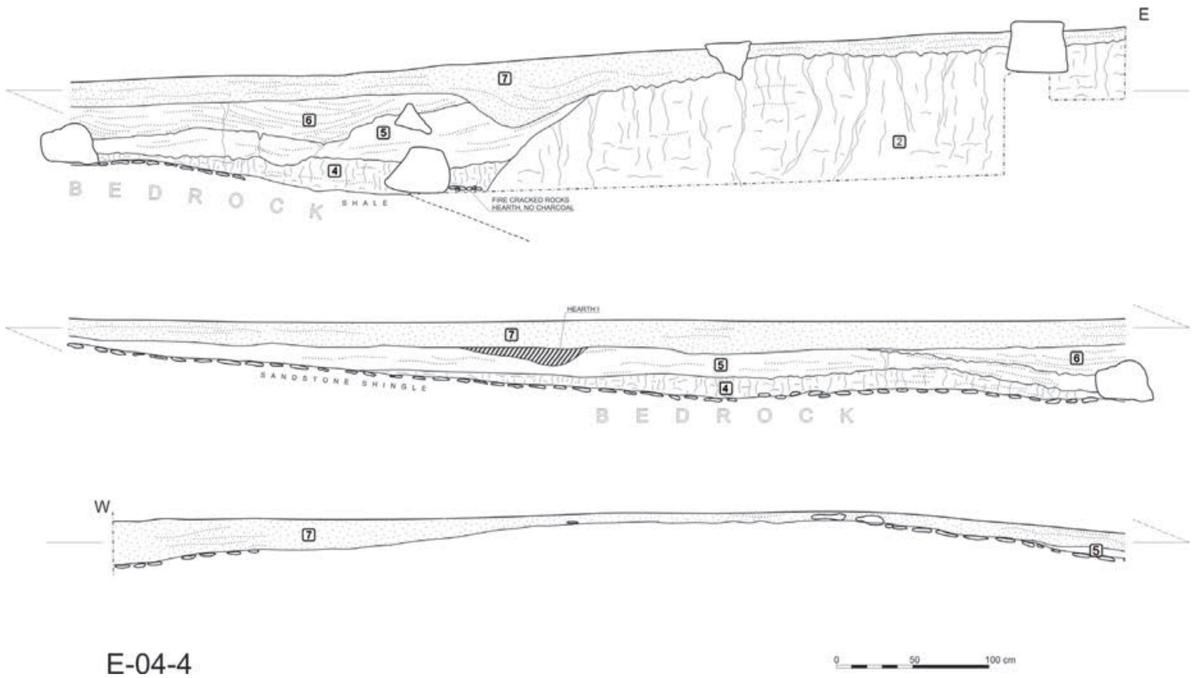


Figure 5.1. Nabta Playa, Site E-04-4, Trench 1. Cross-section. Key: 2 – the 8.2 ka silt, 4-6 – alluvial surface washes, 7 – aeolian sandsheet. Cross-section by R. Schild, drawn by M. Puszkarski.

A suite of alluvial silty sand (Stratum 3), infills the quarry pit. A continuous bed overlies the mining pit floor made up of sandstone shingle waste often enriched in the western section by pebbles washed in a sand matrix (Stratum 3, Unit 3) and wedging to the west. The shingle may show oxidation traces where the faces have been exposed to fire.

A bed (Unit 4) of fine alluvial silty sand, consolidated to slightly cemented, with small blocky to somewhat crumbly structures, overlies the shingle and abuts the faces of the reddish lacustrine silt truncated by the miners. It contains stony hearths and unpatinated blocks of quartzitic sandstone with impact ripples, flake scars, and relatively copious sandstone flakes. They also occur in the overlying bed of Stratum 3, Unit 5.

Figure 5.2. Nabta Playa, Site E-04-4. View looking northeast of excavated Trench 1. Note extracted blocks of sandstone in the background and exposed *in situ* sandstone bed in the foreground. Photo by D. Mańka.

Unit 3 is topped with a wash (Unit 5) of fine, light brown sand (7.5YR 7/4), consolidated and inconspicuously laminated at places. It includes numerous artefacts, hearths, and land snails (*Zootecus insularis*). It contained Hearth 1 cutting into the top of the bed and underlain by a reddish, deoxidized sand. Unit 5 is overlain, in turn, by the yellowish, friable, and conspicuously laminated sand wash of Unit 6. Finally, the whole sequence is continuously covered by a bed of loose aeolian sand (Stratum 4, Unit 7).

The cleaning of the floor of the quarry Site of E-04-4 yielded remains of camping, including abundant charcoal. Seven radiocarbon ages have been measured on charcoal pieces recovered at Site E-04-04. All but one are associated with shallow, relatively small basin hearths embedded throughout Unit 4 and Unit 5 (Fig. 5.3).

Trench 1, Unit 5, Upper, Hearth 1: 6400-6220 calBP (5530 ± 40 BP; Poz-7818)

Trench 1, Unit 5, Upper, Hearth 1: 6440-6290 calBP (5580 ± 40 BP; Poz-73203)

Trench 1, Unit 5, Upper, Hearth 1: 6480-6300 calBP (5600 ± 40 BP; Poz-7917)

Trench 1, Unit 5, Base, Hearth 2: 6390-6120 calBP (5460 ± 40 BP; Poz-7819)

Trench 2, Unit 4, Base, Hearth 4: 6390-6190 calBP (5470 ± 40 BP; Poz-7919)

Trench 2, Unit 4, Base, Hearth 3: 6310-6120 calBP (5450 ± 40 BP; Poz-7918)

Trench 1, Unit 4, Base: 6490-6310 calBP (5630 ± 40 BP; Poz-73335)

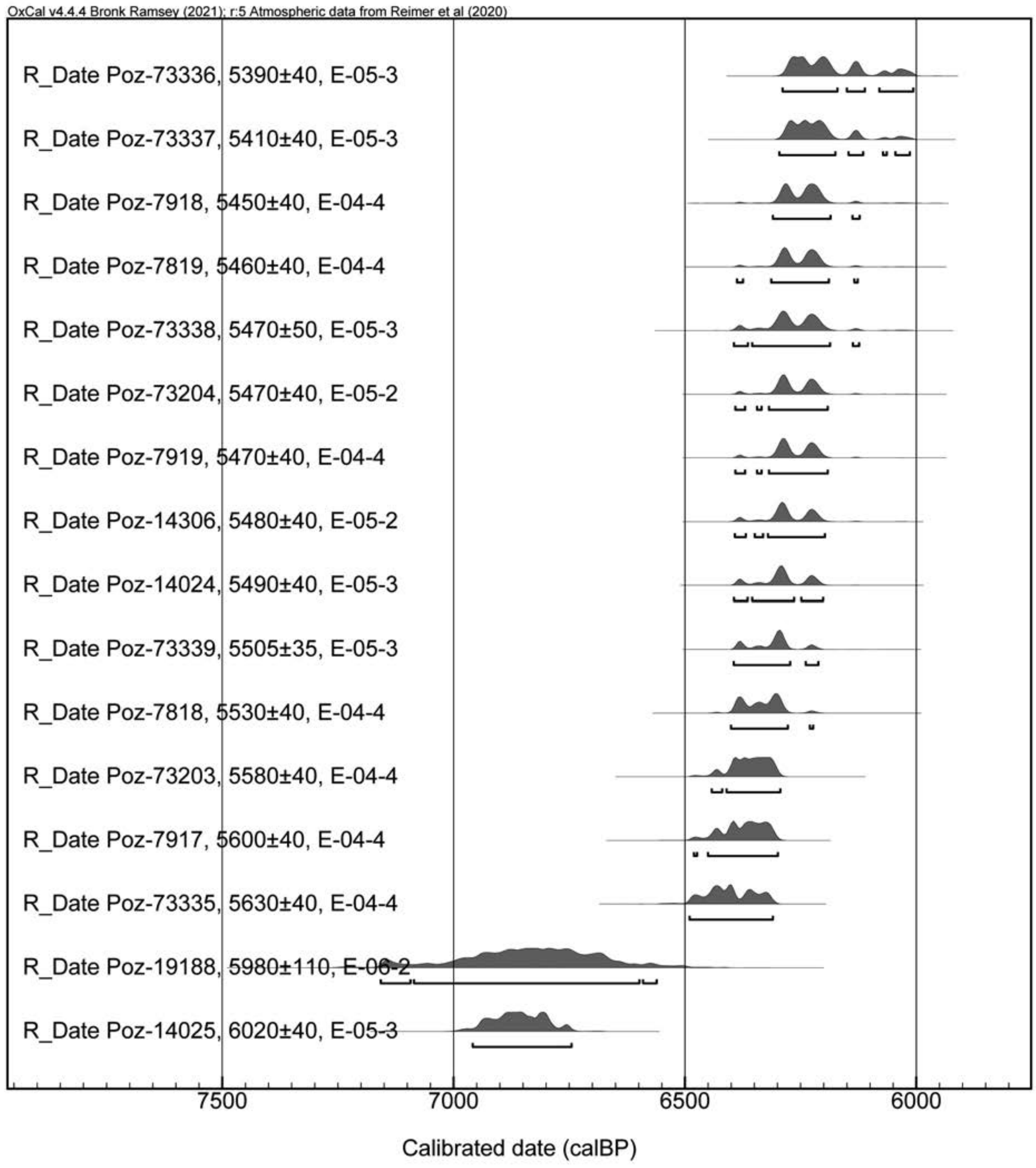


Figure 5.3. Nabta Playa, Quarrys: calibrated radiocarbon age estimates. OxCal v4.4.4. and IntCal 20 calibration curve (at 2σ).

Archaeological Material

The artefacts assemblage (Fig. 5.4, 5.5) includes material recovered from the fills of the explored pits. Altogether, a total of 210 pieces of debitage, five cores, ten retouched tools, 39 pottery shards, 586 small fragments of mammal bones, seven ostrich eggshell fragments, and 83 *Zootecus insularis* shells have been recovered. The majority of the shells occurred at levels 20-40 and 40-50 cm below the recent sand sheet in Units 3 and 4.

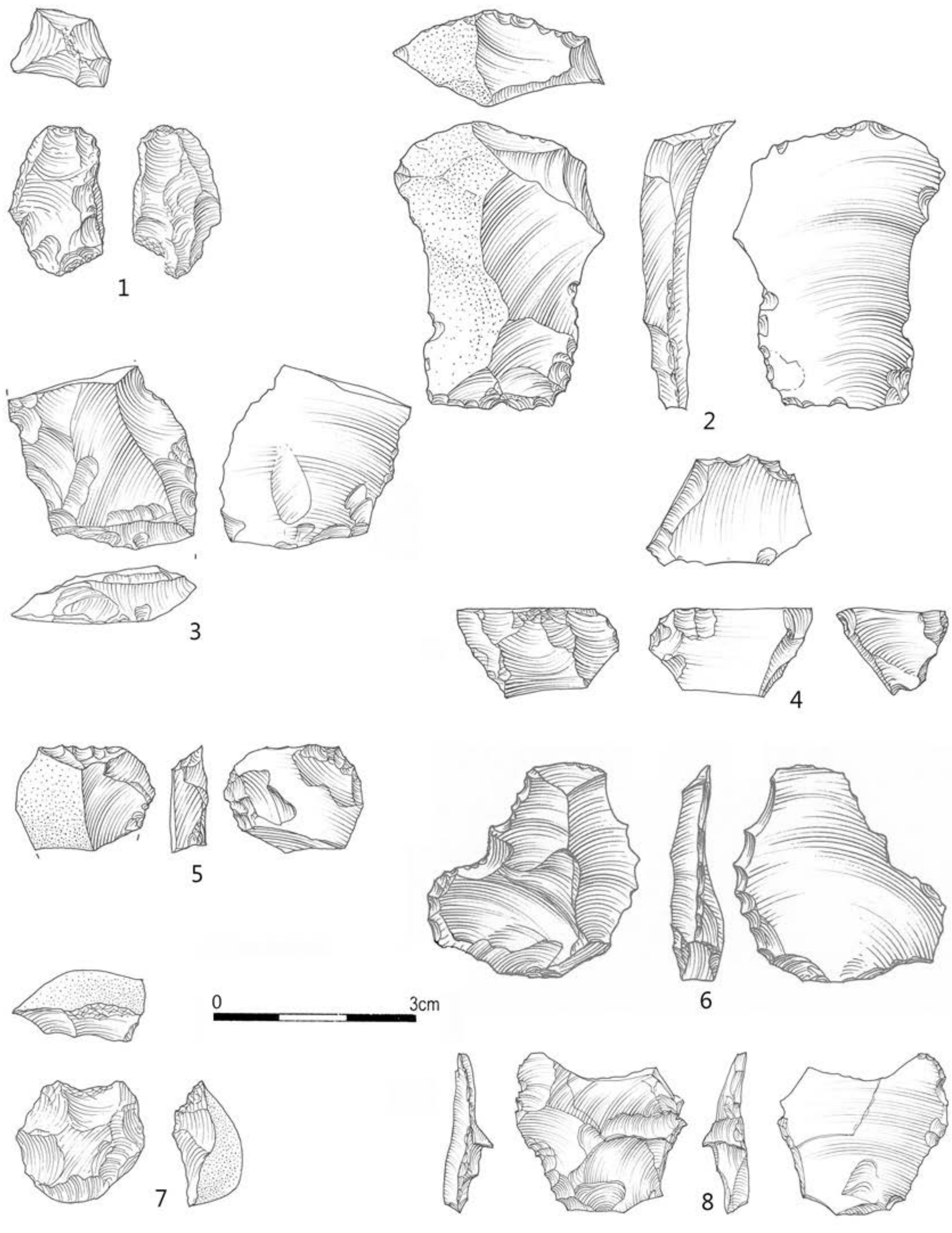


Figure 5.4. Nabta Playa, Site E-04-4, Quarry. Cores and Retouched Tools. Key: 1, 4, 7 – cores, 2, 3, 6, 8 – denticulated piece, 5 – scaled piece. Drawn by M. Puszkarski.

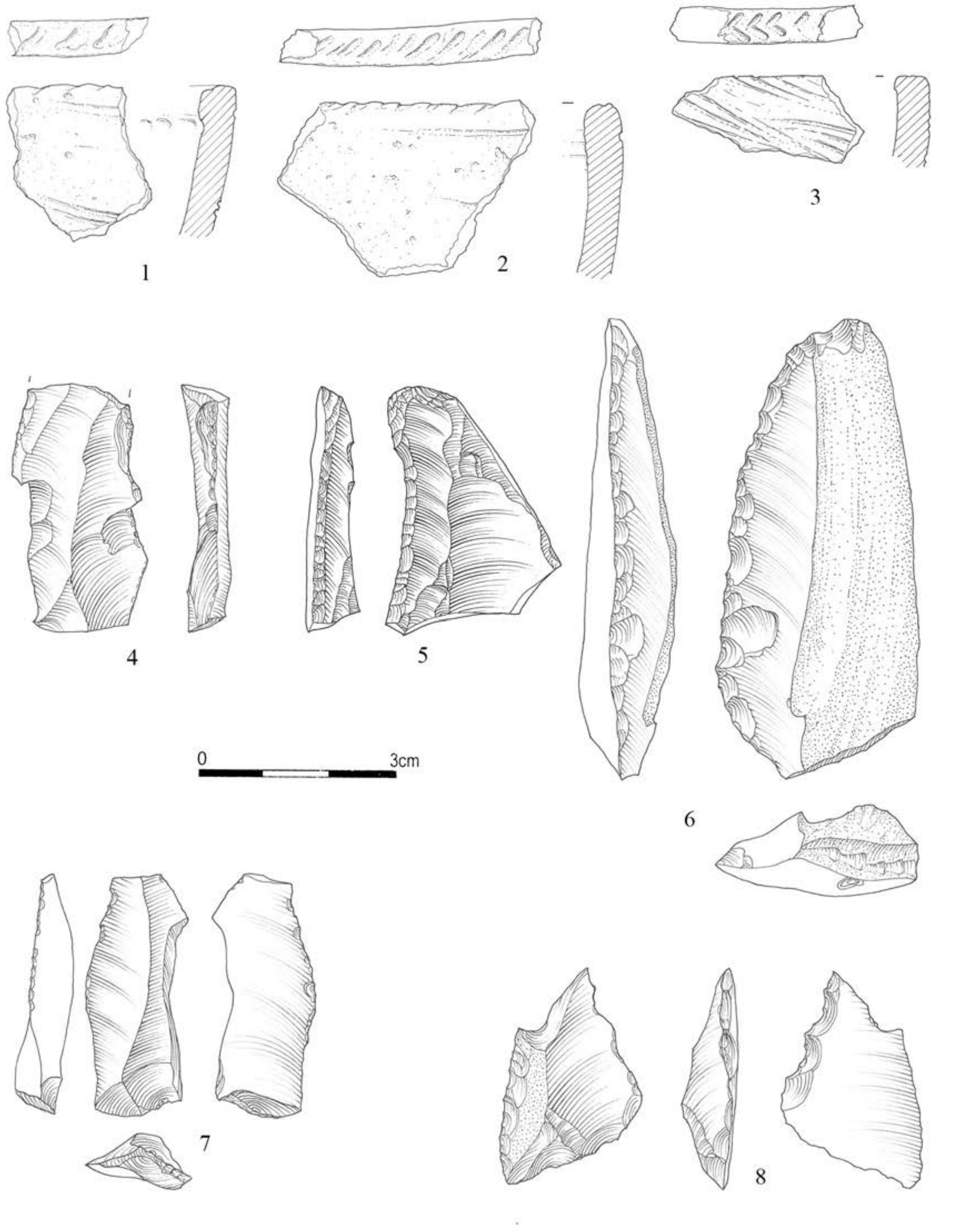


Figure 5.5. Nabta Playa, Site E-04-4, Quarry. Pottery sherds and Retouched Tools. Key: 1-3 – pottery sherds, 4, 7 – fragmentary retouched pieces, 5 – continuously retouched pieces, 6, 8 – denticulated piece. Drawn by M. Puszkarski.

Lithics

Debitage: The frequencies of the debitage types by raw materials are given in Table 5.1. The collection is small, and the most frequent types of identifiable pieces are flaked from single (16 pieces) and multiple (12 pieces) platform unprepared cores. The majority of them are tertiary with less platform, made from quartz and Eocene flint.

Cores: Only five cores have been collected from Trench I (Table 5.2). They are single, opposed, and multiple platform cores made of quartz and Eocene flint.

Retouched Tools: The collection yielded ten retouched tools; made of Eocene flint (Table 5.3). Among these are four denticulated flakes made on tertiary, secondary, or primary blanks by obverse, bilateral or alternate retouch (Fig. 5.4: 2, 3, 6, 8). Two denticulate blades are on tertiary or secondary blanks altered with obverse or inverse continuous retouch (Fig. 5.5: 6, 8), in one case alternating and very delicate. A single scaled piece in the assemblage is made on a small secondary flake with inverse scaled retouch on both lateral edges (Fig. 5.4: 5). A continuously retouched flake (Fig. 5.5: 5) and fragmentary retouched pieces (Fig. 5.5: 4, 7) completes the collection.

Handstones: Two fragments of manos with one polished inverse side, both are made of basalt.

Table 5.1. Nabta Playa, Site E-04-4, Trench 1. Frequencies of debitage types by raw materials.

Type of debitage	Flint No.	Quartz No.	Chalcedony No.	Cristal No.	Quartzitic-Sandstone No.	Total No.
Primary flake	1	2			2	5
Primary blade		1				1
Flake from single platform core	7	9				16
Flake from ninety-degree core	2					2
Flake from multiple platform core	4	8				12
Unidentifiable flake	6	26			1	33
Blade from single platform core	1					1
Core-trimming element	1					1
Chips and chunks	34	102	2	1		139
Total	56 (26.6 %)	148 (70.5 %)	2 (0.9 %)	1(0.5 %)	3 (1.4 %)	210 (100 %)

Table 5.2. Nabta Playa, Site E-04-4, Trench 1. Frequencies of core types by raw materials.

Core type	Flint No.	Quartz No.	Total
Single platform	1		1
Opposed platform		1	1
Patterned multiple platform		1	1
Unpatterned multiple platform		1	1
Unidentifiable fragment	1		1
Total	2	3	5

Table 5.3. Nabta Playa, Site E-04-4, Trench 1. Frequencies of tool types by raw materials.

Tool types	Flint	Bazalt
Denticulated flake	4	
Denticulated blade	2	
Scaled piece	1	
Piece with continuous retouch	1	
Piece with fragmentary retouch	2	
Handstone		2
Total	10	2

Pottery

Most of the recovered pottery sherds are of Red or Brown Top Ware. Of these, 27 are body and three rim fragments; a few are very rolled and presumably redeposited in a secondary position. The fabric was tempered with very fine-grained sand. The exterior face was reddish-brown, smoothed, slightly burnished (2.5 YR 5/4), while the colour of the interior face graded from a dark grey to black (5 YR 6/1; 2.5 YR 4/0). Some of the sherds originated from small, fragile vessels, probably small bowls. Most of the fragments are not identifiable. Three rim fragments are almost flat with cross-hatched, incised decoration along the entire rim (Fig. 5.5: 1-3). One rim, on the other hand, comes from a Black Top bowl. Five body fragments were made from Qusseir clay. Their exterior faces are very pale brown (10 YR 8/3-7/3; 7.5 YR 6/2), and the interior is grey (10 YR 5/1; 7.5 YR 6/2).

Animal bone fragments:

The examined beds yielded one tooth and two horns of Dorcas gazelle, one cattle tooth, and a long bone of a hare. The remaining 581 bone fragments were small, unidentifiable fragments.

Site E-06-2

The trench at Site E-06-2 was, in fact, a continuation toward the west of Trench 1 cut in the same quarry at Site E-04-4. It extends for 23 m between the exposed table rock at the western end of Trench 1 at Site E-04-4 (Fig. 5.6) and a table rock at its eastern end; the trench is 2m wide (Fig. 5.7). The basal rock in the cutting is a weak red (10R 5/4) Qusseir Clastic Member bedded muddy sand, cemented to consolidated and truncated (Stratum 1, Unit 1a). It grades toward the east into a truncated, consolidated Qusseir muddy sand to silt, very pale brown (10YR 7/3) in colour (Stratum 1, Unit 1b). Three burned places on the top of the silt indicate locations of hearths. In the westernmost section of the trench, a few sandstone chunks and a large plate lay on top of the Qusseir sand. The Qusseir Member deposits underlay a sub-horizontally bedded quartzitic sandstone table rock remnant (Stratum 1, Unit 1c). The miners wholly removed the reddish blocky lacustrine silt of Stratum 2 from the entire length of the exposed trench floor.

A layer (Stratum 3, Unit 3) of sheet flow deposit made up of quartzitic sandstone shingle, often angular and sandstone flakes and gravel of 1b in a muddy sand, consolidated matrix, crumbly to slightly blocky, and strong brown (7.5YR 5/6) in colour overlay the uneven, undulating top of Unit 1b, suggestive of quarrying activity (Fig. 5.6: 1b). The bed contains artefacts, often polished, and a hearth on top.

The bed of consolidated, reddish brown to yellowish-red (5YR 5/4-5/6) sheet flow, fine, muddy sand to silty sand (Stratum 3, Unit 4) with artefacts (some polished) and pottery, overlays Unit 3 and, in turn, is truncated. It is overlain with a friable laminated reddish yellow (7.5 6/8) sand to sandy silt surface wash with a small blocky to crumbly structure (Stratum 3 Unit 5). A truncated, brown (7.5YR 5/4), friable muddy sand to sandy silt with a small blocky to crumbly structure (Unit 6) overlays the sand of Unit 5. A large basin hearth (240 cm x 140 cm) containing sandstone shingle and oxidized basal sand (Hearth 1) cuts through the entire depth of Unit 6. The Holocene suite of deposits terminates with a bed of aeolian sandsheet (Stratum 4, Unit 7). A charcoal sample from Hearth 2, collected near the base of Unit 4 (30 cm below Unit 6), gave a result of 7160-6560 calBP (5980 ± 110 years BP; Poz-19188).

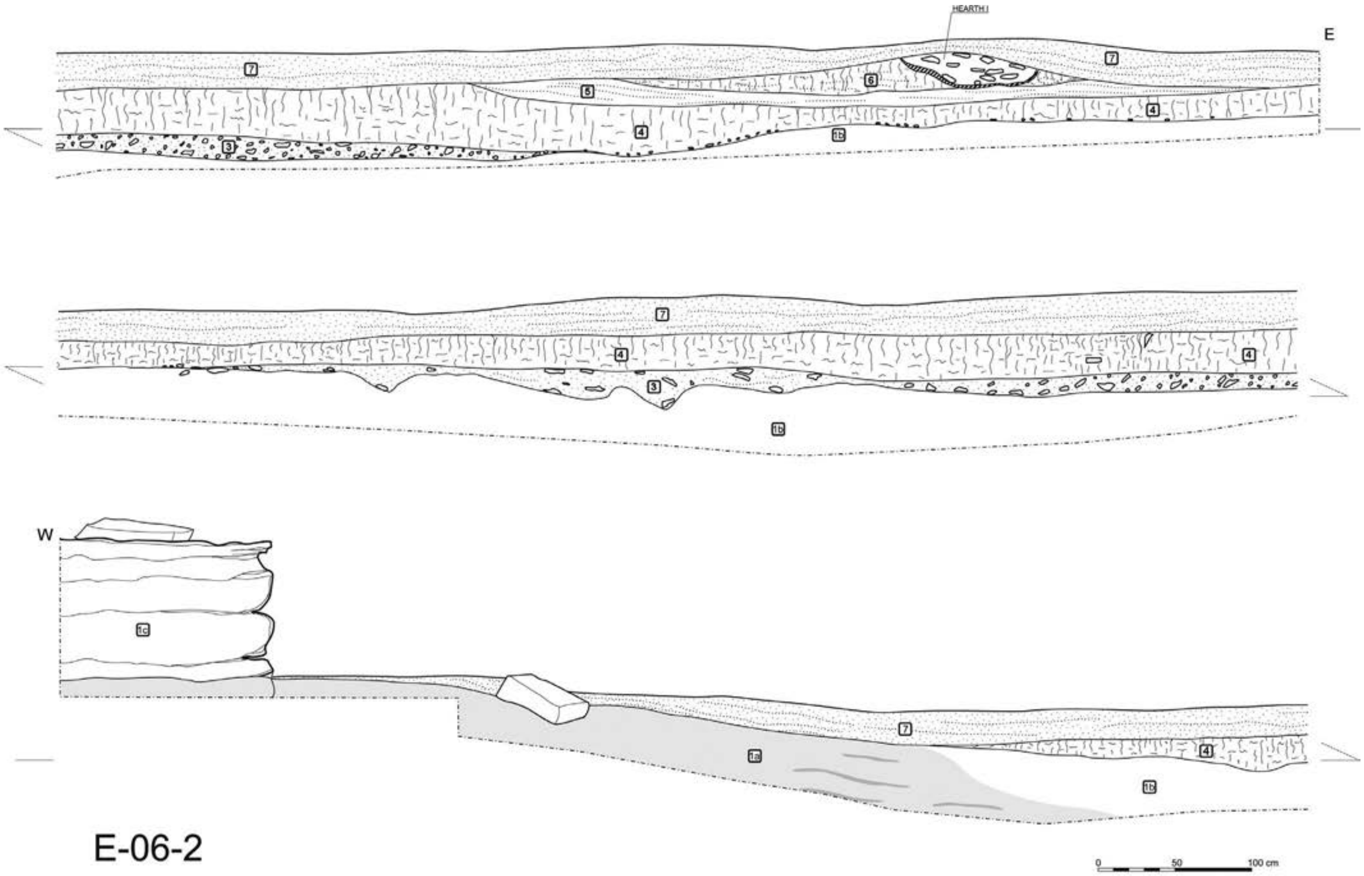


Figure 5.6. Nabta Playa, Site E-06-2. Cross-section. Key: 1a – Qusseir Clastic Member bedded muddy sand, 1b – Qusseir muddy sand to silt, 1c – bedded quartzitic sandstone, 3 – sandstone shingle and flakes in a muddy sand matrix, 4-6 – alluvial surface washes, 7 – aeolian sand sheet. Cross-section by R. Schild, drawn by M. Puszkarski.

Figure 5.7. Nabta Playa, Site E-06-2. The trench floor showing the exploited section of the quarry exposed on the level of the Qusseir muddy sand and sandstone shingle; bedded, *in situ* quartzitic sandstone in the foreground, looking northwest. Photo by R. Schild.

Archaeological Material

Units 3-6 and Hearth 1 in Unit 6 yielded 51 pieces of debitage, 5 cores, 11 retouched tools, three eggshell fragments, and one pottery sherd.

Lithics

Debitage: The recovered assemblage was flake oriented. However, one blade from an opposed platform core and two cores for flakes and blades were also present. The primary raw material was Eocene flint (25 pieces) and quartz (21 pieces). Single pieces were made from quartzitic sandstone, petrified wood, or chert. The frequencies of various types of *debitage* are given in Table 5.4.

Cores: Two small, single platform cores for flakes and blades with the faceted platform and some preparation at the back are made of quartz. Two other quartz cores were initially struck showing lisse or cortex platform. One fragment of core is unidentifiable.

Table 5.4. Nabta Playa, Site E-06-2, Frequencies of debitage types by raw materials.

Type of debitage	Flint No.	Quartz No.	Chert No.	Petrified Wood No.	Quartzitic Sandstone	Total No.
Primary flake		2				2
Flake from single platform core	3	1				4
Flake from opposed platform core		1			1	2
Flake from multiple platform core	3	1	1			5
Unidentifiable flake	2	1				3
Blade from opposed platform core	1					1
Unidentifiable blade	1					1
Chips and chunks	15	15		1	2	33
Total	25 (49.0%)	21 (41.2%)	1 (1.9 %)	1(1.9 %)	3 (5.9 %)	51 (100 %)

Retouched tools: The collection consists of one endscraper made on a tertiary flake (Table 5.5) with a scraping front formed at the distal end by an obverse retouch; the additional retouch occurs at the sinister edge. There are also two truncated pieces made on flakes or blades by obverse retouch at the distal end, as well as a single perforator with a retouched base made on the tertiary blade by alternating and obverse retouch. Three sidescrapers made on tertiary or secondary flakes: two notched pieces formed on tertiary flakes with single or multi-notch edges formed by obverse retouch or a single blow, and one denticulated blade prepared by obverse retouch as well as a chunk with continuous retouch along the edges complete the assemblage.

Pottery

A single undecorated body sherd was found; it was made of a very fine sandy clay. Its exterior face was grey with slightly darker spots; the interior was light brownish.

Table 5.5. Nabta Playa, Site E-06-2, Frequencies of retouched tool types by raw materials.

Raw Material	Flint	Quartz	QuartziticSand-stone	Total
Single endscraper on flake	1			1
Single perforator	1			1
Notched piece	1	1		2
Truncated piece	2			2
Dentuculated blade	1			1
Piece with continuous retouch	1			1
Sidescraper		2	1	3
Total	7	3	1	11

Site E-05-2

An additional cutting (Site E-05-2) 19 m long and 4 m wide was laid out across the depression of the western branch of the largest quarry (Square p/7), southwest of E-06-2. However, only 28 m^2 (Squares 8-21/A-B) were excavated to the top of the bedrock, while Squares 8-26/c-d were taken down to the top of the silty sand wash, i.e., to about 5 cm below the recent sandsheet. The western edge of the trench nearly touched the table rock remnant of the quartzitic sandstone. The stratigraphy revealed a mirrored setup of the strata that were known from the previous trenching of this largest quarry.

Above the base of the quarry pit formed by the bedrock of cemented white Qusseir sand, pink (7.5 YR 8/4) to pale red 5R 6/2), and with or without sandstone shingle plates, is the upper Middle Holocene short sequence. It is formed by a nearly horizontally deposited, consolidated and inconspicuously laminated sand wash (Stratum 3, Unit 3), about 10 to 20 cm thick, pinkish grey (7.5 YR 6/2) overlain by the laminated, light brown (7.5 YR 6/4) silty sand wash, ca. 6-10 cm thick (Stratum 3, Unit 4/5). Both beds contain several washed hearths and a few shallow pits, rare artefacts and the familiar *Zootecus insularis* shells. The beds were topped with the recent aeolian sand sheet (Stratum 4, Unit 7).

It is clear that the sandstone and the middle Holocene reddish playa silt had been removed from the western branch of the quarry by the prehistoric mineworkers to enable the quarrying of the sandstone. However, broken blocks of quartzitic sandstone of about 60 to 40 cm in length and sandstone rubble appear in Unit 4, as well as several large sandstone flakes.

Two hearths gave the radiocarbon estimates on charcoal:

Unit 5, Hearth (5 cm below the base of sandsheet): 6390-6190 calBP (5470 ± 40 BP; Poz-73204)

Unit 5, Hearth (10-15 cm below the base of sandsheet 5): 6390-6200 calBP (5480 ± 40 BP; Poz-14306).

Archaeological material

The laminated and consolidated sand yielded poor archaeological material, namely, 121 pieces of debitage, one core, seven retouched tools, two ostrich eggshell beads, and five fragments of ostrich eggshell.

Lithics

Debitage: The assemblage was heavily flake oriented (Table 5.6), made from Eocene flint (68.6%) and quartz (23.1%). Only a few pieces were of quartzitic sandstone or sandstone. Excluding the primary flakes, the flakes are primarily tertiary with lisse, pointed, or cortex platforms.

Table 5.6. Nabta Playa, Site E-05-2, Frequencies of debitage types by raw material.

Type of debitage	Flint No.	Quartz No.	Quartzitic Sandstone No.	Sandstone No.	Total No.
Primary flake	1	2	1		4
Flake from single platform core	4	2	1		7
Flake from ninety-degree core		1		1	2
Flake from multiple platform core	10				10
Unidentifiable flake	10	3	3		16
Chips and chunks	58	20	3	1	82
Total	83 (68.6 %)	28 (23.1%)	8 (6.6 %)	2 (1.6 %)	121 (100 %)

Core: Only one large core made of sandstone has been found; it is unprepared, except for a lisse platform.

Retouched Tools: The collection includes two single perforators made on a blade or a flake; both show a distal tip; one is prepared with an obverse bilateral retouch, the second is made with an alternating retouch. There is one fragment of a notched blade with the notch at the centre part of the sinister edge, prepared with an obverse retouch, and one denticulated flake with an obverse retouch at the distal end. A sidescraper and a fragment of a continuously retouched piece made on a tertiary flake with the obverse or denticulate retouch and a small portion of the blank with a fragmentary retouch complete this small assemblage (Table 5.7).

Beads

Only two unfinished ostrich egg beads have been recovered. One is a circular piece, ca. 0.9 cm in diameter, with rough, unfinished edges. The second is in a very early stage of preparation without perforation.

Table 5.7. Nabta Playa, Site E-05-2, Frequencies of retouched tool types.

Retouched Tool Types	Flint No.
Simple perforator	2
Notched blade	1
Denticulated flake	1
Piece with continuous retouch	1
Sidescraper	1
Varia	1
Total	7

3. Small, isolated quarry, Site E-05-3 (Square m/6)

The small, oval depression, about 22 m long, was cut by an 18 x 2 m trench laid out in its centre (Fig. 5.8). The trench disclosed a vast, shallow quarry pit measuring about 9 m in length and over 80 cm in depth at its deepest part, cutting through the reddish (7.5 YR 6/6) 8.2 ka playa silt (Stratum 2, Unit 2), covered by the aeolian sand of Stratum 4, Unit 7. Nearly along its entire base, the pit exposed the quartzitic sandstone bedrock (Stratum 1). Beyond the pit, this sandstone was covered directly by the 8.2 ka, reddish playa silt.

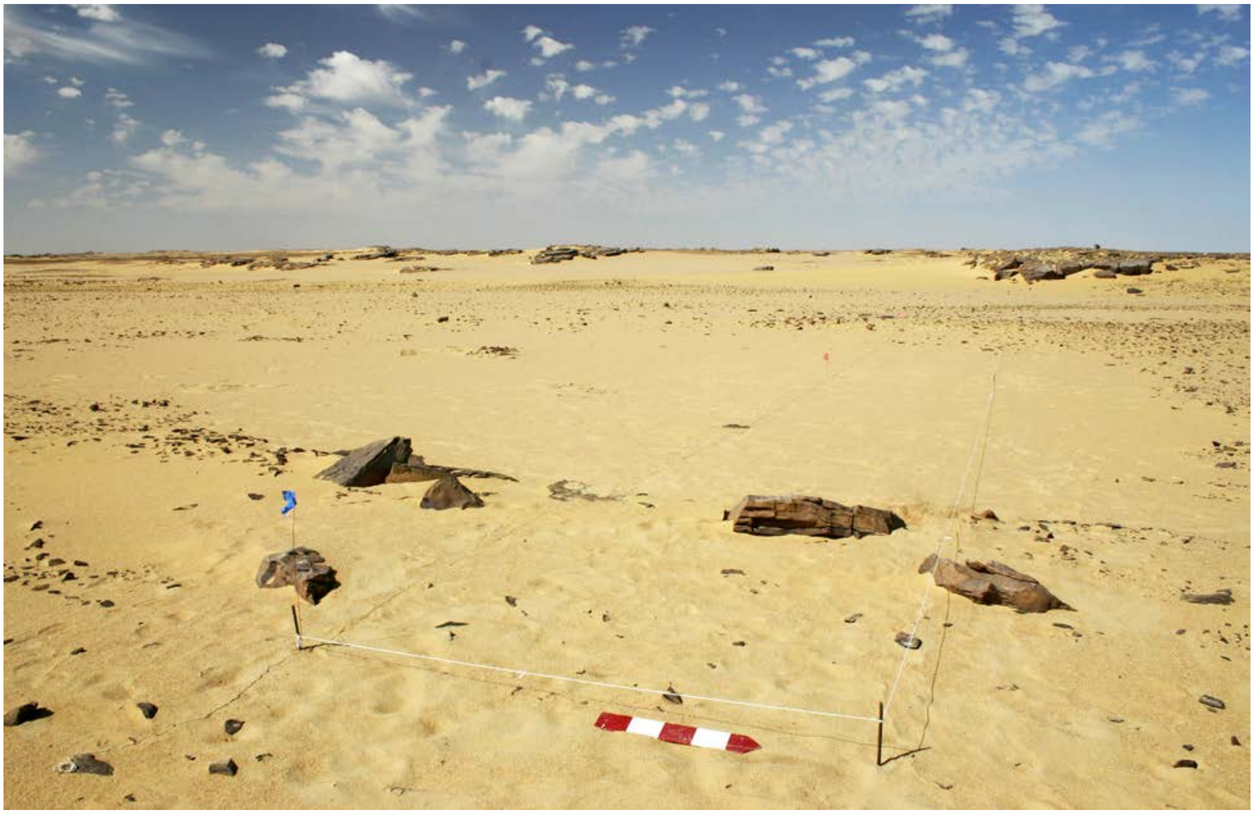
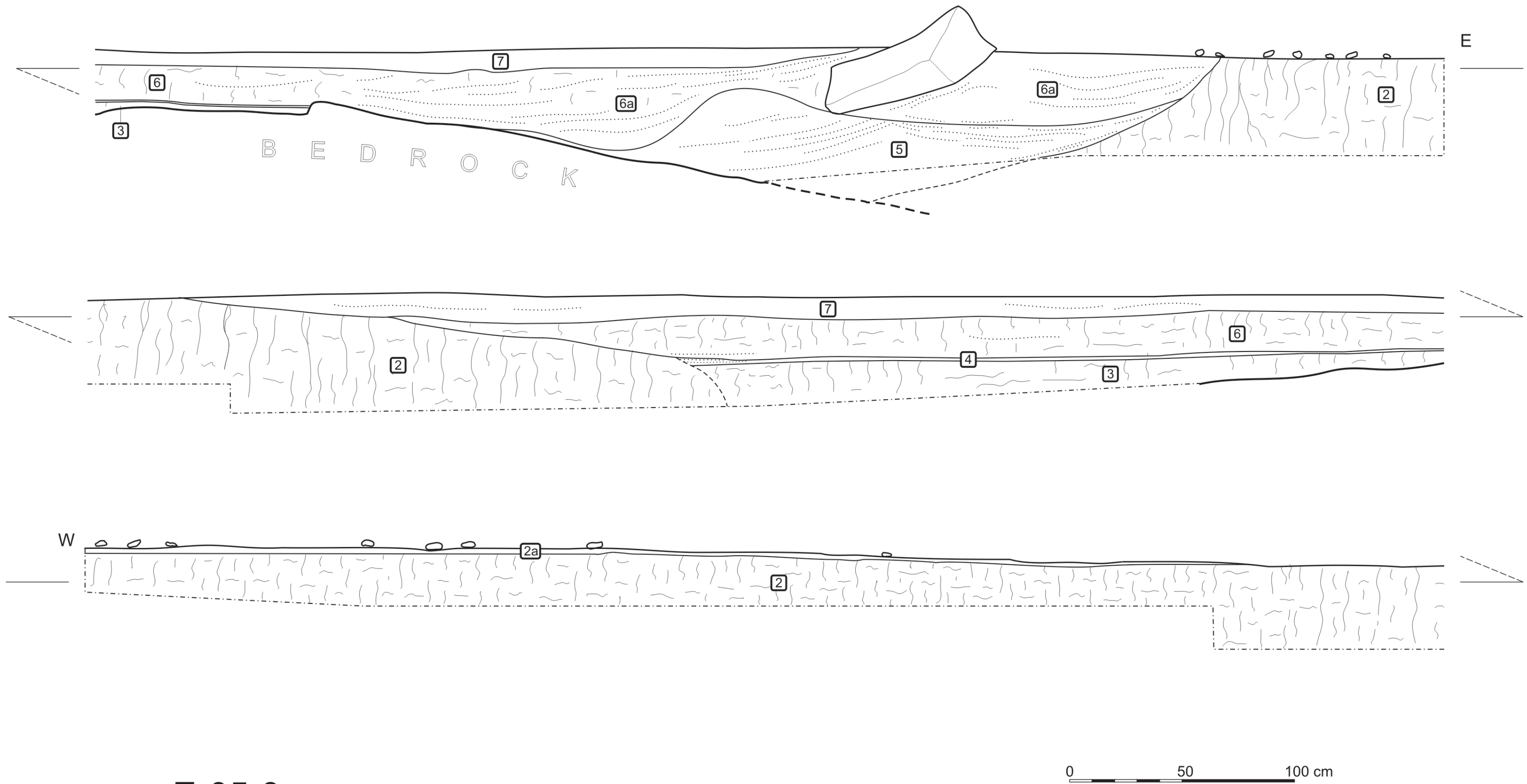


Figure 5.8. Nabta Playa, Site E-05-3. The surface of the quarry before excavation, looking west. Photo by M. Jórdeczka.

The pit was infilled with a brown (10YR 5/3), conspicuously laminated, consolidated silty sand wash with blocky structure, rich in sandstone debris and shingle, as well as rare artefacts (Stratum 3, Unit 3). A thin bed of laminated friable, very pale brown (10YR 7/4) sand (Stratum 3, Unit 4), 4 to 6 cm thick, topped the wash and wedged out toward the west. It was overlain by a laminated, brown (7.5YR 5/4), silty sand wash (Stratum 3, Unit 5), and a brown (7.5YR 4/4) consolidated silty sand with blocky structure (Stratum 3, Unit 6) grading into sand (Stratum 3, Unit 6a); both contained sporadic *Zootecus insularis* shells. The suite of beds was topped with a recent, friable, very pale brown (7.5 YR 8/4) aeolian sandsheet (Stratum 4, Unit 7).

The sand of Units 6 and 6a enclosed two abandoned blocks of fresh quartzitic sandstone about 1 m in length and several smaller pieces of sandstone debris. In addition, four hearths, often sunk to the top of bedrock, and about 10 to 60 cm in diameter, were observed in the bed. These yielded most of the artefacts, which also occurred in their vicinity. Two large, elongated pits, probably up to 2.3m long and 1m wide: one wide and shallow in the east (Pit 1); and a smaller one in the west (Pit 2), complete the human alterations of the deposits (Fig. 5.9-5.11).



E-05-3

Figure 5.9. Nabta Playa, Site E-05-3. Cross-section. Key: 2 – the 8.2 ka silt, 2a – weathered 8.2 ka silt, 3-6 – alluvial surface washes, 7 – aeolian sand sheet. Cross-section by R. Schild, drawn by M. Puszkarski.

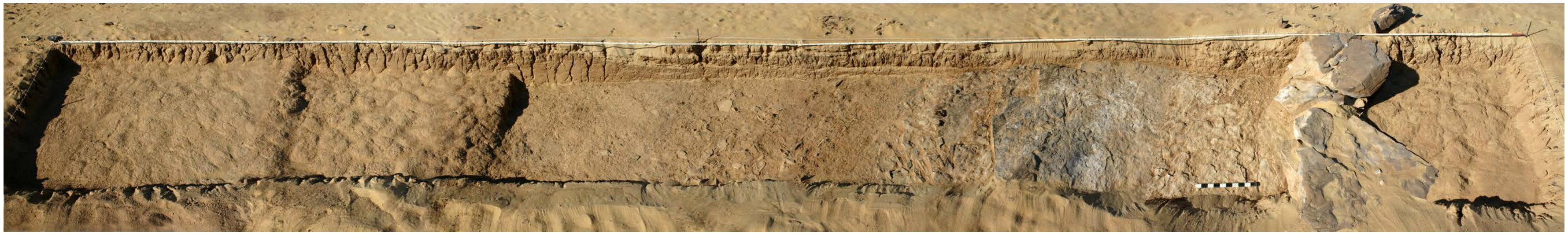


Figure 5.10. Nabta Playa, Site E-05-3. The floor of the excavated trench, looking west. Quarry pit in the foreground followed by exposed Qusseir mud and the 8.2 ka silt in the western section of the trench at the outer end. Photo by M. Jórdeczka.

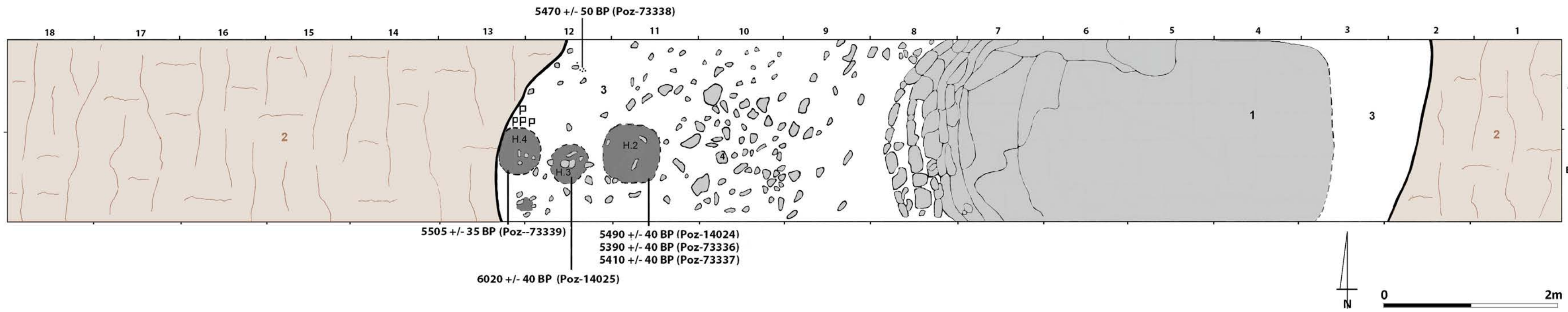


Figure 5.11. Nabta Playa, Site E-05-3. The floor of the excavated trench. Key: 1 – Quartzitic sandstone, 2 – the 8.2 ka silt, 3 – silty sand with shingle and rare artefacts (quarry pit), 4 – Sandstone shingle waste, H – hearths, P – pottery sherds of Unit 3, on the cultural floor, primarily covered by a sand lense of Unit 4. Draft by R. Schild and H. Królik, drawn by E. Gumińska and M. Puszkarski.

Six radiocarbon estimates on charcoal have been obtained as follows:

Hearth 2 (5-10 cm below the base of Unit 7): 6290-6000 calBP (5390 ± 40 BP; Poz-73336)

Hearth 2 (10-15 cm below the base of Unit 7): 6400-6200 calBP (5490 ± 40 BP (Poz-14024)

Hearth 2 (15-20 cm below the base of Unit 7): 6300-6010 calBP (5410 ± 40 BP; Poz-73337)

Quarry Pit (20-25 cm below the base of Unit 7): 6400-6120 calBP (5470 ± 50 BP; Poz-73338)

Hearth 4 (35 cm below the base of Unit 7): 6400-6210 calBP (5505 ± 35 BP; Poz-73339)

Hearth 3 (35 cm below the base of Unit 7): 6960-6740 calBP (6020 ± 40 BPP; Poz-14025).

Archaeological material

Units 3, 4, and 5 yielded 125 pieces of debitage, three cores, three retouched tools, one burin spall, one hammerstone, 28 fragments of pottery, a few scraps of animal bones, as well as a few ostrich eggshell fragments and shells of *Zootecus insularis*.

Lithics

Debitage: The small collection of debitage was flake oriented (Table 5.8), mostly of quartz (61.6%) and Eocene flint (36 %). Only single pieces were of quartzitic sandstone, sandstone and chalcedony. Except for primary ones, the flakes are mainly tertiary with lisse platforms.

Cores: Two single platform cores and one initially struck specimen show cortex, lisse, and faceted platforms and are made of quartz.

Retouched tools: Two denticulated flakes and one scaled piece blade have been found. All are made of Eocene flint. The obverse, continuous retouch form the denticulated piece. The scaled piece is an inverse, bipolar specimen.

Hammerstone: A single, oval hammerstone of quartzitic sandstone with use traces was found.

Table 5.8. Nabta Playa, Site E-05-3, Frequencies of debitage types by raw material.

Type of debitage	Flint No.	Quartz No.	Chalcedony No.	Quartzitic Sandstone No.	Sandstone No.	Total No.
Primary flake	1	1				2
Flake from single platform core	1	1	1			3
Flake from ninety-degree core	2				1	3
Flake from multiple platform core	6	1		1		8
Unidentifiable flake	4	2				6
Chips and chunks	31	72				103
Total	45 (36%)	77 (61,6%)	1 (0.8%)	1(0.8%)	1 (0,8%)	125 (100%)

Pottery

The assemblage of pottery sherds seems to be very homogeneous, made of Qusseir clay. It appears that initially, all the recovered sherds had been whitish grey until the hue of a few of them changed to dark grey due to the exposition to manganese leaching. Several small sherds found in Hearth 3 were visibly burned and had changed their colour to pinkish grey on both the inside and the outside surfaces.

Only two refitted fragments of a rounded rim have been found. The remaining sherds are body fragments. The only reconstructed vessel is a small bowl, measuring about 10 cm in diameter at the rim with the broadest part of 10.5 cm in diameter located ca 2.5 cm below the rim.

Small Pits

Several small pits go together with the tested large features. None have been excavated; however, common sandstone debris accumulated in the vicinity well as the morphology of the area strongly suggest that these represent small quarries concentrated on working individual sandstone remnants (Fig. 5.12).

4. Lithostratigraphic Environment

The lithostratigraphy of the Final Neolithic quartzitic sandstone quarries of Nabta Playa is quite simple. It is primarily composed of: the fine clastic bedrock and quartzitic sandstone beds (**Stratum 1**); the reddish sandy playa silt mantle relating to the 8.2 ka global event (**Stratum 2**); relatively shallow local sheet wash sand and muddy sand (**Stratum 3**); and aeolian, recent sandsheet **(Stratum 4**). The fine sand and muddy beds of Stratum 1 seem to correspond Upper Cretaceous Qusseir Formation of Klitzsch *et al.* (1987) and El Hinnawi *et al.* (2005), or to the troublesome (Issawi *et al.* 2009: 193), Qusseir Clastic Member, the upper member of the Nubia Formation (Issawi *et al.* 1999: 190, 436), of the Nuba Abu Balas Facies (Issawi *et al.* 1999: 147; Issawi *et al.* 2005; 2009) of the Upper Cretaceous of Egypt. Klitzsch e*t alli* define the Qusseir Formation beds as "varicoloured shale, siltstone, and flaggy sandstone" (Klitzsch *et al.* 1987). Bahay Issawi, on the other hand, characterizes the lithology of the Qusseir Clastic Member as "vividly coloured shales alternating with sandstone and siltstone beds", some 20 to 80 m thick (Issawi 2005: 359). A type section of the Nubia Formation is at Bargat El-Shab, about 12 km SW of Nabta Playa. It shows the Qusseir Clastic Member beds closer to the top of the section (Issawi *et al*. 1999: 436). Flaggy sandstone remnants overlie the fine clastics in the area of the quarries and dot the landscape to the west and southwest of the mines.

5. Chronology and Taphonomy of the *Bunat El Asnam* Final Neolithic Quarries at Nabta Playa, a Summary

The muddy sand washes, often with sandstone waste debris and/or artefacts, witness the human occupation and the specific sandstone mining for the raw material used to produce the stelae. Hearths, living (?) pits, artefacts, and bones occur throughout all the units of Stratum 3, suggesting that mining depressions were also used as camping places while working the neighbouring quarries. However, sandstone waste flakes and fragments litter the surface of the topmost Qusseir clastics beds, indicating that this was the mining and primary shaping area of the extracted blocks. In addition, rare broken, abandoned blocks are seen embedded in various units of Stratum 3. These are the beds deposited during the time of human occupation, but not necessarily during the actual quarrying of the specific parts of the quarry.

Figure 5.12. Nabta Playa, Western Field of Menhirs. A sample of small quarries. Drawn by M. Puszkarski.

The deposits of Stratum 3 are alluvial in origin and can be linked to sheet flows triggered by local rainfall. The matrix of these deposits had originated from the accumulations of the washed backdirt from the quarries. Thus, it is a mixture of sediments, such as playa silt, sand, and fine Cretaceous clastics, now eroded and not present in the area, except for the fillings of prehistoric pits. Nevertheless, the marked abrasion of some artefacts suggests that they had suffered alluvial displacement within a coarse sedimentary environment.

A significant contribution of these trenches to our knowledge of the site is in helping to determine the precise chronology of the construction and use of the complex megalithic structures in the immediate vicinity. The age of the quarrying activity at the mines could be cross-checked with previous conclusions on the chronology of the astronomical alignments.

Following several reservations concerning the precise, ancient position of the components of the alignments (cf. Chapter 7, this volume). McKim Malville and Brenmer (Malville *et al.* 2007: 23) proposed new chronologies for the erection of the alignments as well as their stellar correlations. This reassessment, complemented by Brophy and Rosen (2005) with the Quickbird imagery and GPS data, motivated Malville *et al.* (2007: 23) to reduce the number of alignments. According to these revisions, alignments A1-A3 were oriented towards Arcturus at about 3810-3630 BC, 4220-4020 BC, 4530-4320 BC, respectively, and the reorientation of the alignment may be attributed to a response to precession (McKim Malville 2015). Likewise, it seems that alignment B1 targets Sirius at about 4640-4400 BC, while B2 aims at Alnilam at about 4340-4150 BC and Sirius at 3700-3430 BC. It is interesting to note a correlation between the aging of the A and B stelae alignments of Nabta Playa and the radiocarbon dates for quarrying activities.

The enigmatic presence of relatively young charcoal pieces in a secondary small pit (Site E-96-1E) under the cluster of fallen stelae in Square k/11 (Wendorf and Królik 2001: 519) suggests that the hole is not directly associated with the installations of stelae groups. The charcoal yielded a radiocarbon estimate of 4800 ± 85 BP (DRI-3358) at 2σ about 5720-5320 calBP and 3765-3370 calBC, a date significantly later than the cluster of dates from the quarries. The modal values of these dates show an even more significant time hiatus. Even the youngest radiocarbon age estimates in the quarry group (Poz-73336 and Poz-7918) are at 2σ about 400 to 900 years older than DRI-3358. Thus, it may be assumed that the pit at the foot of the then still upright stelae (E-96-1E) has no connection with the *Bunat El Asnam* presence in the area and could be linked with the younger settlement.

The radiocarbon dates from the quarry form an interesting pattern (cf. Fig. 5.3). The sixteen results obtained (2xσ,) spread from 7160-6560 calBP (Poz-19188), or 5210-4610 calBC at Site E-06-2, Bed 3, Base, to 6290-6000 calBP (Poz-73336), or 4340-4050 calBC at Site E-05-3, Bed 6a. However, within the 2xσ range of Poz-19188 is Poz-14025 extending from 6960-6740 calBP or 5010-4790 calBC at Site E-05-3, Hearth 3. Both ages are significantly older than all the remaining age estimates, which overlap with each other at 2σ and cluster within a group ranging from 6490-6310 calBP (Poz-73335), or 4540-4360 calBC at Site E-04-4, Bed 3, Base, to 6290-6000 calBP (Poz-73336), or 4340-4050 calBC at Site E-05-3, Hearth 3.

As a result, one may hypothesize that the quarrying activity at Nabta and installing the various structures of menhirs took place between about 4600 BC and 4200/4100 BC. However, not all of the quarry pits have been dated. It is likely that some of the surface table rocks could have been quarried out after 4100 BC. Of interest is a disordered, elongated cluster of various sandstone blocks seemingly stored in the Western Field in Squares q-n/12.

This situation is not surprising in light of the depositional dynamics of the sediments in the quarry pits. The massive 8.2 ka silt initially capping the sandstone is of an age preceding even the Middle Neolithic presence in the area and often shows superimposed, eroded traces of Late and Final Neolithic on the surface. The two age estimates from the quarries E-06-2, and E-05-3 (Poz-19188 and Poz-14025 respectively), on the other hand, are well within the time of the Middle-Late Neolithic, or mid-*Ru'at El Baqar* variant (Schild and Wendorf 2001a: 47; 2001b: 53). Nevertheless, one cannot exclude that the systematic beginning of sandstone quarrying at western Nabta Playa began during the Late Neolithic Interphase.

Four radiocarbon age estimates have been obtained from the Final Neolithic graves at Cemeteries E-01-2 and E-03-1 at Gebel Ramlah (Kobusiewicz and Kabaciński 2010b: 119). All closely overlap at 2σ with the younger cluster of radiocarbon ages from the Nabta Playa quarries. Of similar age is an infant cemetery (Site E-09-2) at the foot of Gebel Ramlah, dated to about 4500-4300 BC (Kabaciński *et al.* 2018).

It appears that the quartzitic sandstone quarries to the west of the Western Field of Stelae served both the Western and Eastern Fields, as suggested by the physical similarity of the stones as well as the relatively short distance separating the source from the final destination of the quarried slabs. Therefore, the chronology of the extraction of stone established at the quarries sheds some light on the dating of at least the two closest stelae fields since there are practically no means of direct dating the time of installation of the particular stelae. All the attempts at the recovery of datable materials in the deep pits under the clusters of stelae at Sites E-96-1A, E-96-1B, and the one at Sq. 0/12 (cf. Chapter 12, this volume) failed, as did the efforts in the Eastern Field of Stelae.

Chapter 6.

Fields of Menhirs

Romuald Schild and Halina Królik

1. Introduction

Nabta Playa was not only a major Neolithic settlement region of the Sahara, but it was also the nearly undying focus of Neolithic ceremony during the entire African Humid Period. It covers about 10 sq. km. and stretches in time from about 7000 to 4050 BC (cf. Chapter 3, this volume; Wendorf and Schild 2001a; Schild and Wendorf 2004). It embraces an immense quantity of sacral arrangements assembled in discrete sets and composed of the following groups of installations dating to different chronological periods (cf. Table 3.3):

1. Two large zones of offering tumuli, one Early Neolithic, on the E-06-4 "Sacred Mountain", or Gebel El Muqaddas in the north, and the second, Late Neolithic, about two kilometres to the south of the Gebel, "Wadi of the Sacrifices" (cf. Chapter 3 i 4, this volume);
2. Vast, Middle Neolithic hearth expanses in the southern cirque of Gebel El Muqaddas (cf. Chapter 3, this volume) and in the southwestern corner of the depression (cf. Fig. 1.4);
3. Late Neolithic, or *Ru'at El Baqar* tumuli in the "Valley of the Sacrifices" (cf. Chapter 4, this volume);
4. Four Final Neolithic, *Bunat El Asnam* fields of menhirs stelae with hundreds of worked sandstone blocks farther to the south and southeast (cf. Chapter 6, this volume);
5. At least two principal, Final Neolithic megalithic alignments of stelae (cf. Chapter 7, this volume) directed towards the polar region in the northern celestial hemisphere, and Sirius and/or Orion (?)
6. An imposing burial mound overlooking the Fields of Stelae from the west (cf. Chapter 9, this volume);
7. C-Group possible "Solar Calendar" at the mouth of the Valley (cf. Chapter 11, this volume).

The stelae, or menhirs, occupy the southwestern and western sector of the Nabta Playa Basin. All are made from light grey to whitish quartzitic sandstone of the Qusseir Clastic Member of the Nubia Formation, Santonian in age. The Member in the general Nabta Playa Area is represented by a suite of sandstones with shale or clay interbeds (Issawi *et al.* 2009: 207). Today, the menhirs exposed to the atmosphere are covered by a brownish patina.

Most of the menhir blocks are worked around the perimeter by hard stone flaking. A few are not shaped or only partially worked. The most common forms are anthropomorphic shouldered figures with rounded heads or oval distal ends. The bases are broken, with flat planes, but often worked and sometimes pointed. Sizes are extremely variable, ranging from a few metres to a few dozen centimetres (Fig. 6.1-6.9). It appears that most of the final shaping took place at the sites where they were set up, as most flakes occur on the surface and in the infills of the deep pits underneath the erected monuments.

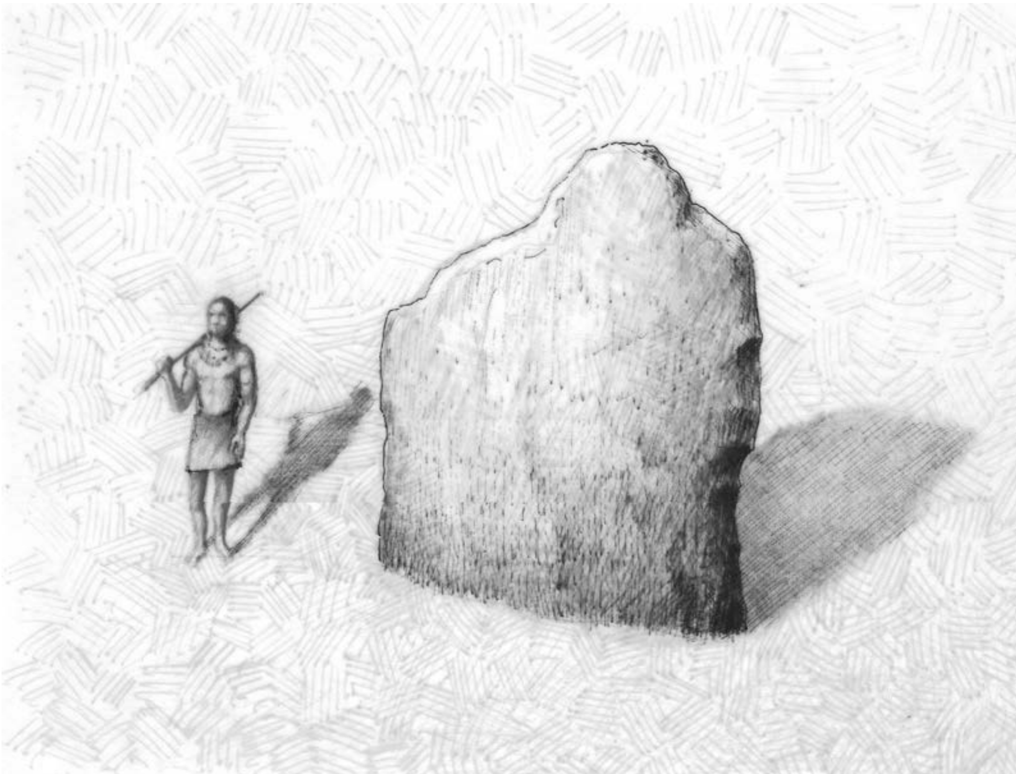


Figure 6.1. Nabta Playa, a separate stele, Sector C, Square j, i/19. Reconstruction by M. Puszkarski.

Except for isolated stelae and the alignment, there are four major fields of stelae or clusters of megalithic structures along the western and southwestern shores of the Nabta Playa Basin: the Western, Eastern, South-Eastern and Southern Fields and the Salt Hill (cf. Fig. 1.5-2.5, , 2.7). All dot the gentle, erosional silt mounds and hummocks carved by the desert winds in the reddish brown to brown playa silts deposited during the 8.2 ka event. These fields and the Salt Hill form an edge to the ancient centre of the Nabta Playa Basin (cf. Fig. 1.5). Each of the fields contains from several to more than twenty tight clusters of shaped and sometimes unshaped megalithic blocks and slabs as well as single, isolated stones. Today, except for a dozen or so menhirs that are still standing upright, although often broken or tilted (Fig. 6.10), the megalithic slabs lie flat on the surface of the 8.2 ka event playa silt (Fig. 6.11, 6.12). There are isolated stelae as well as minor clusters of them located upon the Salt Hill, which is an erosional isolated playa-silt rise lying to the north of the South-Eastern Field. Overall, several dozen stelae clusters containing in total several hundred individual stelae have been recognized thus far along the shores of the ancient Lake Nabta.

In 1996 and 1997, the Combined Prehistoric Expedition (CBE) excavated three clusters of collapsed and broken megalithic stelae designated as Structures A, B, and E at Site E-96-1 (Fig. 6.13; cf. Fig. 2.4), located in the Western

Field of Stelae (Wendorf and Królik 2001). In all instances, the excavations revealed huge pits dug into the lake silt underneath the sandstone blocks which rested on the surface of silt. The pits were excavated down to the depth of mushroom-like sandstone bedrock rises, i.e., table rocks. These table rocks stood up above the continuous bed of Cretaceous bedrock and had been shaped by wind erosion well before the deposition of the lake silt. At Structures A and B, the table rocks were slightly worked by knapping to form crude nose-like projecting points on the northern side of the rock. After placing the stelae in the pits, the deep holes were filled up again with the remaining matrix.

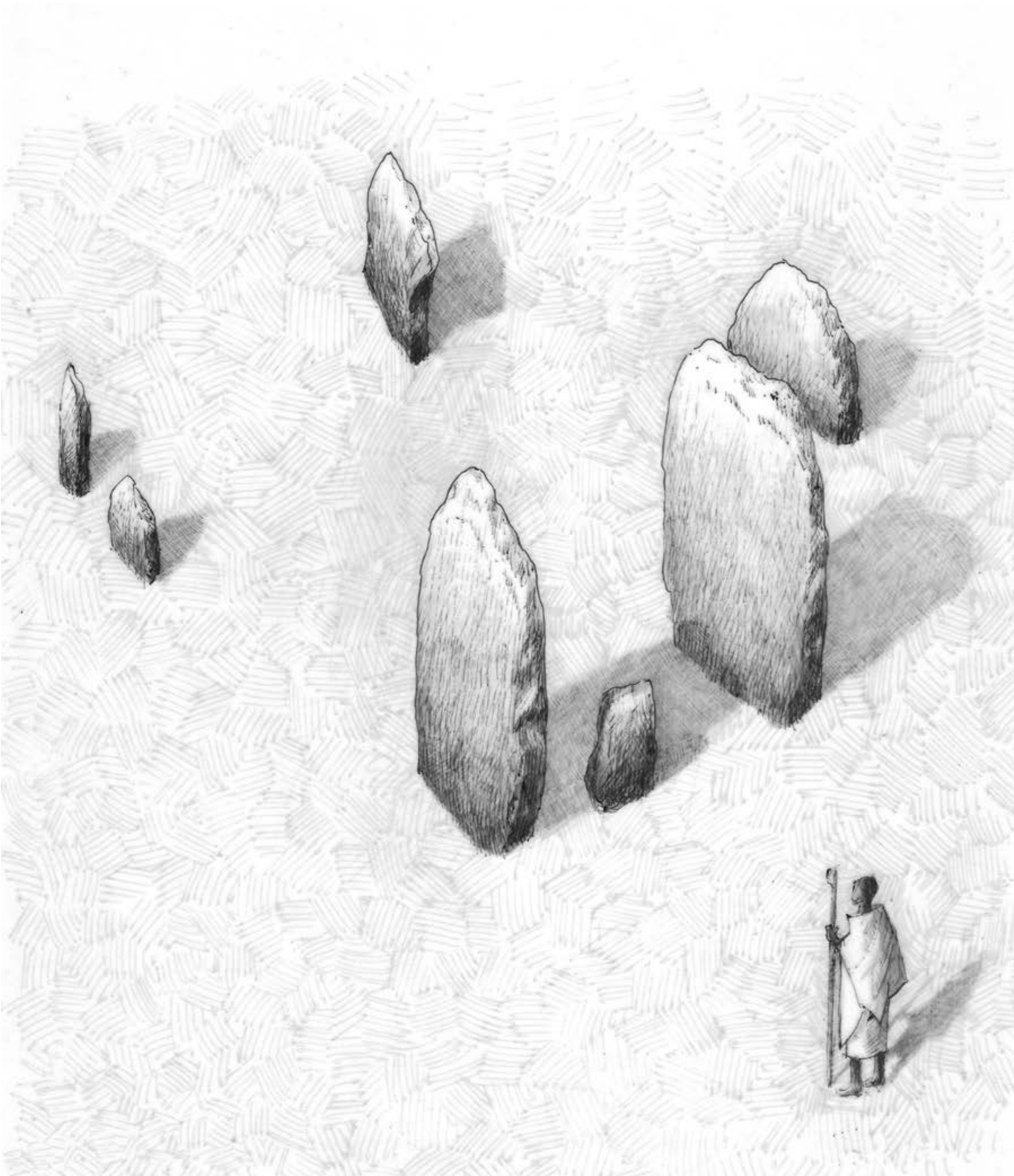


Figure 6.2. Nabta Playa, a group of stelae, Sector C, Square j/19. Reconstruction by M. Puszkarski.

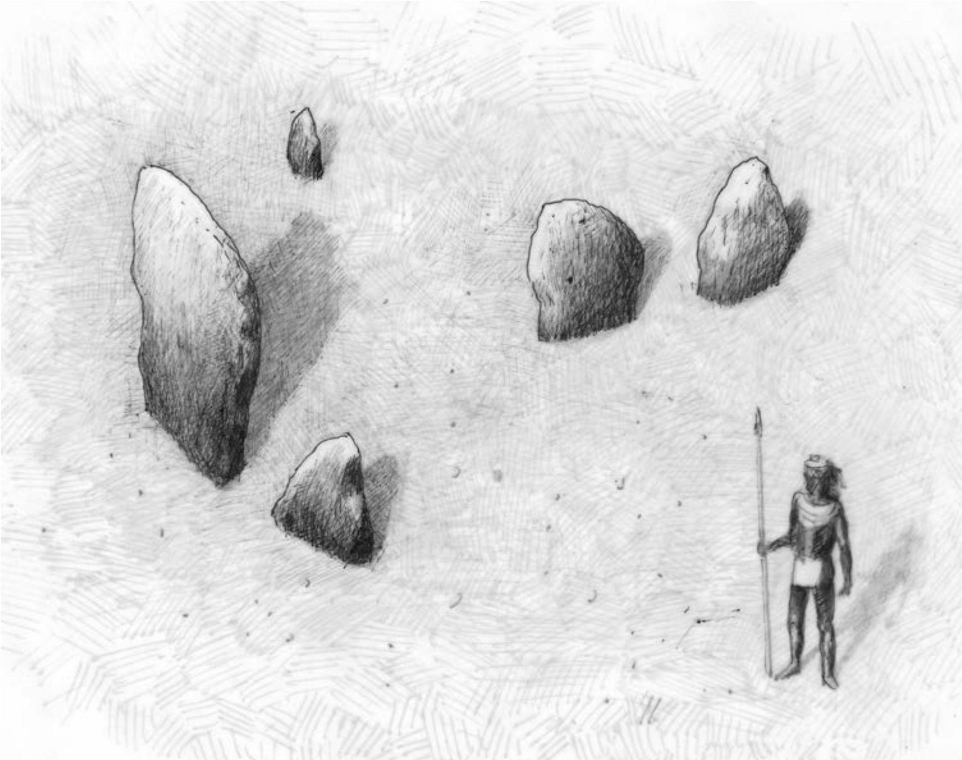


Figure 6.3. Nabta Playa, a group of stelae, Sector C, Square f/9. Reconstruction by M. Puszkarski.

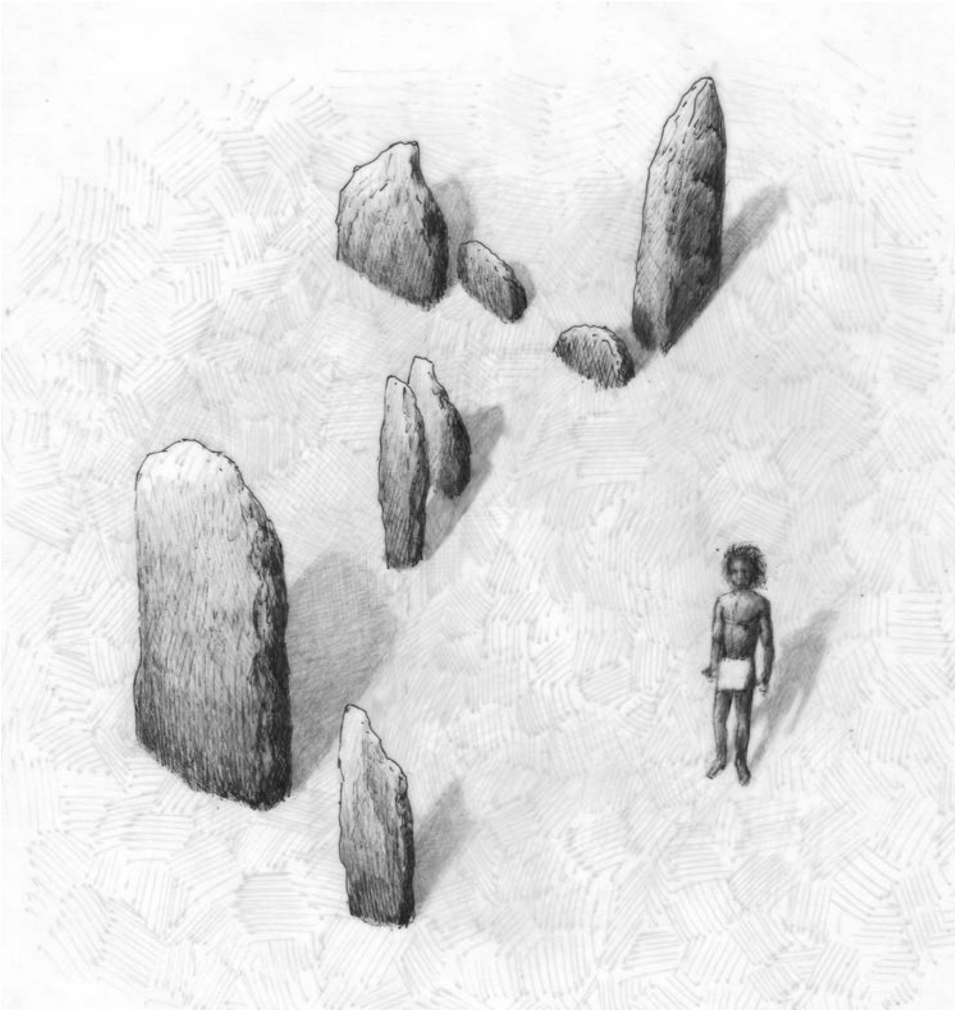


Figure 6.4. Nabta Playa, a group of stelae, Sector C, Square f/10, Reconstruction by M. Puszkarski.

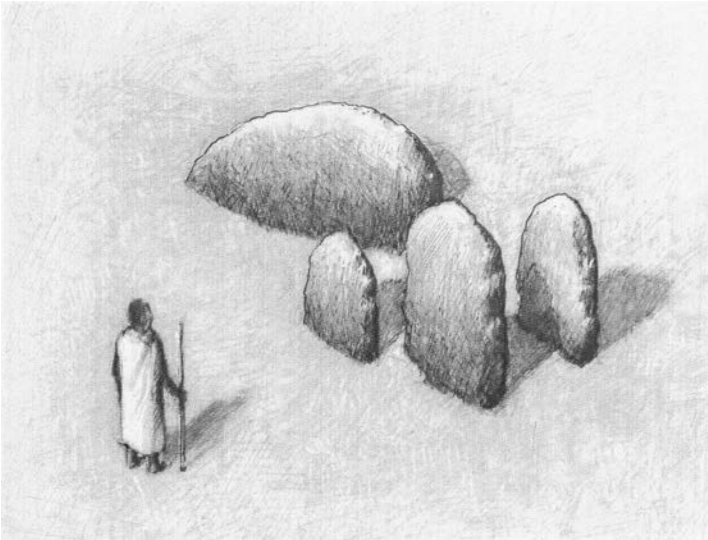


Figure 6.5. Nabta Playa, a group of stelae in the Alignments A3, Sector B, Square n/21. Megaliths A-1 and A-2 of Wendorf and McKim Malville (2001:490). Reconstruction by M. Puszkarski.

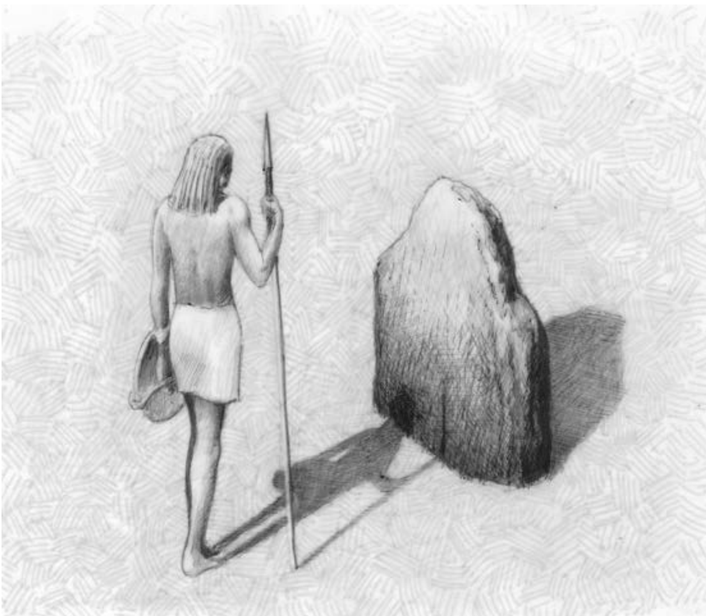


Figure 6.6. Nabta Playa, a separate stele, Sector C, Square n/19. Reconstruction by M. Puszkarski.

Figure 6.7. Nabta Playa, an isolated stele (Megalith B-7) in the B Alignment of Wendorf and McKim Malville (2001: Fig. 16.12). Sector C. Square o/26. Reconstruction by M. Puszkarski.

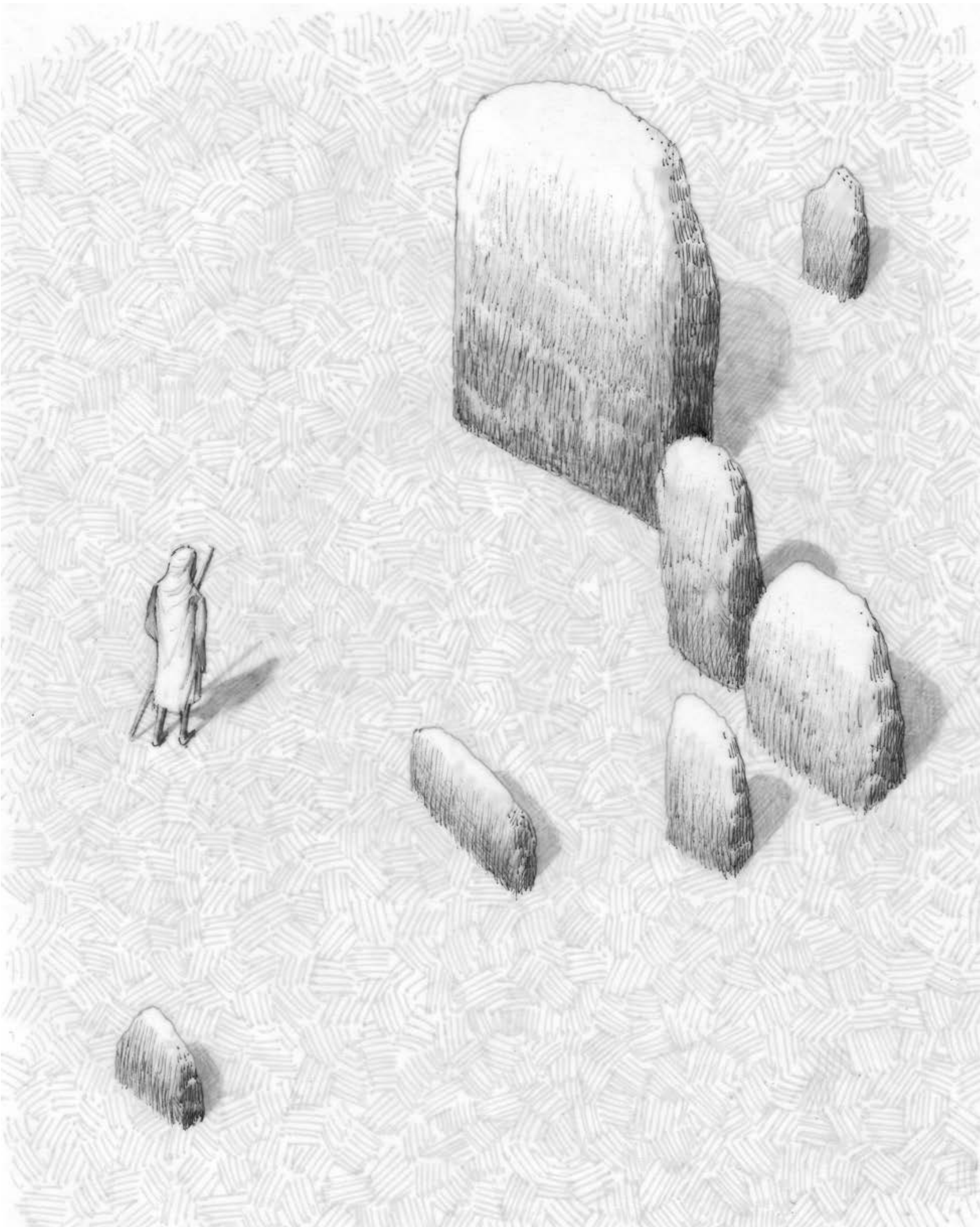


Figure 6.8. Nabta Playa, a group of stelae, Sector C, Square k/10. Reconstruction by M. Puszkarski.

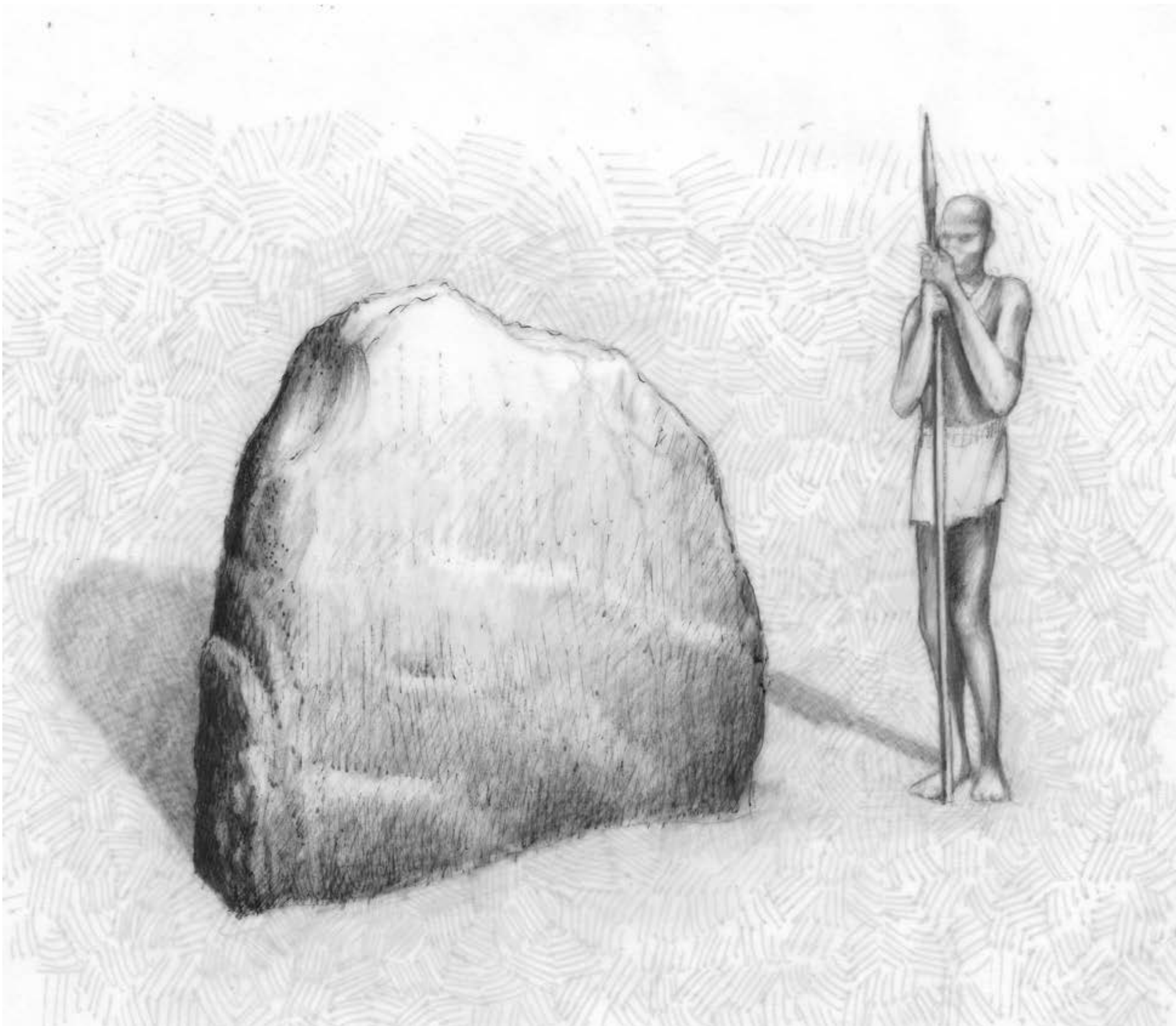


Figure 6.9. Nabta Playa, a single stele, part of Alignment B, Sector C, Square 0/26. Reconstruction by M. Puszkarski.

An augur sounding of the bedrock under five of the stelae clusters in the northern section of the Western Field showed the outlines of rises in the bedrock under the clusters. During the 2006 and 2008 field seasons, Tomasz Herbich conducted an electro-resistivity survey of several collapsed stelae clusters in the northeastern section of the same field (Fig. 6.14), as well as under the clusters in the Eastern Field. The survey revealed that most of the stelae clusters had the table rock structures underneath (cf. Chapter 8, this volume).

This was not, however, a general architectural canon. In the South-Eastern Group of Stelae, on Site E-04-1, one of the clusters of collapsed whole and broken stelae (*Concentration A*) was tested in 2004. The trenching revealed shallow pits, which served as settings for the bases of the primarily vertical stelae. No large pits similar to those found under the Megalithic Structures in the Western Group (Wendorf and Królik 2001) were observed at Site E-04-1 (compare below).

Only a secondary pit under Structure E of Site E-96-1 contained charcoal that dated about (at 1σ) 3650-3380 cal BC (Schild and Wendorf 2001b: 54), placing the age of the pit at 2σ some 400 to 900 years after the youngest *Bunat El Asnam* (Final Neolithic) quarrying activity at Nabta Playa (cf. Chapter 5, this volume).

Figure 6.10. Nabta Playa, megalith A-1 of Alignment A, note the embedded and tilted megalith and a shattered and fallen neighbouring block. The CPE camp in the far background, looking northeast. Photo by R. Schild.

Figure 6.11. Nabta Playa, fallen menhirs north-west of the E-96-1A cluster, looking north-west. Gebel Nabta in the background. Photo by R. Schild.

Figure 6.12. Nabta Playa, fallen menhirs north-west of the E-96-1A cluster. Note the southern slopes of Gebel Nabta in the upper right corner of the picture. Photo by R. Schild.

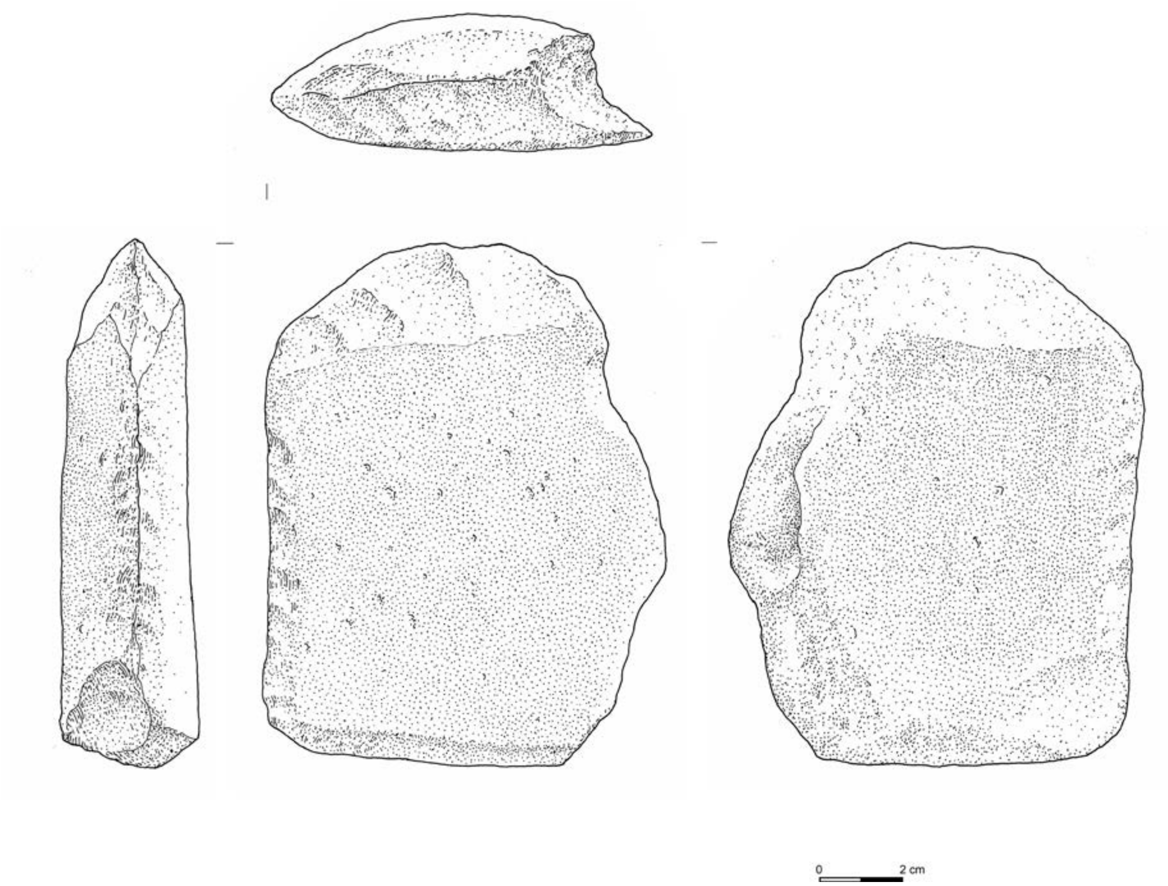
Figure 6.13. Nabta Playa, Site E-96-1, Structure A. Fred Wendorf and Steven Duncan begin the excavations. Photo by R. Schild.

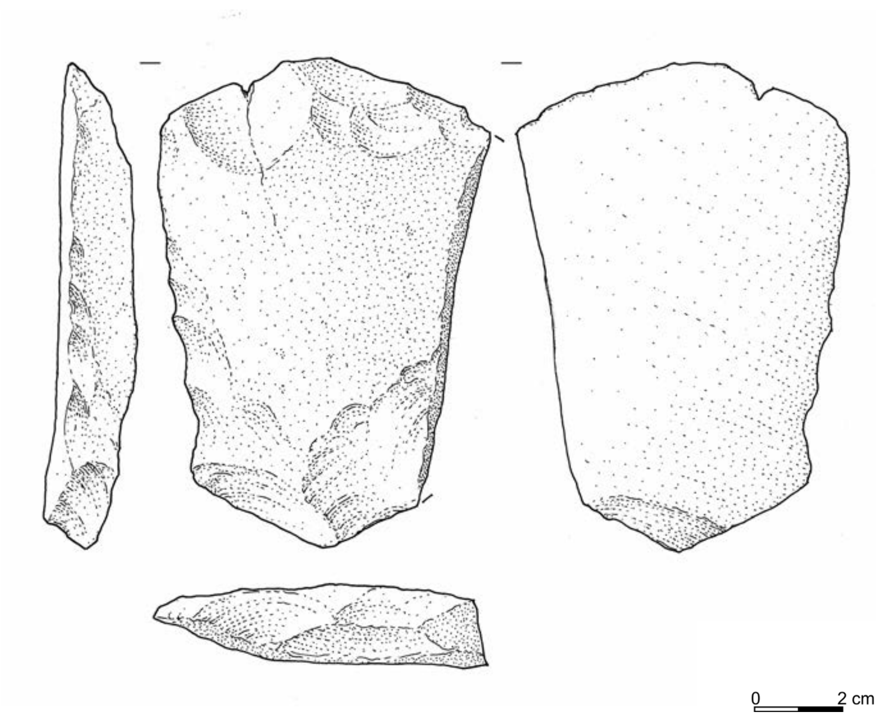
Figure 6.14. Nabta Playa, Tomasz Herbich conducting resistivity profiling at the Eastern Field of Megaliths, looking north-east. Photo by A. Czekaj-Zastawny.

The infill of the excavated pits also contained sandstone flakes and chunks resulting from shaping the stelae, hoes made of sandstone flakes (Fig. 6.15, 6.16) and occasional displaced flint artefacts. On the other hand, the pit under Structure A (Fig. 6.17), centrally placed over a low rise, held a large block of sandstone weighing over a ton and only slightly shaped and possibly abraded into a form resembling, to a very imaginative observer, a cow (Wendorf and Królik 2001: 511; Schild and Wendorf 2015).

Cross-sectioning of the upper part of the lacustrine clay/silt beds upon which the blocks rested as well as studying the dispersal of the broken fragments has led to the refitting and reconstruction of the original arrangement of some individual megaliths and their groups (cf. Fig. 6.1-6.9). In many instances, these sections and the cleaning of the reddish silt surface revealed the pits in which some of the stelae were set, as well as the shallow alluvial sand filled basins underneath the stelae created by wind erosion after the blocks had fallen. These findings, as well as the OSL dating of sand filling the post-collapse basins, have helped to define the reasons for the fall and the kinetics of collapse.

At the southern end of the Western Field of Stelae, large yellow patches of sand infilled apparent depressions in the reddish playa silts were the remnants of sandstone quarries, the source of the stelae blanks. Halina Królik, Dagmara Mańka, HebatAllah A.A. Ibrahim, and Maciej Jórdeczka tested four of these (Sites E-04-4, E-05-2, E-05-3, and E-06-02) during the 2004-2007 seasons. Abundant traces of sandstone block extraction, as well as numerous hearths and camp refuse, occurred in the test trenches. A series of radiocarbon dates obtained on charcoal gave the ages of this activity between about 4600-4400 and 4200-4100 cal BC (cf. Chapter 5, this volume), thus firmly placing the sandstone block extraction and megalithic field installations of the Western Field of Stelae in the *Bunat El Asnam* Final Neolithic.





▲ **Figure 6.15.** Nabta Playa, the South-Eastern Field of Megaliths, surface. A hoe on a quartzitic flake. Drawn by M. Puszkarski.

◄ **Figure 6.16.** Nabta Playa, Site E-96-1, Structure A, Pit. A hoe on a quartzitic flake. Drawn by M. Puszkarski.

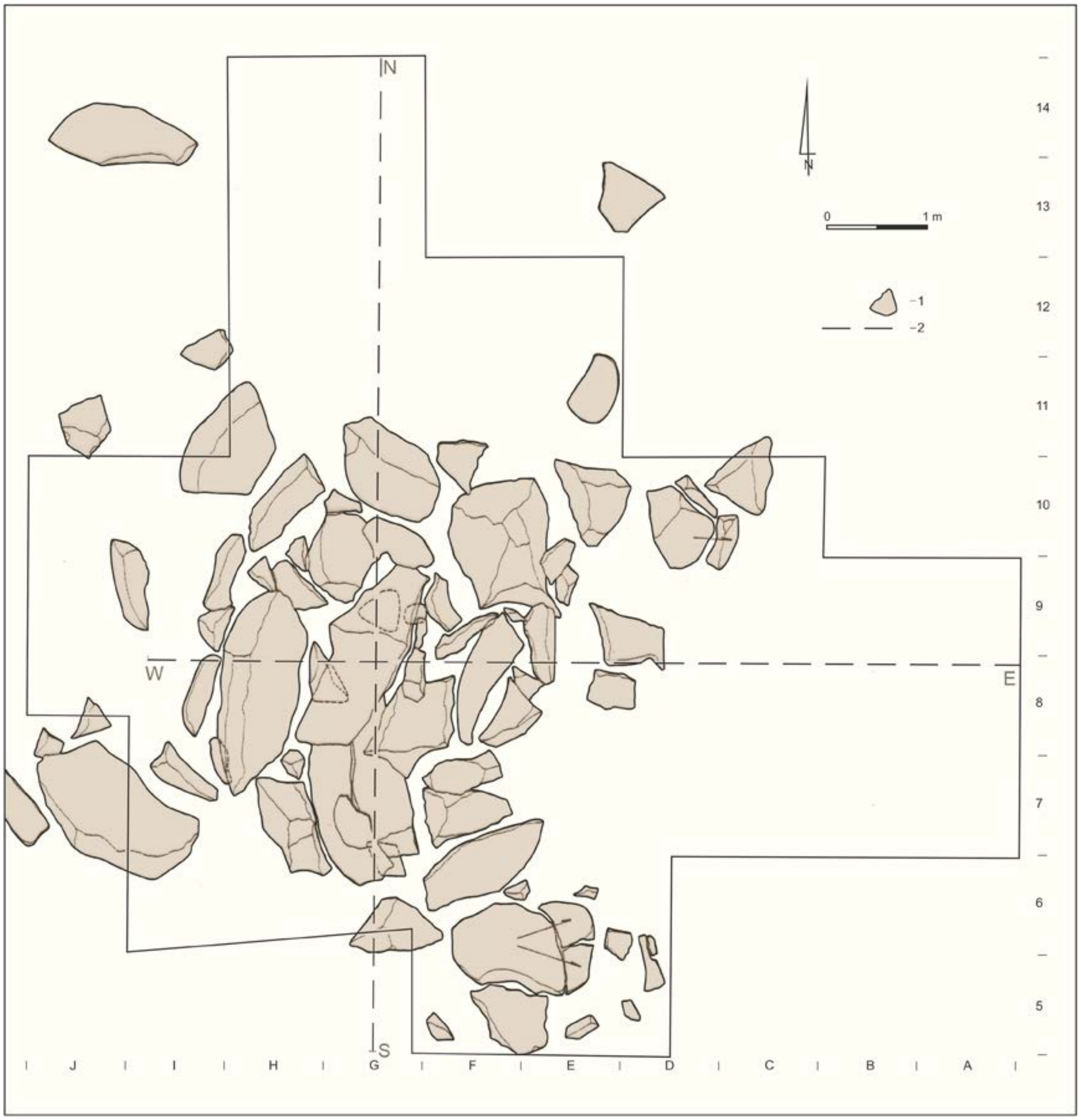


Figure 6.17. Nabta Playa, Site E-96-1, Structure A. Scatter pattern of fallen complete quartzitic sandstone blocks and fragments. Key: 1. Blocks; 2. Major cross-sections. Drawn by M. Puszkarski. Based on a map by F. Wendorf and S. Duncan (Wendorf and Królik 2001).

2. Basic stratigraphy

A very basic stratigraphy at the Fields of Stelae and all the alignments comprises a rudimentary synthesis of the pre-8.2 ka event geomorphic history of Nabta Playa (Wendorf and Królik 2001: 505). The basal Stratum 0 consists of the Qusseir Clastic Member of Nubia Formation. A complex group of deposits (Stratum 1) made up of sandy, aeolian, alluvial, and lacustrine deposits topped by Stratum 2, the reddish brown, 8.2 ka event silt ending the Early Holocene deposition. For instance, its top near Megalith 10 of the Alignment A (Sector B, Square j'/17) gave an OSL date (GdTL-2816) of 8.52 (0.35) ka, while the 8.2 ka event massive reddish brown silt deposit directly OSL measured dated 8.01 (0.35) ka (GdTL-2818) in Sector C, Square 0/12. All the deep and wide pits under the stelae are cut in this massive reddish silt. Stratum 3 comprised sandy, muddy sheet flows characterizing the post-8.2 ka event clastics deposited in shallow erosional basins and quarry pits. A recent friable sandsheet (Stratum 4) concludes this simple stratigraphic suite.

3. Spatial patterning of stelae within the fields

The Western Field

Even a casual look at the map of Sector C of Nabta Playa map containing the plan of stelae of both the Western and Eastern Fields discloses a clear-cut patterning of these monumental installations. Except for the alignments of stelae, one may distinguish several discrete, small groupings of the stelae in the northern and western parts of the Western Field (Squares e/8, d.8, f/9/, f/10, g/7, g/9,g/10, 1/7, 1/10 (Structure A), j/8. j/10, 1/11 (Structure B), k/9, and k/10. Larger groups, including a few dozen tightly clustered monuments, occupy the eastern side of the 100 m contour rise in Squares k-l/10-11and n-q/12-13. A dozen or so objects rest near the southeastern tongue of the E-04-4 quarry basin, while about 20 seemingly unfinished and abandoned sandstone blocks lie flat around quarries E-04-4, E-05-2, and E-06-2 as well as around very small quarry pits containing a single or a few erosional sandstone blocks.

The Eastern Field

Some 200 m east or so of Site E-96-1B is a small, relatively tall silt knoll with a flattish, broadish top at around the 101 m contour line (Compare Sector C). Except for two lines of fallen stelae on the northern and southern feet of the hillocks and a separate, slid fragment of a stele on the upper western slope of the mound (Square j/17), the hill contains a huge single stele and several small clusters of monuments. The massive piece is a broken, flat anthropomorphic stele (Square j/19 South), evidently the most significant monument of all the recorded ones. The four clusters of broken, fallen stelae (Square j/19 Centre and North) occupy the eastern section of the flat hilltop. Among the stelae, several specimens show evident traces of flaking and rounded tops. They also differ significantly in their size.

Of great interest are the traces of a pit around the colossal stele in Square j/19 South. The matrix within the outline of the pit, marked by a fissure filled with an aeolian sand, has no lag shingle and pebble cover of the hamada, a characteristic of the purposely disturbed ground. Both the central and the southern sections of Square j/19 were surveyed and mapped with the help of an electro-resistivity survey by Tomasz Herbich (cf. Chapter 8, Fig 8.5, this volume), indicating the presence of a table rock underneath.

The South-Eastern Field (Sector F)

Nearly 800 m to the southwest of the Eastern Field is an irregular elongated hillock with several small rises along the crest running in the general south-north direction and reaching an elevation between around 99 and 101 m above the benchmark of Nabta Playa. Each of these small raised places contains a small cluster of broken stelae between Squares n-f/17 of Sector F. Only in Square f/11 are four fragments of a broken stele or stelae on the north-western slope of the hillock, evidently having slid from the group in Square g/13.

The source of the sandstone for the stelae of the field was seemingly strictly local, and it was located within or near the area of the Southern Group where several weathered sandstone table rocks are still evident (cf. Fig. 1.5). It is a rock of mediocre quality, somewhat coarse-grained, poorly cemented, and crumbly. That is why the broken stelae of the field are almost always highly disintegrated and reduced to small chunks. Only a few fragments show traces of shaping into stelae with rounded tops, as is the case of the piece in Square m/15 North.

The Southern Field (Sector F)

Some 500 m to the southeast of the previous Field of Stelae begins a very broad but dispersed field of small stelae fragments between Squares l'-q/19-31. The original stones are very disintegrated and difficult to recognize, whether or not the remains belong to stelae or weathered table rocks. Furthermore, the eastern part of the field is covered by a new drifting dune. Only in the northeastern part of the field are the broken stelae made of a much better quartzitic sandstone. It is in this area where the clusters of broken pieces make an irregular ellipse, and it is from here where a very beautiful, worked, sizeable entire stele (Square r/30) made of a good quality quartzitic sandstone was collected in the 2008 season to be displayed in the Nubia Museum. It measures 200 x 100 x 26 cm and has a rounded proximal end, a heavily wind-eroded, converging distal end.

Salt Hill (Sector D)

Salt Hill is a small, tall, rounded hill in the central section of Nabta Playa. The name of the hill comes from the salt evaporate deposited in the top part of the hill, probably marking the central and the deepest point of the post-Al Jerar Playa silt. The uppermost part of the hill contains 15 fragments of fallen stelae. The group includes one entire specimen with a rounded flaked tip and slightly concave, worked base (1,3 x 0.70 m) in Square d/9 as well as a metre long fragment with a worked tip and side edge in Square f/9. There are also a fragment with a worked tip in Square f/11 and five large fragments in Square d/10. Among the latter is a piece with a shouldered top and another one with a rounded top.

4. Excavating the stelae

Group E-96-1A

At the very beginning of the 1996 field season, Fred Wendorf had decided to begin the full excavations of clusters of megaliths to solve the mystery of their function and age. This was still in the time when these features were regarded as blocks of quartzitic sandstone gathered by man for unknown purposes, although we all realized the importance of stone alignments and had some ideas linking these installations with celestial bodies. The first choice was a prominent cluster of blocks on top of a low silt rise in the megalithic area, which in later years was defined as the Western Field of Stelae. Steven Duncan helped Wendorf in this challenging task. As a consequence, Site E-96-1A (Section C, Square i/10) was the first of five selected clusters of sandstone megalithic features (in 2001, termed by Wendorf and Królik *Complex Structures or Shrines*) to be fully excavated and recorded.

The cluster E-96-1A sits on top of a slight reddish playa silt rise in the centre of the Western Field of Stelae. It looked very prominent and therefore it was selected as the first in an attempt at solving the mysteries of Nabta Playa's megalithic installations. At the time of the final decision to begin with this particular group of monuments, Wendorf believed that it was the largest such assemblage in the area and that it served as a burial site and the central hub of six megalithic stellar alignments fanning out from it. Indeed, the cluster was the most intriguing of all, because of the number of components as well as its prominent position among the others in the vicinity.

After the first cleaning of the area, Wendorf realized that the cluster had been made up of 71 large, mostly horizontal, quartzitic sandstone blocks and plates, counting also the broken ones, nearly all partially embedded in the underlying laminated surface silty sand wash. The cluster formed an oval measuring some 5 m by 4 m. (Fig. 6.17). Some of the blocks had crept down the gentle slope of the rise. The most significant three blocks lay in the centre of the cluster and like several others had been partially shaped, commonly by flaking. The tallest block, triangular in cross-section, lay over the other two (along with a few others, the block is exhibited in the garden of the Nubia Museum in Aswan). It soon became evident that the blocks had initially stood upright. Most of the blocks in the group were not worked or were only slightly chipped along the sharp edges, probably to prevent the draw ropes from being cut. Some blocks had a pointed top.

The testing for the expected burial required the removal of the stones to expose the interment. A tripod was therefore built and equipped with a 3-ton pulley and the appropriate steel chains, ropes, etc. Workers were assigned to operate the apparatus. The removal of blocks revealed a shallow concavity about 30 cm deep and 4 m in diametre filled with consolidated, laminated sand and silt, a classic sheet flow deposit in a shallow deflation basin underneath the fallen block.

The digging beneath the cluster of sandstone slabs and the shallow depression, down to the depth of about 2.5 m, exposed a monotonous sequence of rocks made up (from the top) of:

a. a crumbly grading down reddish soil, truncated by deflation, about 20 to 30 cm thick;

b. the reddish-brown heavily consolidated sandy playa silt with medium blocky structure, slickensides and large desiccation cracks from 5 to 20 cm wide, often descending to the sandstone bedrock formed by a small table rock and adjacent Qusseir yellowish green sand;

c. At about 30 cm above the bedrock, the edges of a pit became evident. Above, the boundaries of the pit, as well as the bedding, were masked by the vertisol-like churning phenomena of the playa silt. The infill of the pit included sandstone flakes, tools (tranchet hoes), chunks and small blocks. Of especial interest was a large cow-like sandstone block slightly shaped (Fig. 6.18-6.22) and buried midway between the top of the pit and the table rock at the bottom. It was clear that there was a vast pit sunk to the base of the silt. The pit was slightly larger than the exposed table rock.

Figure 6.18. Nabta Playa, Site E-96-1, Structure A. The cow effigy finally lifted. Photo by R. Schild

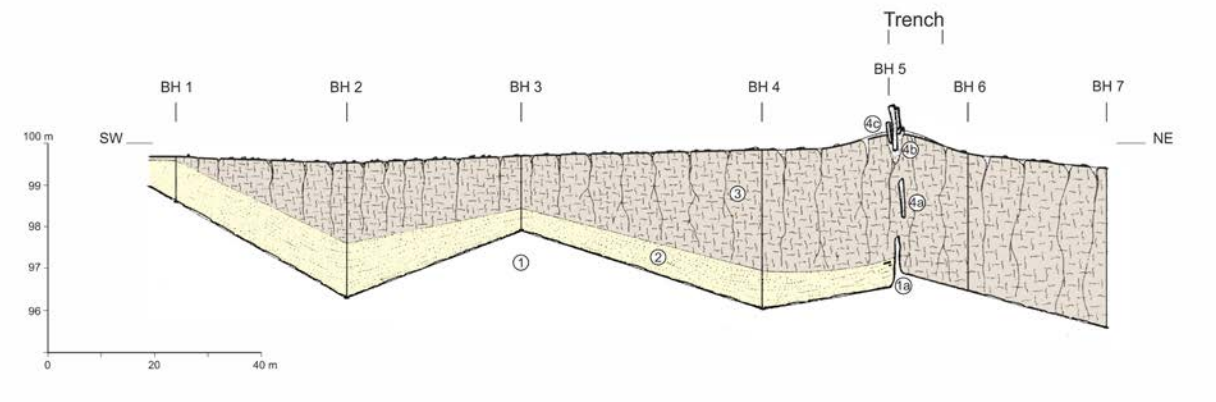


Figure 6.19. Nabta Playa, Site E-96-1, Structure A. Cross-section. Key: 1. Sandstone; 1a. Sandstone table rock; 2. Sand; 3. The 8.2 ka event playa silt with deep desiccation wedges; 4a. Buried effigy; 4b. Deflational basin; 4c. Collapsed megalithic installation; BH. Boreholes. Drawn by R. Schild and M. Puszkarski (based on Wendorf and Królik 2001).

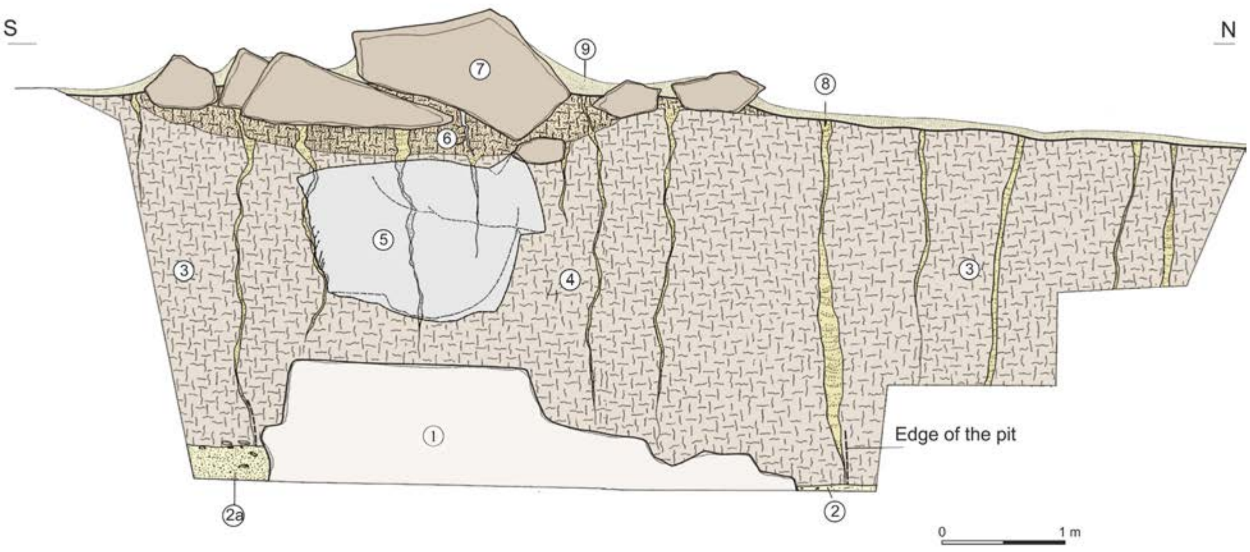
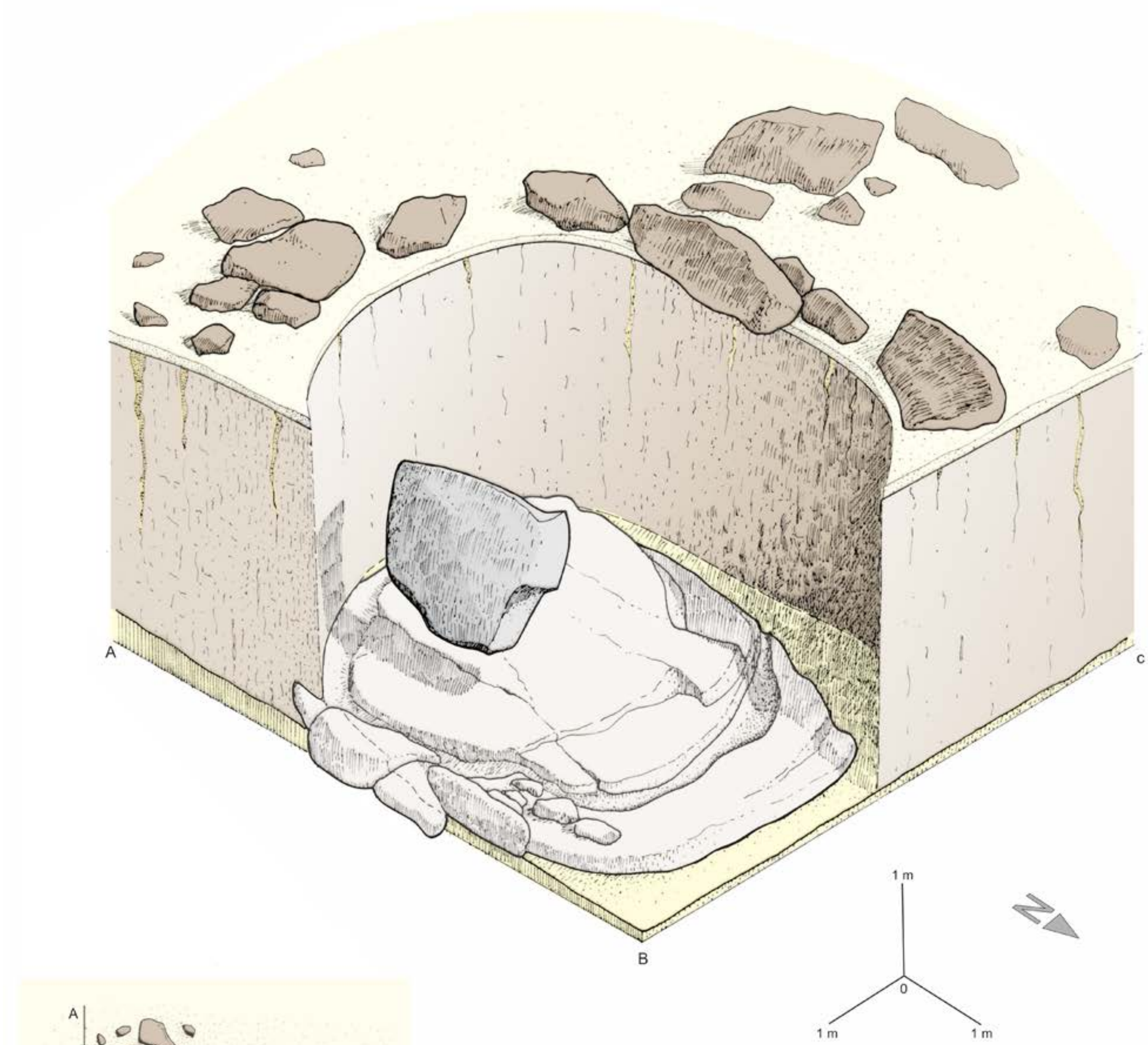


Figure 6.20. Nabta Playa, Site E-96-1, Structure A. Cross-section. Key: 1. Table rock; 2. Sandstone; 2a. Sand with sandstone slabs; 3. The 8.2 ka playa silt with deep desiccation wedges; 4. Silt backfill inside the pit; 5. The effigy; 6. Laminated post-collapse silty sand wash; 7. Elements of the installation; 8. Sand in the desiccation wedges; 9. Aeolian sand. Based on a section by R. Schild, F. Wendorf, S. Duncan, and H. Królik, drawn by M. Puszkarski (Wendorf and Królik 2001).

d. The rock measured 3.6 x 3.4 m and was worked by pecking and smoothing as well as shaped by the removal of two side blocks of sandstone, probably used as the elements of the surface installation. The removal of these two blocks created two projections of the rock, one stretching somewhat west of north, and extending in the same line as the buried cow-like sandstone block. The second projection was pointing towards the southwest. The former was pointing in the same direction as the long axis of the cow-like block. There were no traces of grave chambers or other pits (Fig. 6.23, 6.24).



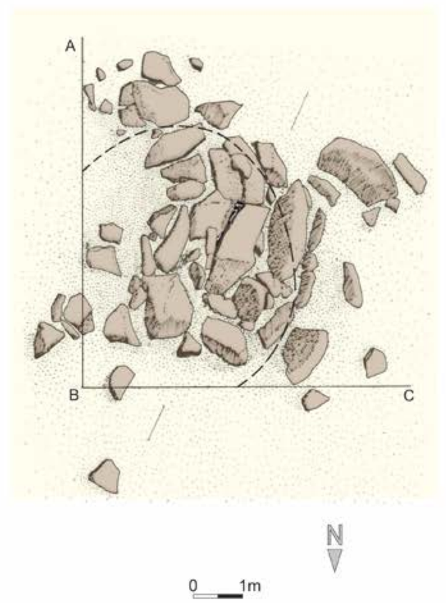


Figure 6.21. Nabta Playa, Measured 3D view of the positions of the cow effigy and the basal table rock. Drawn by M. Puszkarski.

Figure 6.22. Nabta Playa, the *Cow sculpture* exposed in the gardens of the Nubia Museum, Aswan. Photo by R. Schild.

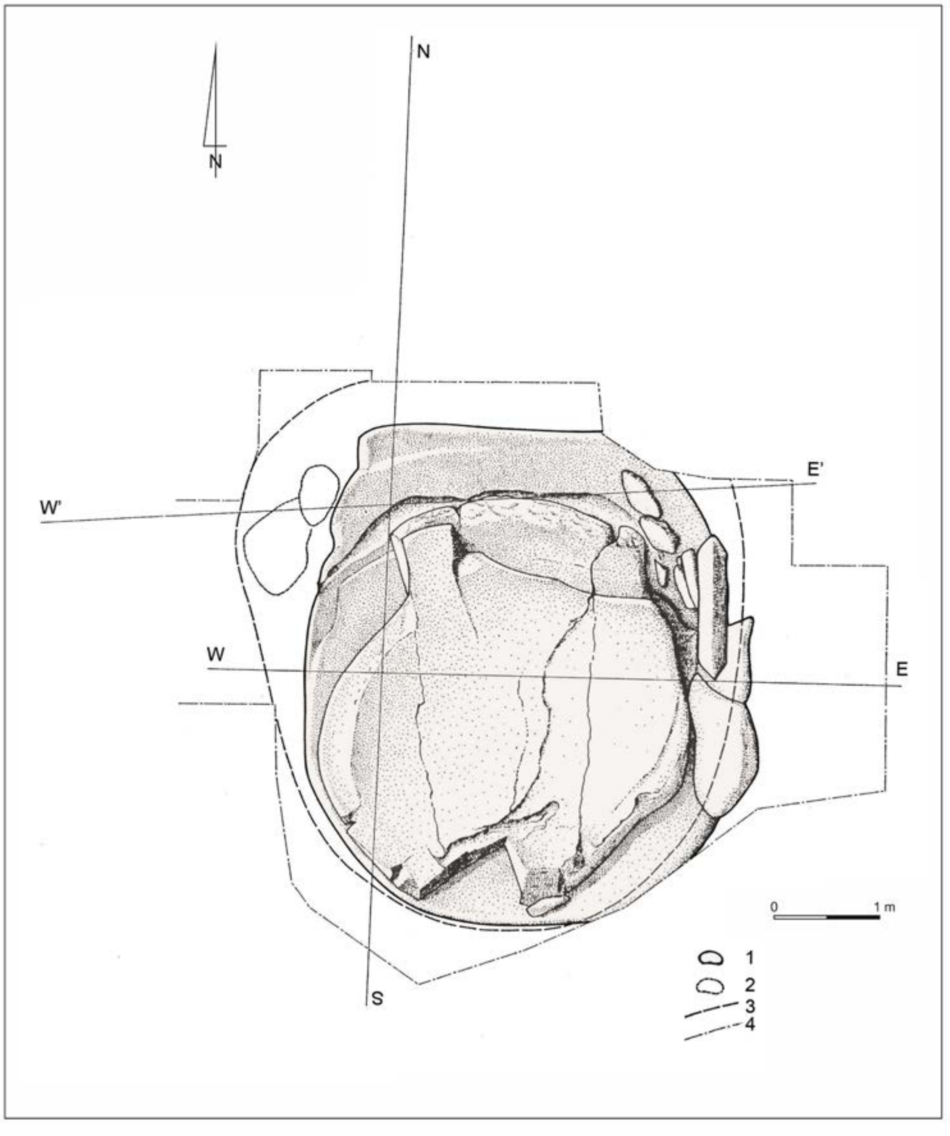


Figure 6.23. Nabta Playa, Site E-96-1, Structure A. The basal table rock. Key: 1. Outlines of table rock; 2. Outlines of other rocks; 3. Edge of the pit; 4. Boundaries of the dig. Based on the plan by R. Schild and H. Królik (Wendorf and Królik 2001). Drawn by M. Puszkarski.

Figure 6.24. Nabta Playa, Site E-96-1, Structure A. The basal table rock after excavation, looking north. Photo by R. Schild.

Group E-96-1B

Halina Królik excavated the monument in the 1996 field season (Fig. 6.25). The B cluster is located some 45 m to the southeast of Cluster A in Section C, Sq. j/11. The blocks, all collapsed, in a horizontal position, formed an oval 7 m long and 4.5 m wide. Almost all of the elongated ones pointed slightly west of north. The two most massive stones of the group rested in the centre of the concentration while broken fragments of the others lay on its periphery, including a fully shaped, relatively platy stele with ogival top, which was resting on top of the reddish silt beyond the oval concentration (Fig. 6.26).

As at Site E-96-1A, a shallow basin measuring 2.5 x 1.5 m and 20 cm in depth formed underneath the two large, central stones. It was filled with laminated sand and silt of the surface sandy wash. Below the basin was the massive, blocky, reddish-brown silt, about 3 m deep, with a weak, truncated aridisol developed in the top, and deep desiccation cracks. The silt was deposited over the sandstone bedrock as well as the Qusseir Clastic Member sand. A table rock hump occurred right below the central two stones of the superstructure. Traces of the oval pit, leading to the table rock appeared in the lower section of the backfill. The pit measured some 4.0 by 3.8 m at the base. About 0.5 m above the base, the walls of the pit flared outward and were masked by the churning of the infill.

The table rock is somewhat egg-shaped, highly eroded and very similar to the table rock remnants dotting the surface of the desert badlands to the south of the Western Field of Stelae. It also has been shaped by knapping off some large flakes at the north end, which created two crude nose-like points oriented 20° west of north (Fig. 6.27).

Some silt-polished artefacts have been collected from the sandy alluvial infill of the shallow basin in the topmost section and the upper section of the reddish, blocky silt. Among these are seven cores, five, non-diagnostic tools, and three bifacial projectile points (Wendorf and Królik 2001: fig. 17.20). All chipped artefacts are considered to be in a secondary position and originating from Final Neolithic camp refuse washed in and worked in by soil churning processes.

Figure 6.25. Nabta Playa, Site E-96-1, Structure B. Halina Królik and her helper excavating the pit under the cluster of stelae. Photo by R. Schild.

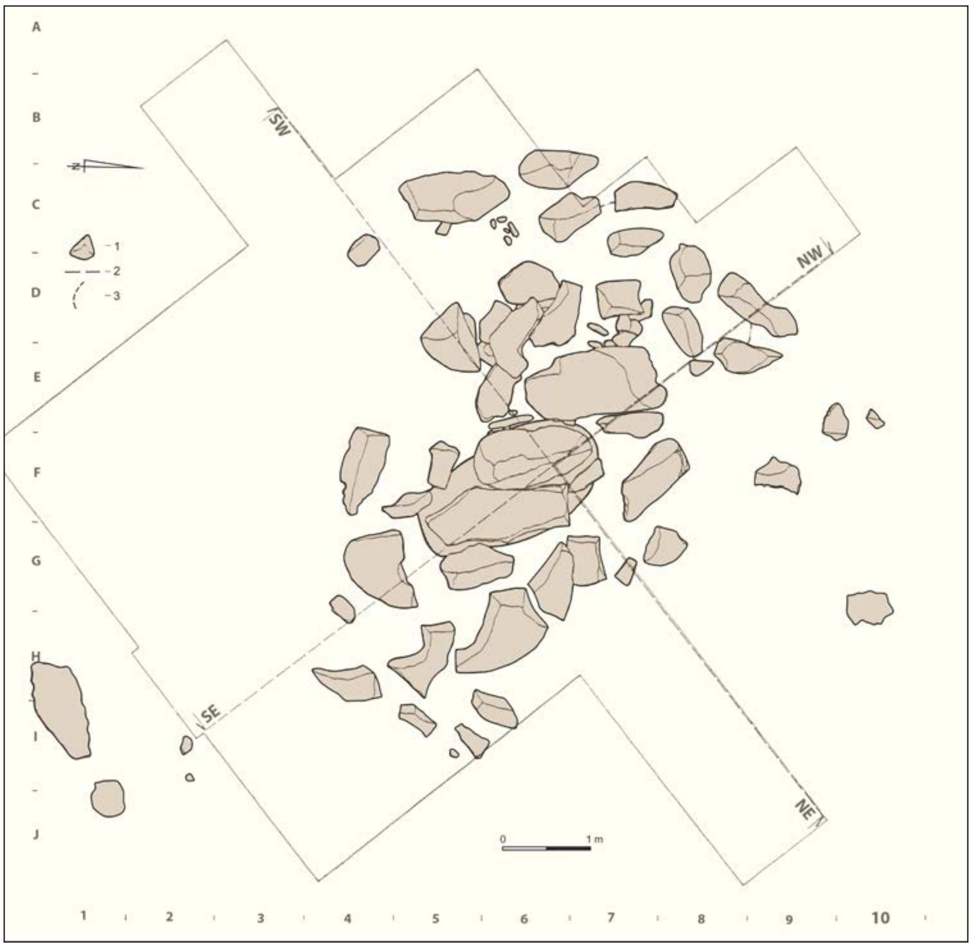


Figure 6.26. Nabta Playa, Site E-96-1, Structure B. Scatter pattern of fallen quartzitic sandstone blocks and fragments. Key: 1. Blocks; 2. Cross-sections; 3. Refits. Based on map by H. Królik (Wendorf and Królik 2001). Drawn by M. Puszkarski.

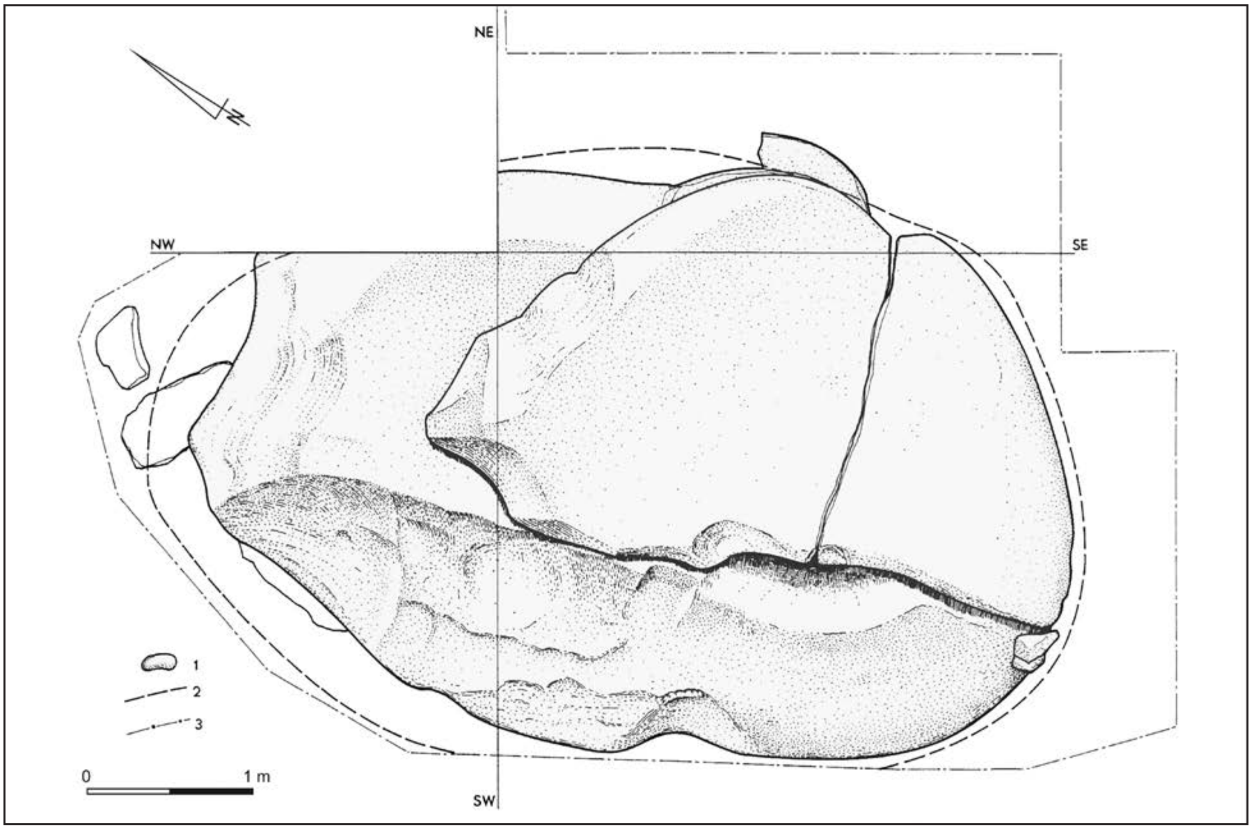


Figure 6.27. Nabta Playa, Site E-96-1, Structure B. The basal table rock Key: 1. Table rock; 2. The boundary of the pit; 3. Edge of excavation. Based on plan by R. Schild and H. Królik (Wendorf and Królik 2001). Drawn by M. Puszkarski.

E-96-1E

Some 20 m to the south begins a large, nearly 50 x 15 m area of densely concentrated fallen, often broken and shattered sandstone blocks grouped in repeating, semi-discrete clusters. Halina Królik selected a small cluster of the blocks in the northwestern corner of the area for test trenching (Sector C, Sq. k/11). It contains about eight sub-clusters of blocks (Wendorf and Królik 2001: fig. 17.24), often intersecting, and measuring ca. 11.5 by 7.5 m. Only the northern sub-cluster containing three blocks, between about 1.5 and 2 m long, and a dozen smaller, broken ones were partially excavated to the depth of nearly 3 m. The trench uncovered a shallow basin under the top stones filled with laminated sand and silt laminae descending to the top of the first step of the backfill of a large pit (Wendorf and Królik 2001: fig. 17.25). Underneath was the 8.2 ka reddish blocky, massive playa silt, with deep desiccation cracks. In contrast to Clusters E-96-1A and E-96-1B, the walls of the deep pit under the sandy basin were quite discernable already from the top of the silt infill, and its matrix seemed less cemented than in the previously investigated units.

In the top section, 0.6 m below the surface, the pit showed a narrow step and then another one at a depth of 2.5 m below the surface, just a few centimetres above the cemented Qusseir sands of the bedrock. There was no table rock evident in the trench, although the cut exposed only a fragment of the ancient pit.

There were fire-cracked rocks and pieces of charcoal found on the upper step of the pit (Wendorf and Królik 2001: 517) at the lithologic interface between the reddish silt floor of the step and the alluvial sand with silt laminae of the top basin. There is no hard evidence that the charcoal sample was indeed embedded in the silty infill of the pit. It is highly possible that it formed a part of the deposit filling the topmost erosional basin and, therefore, dates from a later episode of the occupation of the area, the remains of which had been washed into the basin during a sheet flow episode. The charcoal gave an age estimate of 4800±80 years BP (DRI-3358), or about at 1σ 5600-5330 calBP, at 2σ 5710-5320 calBP; 3760-3370 calBC, a result significantly younger than the ages obtained from the sandstone quarries, the youngest of which are about 500 to 800 years older than the secondary pit charcoal from Cluster E-96-1E. Furthermore, the date does not match the OSL assays on the sand wash underneath fallen stelae at other locations (see OSL ages mentioned below).

The infill of the ancient pit yielded several chipped stones, non-diagnostic artefacts as well as two fragments of a metate and a few scraps of bones.

Structures C and D

About 40 m southwest of Structure A is the unexcavated Structure C (Sector C, Sq. j/8) composed of a very large, nearly 3.5 m long and 1.5 m wide plate of sandstone with rounded proximal and distal ends; as well as five elongated blocks and several shattered fragments of sandstone blocks. Much more complex is the unexcavated Structure D in Sector C, Sq. f/9, North. Its central, thick sandstone plate measures about 3 x 2 m and is broken into three large fragments. The northern, distal end, on the other hand, is worked by knapping all along its edge, which shaped the stele in the form of an enormous rounded endscraper. At the proximal end are the truncated, but still upright bases of two other stelae and a dozen or so broken fragments of other blocks clustered around the central plate. Four boreholes sunk around Cluster D indicated a rise in the bedrock underneath the group and suggested the presence of a table rock below the superstructure. The electro-resistivity sounding in the area of Cluster D in the northern section of Sector C and on the hill of Eastern Field disclosed several anomalies indicating that the underground bedrock raises precisely under the clusters of fallen stelae (cf. Chapter 8, this volume).

South-Eastern Field, SITE E-04-1

Not everywhere were ancient pits dug, linking clusters of stelae with erosional table rocks under the surface. In the South-Eastern Field of Stelae, at Site E-04-1 (Sector F, Squares l,m/15), a cluster of collapsed whole and heavily fragmented stelae (Concentration A) was tested in 2004 by Halina Królik in the 2004 field season (Fig. 6.28). A trenching revealed relatively shallow pits, which served as receptacles for the bases of the stones. Still, no large pits similar to those found under the Megalithic Structures in the Western Field have been observed.

The rudimentary stratigraphy is similar to that encountered in the Western Field. The basic underlying sediment is sandy reddish brown (10YR 4/3), consolidated to cemented silt (Unit 1) with blocky structure, slickensides, and deep fossil desiccation cracks deposited during the 8.2 ka event and truncated by the pits of Unit 3. The silt contains salt crystals and aggregates. A reddish brown (10YR 4/4) crumbly and sandy aridisol containing rare *Zootecus insularis* shells developed in the top section of the silt (Unit 2). A few shallow pits cut into the soil and are filled with an anthropogenic infill (Unit 3) of inconspicuously bedded redeposited soil with salt crystal formed along the basal unconformity (3a) and throughout the infill. The matrix suggests a back dirt origin of the infill. The layer is reddish brown and contains rare artefacts (half of a mano).There are two collapsed menhirs partially embedded in these pits in the eastern part of the trench and another short and worked one in the western end. Four wedged large sandstone plates additionally stabilized the base of the latter one. The void space between the plates was filled with reddish yellow (7.5YR 6/4) friable sheet wash sand, as were the shallow blow out swales, showing desiccation wedges (Unit 4). Both formed after the collapse of the stelae. The sequence was overlain with a thin layer of loose very pale brown (10YR 7/4) recent aeolian sand (Unit 5). The coarse bedded sandstone blocks of the menhirs easily disintegrated and broke along the bedding, showing a very pale brown (10YR 8/3) colour when chipped.

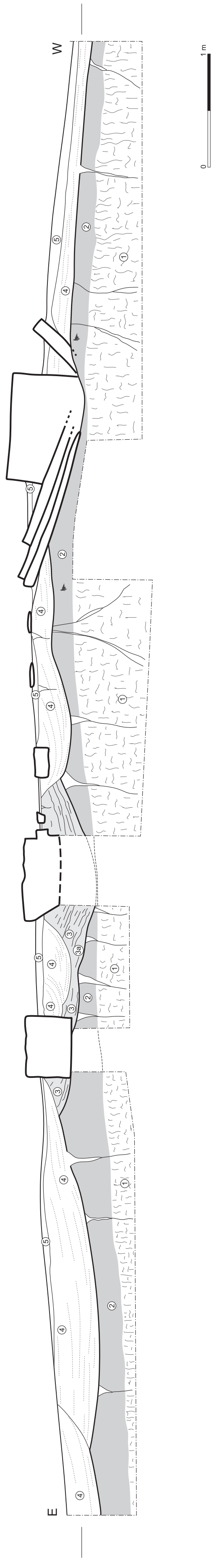


Figure 6.28. Nabta Playa, Site E-04-1. Cross-section through a cluster of fallen menhirs. Key: 1. Reddish brown 8.2 ka silt; 2. Aridisol; 3. Pits with anthropogenic infill (back dirt) of redeposited soil with salt crystals (3a) and three embedded fallen menhirs; 4. Recent eolian sand. Profile by R. Schild, drawn by M. Puszkarski.

5. Sandy shallow basins

The Western Field (Sector C, Stele in Square o/12)

A trench five metres long and 50 cm wide was laid out along a thick, nearly two metres long block of quartzitic sandstone located in the midst of a large concentration of stelae in the southeastern corner of the Western Field. The block was surrounded by a wedging out layer of consolidated, conspicuously laminated, reddish yellow (7.5YR 6/6) fine sand. The cross-section of a trench sunk right along the side of the block revealed an intriguing stratigraphic situation of the stele almost entirely buried in a pit cut into the reddish brown (5YR 5/4), blocky sandy silt with slickensides and desiccation cracks (Layer 1) and the overlying reddish, crumbly aridisol (Layer 2). This is the 8.2 ka event silt deposited by the flash floods (Schild and Wendorf 2001c) as demonstrated by its general stratigraphic setting and by the OSL age estimate from a sample obtained from the pit of 8.01 (0.35) ka (GdTL-2818).

The base and sides of the pit have been filled with a brown (10YR 5/3) sandy, laminated alluvial silt (Layer 3a) wedging out to the surface, comprising abraded and fresh sandstone debris and calcium carbonate specks in contact with the reddish silt of Layer 1. A reddish yellow, consolidated and conspicuously laminated, fine alluvial sand (Layer 3) fills the space between the sandstone block and the basal infill of the pit. A cow tooth recovered from the sand gave two radiocarbon estimates of 6550±50 BP (Poz-7920), on collagen, and 6440±40 BP (Poz-7979), on structural carbonates. Both ages may indicate a late Middle Neolithic or *Ru'at El Ghanam* variant time; however, the results should be considered of minimal value and the tooth intrusive, probably washed in together with the surface wash sand. Two OSL ages measured on the alluvial sand, on the other hand, gave ages of 4.08 (0.16) ka (GdTL-2817) and 4.23 (0.17) ka (GdTL-2767), similar to five other OSL measurements on post-menhir collapse silty sand wash (see below).

The Western Field (Sector C, Stele in Square f/10

The stratigraphic setting of a stele (about two-metres tall within a cluster of stelae surrounded by a sandy alluvial layer splaying out towards the surface) has been studied in the northern part of the Field. A 4.5 m long east-west trench exposed a bed sequence under the fallen stele very similar to that seen in the trench in Sq. j/19. Here again, the massive reddish playa silt (Unit 1) with blocky structure, slickensides, and deep desiccation cracks is at the base. It is topped by a truncated aridisol (Unit 2) formed in Unit 1 and overlain by a shallow basin, containing a fallen stele, filled with the fine, laminated sandy matrix of a surface wash. The wash gave an OSL date of 4.18 (0.45) ka (GdTL-2810).

The Eastern Field, Southern Stelae (Sector C, Sq. j/19)

A torriya (hoe) scraping and cleaning of the surface around the largest and the southernmost broken, collapsed stele (cf. Fig. 6.1) upon the top of the Eastern Stelae Field hillock, disclosed a vast quadrangular area with a panhandle-like feature of an infilled pit at its southwestern end (cf. Chapter 8, Fig. 8.5, this volume), opposite the broken stele at the northeastern termination. A narrow five-metre long trench, some 100 cm in depth, was laid out along the northeastern edge of the stele. The trench revealed the simple, but intricate, lithostratigraphic context of the horizontal stele. The reddish brown playa sandy silt, base unexposed, with medium blocky structure and slickensides (Unit 1) is at the base of the cutting. Its top is altered by pedogenic processes, which have formed a reddish, aridisol with crumbly structure, whose truncated top creates a shallow basin underneath the stele. The basin is filled with a reddish yellow (7.5YR 6/6), conspicuously laminated fine sandy surface wash partially covering the stele. Four OSL samples taken from various locations in the sandy wash gave the following results:

1. Eastern Field of Stelae, Sector C, Square j/19,SW – 4.33 (0.26) ka (GdTL-2811)
2. Eastern Field of Stelae, Sector C, Square j/19,SW – 4.50 (0.36) ka (GdTL-2813)
3. Eastern Field of Stelae, Sector C, Square j/19,SW – 4.62 (0.38) ka (GdTL-2814)
4. Eastern Field of Stelae, Sector C, Square j/19,SW – 4.45 (0.64) ka (GdTL-2815)

6. Taphonomy of the stelae

Among several hundred or so recorded stelae/menhirs (cf. Catalogue of Megaliths) along the western shores of Nabta Playa, only a few are still upright. Also, several vertical and/or tilted, broken bases even now are still partially submerged in the playa 8.2 event silt, clearly indicating that initially the monuments had been set vertically, probably facing a general North direction. Today, almost all are fallen, having broken during the collapse and fragmented by the impact and the desert weathering due to the radical changes of temperatures throughout the year. The collapse of the stelae may be explained either by the gradual wind erosion creating a depression in front of the stelae and causing them to collapse, or purposeful, caused by man – or both. Most probably, the culprits were the prevailing northerly desert winds, which carved the shallow basins in front of the megaliths that weakened their footings – and people who benefited from the opportunity. Such depressions are still visible today in front of the still vertical stelae. That is how we know that most of the stelae, if not all, were facing the general north.

Cross-sectioning of the upper part of the lacustrine clay/silt beds upon which the fallen blocks rested as well as studying the dispersal of the broken fragments have led to the refitting and reconstruction of the original arrangement of separate megaliths and some of their groups. In many instances, the sections revealed the pits in which some of the stelae were set. Apparently, in the case of Sites E-96-1A, E-96-1B and E-96-1E the pits are too deep to suggest that these pits served only as stone settings. Nevertheless, they helped to vertically set the monuments, notably the most massive objects. At Site E-04-1, on the other hand, the stratigraphy of natural and anthropogenic deposits suggests that the base of the biggest stele of the cluster was put in a rather shallow pit and stabilized by wedging in a few sandstone slabs between the base of the stele and the surrounding sediment. The collapse of the stele displaced the plates (Fig. 6.28). The unbroken horizon of the aridisol underneath the stele may imply that the primary stone setting was relatively shallow and that a considerable time elapsed before the erection of the menhir and the final collapse.

Much more difficult is understanding the dynamics of the formation of shallow basins underneath most of the fallen stelae filled with washed in sandy silts and silty sands of the surface washes. These phenomena are frequently present under the fallen monuments, except for those that are resting on cemented or consolidated silt/clay slopes. Initially, during the excavations of the three first groups of stelae (Wendorf and Królik 2001), we adopted a hypothesis that these basins had formed during natural, gravitational settling and compacting of the fills of the deep pits under the settings (Wendorf and Królik 2001: 516). Sediments entering void spaces would gradually fill these depressions. However, a micro stratigraphic study of some individual cases seems to falsify this hypothesis. Connecting these basins only with the deflation that created them in front of the megaliths before they collapsed cannot fully explain the phenomena either, for the depressions are slightly larger than the collapsed, often broken, fragmented and dispersed megaliths and their floors are the deepest in the centre of the fallen stelae. In short, these phenomena are most likely to follow the collapse and fragmentation, if such had occurred.

It seems that the most likely explanation of the widespread presence of the basins under the stelae and/or tight clusters of stelae needs to be linked, first with the prevailing northerly winds creating the air streams that would be steadily removing the fine sediments from the area in front of the monument. In the second stage, after the collapse, the void spaces would be filled with alluvial washes. That is another reason why we hypothesize that most of the stelae were facing the general north, or rather the sphere of the night skies that is occupied by the circumpolar stars (Schild and Wendorf 2004). Furthermore, the cyclic swelling and shrinking of the Playa silts during the radical changes in moisture content in the very seasonal climates induced churning of the silt as well as the formation of void spaces, particularly during dry seasons, under the thick, often very substantial stones as the one at Sector C, Square o/12. These could have caused the slow sinking of the massive blocks into the soft muds in the wet seasons. The rainy seasons. on the other hand, would bring the surface washes filling the void spaces with alluvial deposits (cf. Fig. 6.20: 6). In any case, the menhirs must have fallen during a humid climatic episode, otherwise the basins would also contain aeolian sand deposits. In a larger scale, fallen stelae clusters created a barrier protecting the silt from deflation and thus, helped to form low hillocks around the groups of stelae in the arid phases.

The constant absence of aeolian deposits between the embedded collapsed menhirs and their fragments strongly supports the hypothesis suggesting that the collapse of the monuments was also associated with the presence of the C-Group population in the area during the 4.2 ka wet event. The wetting episode seems to be largely coeval with the younger part of the *Sakkara Sub-pluvial*, a humid pulsation defined by Fabian Welc in the lower Nile basin between around 4.5 and 4.2 ka (Welc 2016: 238). The *Sakkara Sub-pluvial* appears to be primarily contemporaneous with the global 4.2 ka event showing a span of 4.15 ka to 3.93 ka and bringing southwards moister conditions while progressing southwards (Railsback *et al.* 2018), and suggesting an Atlantic circulation over northern Africa.

Some of the collapsed stelae show smaller man-made pits underneath, which facilitated the collapse of the stone. Such seems the case with the upper step pit at Structure E, as well as pits under a large stele at Site E-04-1 (Fig. 6.28). These pits also suggest that humans helped in the downfall of the stelae, as do the ages of the OSL samples on sheet wash sand under the fallen stelae. The time for this action is set by 7 OSL ages measured on alluvial sand filling the depressions underlying the collapsed stelae and processed in the field by Professor Andrzej Bluszcz from the Institute of Physics, Silesian Technical University, Gliwice.

MEASURED TIME OF THE COLLAPSE OF THE MENHIRS

There are seven OSL dates measured from quartz grains originating from the alluvial surface wash sand immediately underlying the fallen stelae:

1. Eastern Field of Stelae, Sector C, Square j/10,SW – 4.18 (0.45) ka (GdTL-2810)
2. Eastern Field of Stelae, Sector C, Square j/10,SW – 4.33 (0.26) ka (GdTL-2811)
3. Eastern Field of Stelae, Sector C, Square j/10,SW – 4.50 (0.36) ka (GdTL-2813)
4. Eastern Field of Stelae, Sector C, Square j/10,SW – 4.62 (0.38) ka (GdTL-2814)
5. Eastern Field of Stelae, Sector C, Square j/10,SW – 4.45 (0.64) ka (GdTL-2815)
6. Western Field of Stelae, Sector C, Square o/12 – 4.08 (0.16) ka (GdTL-2817)
7. Western Field of Stelae, Sector C, Square o/12 - 4.23 (0.17) ka (GdTL-2767)

At 2 σ the dates overlap and, statistically, are of the same age. They all fall within the time brackets of early (2500-2160 BC) C-Group (Phase Ia), while the calibrated radiocarbon date from Dungul and the older sample from Nabta Playa cover (at 2 σ) the entire time span of the C-Group. The younger sample from Nabta Playa house, on the other hand, better fits a late C-Group chronology (1650-1550 BC) of Phase IIb (Hafsaas 2005; Hafsaas-Isakos 2010).

It is assumed that the OSL dates indicate the time of the collapse of the stelae. The dates are remarkably close to the time of the first arrival of the C-Group pastoralists to the area and support the proposition that the newly arrived strangers purposefully destroyed the monuments and souls of the strangers.

7. The interpretation of the Nabta Playa Menhirs

The Nabta Playa *Bunat El Asnam* sanctuary is North Africa's largest amassing of menhirs of the same archaeological cultural complex (Fig. 6.29-6.33). A great deal of organized labour was needed to set up the menhirs and construct the installations. This suggests complex and structured societies, with dominating extended family lineages or clans as well as an inherited power structure.

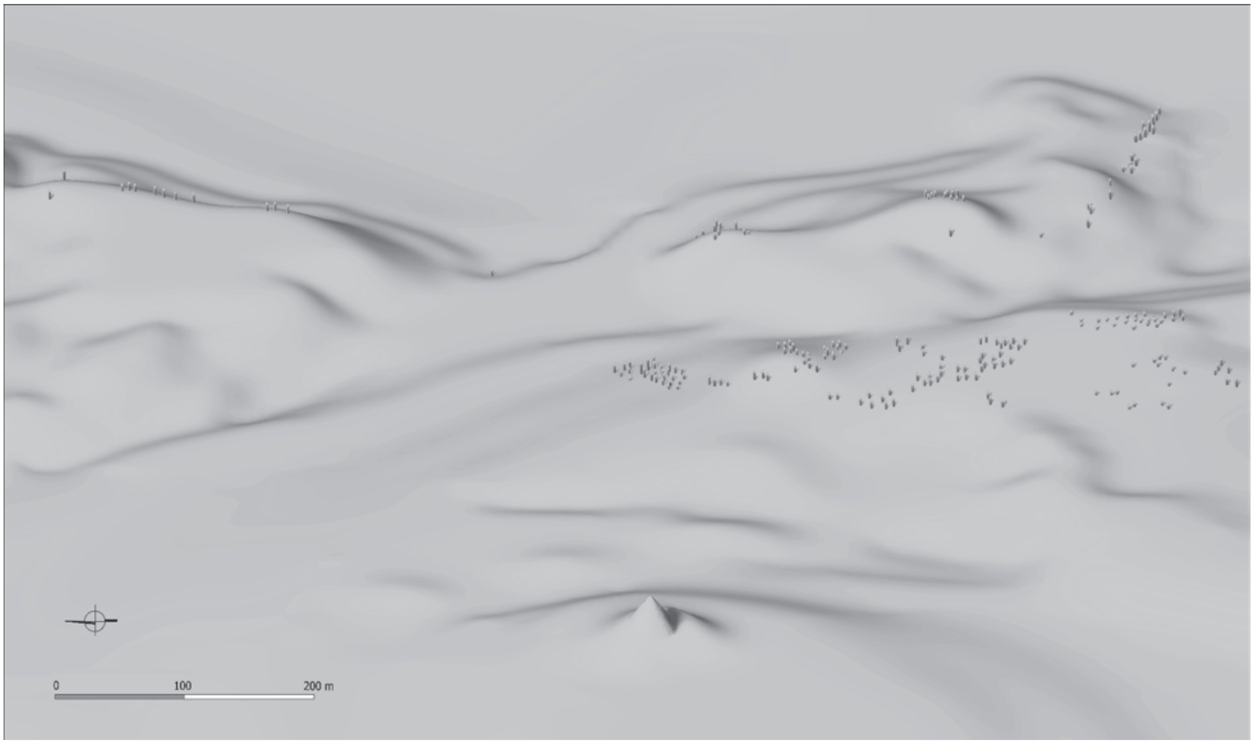


Figure 6.29. Nabta Playa, measured reconstruction of the Fields of Menhirs. Tumulus of the "Little Lord of Nabta Playa in the foreground; the Western Field in the middle with the Eastern Field behind; Alignment A in the left". Figures of menhirs not to scale. Drawn by M. Puszkarski.

The discrete groups of menhirs may portray lineages of such families grouped on separate hills. The manifold character of the menhirs and their clusters seen in the difference in sizes and shapes of the menhirs seem to represent departed members of the group. Similar clustering is also sensed in the patterning of the graves at Gebel Ramlah at the E-01-2, E-03-1 and E-03-2 sites (Kobusiewicz *et al.* 2010), set up in an early phase of the menhir installation at Nabta Playa. It is quite likely that some people of the Ramlah group might have participated in the erection of the Nabta Playa fields of menhirs.

The archaeology of the "Megalith Builders" (*Bunat El Asnam*) shows that their socio-economic structure was based on nomadic pastoralism highly dependent on cattle and small ruminants husbandry. Erection of complex structures of menhirs implies that these installations are an expression of an intricate Final Neolithic ceremonialism unprecedented in Africa. Seemingly similar, although generally much later regional ceremonial centres with megalithic alignments, tumuli, and stone circles have been reported from the Sahelian and Sub-Saharan parts of the continent. Some resemblances to the centre of Nabta Basin have been found among modern cattle pastoralists of the Sahelian Belt of Northern Africa such as Habana, Beni Helba Baggara, and Qur'an (Wendorf and Schild 2001a: 671-674). Their functional nature, however, appears to be entirely different. The symbolic menhir installations of Nabta Playa bring to mind huge fields of remembrance erected by a relatively complex and structured society.

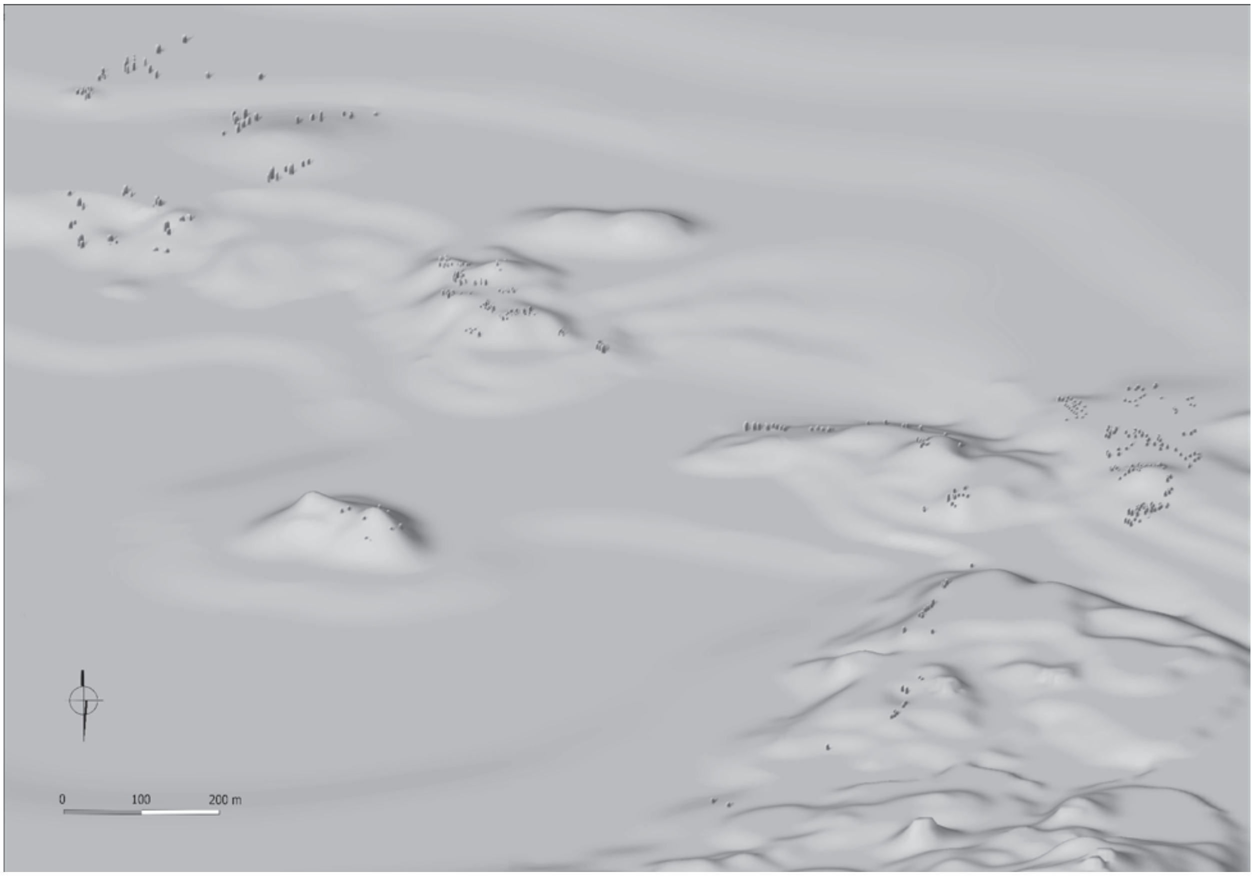


Figure 6.30. Nabta Playa, measured reconstruction of the Fields of Menhirs. Alignment A in the foreground with the Eastern and Western Fields behind; the "Salt Hill" in the centre left with the South-Eastern Field behind, and the Southern Field in the left corner of the panorama. Figures of menhirs not to scale. Drawn by M. Puszkarski.

The Final Neolithic societies of the South-Western Desert lived in a symbiotic relationship with their rural counterparts in Upper Egypt. This relationship is seen in the presence of many imported goods from the Nile Valley in the graves of the Gebel Ramlah graveyards (Kobusiewicz and Kabaciński 2010a; Kobusiewicz *et al.* 2010) and pottery types, perhaps also in the multiethnic character of the desert groups (Irish 2010: 219; cf. Chapter 10, this volume).

Most interesting of all, however, might be the various lines of evidence that place the ceremonial centre of Nabta Playa at the roots of at least some of the ancient Egyptian beliefs, magic, and religion. Perhaps the critical links bringing together the Ancient Egyptian myths and religion and the cattle herders of the South-Western Desert are the groups of menhirs at the Nabta Playa Basin. At Nabta Playa, most of the menhirs, except for the B alignments and displaced monuments, face the northern, circumpolar region of the heavens, an area of sacred significance in Ancient Egyptian cosmogony and religion (cf. Chapter 12, this volume).

The social structuring of the *Bunat El Asnam* societies of the South-Western desert seems to have been echoed by the dramatic difference in the character of interments: the imposing tumuli of significant hereditary chiefs, on one hand, and the tightly packed family graves at Gebel Ramlah Playa showing no social differentiation (Kobusiewicz and Kabaciński 2010c: 256), on the other. Perhaps social structuring and ranks within the families or clans may be seen in the prominent placement of some clusters of the menhirs, as those on the Eastern Field hill or the Site E-96-1A knoll.

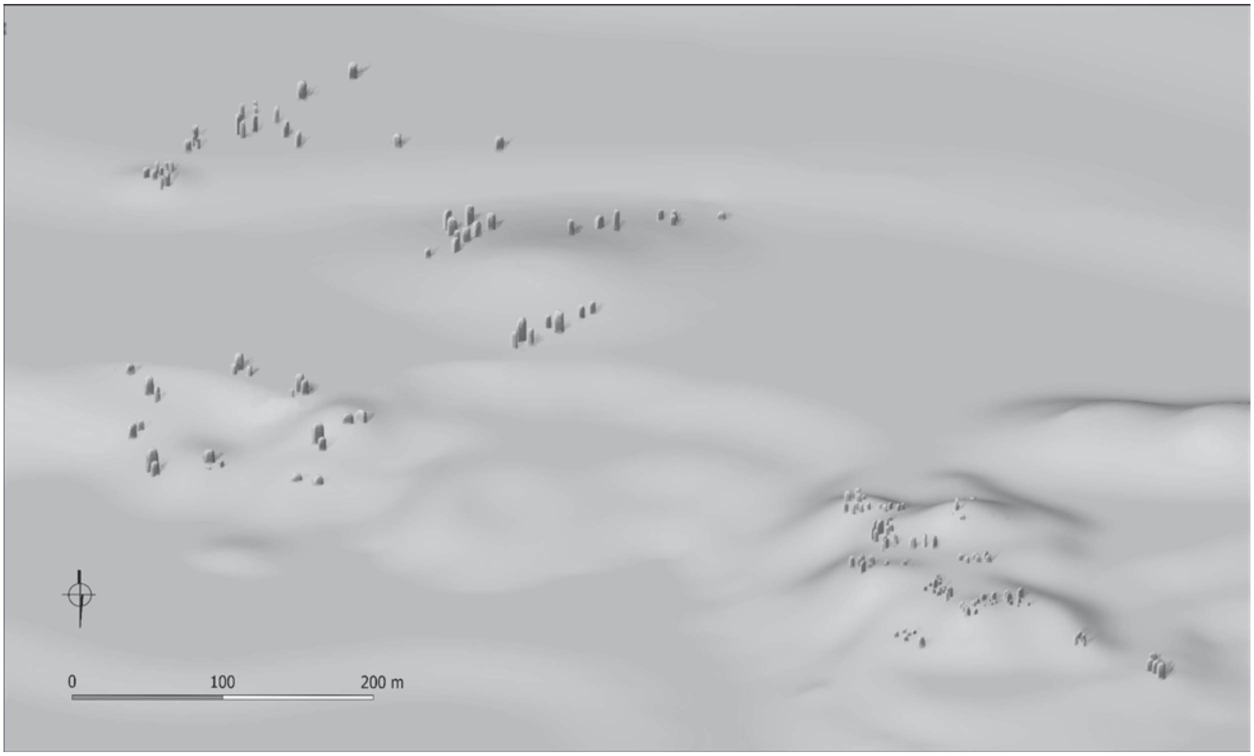


Figure 6.31. Nabta Playa, measured reconstruction of the Fields of Menhirs. The South-Eastern Field of Menhirs in the right, lower corner and the Southern Field in the left upper section of the panorama. Figures of menhirs not to scale. Drawn by M. Puszkarski.

The world of the megalith builders of the South-Western Desert most probably ended around 6000 years ago with the return of the hyper-arid condition in the Nubia Shab Peneplain. The symbolic demise of the *Bunat El Asnam* comes with the Nubian C-Group colonizing the area and the last greening of the Desert some 4.2 ka years ago.

Except for the vast fields of vertical stones, sometimes 5m tall, standing on oval tumuli in Bouar, Central African Republic (Vidal 1969), the Nabta Fields of Stelae seem to be the largest in Africa. Also, the latter differ a lot, being, in most cases, shaped by flaking into anthropomorphic statures. To some extent, early stelae at Messak Settafet, Libya, are associated with burials of cattle and other mammals (di Lernia 2006). The relatively early stelae from the cemetery of Kadruka, Northern Sudan, are dated to the beginning of the 4th millennium BC (Reinold 2004; Hafsaas 2005). The stones are associated with funeral circumstances, as are the early group C stelae from cemeteries N at Aniba and 101 at Dakka (Bietak 1986) and other cemeteries in Lower Nubia (cf., e.g., Hafsaas 2005: 30-31). The inscribed stelae appear as offering tables (*abA*) during the First Dynasty at Abydos on grave owners' tombs and are present in various forms throughout the Ancient Egyptian world. Contrary to all the similarities linking the funeral stelae with the *Bunat El Asnam* menhirs, the latter's ideological meaning is radically different from the funeral stelae.

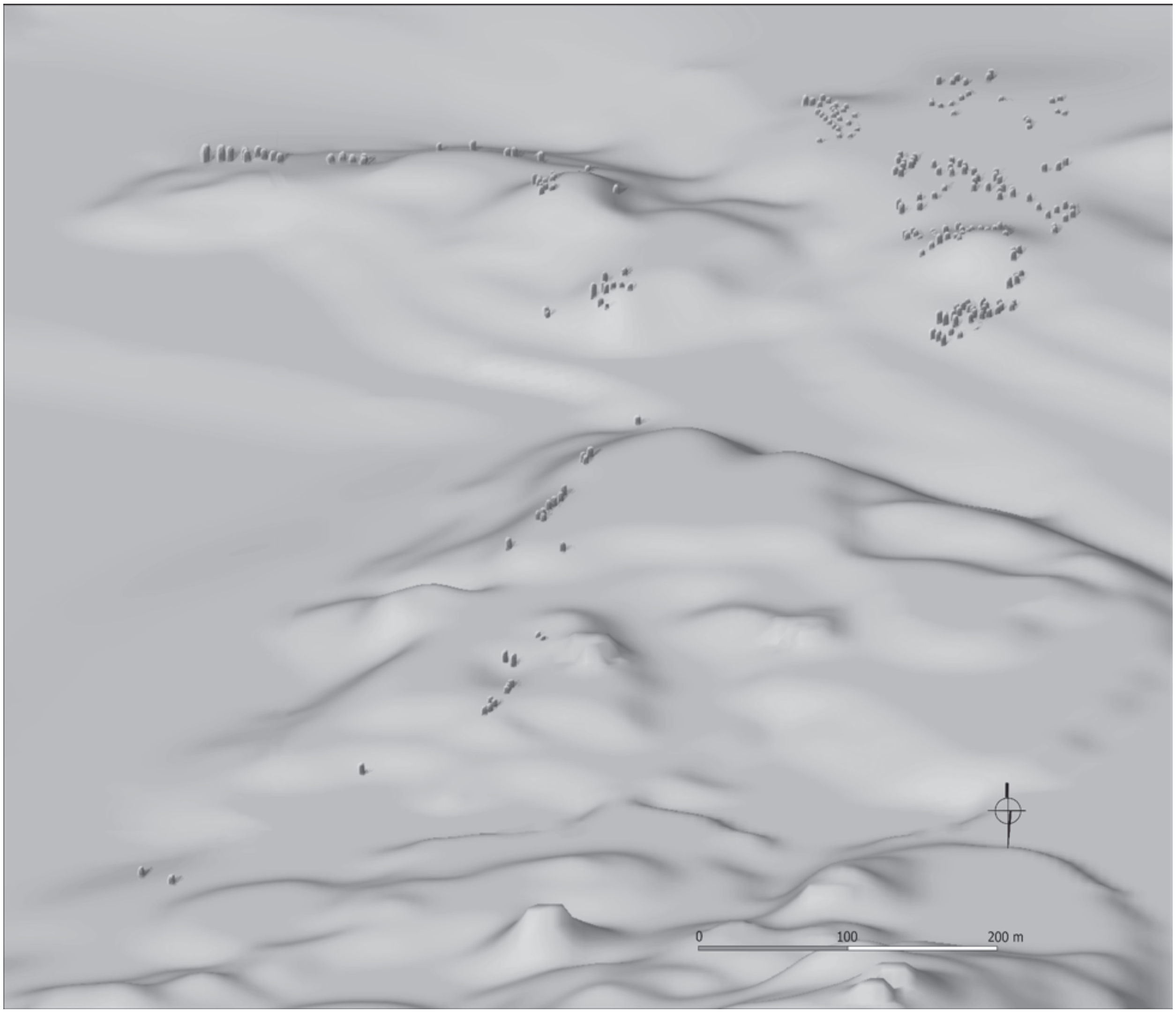


Figure 6.32. Nabta Playa, measured reconstruction of the Fields of Menhirs. Alignment A in the foreground with the Western Field behind, and the Eastern Field to the left. Figures of menhirs not to scale. Drawn by M. Puszkarski.

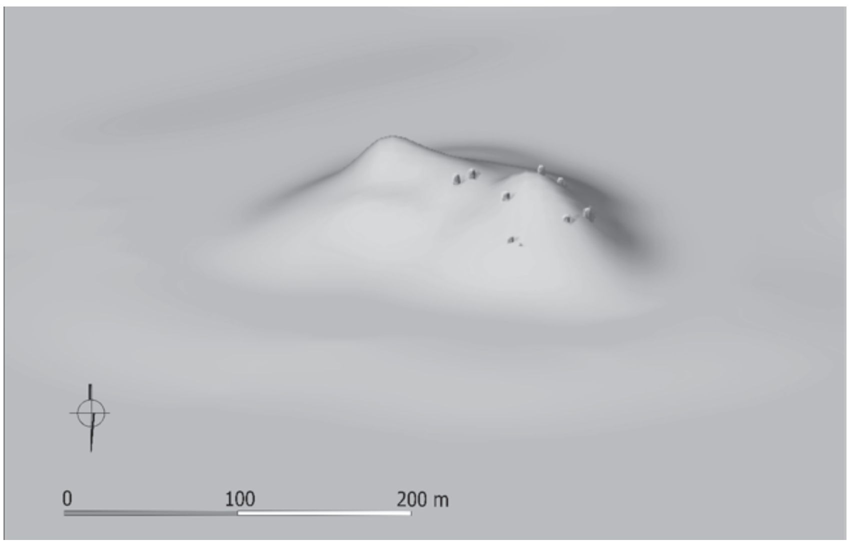


Figure 6.33. Nabta Playa, the "Salt Hill". Figures of menhirs not to scale. Drawn by M. Puszkarski.

8. Nabta Megaliths in the Nubia Museum

Given the constant threat of illegal interference with the exposed sites containing these monuments of Nabta Playa by tourists and New Age followers, it was agreed that at least a sample of the stones, including the most threatened objects, needed to be removed from the area. Thus, with the permission of the Supreme Council of Antiquities and the personal assistance of M. Attia Radwan, the late Undersecretary of State, six stelae, the "cow sculpture" and the "Solar Calendar" were removed from Nabta Playa and permanently installed in the gardens of the Nubia Museum in Aswan (Fig. 6.34) in February 2010 (Schild and Wendorf 2015).

The following six menhirs have been removed from the Western Field and one from the Southern Field:

1. Sector C (Western Field), Square b/10, 93x60x21 cm. The piece is notched along the right edge. The distal end is converging and the base straight, not worked.
2. Sector C, Square. b/10, 61 x 66 x 18 cm. A horseshoe-shaped slab unifacially worked (flaked) along the edges and the distal end, the base is straight.
3. Sector C, Square c/8, 133 x 100 x 18 cm. A huge horseshoe-shaped slab with a straight, broken base; the specimen is unifacially flaked around the perimeter, except for the base.
4. Sector C, Square f/8, 86 x 45 x 9 cm. A teardrop outlined slab worked along the perimeter (?), unifacial.
5. Sector C, Square i/10, Site E-96-1, Megalith A Group, 202 x 48 x 49 cm. An elongated sandstone block with an endscraper-like, shaped distal end (flaked).
6. Sector C, Square. j/11, Site E-96-1, Megalith B Group, 115 x 51 x 15 cm. An elongated stele with a converging short, denticulated, unifacially flaked distal end and planar, base.
7. Sector F (Southern Field) , Square r/30, 200 x 100 x 26 cm. A piece with a rounded proximal end, seemingly flaked, and a converging distal end; heavily wind-eroded (Fig. 6.35).

Figure 6.34. Nabta Playa, the possible "Solar Calendar", selected menhirs, and the Cow effigy in the western gardens of the Nubia Museum in Aswan. Photo by M. Kobusiewicz.

Figure 5.35. Nabta Playa, the Southern Field of Menhirs, Sector F, Stela 7 transferred to the Nubia Museum in Aswan. Photo by R. Schild.

Chapter 7.

Alignments of Megaliths

Romuald Schild

1. Introduction.

It was relatively late in the research programme at Nabta Playa, which began in 1974, that several alignments of menhirs were identified for the first time. The first, most conspicuous – Line A – was identified in the 1991 field season (Wendorf *et al.* 1992-93). Alignments B and C were spotted in the late 1990s by J. McKim Malville and others (McKim Malville *et al.* 1998). At first, there were three alignments attributed to line A, two to line B, and one to line C (McKim Malville *et al.* 2001: 498). However, Alignment A was the first to be published in detail in 2001 (Wendorf and Malville 2001: 489-502). The prominent group of fallen stelae termed Megalithic Structure A at Site E-96-1 was presumed to be the focus or hub of all the alignments.

All three alignments occur along the western shores of the Nabta Playa Palaeolake on a rolling erosional surface of the 8.2 ka event silt. A few menhirs are still partially embedded in the silt, while the remaining ones are collapsed, resting on the surface of the silt, and presumably displaced by the desert creep phenomena.

In later seasons (2003-2009) though, the project concentrated on detailed mapping and sketching of the megaliths. Alignments A, B, and C were additionally studied and mapped. In 2007 and 2008, Malville and others excluded Alignment C from the list of menhir alignments of Nabta Playa (McKim Malville *et al.* 2007: 23, fig.10).

Meanwhile, Thomas Brophy and Paul Rosen (2005) complemented the original measurements of the locations of the alignments by McKim Malville (McKim Malville *et al.* 1998; Wendorf and McKim Malville 2001) using the Quickbird satellite imagery and GPS data indicating good agreement on the position of the discrete components of the alignments (McKim Melville *et al.* 2007: 23, fig. 10).

Recently, McKim Malville (2007; 2015) has proposed that two major periods of alignment installation may fall in two age windows, one about 4600-4200 BC and the other about 3800-3400 BC (McKim Malville *et al.* 2007: 5). The first phase closely matches the most recently established dating of the activity of the Megalith Builders, whereas the younger one would be too recent to fit even the most recent ages of these desert dwellers.

It seems that Arcturus, the "brightest star in the northern celestial hemisphere", was the target of Alignments 2 and 3, whilst Alnilam would have been the objective of Alignment B2 (see also Belmonte and Shaltout 2009).

2. Alignment A

This alignment extends for about 900 m along the western shores of Nabta Playa in Sector B of the general Map of Nabta Playa (cf. Fig. 1.5, 2.1). It is composed of the components given below (Wendorf and McKim Malville 2001: 493).

Megalith A-10, Square j'/17. It is the southernmost element of the alignment installed close to the main trench of the deflated Site E-75-7. It is a still-standing upright base of a highly weathered, unusual, flaked sandstone block deeply embedded in the underlying silt deposited during the 8.2 ka event. The remaining base is 0.7 m wide and 0.6 m thick; several large sandstone splinters along the bedding plane still adhere to the block remnant, and a few occur in its nearest vicinity.

Megalith A-9, the second from the south, is located in Square d'/18 and consisted of five blocks (Wendorf and McKim Malville 2001: 493), three of which make a cluster. All of them probably created a single or two anthropomorphic stelae. Today, the group counts only four broken blocks. The blocks are resting on the cemented, slightly elevated surface of the silt and most probably were subjected to desert creep.

Megalith A-8, Squares b'/19 and a'/19, the third from the south. It consists of eight broken blocks of which six make a partially refitting cluster, and two smaller ones are at a distance to the south of the first group. The refitting fragments make a block (stele with worked rounded tip) ca. 1.7 x 0.7 x 0.4 m (Wendorf and McKim Malville 2001: 493). The fragments rest on the hard silt surface of the slope and have clearly been subjected to surface creep.

Megalith A-7, Square z/19, the fourth from the south, The group is composed of a cluster of seven blocks, of which three refit making one pointed stele with a worked side and base about 0.9 x 1.2 x 0.5 m, a small worked stele (0.6 x 0.5 x 0.3 m), and a small block with traces of working. According to the suggestion of Wendorf and McKim Malville (2001: 491), the recorded fragments originated from two blocks (stelae). Like the others, the fragment resting on a hard sloping silt surface must have been exposed to desert creep.

Megalith A-6, Square x/20, the fifth from the south. It is a loose cluster of 10 fragments of a larger stele, of which only two parts refit. Wendorf and McKim Malville (2001: Fig. 16.9) had suggested that the fragments might have represented two stelae. The cluster rested on the hard sloping silt and was most likely subjected to the desert creep phenomena. Wendorf and McKim Malville included megaliths A-10 – A-6 and Megalithic Structure E-96-1A into their Alignment A1 (Wendorf and McKim Malville 2001: 500).

Megalith A-5, Square x/20, the sixth megalith from the south. A relatively large cluster containing 10 fragments of a single stele. However no refits were evident. According to Wendorf and McKim Malville (2001: 491), the supposed size of the stele would have been about 1.8 x 2.0 x 0.4m.

Megalith A-X, Square r/20, the seventh megalith from the south. It is a single stele with a rounded tip. The piece is roughly flaked into an oval shape measuring ca. 1.8 x 1.3 x 0.3 m. (Wendorf and McKim Malville 2001: 491). It rests flat on the hard silt, and was probably displaced by desert creep.

Megalith A-W, Square s/19, the eighth megalith from the south. It includes three medium-sized broken fragments of a block. However, it is not certain that they were parts of a stele. No refits are evident, and the silt underneath is only 30 cm thick (Wendorf and McKim Malville 2001: 491).

Megalith A-4, Square r/20, the ninth megalith from the south. It contains a rather thin cluster of fragmentary blocks, perhaps forming a large stele estimated at ca. 1.5 x 1.8 x 0.5 m (Wendorf and McKim Malville 2001: 491).

Megalith A-3, Square p/20, the tenth megalith from the south. The group contains four blocks of which two refit into a complete stele (1.8 x 1.6 x. 0.35 m.), one cordiform in shape. It is flaked around the perimeter, and its base is still embedded in the upright position.

Megalith A-2, Square n/21, the eleventh megalith from the south. The group most probably consisted of two very large stelae, of which the northern one is tilted and still embedded about a metre into the red playa silt (2.6 x 1.4 x 0.4 m, above the surface). The tip is rounded and worked. The other one, fallen and broken into ten blocks is about a metre to the southeast of the first one and some 2.6 x 1.6 x 0.6 in size. Its tip is rounded by flaking.

Megalith A-1, Square, n/21North, the twelfth megalith from the south. It includes nine fragments, three of which refit. All of the fragments probably initially formed one oval stele worked around the perimeter (1.9 x 2.8 x 0.8 m), with a shouldered, anthropomorphic top (Wendorf and McKim Malville 2001: fig 16.3). The remains of the A-1group have been illegally disturbed by visitors. Megaliths A-1 and A-2 initially formed one group containing four menhirs (cf. Fig. 6.5).

Megalith A-0, Square L/24, the thirteenth megalith from the south. A single upright stele worked along the perimeter with a pointed tip, highly wind-weathered (1.1 x0.8 x 0.25 m) above the surface (Fig. 7.1). The menhir was frequently visited by illegal visitors who used to decorate the statue with various offerings.

Megalith A-Y, Square e/29, the fourteenth megalith from the south. A single fallen, entire, shouldered, anthropomorphic stele on a cemented, smooth silt surface dipping toward SE (1.1 x 1.4 x 0.3 m.). Both sides and tip flaked, the base formed by a break. The piece has almost certainly been displaced by desert creep.

Megalith A-Z, Square d/28, the fifteenth megalith from the south, An entire small trapezoidal fallen stele resting on a smooth, hard silt surface dipping to the SE top flaked sides formed by break planes (0.85 x 0.55 x 0.2 m).

Figure 7.1. Nabta Playa, Sector B, Alignment A, Megalith A-, Squ. k-l/24. Photo by R. Schild.

3. Alignment B

According to McKim Malville *et al.* (2007; 2008) Alignment B is represented by two lines B1 and B2. On the map of Section C, it is composed of blocks of sandstone in Squares: m/18, n-19, n/20, n/21, n/22, o/23, o/24, o/25. o/26, and o/27. All of the stones of the lines lie collapsed on the hard, cemented playa silt of the south and southeastern foot slope of the erosional knoll of the Eastern Group of Stelae. The collapsed blocks were most likely subjected to desert creep and/or slide, particularly the lighter blocks located in the upper section of the slope in Squares m/18 and n/19-22 forming Alignment B2.The blocks making up the alignment vary from relatively small blocks to very large specimens in line B1. All are fallen and more or less fragmented.

Alignment B2

Square m/18. A broken stele with a rounded worked tip and a missing pointed (?) base about 1m long and about 0.65 m thick.

Square n/19. An anthropomorphic, shouldered, and worked stele measuring about 1.10m x 0.8 m. Broken into two pieces.

Square, n/20. Two fragments of a stele (?), both about 20 cm in length.

Square n/21. A broken tip of a shouldered or anthropomorphic worked stele measuring about 0.7 m in length.

Square n/22. A fragment of a stele measuring about 80 cm in length.

Alignment B1

Square o/23. It contains three fragments of a stele, all nearly 0.7 m in length.

Square o/24. The square shows a large fragment of a broken stele measuring nearly 2 m in length as well as two small fragments.

Square o/25. It contains five relatively small fragments of a large stele, about 2.1 x 1.4 m, resting together with its 15 fragments in Square o/26.

Square o/27. It contains six subsequent fragments of seemingly a single large stele.

4. Other Alignments

To the north and northeast of the Western and Eastern Groups or Fields of Stelae occur two debatable lines of stelae. The first, in the northeastern footslopes of the Eastern Field knoll, closely resembling the geomorphic position of Alignment B, spreads through Squares d/17 – d/19 of Sector C. The second, quite fuzzy and thick belt of the stelae and their fragments occupies Squares b-c/8-10 in the same Sector and is nearly perpendicular to the hillslope.

The group on the northeastern foot slope of the knoll in Squares d/17 – d/19 (Sector C) contains a small number of shattered blocks, presumably originating from broken stelae. Square d/17 contains six specimens ranging in length from 0.5 to 0.7 m; Square d/18 – comprises 13 pieces, of which the smallest has 0.4 m. in length and the largest 0.8 m in length, and Square d/19 includes a few fragments of shattered stelae (?).

Of higher interest is the belt of broken stelae extending between Squares c/8 – c/10 and b/9 – b/10 (Sector C). A closer look at this discrete scatter reveals that it includes a much narrower and a denser line of broken stelae fragments spread between the centre of Square c/8 and the south edge of Square b/10. Also here are concentrated the most abundant fragments of broken, often worked stelae, attaining lengths of between about 2.1 and 0.8 m. It is quite likely that this denser line of fragmented megaliths initially formed an alignment of stelae, which after collapse and fragmentation formed a wider belt of menhirs as a result of desert creep and slope slide.

Chapter 8.

Geophysical research in the study of the megalithic structures in Nabta Playa

Tomasz Herbich

1. The site

Along the southwestern rim of the Nabta Basin there are about 30 clusters of rock blocks. The second, smaller grouping is located approximately 300 m to the east from the edge of the basin (Fig. 8.1). At first, it was thought that the blocks were the remains of geological outcrops of the ground rocks, covered with Middle Neolithic playa sediments and modern wind-blown sand. A more detailed inspection of the structures showed that they were created as a result of human activity. This was indicated by the traces of working of the blocks and their location according to a repetitive plan: the blocks are located within a space with an oval contour, 5 to 7 m long and 4 to 6 m wide, with rectangular blocks in the centre. The longer axis of the oval and blocks in the centre of the structures are oriented towards the north (with a slight deviation towards the west). Most structures occur in groups of 3 to 4 units, being 2-3 m apart and not touching each other (Fig. 8.2). These observations prompted the researchers to deem these blocks to be megalithic structures, reinforcing Nabta's interpretation as an important regional ceremonial centre during the Late Neolithic (Wendorf and Schild 1998: 110; Wendorf and Królik 2001: Fig. 17.1).

More details on the architecture, chronology, and functions of the megaliths were obtained as a result of excavations carried out within the grouping of structures marked as Site E-96-1 (cf. Fig. 8.1). Two structures were completely investigated, another one partially, and drilling was carried out in the area of two more. This work showed that in all cases the same features could be observed, the most intriguing of which was that the structure was erected in a place where there was a rocky plateau (table rock), which rose nearer to the ground surface but was not visible on it. The highest parts of this table rock in the case of completely examined structures marked with numbers A and B, were 2.6 m from the surface. The horizontal dimensions of the table rock in structure A were 3.3 and 2.3 m, in structure B were 6 and 3.6 m. The table rock rises to a height of about 1 m above the level of bedrock, located from 2 to 3 m in depth (Wendorf and Królik 2001: 505-515). The presence of table rock below the structures tested solely by drilling was judged on the basis of the elevations in the top of the underlying rock beneath the structures.

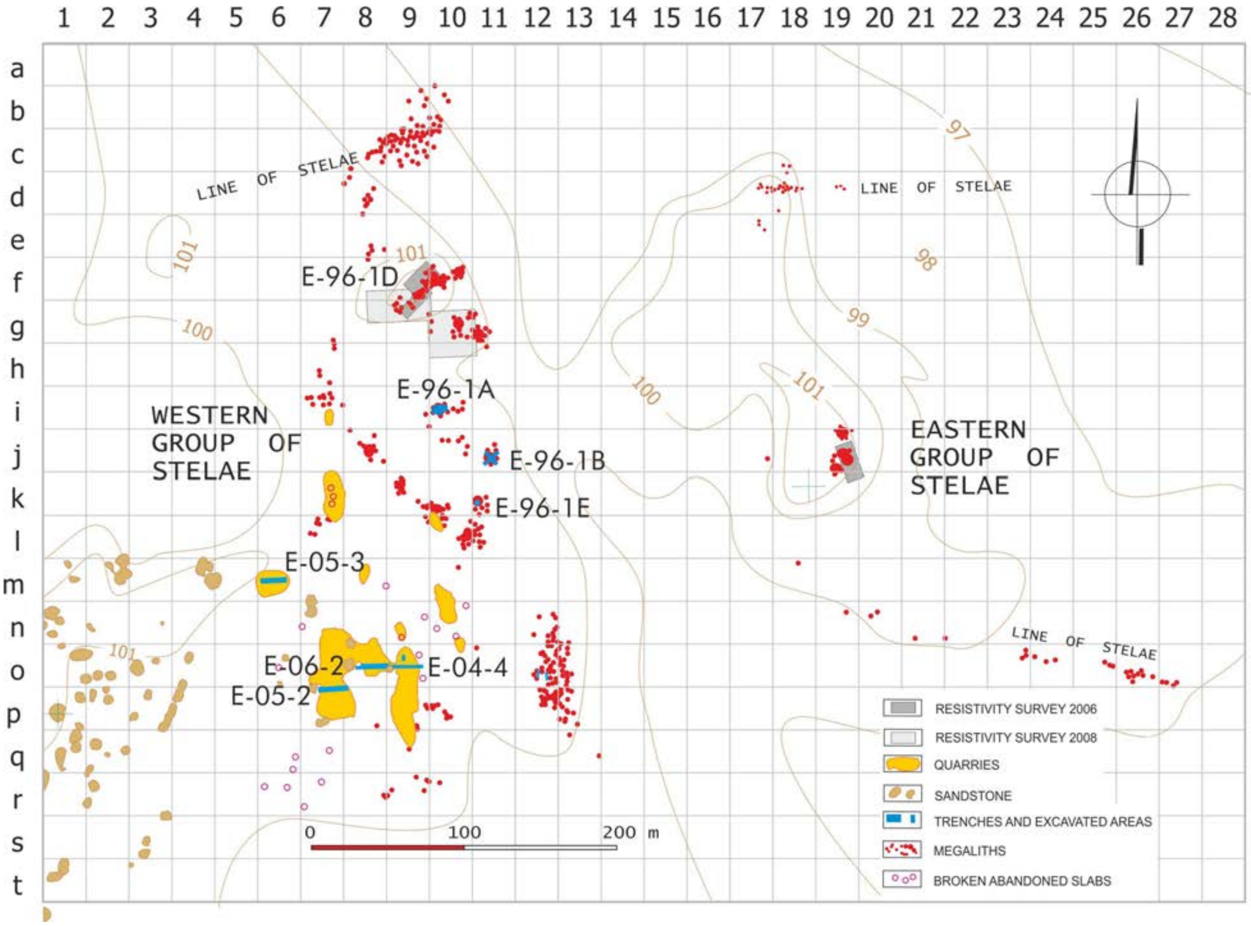


Figure 8.1. Nabta Playa, Site E-96-1. Map of the western and eastern clusters of megaliths, location of excavated areas, and location of resistivity surveys. Drawn by M. Puszkarski.

It is impossible to know how the table rock was located by the builders of the megaliths. On the basis of the test excavations of units A and B, it is known that before setting the megalithic blocks, the presence of the table rock was verified by excavating a pit, which was then backfilled with the extracted material. As a result of processes caused by changes in the moisture content of the substrate, the boundaries of the pits were completely obliterated in plan, and they were distinguishable only in the bottom part. No remains of burials were found in the pits; only in the one in structure A was found a block of rock approximately 1.9 x 1.5 x 0.7 m with traces of working, interpreted as a geometrized likeness of a cow (Wendorf and Królik 2001: 509-511, figs. 17.8 - 17.11).

Due to the lack of any remnants of burials in pits below the rock blocks, according to the researchers: "the features may have been monuments to elite individuals who died elsewhere during seasonal movements with the cattle herds, or perhaps they were shrines or structures erected during some unknown ceremony" (Wendorf and Królik 2001: 503). Due to the fact that during the project, the work carried out near these constructions took the form of surface fieldwork as well as excavation in the layers to the depth of the bedrock, the units were named "Complex Structures or Shrines".

Archaeo-astronomical observations, in connection with radiocarbon dating, allow the structures to be dated between 6800 and 4800 bp (Wendorf and Królik 2001: 520).

Figure 8.2. Nabta Playa, complex structures in the northern part of the western cluster (E-96-1D). Photo by T. Herbich.

2. Aim of the research, measurement method, processing of the results

The researchers had intended to confirm the reproducibility of the observed features of Complex Structures – including the relationship of their location to the table rocks and the presence of blocks in pits – by examining a larger number of them. Difficult exploration conditions, however, meant research had to be limited to four units, including only two excavations (structures A and B), and the others by partial exposure (structure E) or drilling (structure D). In this situation, it was decided to use non-invasive methods, and more specifically – the electrical resistivity method.

The choice of the electrical resistivity method resulted from the assumption that the rock forming the table rock is characterized by a much higher resistivity compared to the resistivity of the surrounding sediments. In addition, stone blocks located in pits below the surface parts of the structures may also affect the image of the resistivity distribution. The measurements were made using resistivity profiling. In this method, the resistivity is examined with a probe array with constant intervals between current probes AB and potential probes MN, in a grid with regular intervals between measurement points, recording changes in resistivity in the layer to the depth determined by the geometry of the array, mainly the distance between the current electrodes (Schmidt 2013: 38-47).

The selection of the electrode array was a result of tests in the region of the complex containing structure D, in the northern part of Site E-96-1.

Symmetrical Schlumbereger arrays with electrode spacing AB = 16 and AB = 8 m (MN = 2 m) were tested, followed by the Wenner array AB=6 m, MN=2m. Measurements with the latter system gave the most readable image of changes, and this array was used in further measurements (Fig. 8.3). According to theory, in the geological situation of the research area, a homogenous thin-bed layer (clays and silts) on a higher-resistance substrate (sandstones) is an array that gives the possibility of observing changes in the layer to a depth of about 2 m. From the comparison of the results of measurements in layers to different depths, however, it transpires that the prospection went deeper (the image of changes detected by arrays with larger spacing of the electrodes suggested that the readings were significantly influenced by the bedrock). The difficult measurement conditions in the desert environment: poor contact between the electrodes and the ground due to the negligible humidity of the soil, and the resulting need to water each point of contact between the electrodes and the ground, dictated the limitation of the number of measuring points, and thus the dilution of the sampling grid. On the other hand, the spacing between the measurement points had to be dense enough for any table rock to be within the reach of at least 3-4 measurement points, so that it would evoke clear and reliable changes in soil resistivity. With this in mind, the measurements were carried out along lines 2 m distant from each other, with measurements taken every 1 m on the line.

The research was carried out in 2006 and 2008, during the author's several-day stays in Nabta. Expecting unfavorable measurement conditions, during the first test season, a PKE10 direct current unit was used, manufactured by Przedsiębiorstwo Badań Geofizycznych in Warsaw, which has the possibility of manual measurement compensation. Difficulties in using the old-time apparatus (with a manual measurement record) were compensated for by the dependability of the apparatus and the reliability of the measurements that it produced in difficult desert conditions (cf. Fig. 8.3). In the second season, the soil resistance meter ADA05 produced by Elmes was used. Repetition of a small part of the area examined during the first season using this apparatus gave an identical image of resistance changes.

The results from both seasons were processed using the Geoplot (processing) and Surfer (map printout) programs. Both *despike* and *low pass* filters were applied, and then the results were interpolated to a grid of 0.5m. The results are presented in the form of maps of changes in the apparent ground resistivity distribution (hereinafter referred to as resistivity maps), where the lowest values are shown in light tones – and the highest values in black.

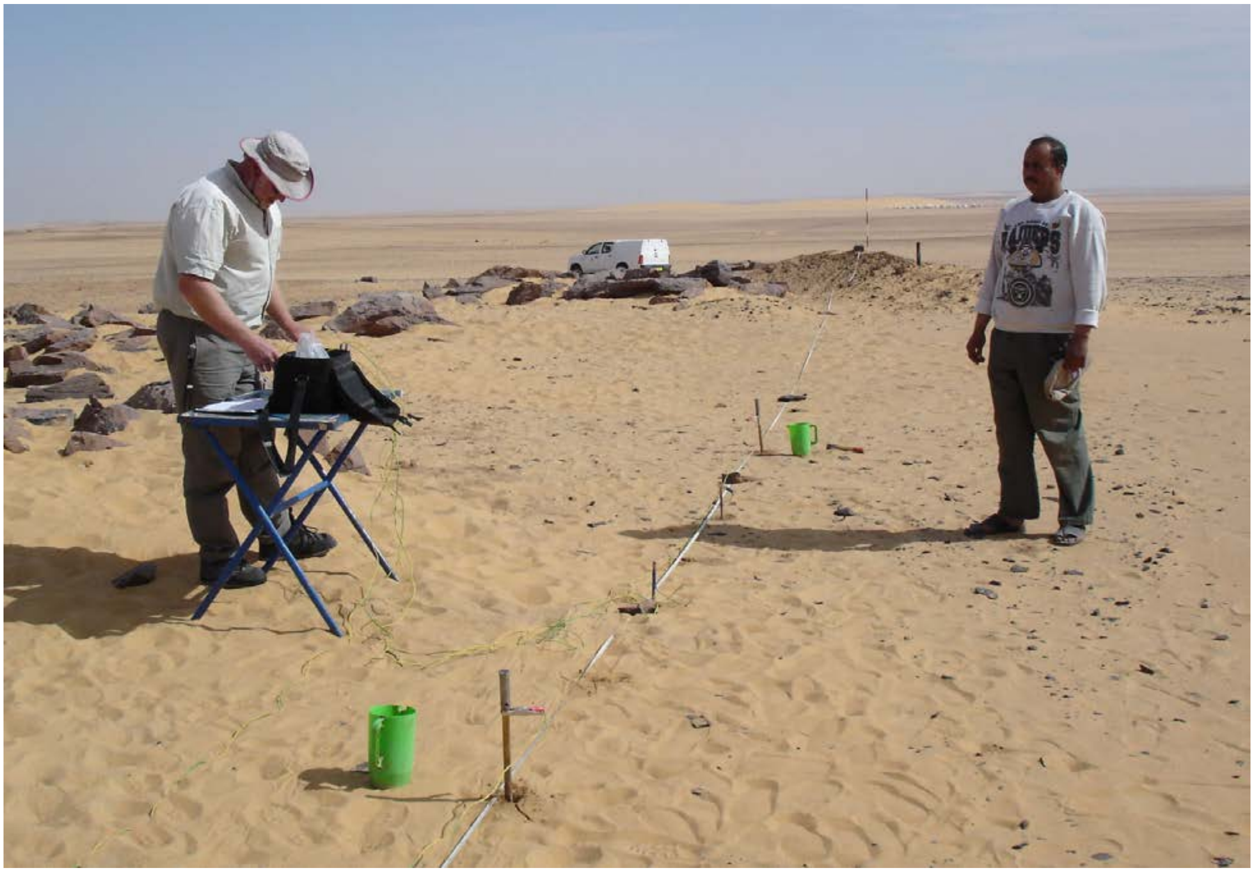


Figure 8.3. Nabta Playa, resistivity profiling with the use of Wenner array. Photo by R. Schild.

3. The Results of the Measurements

Measurements in the western stele group (Site E-96-1, cf. Fig. 8.1).

During two seasons, an area of 2 330 m^2 was examined. Seven Complex Structures were included in the survey area, one of which (D) was tested by drilling. The measurements showed a large variation in the substrate resistivity values within the layer covered by the measurements: the values range from 850 to 2600 ohm-m. On the resistivity map, seven oval anomalies showing increases of values are visible, with a longer diameter of 5 to 9 m, the shorter in the range from 4 to 6 m. These anomalies are characterized by resistivity from 1200 ohm-m at the edges to resistivity from 1500 ohm-m to 2600 ohm-m in the central part (Fig. 8.4).

In addition to the oval-shaped anomalies, the map features areas of increased resistivity values across larger areas. Such areas are visible in the northeastern part of square g10 and on the south side of this square (cf. Fig. 8.4).

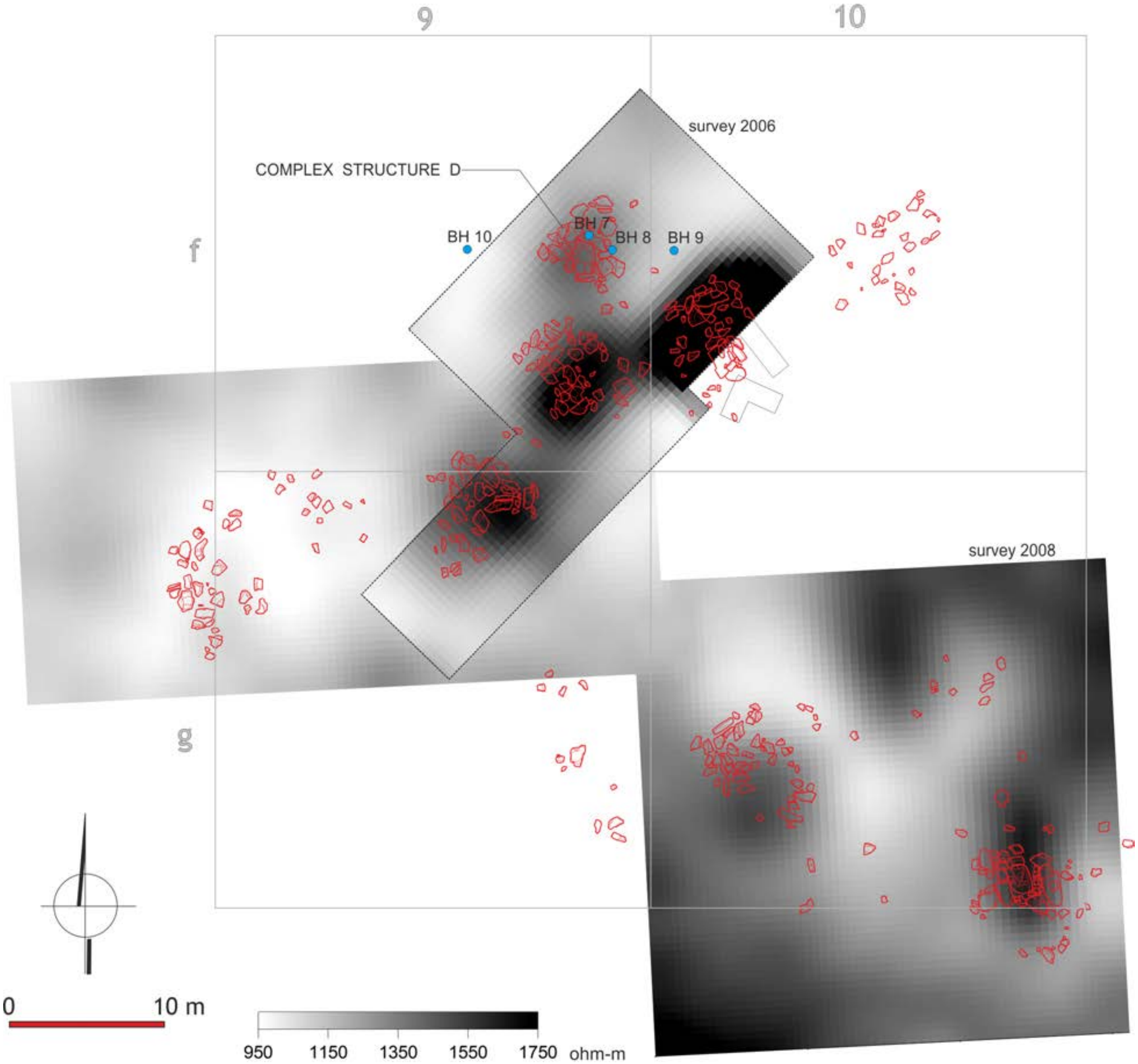


Figure 8.4. Nabta Playa, survey in the area of structure D (E-96-1, western cluster). Complex structures (in red) superimposed on resistivity maps. Boreholes marked in blue. Drawn by T. Herbich.

Measurements in the eastern stele group (cf. Fig. 8.1).

An area of 390 m2 was examined. The measurements showed a large variation in the substrate resistance value within the layer covered by the measurements. In most of the area, these values are in the range from 130 ohm-m to 220 ohm-m. In the central part of the eastern border of the area, the edge of anomalies with increased resistances, reaching 650 ohm-m is visible (Fig. 8.5). The average resistivity value of the substrate is lower than in the case of resistivity in the region of Site E-96-1.

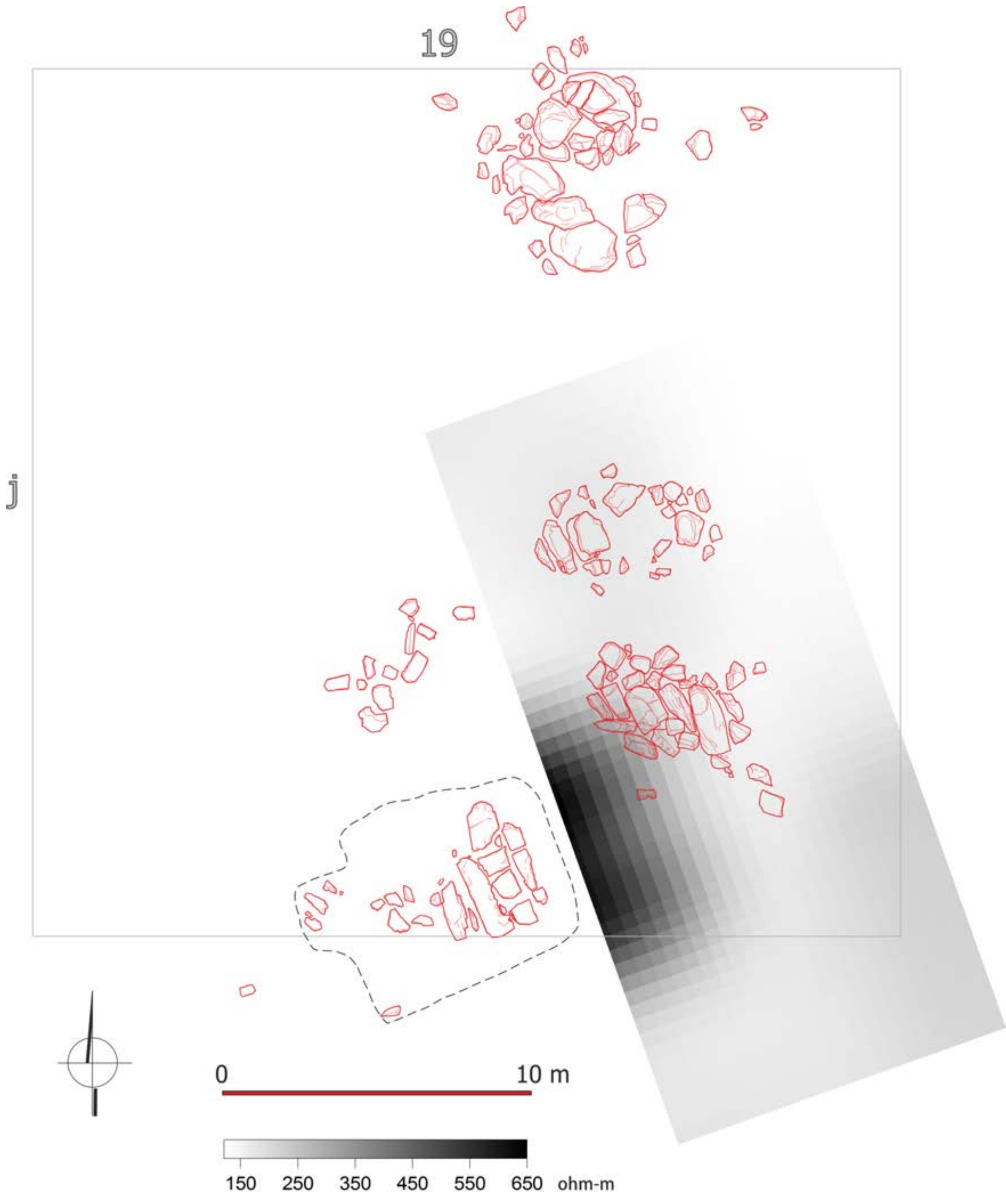


Figure 8.5. Nabta Playa, survey in the area of eastern cluster. Complex structures (in red) superimposed on resistivity map. Drawn by T. Herbich.

Knowing the geological structure of the substrate and knowing what order of resistivity values can be caused by both sandstone (characterized by elevated values) and clay and silts (characterized by reduced values), it seems that the oval anomalies that are characterized by high resistivity values can be deemed to reflect the presence of table rocks close to the surface, with the reduced resistivity of the surrounding areas being reflections of clay and silts.

4. Discussion of the results

In the case of the western stele group, the image of soil resistivity changes obtained as a result of geophysical measurements seems to confirm the observations made as a result of excavations and drilling – namely, that there is a close relationship between the placement of Complex Structures and the presence of table rocks. Seven Complex Structures were located within the area covered by the measurements. In the case of six of the seven anomalies with increased resistivity values, their location coincides with the site of Complex Structures; the only oval anomaly that does not have a corresponding cluster is located in the northern half of the g10 square (cf. Fig. 8.4).

The differentiation of the resistivity values of individual anomalies on the sites of Complex Structures, as well as their differentiated diameters, can be indicative of different vertical and horizontal dimensions of the table rocks. Anomalies with the highest values would be the reflection of table rocks with the highest vertical size – that is, their upper surface is closest to the surface. It cannot be ruled out, however, that high resistivity is caused both by the table rock and stone blocks lying over it (as in the case of structure A).

In the case of the Complex Structure located on the western border of g9, the situation is unclear. This place is characterized by the lowest resistivity measured throughout the entire E-96-1 site, although there is a slight increase in the values in the place where there is a cluster of remnants of the stelae. This may be a reflection of a table rock of a small mass with an upper surface at a greater depth than is the case with other structures.

Hypotheses about the close connection between Complex Structures and the table rocks, however, are not confirmed by studies within the eastern group of stelae. The research included three clusters of stelae. A clear increase in resistivity seems to be related to only one structure. The relatively lower values than in the case of Site E-96-1 may indicate a much greater thickness of the clay and silt layers and their lower sand content.

Part IV. A special tumulus and stone installation in a circle

Chapter 9.

The Tumulus from the Site E-04-2 –"Little Lord of Nabta Playa"

Romuald Schild, Halina Królik, Dagmara Mańka, and Maciej Jórdeczka

1. Introduction

Just about 550 metres northwest of the Cluster of Megalith A, in the Western Field of Stelae, excavated during the 1996 season as Site E-96-1A (Sector C), is a lonely, small, flat-topped sandstone knoll termed Ring Hill, gently sloping to the northwest, measuring about 50 by 40 metres (cf. Fig. 1.5, 2.6), Sector E). At the very top of the hill is a very conspicuous double stone ring marking the remains of an ancient deflated tumulus (Sector E, Squares f, g/8, 9) overlooking from the southwest the Nabta Playa Basin including the entire expanse of the Nabta fields of menhirs, together with those resting upon the Salt Hill. The flat-topped Ring Hill and the tumulus were found in the 2001 field season by the senior author of the chapter and excavated in the 2004 season by Halina Królik and Dagmara Mańka.

The flattish top of the Ring Hill is at slightly above 105 metres (Nabta benchmark). In comparison, the closest Western Field of Stelae is at ca. 100-101 m, the Eastern Field stands at 98-101 m, and the Salt Hill at 99-100 m, the South-Eastern Field is at 99-101m, while the Southern Field is at 100-101 m. Alignment A of the menhirs on the elongated rise in Sector B is at about 98-100 m contour lines of the Nabta benchmark.

The grave pit inside the inner stone ring contained the remains of a young boy between two and four years of age at death (cf. Chapter 10, this volume). This finding led to the naming the monument as "The Tumulus of the Little Lord (or Prince) of Nabta Playa".

2. The Tumulus

The rather level surface of the hilltop is of pinkish to white, consolidated to slightly cemented shale, and is part of the Qusseir Formation. At a depth of 1 m the shale is consolidated, white (7.5 YR 8/0); at a depth of 30 to 45 cm, it is variegated, oxidized, pink (7.5 YR 8/3), and overlaid with a 5 cm thick bed of a cemented, reddish yellow sand (7.5 YR 6/6) about 5 cm in thickness. The sand is weak, reddish yellow (7.5 YR 7/6). A Holocene aridisol has developed in the top of the shale. The pea gravel of the hamada overlies the sequence. At the southeastern edge of the flattish top, three blocky, erosional remnants of the quartzitic sandstone occur, immediately topping the white shales. A similar, but larger remnant is seen at the northwestern edge of the hilltop.

The outer ring of the tumulus, measuring about 15 m in diameter, was initially composed of 22 large, probably evenly spaced thick quartzitic sandstone slabs. This surrounded an inner ring constructed of dry sandstone masonry. When built, it was approximately 7 m in diameter and at least 0,7 m in height. Its wall has been damaged and the individual slabs have mostly been dispersed (Fig. 9.1).

Figure 9.1. Nabta Playa, Site E-04-2. Deflated tumulus before excavation. Looking southwest Photo by R. Schild.

The floor of the central ring was cleaned in 2004. This exposed a small pit east of the centre. It was 1.2 m in diameter, oval in plan, and sunk into the shale to a depth of about 1.15 m (Fig. 9.2, 9.3). The pit had initially been filled with carbonate cemented backfill composed of broken fragments of shale. A sub-circular pit measuring about 80 cm in diameter made by grave robbers was sunk into the original grave pit down to its bottom. The new pit almost wholly removed the old grave backfill, except for some limited areas showing the ancient infill still adhering to the northern and eastern walls of the grave pit. The new pit was, in turn, filled with loose sub-recent windblown sand. At the very base of the new pit, a fragment of human skull broken into two parts was found (Fig. 9.4) as well as half of a brown, black-topped, smoothed deep bowl with a conical base (Fig. 9.5).

The skull belonged to a two- to-four-year-old boy (cf. Chapter 10, this volume) with North African physical features. On the other hand, a fragment of a Qusseir shale pot was recovered from the surface just outside of the outer stone ring in the northern section of the site (Fig. 9.6).

It is very likely that the floor for the tumulus setting was initially prepared by the removal of the remains of hard sandstone plates originally overlaying the variegated Qusseir shale. On the other hand, the outer ring of sandstone large blocks most possibly formed a border of the superstructure of the tumulus. Assuming that the angle of repose of the earthen matrix forming the barrow was around 45°, the height of the tumulus could have been close to 7 m (Fig. 9.7, 9.8).

▲ **Figure 9.2.** Nabta Playa, Site E-04-2. Deflated tumulus. Note a whitish grave shaft near the eastern edge of the inner ring. Gebel Nabta in the background. Looking west. Photo by M. Jórdeczka.

◄ **Figure 9.3.** Nabta Playa, Site E-04-2. The grave shaft. Photo by R. Schild.

Figure 9.4. Nabta Playa, Site E-04-2. The grave shaft with the broken skull at the bottom. Photo by R. Schild.

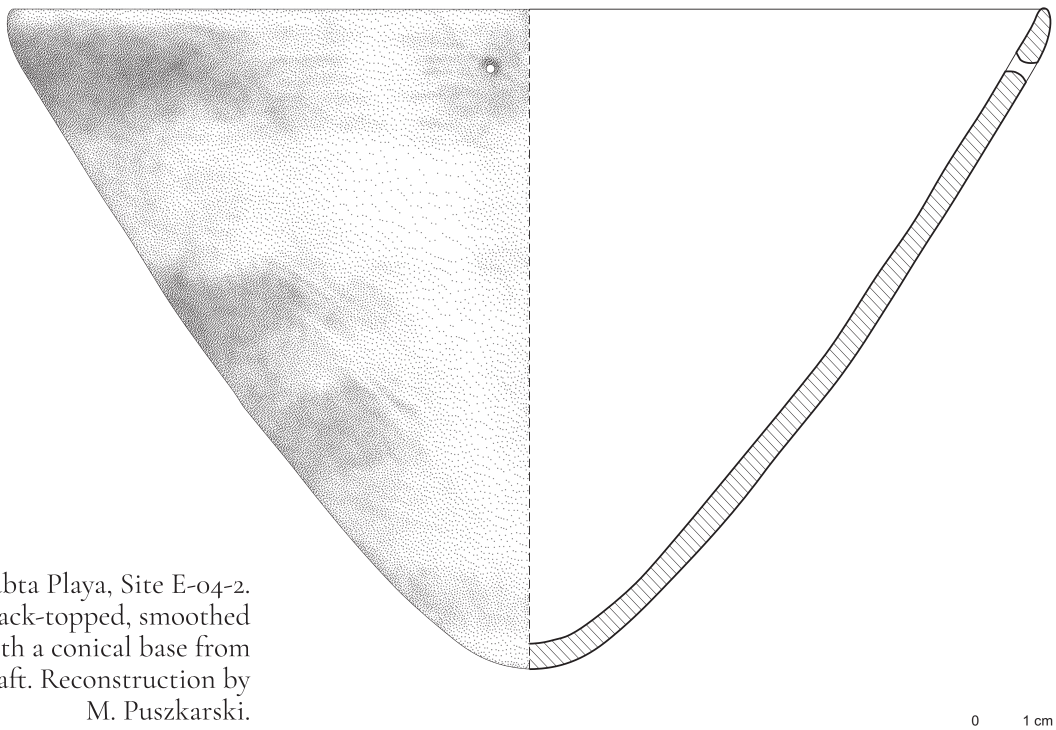


Figure 9.5. Nabta Playa, Site E-04-2. A brown, black-topped, smoothed deep bowl with a conical base from the grave shaft. Reconstruction by M. Puszkarski.

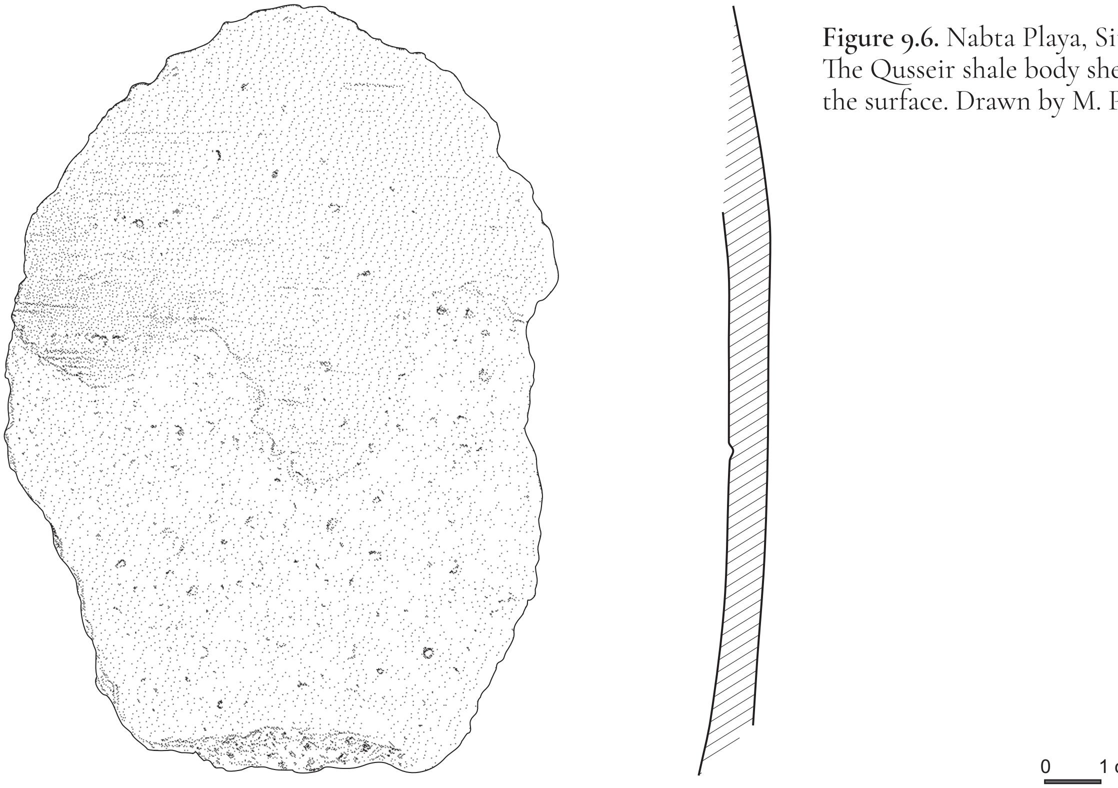


Figure 9.6. Nabta Playa, Site E-04-2. The Qusseir shale body sherd from the surface. Drawn by M. Puszkarski.

Taphonomy

The barrow was probably made of local material, possibly of sand and broken, consolidated Qusseir shale. Despite a careful survey conducted around the hill, no traces of mining pits were spotted. The cemented, broken shale matrix of the burial pit with deposition of carbonates and root casts seen on the pottery sherds indicate that the burial mound was exposed to rainfall and the resulting growth of vegetation during a considerable period of time. According to the middle and late Holocene climatic record from the South-Western Desert, the final period of wetter climates in this area were coeval with the C-Group settlement.

The hyper-arid climates that occurred after the Final Neolithic Humid Interphase (*Bunat El Asnam*; cf. Table 3.3), along with a wetter 4.2 ka event, was responsible for the deflational removal of the earthen supra-structure of the barrow. The very friable aeolian sand infill of the robbers' pit indicates that the pit was naturally filled up with wind-blown sand in a relatively recent time. The robbers, after having cleared the grave, carefully put back the sole remains of the boy, and thrust in a half of the brown bowl, probably broken during the looting, and tossed out a Qusseir ware.

Figure 9.7. Nabta Playa, Site E-04-2. A reconstruction of the tumulus. Drawn by M. Puszkarski.

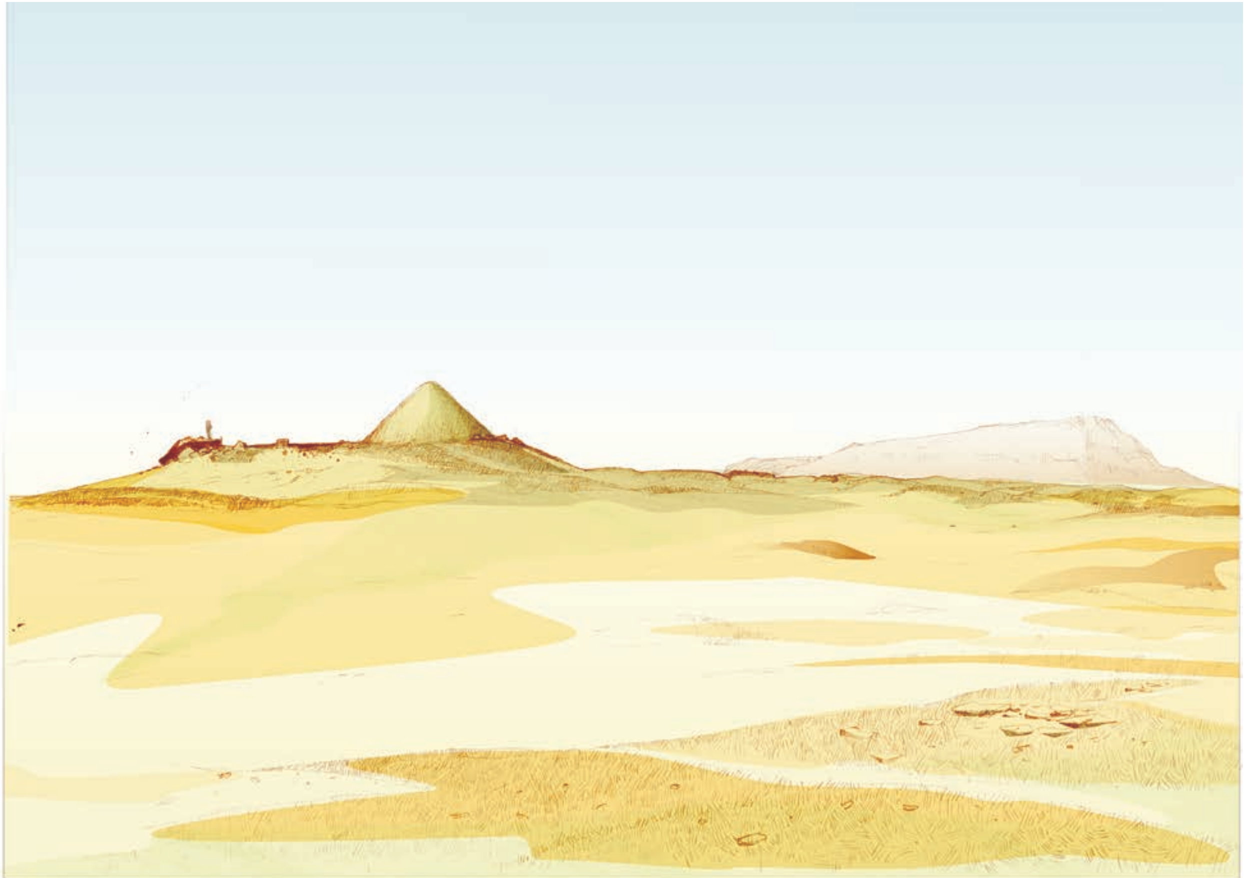


Figure 9.8. Nabta Playa, Site E-04-2. An artist view of the "Little Lord" Tumulus with Gebel Nabta in the background. Looking west. Painting by M. Puszkarski.

Age of the interment

A few skull fragments have been AMS dated in the Poznań Laboratory. The date on collagen of 4450±60 uncal BP(Poz-8036) has been considered uncertain due to the tiny amount of the collagen present (0.15 mgC) and, therefore, it is regarded as minimal. As a result, another AMS date was carried out on a structural carbonate, and it gave a significantly earlier age of 4820±40 uncal BP (Poz-8267). Nevertheless, the visible accretion of carbonates in the grave pit matrix indicates a post-depositional carbonate enrichment in the arid environment, a specific characteristic of aridisols and cannot eliminate the hypothesis of a rejuvenated age of the bones. The calibration of the obtained ages (2σ) gave the following results (cf. Fig. 12.24, 12.25):

Sample Poz-8036: 5290-4870 calBP; 3350-2920 calBC

Sample Poz-8267: 5610-5470 calBP; 3660-3520 calBC.

During the 2017 field season of the Combined Prehistoric Expedition, a similar tumulus in the Bargat El-Shab Area (Site E-12-04) yielded four radiocarbon dates on charcoal (Bobrowski *et al.* 2021), of which three are overlapping with each other within two σ. All four dates, however, are significantly older than the tumulus from the Site E-04-2 and are within two σ of the older section of the main set of dates from the Nabta Playa quarries for quartzitic sandstone.

Pottery

Smoothed, Qusseir Clastic Yellow Ware: This is a large sherd, 13.1 x 9.5 x 0.8 cm, partially wind abraded on the inside. It is a body sherd, probably from a large, deep, incurving bowl, with abundant biotite inclusions. It has traces of carbonate deposit on the exterior and root casts on the interior, both indicating that the sherd was buried in a moist/dry depositional environment.

Black Topped Brown Ware: This is a piece of a black topped, smoothed bowl with a conical base with an estimated diameter of 22.5 cm and a depth of 12.8 cm. The bowl is made of fine alluvial clay, tempered with abundant small rounded white grains, possibly granite. The exterior and interior are smoothed, and some horizontal smoothing striations are seen on the interior. The rim is rounded, straight to slightly bevelled. A 4 mm in diameter repair hole (?) is seen near one edge, about 2 cm below the rim.

Conclusions

The Black Topped Brown Ware sherd from a deep bowl with a conical base could be either Late or Final Neolithic in age. According to Maria Gatto (2016), the shale wares appeared first in the mid-sixth millennium BC in western oases and in the early fifth millennium in the Nubian Shab Pediplain as a result of the Nubian groups' movement towards the north. According to K. Nelson (2002:14), in the Bir Kiseiba/Nabta Playa Area, the Qusseir Clastic Yellow Ware is undoubtedly of Final Neolithic date. Such a vessel type has never been found in a Late Neolithic context. This indicates that the tumulus of Site E-04-2 should date within the Final Neolithic (or *Bunat El Asnam* complex).

3. Similar Tumuli

The Umm El Akhdar Tumulus

Broken sandstone hills mark the northeastern edge of the Umm El Akhdar Playa. The playa was discovered and given the name of Umm El Akhdar ("Mother of Green") by Vance Haynes while surveying the desert north of Bir Nakhlai and west of Gebel Ramlah. The fossil playa lake lies about 1 km due north of Bir Nakhlai and around 3 km northwest of Gebel Nabta (Nicoll 1998).

At the foot of one of the sandstone hills and the eastern end of the playa, is the base of a circular tumulus (Fig. 9.9) with the blown away superstructure located by the CPE in the 2000 field season (22º 36'05N; 30º 18'16E; 191m ASL). The structure was recorded in the 2003 season by Agnieszka Czekaj-Zastawny, Halina Królik, Marek Puszkarski, Romuald Schild, and HebatAllah A.A. Ibrahim. The tumulus is sited on the playa floor at the southern foot of the sandstone scarp. Its base seems to rest directly on an outcrop of the Qusseir Clastic Member shale forming a small ground rise. It has the form of a slightly irregular ring (Fig. 9.10, 9.11), measuring nearly 9 m in diameter and shaped by rather large sandstone plates tilting toward the centre and/or poised semi-vertically. The superstructure of the tumulus has been blown away, leaving a ring of plates that had served to reinforce the base of the tumulus and prevent it from subsiding.

Figure 9.9. Umm El Akhdar Playa, tumulus Umm El Akhdar. View from above. Looking south. Photo by R. Schild.

Figure 9.10. Umm El Akhdar Playa, tumulus Umm El Akhdar. Measuring the monument. Photo by M. Puszkarski.

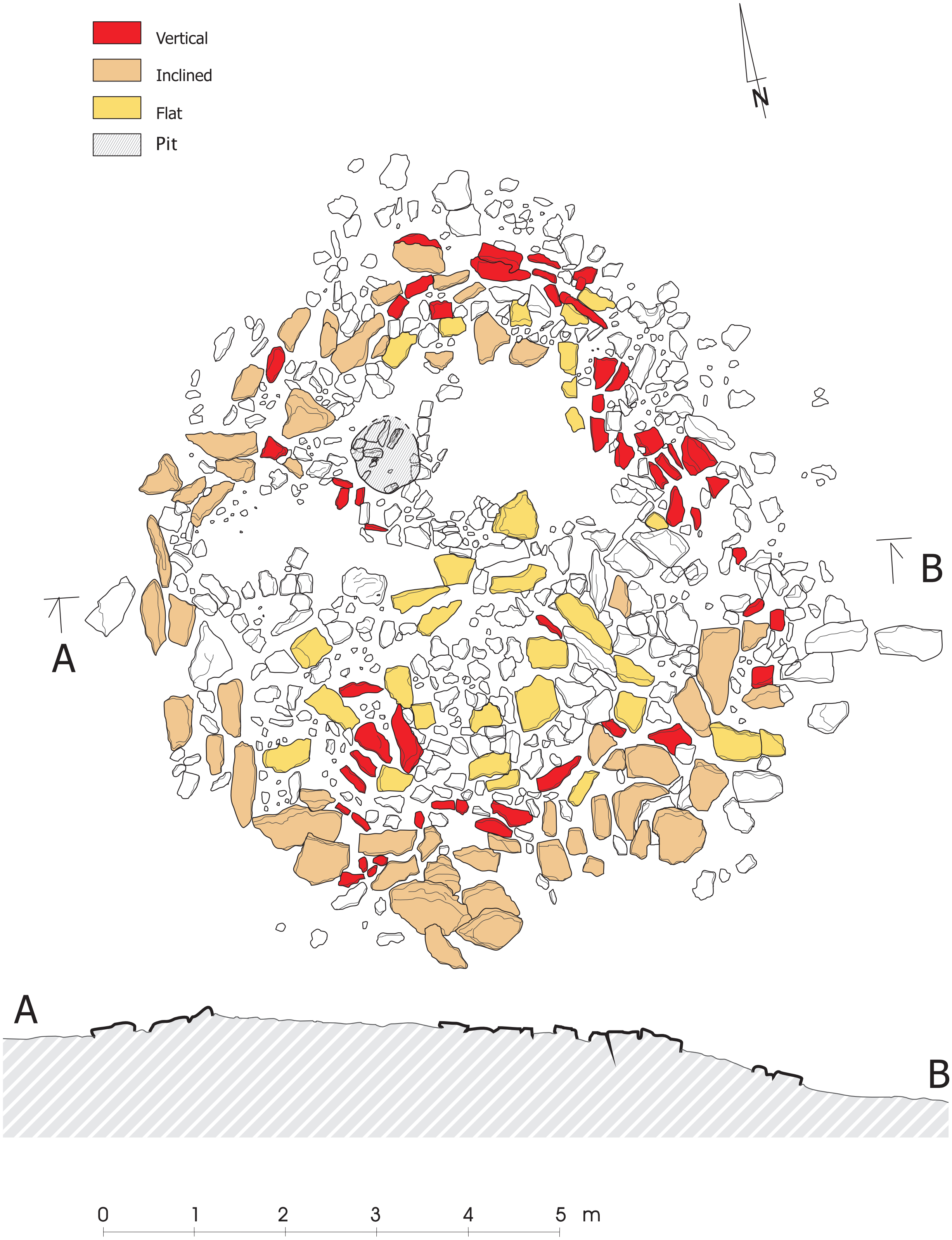


Figure 9.11. Umm El Akhdar Playa, tumulus Umm El Akhdar. Map by Agnieszka Czekaj-Zastawny, Halina Królik, Marek Puszkarski, and HebatAllah A.A. Ibrahim. Drawn by M. Puszkarski.

The floor of the structure seems to have been paved with larger plates and small fragments of plates with three unpaved semi-circular places in the northern section of the ring. Two of these measured about 2 m in diameter, and one, positioned between the two, turned out to be a circular pit measuring about 80 cm in diameter. No artefacts were found in the pit. However, two fragments of ripple ware pottery and a sherd of smoothed Qusseir clastic yellow ware (Fig. 9.12) were recovered from the surface inside the ring, and so was a denticulated flake. No excavations of the structure were attempted. The recovered sherds clearly suggest the Final Neolithic age of the structure (cf. Table 3.3).

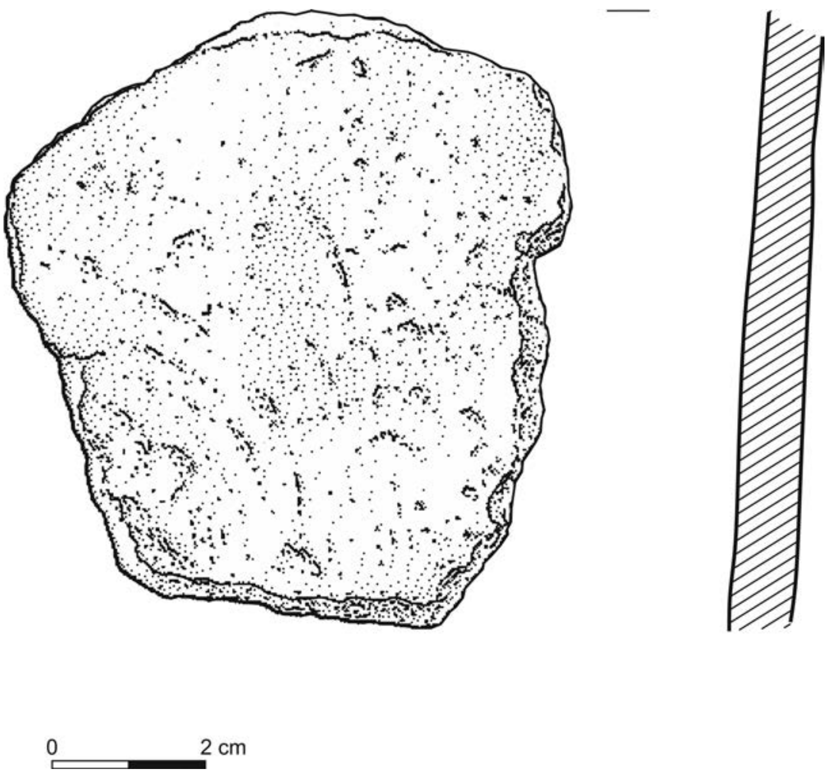


Figure 9.12. Umm El Akhdar Playa, tumulus Umm El Akhdar. A sherd of smoothed Qusseir clastic yellow ware. Drawn by M. Puszkarski.

The Shaab Negema Tumulus

Relatively recently, Maria Carmela Gatto (2006) reported the discovery of the remains of the base of a tumulus composed of two stone rings (Gatto 2006: 231) on the floor of Wadi Shaab Negema, a minor tributary of Wadi al Lawi, in turn a tributary of Wadi Kharit in the Eastern Desert, north of Aswan. The larger stone ring had a diameter of ca. 7.5 m. The superstructure, as in the case of the tumuli in Nabta Playa and Umm El Akhdar, had been removed by wind erosion.

Fifteen pottery sherds originating from three different pots have been collected from the surface. The fabric and forms of the pots suggested to Gatto that the tumulus could be dated to the late stage of the early A-Group, i.e., the mid-4th millennium BC (Gatto 2006: 232).

Chapter 10.

Craniodental Analyses of the Skeletal Remains from Site E-04-2

Joel D. Irish

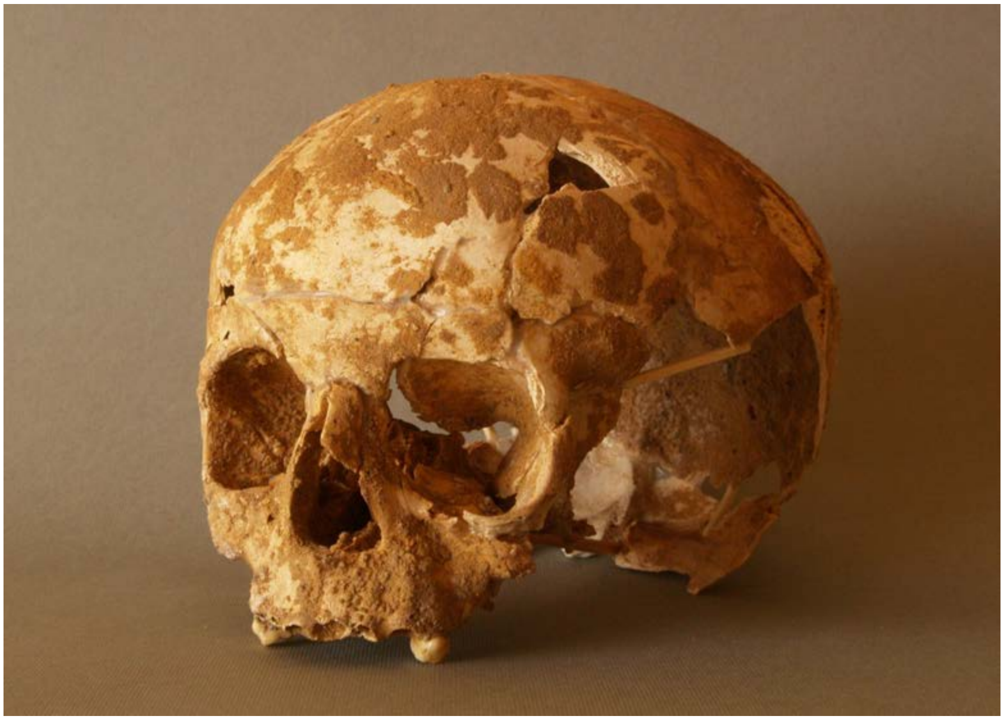
1. Background and Skeletal Inventory

As noted in Chapter 9, the human skeletal remains recovered from the tumulus at the Site E04-2 ("the Little Lord of Nabta Playa") in 2004 comprise a well-preserved, though fragmentary partial cranium. The surfaces of the undamaged cranial vault sections are similar in colour to most fractures, suggesting that breakage occurred in antiquity – which further supports the archaeological evidence of grave robbing. Based on their bleached appearance, two occipital fragments apparently lay on the surface for an extended period after the cranium was damaged. Despite their age, the fractures fit together cleanly to allow reconstruction. The result is a complete splanchnocranium (i.e., facial skeleton) with a majority of the calotte (skull vault; Fig. 10.1). The deciduous left dc, dm1, and dm2, and right dm1 and dm2 teeth were found *in situ* within the maxilla (Fig. 10.2). Also present are both unerupted M1s and, presumably, the partial crowns of the left and right permanent I1, I2, C, P1, and P2 teeth; in the latter cases, radiographic equipment was not available on site to verify their presence and state of development (Fig. 10.3). The temporal and entire base (i.e., basicranium) are missing. The mandible, remaining teeth, and all post-crania are similarly absent.

2. Aging

Various cranial features, including the: 1) overall small size and proportions, 2) frontal and parietal bossing, 3) thin vault bones, and 4) relatively long metopic suture remnant visible above nasion, indicate that the remains belonged to a child. Specifically, the sphenoid's foramen spinosum is completed, which indicates an age of at least two post-natal years. Though long, most of the metopic suture along the frontal squama is closed, which occurs between two to four years. The nasal spine, evident in Fig. 10.4, forms around the third year. The lacrimals, zygomatics, and palatine all emulate adult morphology; these developments occur in years two and three (Scheuer and Black 2004).

The most reliable way to age these remains is with the dentition. Based on the aforementioned eruption pattern, an age of 3 ± 1 to perhaps 4 ± 1 years is the most likely (Ubelaker 1989; Al Qahtani *et al.* 2010). The fully-erupted left deciduous canine, with slight attrition on the cusp tip, completed its root growth but retains an open apex. The left m2 exhibits very slight attrition on the mesial cusp tips; its roots are not formed to the same degree as the canine. According to Liversidge and Molleson's (2004) work, these teeth correspond to crown and root stages H1 and G which, in turn, suggest ages of 3.09 ± 0.25 and 3.05 ± 0.28 years, respectively. Comparable developmental ages were obtained using the methods of Gustafson and Koch (1974) and Moorrees *et al.* (1963).



▲ **Figure 10.1.** Nabta Playa, Site E-04-2. Three-quarter view of the child's cranium. Photo by J.D. Irish.

► **Figure 10.2.** Nabta Playa, Site E-04-2. View of the maxilla. Note unerupted permanent molars. Photo by J.D. Irish.

Figure 10.3. Nabta Playa, Site E-04-2. The cranial base. Photo by J.D. Irish.

In sum, the remains likely belonged to a child between two to four years of age at death, with a median age of three. The dental aging suggests three years as well. This estimate would vary a few months up or down depending on the individual's sex (below); females are generally more developmentally precocious than males (Liversidge and Molleson 2004). Of interest, given the elaborate entombment, seemingly befitting of an adult, the age at death corresponds with the estimated cut-off point for affording adult funerary rites at nearby Gebel Ramlah. Though dating ~1000 years earlier (ca. 4700-4300 BC – compare with dates in Chapter 9), it appears that three years marked the point at which deceased individuals were excluded from the newborn cemetery at Gebel Ramlah in favour of inclusion with adults (Czekaj-Zastawny, Goslar *et al.* 2018). Perhaps this signifies the attainment of 'personhood', the age at which children are "socialised into being 'people'" (Zakrzewski 2018: 2).

Figure 10.4. Nabta Playa, Site E-04-2. Side view of the cranium. Note the fully-formed nasal spine. Photo by J.D. Irish.

3. Sexing

Sex determination of sub-adult skeletons is difficult. It is particularly problematic in this case due to a lack of such diagnostic elements as the pelvis (Reynolds 1947; Fazekas and Kósa 1978; Mittler and Sheridan 1991; Schutkowski 1993), long bones (Gasser *et al.* 2000), and mandible (Schutkowski 1993; Loth and Henneberg 2001). Thus, it was decided to analyze remnant nuclear DNA (nDNA) from one of the teeth to attempt genetic sex determination.

The left dm2 was sent to the Paleo DNA Laboratory at Lakehead University, Thunder Bay, Ontario, Canada where it was prepared according to strict ancient DNA (aDNA) protocols. Testing by a second aDNA lab can provide confirmation, but the current findings, from a report by Dr. Carney Matheson (pers. comm. 2006), are paraphrased below.

The tooth surface was washed with bleach and ethanol, and UV irradiated with a thin film of water. The root was removed with a rotary sander and its interior used for extraction. Sample preparation was such that the reduction of contamination from unknown handlers is likely.

Next, a proteinase-K-with-phenol-chloroform extraction method was used. Once aDNA was extracted, its presence was determined by a detection PCR of mitochondrial DNA (mtDNA) from the control hypervariable region 1 (HVR1); this technique also was used to assess potential contamination by sequencing the amplicon, and comparing it to all known Egyptian sequences to ensure its population affinities. The identification process used many sex chromosome-specific targets, including gene regions and Alphoid repeats. Some amplified products were performed using gel electrophoresis and ethidium bromide staining; others were detected using fluorescent labeled primers and capillary electrophoresis.

Mitochondrial DNA detection PCR and sequencing revealed the presence of degraded DNA. Detection of nDNA is more difficult due to its low copy number relative to mtDNA (1000-fold). As such, a new analytical method was developed to enable detection of such low DNA quantities; a nested PCR procedure was used and compared to another method of Booster PCR; the results were consistent. Analysis involved two different extractions and more than eight independent amplifications. No contamination was found, but amplification was not detected on two attempts.

The results reveal that the sample is most consistent with having been recovered from a male. While contamination at the DNA lab can be ruled out, the confounding effects of prior handling cannot. Still, because all efforts were made to eliminate the problem, sex determination is felt to be credible.

4. Biological Affinity

Beyond the cranium's geographic provenience, a comparison of the amplicon to Egyptian sequences is consistent with a regional origin. Moreover, despite the child's youthfulness, non-metric dental traits (Turner *et al.* 1991; Scott and Turner 1997; Sciulli 1998; Scott and Irish 2017) appear compatible with those in Neolithic skeletons from Nabta Playa and nearby Gebel Ramlah (Irish 2001; 2005; 2006; Irish *et al.* 2002; Kobusiewicz *et al.* 2010). Specifically, the deciduous canine and molars appear morphologically simple (Sciulli 1998), i.e., mass-reduced, whereas the unerupted permanent molars exhibit traits, including a grade-3 Carabelli's cusp (Turner *et al.* 1991; Scott and Irish 2017; cf. Fig. 10.2), that fit within the range of variation recorded at these other locales. Cranial morphological and metric features (e.g., Berry and Berry 1967; 1972; Gill 1986; 1995; among others) can also help estimate affinity, but are of limited value in sub-adults. Nevertheless, to provide a more complete description of the cranium, 15 standard craniometric measurements (Martin and Saller 1959; Howells 1989; Froment 1992) are provided in Table 10.1.

5. Other Considerations

Various environmental and congenital factors can affect the skeleton, including trauma, infections, hemopoietic and metabolic disorders, tumors, and malformations, among others. For example, a skull may evidence porotic hyperostosis, while the dentition can exhibit caries and enamel hypoplasia (Steinbock 1976; Ortner and Putschar 1985; Isçan and Kennedy 1989; Aufderheide and Rodriquez-Martín 1998). Purposeful or unintentional cultural modification may also be evident; incisor ablation has been reported among Neolithic and earlier groups elsewhere in North Africa (Briggs 1955; Ferembach 1962; Camps 1974; Medig *et al.* 1996). In the present case, other than slight deciduous crown attrition (visible with a 10X lens), there is no evidence of disorder, disease, or modification.

Based on the evidence, the child appears to have been 'normal', cranially, prior to death. The dental health can even be characterized as excellent, much like that seen in the remains from Gebel Ramlah (Kobusiewicz *et al.* 2010). No other observations were, or could be performed on the remains which, at the behest of the Egyptian Supreme Council of Antiquities, were reburied on-site in 2008.

Table 10.1. Nabta Playa, Site E-04-2. Craniometric measurements* in cm of the cranium

Maximum length	17.3
Maximum breadth	14.1
Maximum height (Basion-Bregma)	9.8**
Basion-nasion length	7.3**
Basion-prosthion length	8.1**
Upper facial height	5.4
Nasal height	3.7
Nasal breadth	2.3
Bizygomatic breadth	10.2**
Minimum frontal breadth	8.9
Interorbital at dacryon	2.4
Orbital breadth	3.4
Orbital height	3
Palatal length	4.4
Palatal breadth	2.3

* From Martin and Saller (1959)

** Estimated dimensions

Chapter 11.

Stone installation in a circle from the Site E-92-9 – a possible "Solar Calendar"

Romuald Schild

1. Introduction

During the 1990 field season, the survey conducted on foot along the right bank of the "Wadi of the Sacrifices" revealed an exposed and partially buried feature made of elongated sandstone blocks and slabs and partially embedded in the fossil Older Dune. Nine of the elongated blocks remained upright, although some were tilted (Figs 11.1, 11.2). The structure, albeit severely damaged by desert creep, gave the impression of a roundish concentration of stones and was initially thought to have been the base of a recent tent and not worth further consideration. Nobody ever dreamed that this group of Nubian Sandstone slabs placed on the top of a low, small sand hillock in the mouth of the "Wadi of the Sacrifices" would arouse the interest of a large number of persons interested in archaeology (as well as those interested in alleged visits to Earth by extraterrestrial beings).

Later on, in 1992, during a more detailed survey and the subsequent extensive investigations along the western banks of the "Wadi of the Sacrifices", the small cluster of sandstone blocks and slabs began to be regarded as an unusual construction. This was because of its four pairs of still upright elongated sandstone blocks around an apparent circumference and several similar upright elongated sandstone blocks in the centre (Applegate and Zedeño 2001b: 463), forming something of the sort of gates or sights, a strange feature for a tent. Several other similar slabs had fallen. The concentration of a dozen or so sandstone slabs in the northwestern section of the feature suggested an outer ring, whose elements in the southeastern section seemed to have been much more dispersed down the slope by desert creep processes. During the fieldwork, Dr. Nieves Zedeño counted a total of about 55 elongated blocks of quartzitic sandstone comprising the feature. Several of them were worked, some of them were in pairs and upright, however often tilted and partially embedded. There were also sandstone plates frequently dispersed over the slope. All this together suggested a planned construction. A more detailed investigations of this mysterious installation seemed to be appropriate (Applegate and Zedeño 2001b: 463-467).

Figure 11.1. Dr. Nieves Zedeño at the possible "Solar Calendar" before excavation in 1992. Looking north, north-east. Photo by R. Schild.

Figure 11.2. "Solar Calendar" in 2005. Looking north, north-east. Photo by HebatAllah A.A. Ibrahim.

2. Stratigraphy

The area is massively deflated and eroded by the tributary wadi entering the basin from the north. The area is additionally characterized by a few recent, shallow wadi runnels often infilled with a recent sand sheet and/or wadi wash. The degraded relief includes, however, a linear sandy hillock in the south with a roundish, northern culmination, the location of the installation. The hillock is a remnant of a relatively thick Old Dune with a thin residue of the red 8.2 ka silt on its eastern face (Fig. 11.3). The surface of this raised area is covered by a scatter of artefacts and *in situ* burned stones of copious hearths.

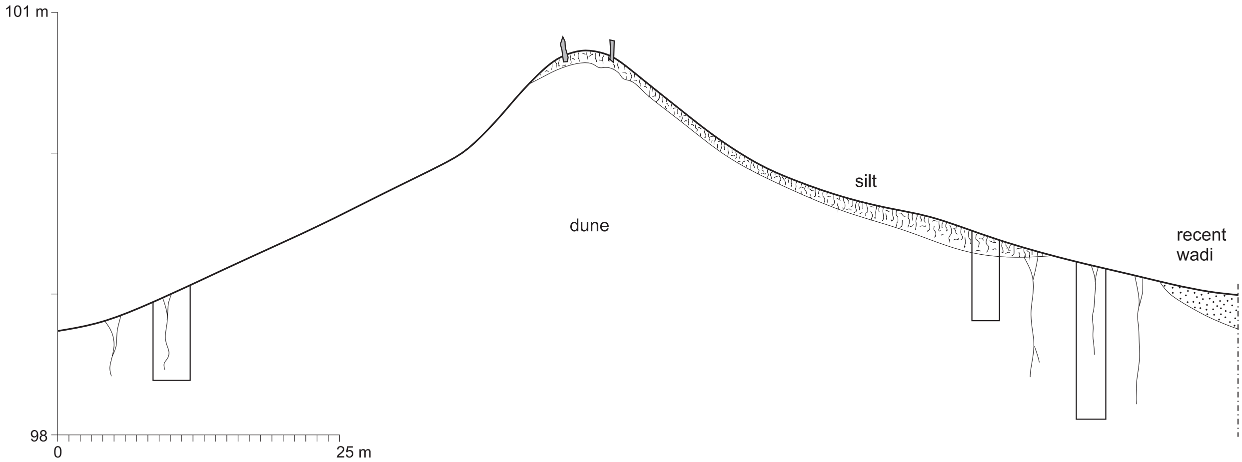


Figure 11.3. Nabta Playa, Site E-92-9. Cross-section of the Old Dune and the remains of the overlaying 8.2 ka silt. The "Solar calendar" on the top. Drawn by R. Schild.

Investigation showed that the main elements of the installation of stones discussed here were set into the consolidated and highly consolidated top sands of the dune that have a reddish hue due to the development of the subsoil of an aridisol in the sand. The setting of the remains clearly indicates that the installation, as well as the burned stones, pottery, and hearths on the surface and in the subsurface of the dune postdate the marker episode of deflation and the following massive red silt deposition coeval with the post-*Al Jerar* Arid Phase (cf. Table 3.3) firmly related to the 8.2 ka event.

A subsurface hearth located just 2 m to the north of the circle, which gave a radiocarbon date (Applegate and Zedeño 2001b: 464) of 6000±60 bp (CAMS-17287), confirms that the massive erosion happened before that date, or before the Late Neolithic). While indicating a time section within the Late Neolithic Humid Interphase (*Ru'at El Baqar*), the sample might not be precisely contemporary with the construction of the installation. On the other hand, the CAMS-17287 date suggests that the erosion of the hillock and the removal of most of the red silts continued after the Late Neolithic Humid Interphase.

3. Archaeological Context

The entire surface of the knoll was littered with a dense scatter of stone artefacts, burned stones and pottery, including six rims and 39 burnished red body sherds of Late Neolithic aspect (for Late Neolithic pottery characteristics compare Zedeño 2002: 53). The refitting of some of these showed they had come from a restricted bowl. A meagre lithic assemblage was also collected from the vicinity of the feature. It has yielded the fragment of a triangle made of agate and a small collection of debitage. The pattern of the spread of artefacts and manuports was plotted during the 1992 field season A few bone scraps and fragments of ostrich eggshell complete the picture (Applegate and Zedeño 2001b: 463-464), seemingly forming a perfect palimpsest of artefacts. The structure of quartzitic sandstone blocks and slabs dispersed over the slope was apparently the latest feature of the entire mix.

4. Taphonomy and Age

The installation was constructed after the deflation of the dune, and the overlaying red silt had settled. These phenomena are related to the post-*Al Jerar* Arid Phase and the 8.2 ka dry/cold event, which are an apparent *terminus post quem* for the construction of the feature. The Late Neolithic artefacts and hearths on the surface and subsurface demonstrate that the already deflated surface had been accessible for human use from the Late Neolithic until recent times. This is paralleled by the similar setting of a solitary, elongated, large, upright sandstone block on a low erosional rise of the terrain set into the sand in front of a cluster of the C-Group houses (Site E-92-8), probably a waymark stone leading to the settlement (Schild and Wendorf 2012). The houses have been radiocarbon dated, on charcoal, to 3860 ± 40 (DRI-3357) uncal BP and 3130 ± 110 (Gd-6746) uncal BP, (Applegate and Zedeño 2001a: 533; Schild and Wendorf 2001b: 54).

The construction of the "Calendar Circle" installation is very simple and seems to have been intended to be only temporary, when we take into account the very shallow embedding of the sights into the sand. The notion that only the surface artefacts and burned stones covering the surface have stopped the further deflation of the sandy hillock might explain why many of the installation's elements have remained upright.

The circumstance that the selected sandstone blocks had been worked by knapping indicates that the builders of the device had commonly used this method of shaping stone objects. This does not exclude travellers of the Egyptian Old Kingdom and/or the C-Group occupants of the area. The worked stone elements of the sights were of course the essential components of the "calendar" and might have been portable and could have been used at any new site.

5. Non-Archaeological Interest in Nabta Playa Monuments

The site became quite well-known through publications. There was a *Nature* article by McKim Malville et alii (1998), and the first volume of the publication series *Prehistory of Nabta Playa*, included a description of this site (Wendorf *et al.* 2001). In 2002, the physicist Dr. Thomas G. Brophy began investigations of the Nabta Playa monuments.

Shortly afterward, he was followed by Mr. Robert Bauval, the author of several popularly-read books on ancient Egypt and the creator of several websites. In these materials he has advocated the interaction of Pharaonic Egypt with extraterrestrial creatures.

In 2002, Dr. Brophy published a book on some Nabta Playa megalithic monuments, linking them with certain features of the Giza pyramid complex entitled: *The Origin Map. Discovery of a Prehistoric Megalithic Astrophysical Map and Sculpture of the Universe*. In it he discusses the possible "Calendar Circle", and the slightly shaped Nubia Sandstone erosional table rock (Site E-96-1), a part of the sandstone bedrock, underneath the cluster of fallen stelae termed 'Complex Structure A' by Wendorf and Królik (2001: 505). He argued that the "Calendar Circle" structure had been a star viewing diagram constructed about 16 500 years ago that represented a map of the stars of the Orion constellation. He saw the erosional mushroom-like sandstone rock underneath 'Complex Structure A' as the depiction of a detailed map of our galaxy seen from its northern pole and carved around 17 500 BC.

The book triggered considerable interest in the remote desert area of Nabta Playa among adherents of *New Age* religion as well as those interested in extraterrestrial phenomena. Soon, numerous illegal "tourists" began visiting the Nabta Playa megaliths in the archaeological off-seasons. In the years 2004-2007, such "tourists" started to build new megaliths and reconstruct the old ones, particularly the hypothetical calendar, first using the original stones and later by bringing them from the neighbouring prehistoric installations or haphazardly picked up in the area. One of the "fully reconstructed monuments" was the "Solar Calendar", which was substantially remodelled in 2007 by including many elements brought from the outside areas (Fig. 11.4). The Supreme Council of Antiquities of Egypt could not provide constant surveillance and protection of the remote Nabta Playa Basin Area (Schild and Wendorf 2012). By 2006, it had become clear that the most endangered elements of the Nabta Playa monuments, particularly the almost ruined "Calendar Circle", had to be moved to locations where they could be viewed and protected from interference. The best of these seemed to be the Nubia Museum gardens in Aswan.

Figure 11.4. Nabta Playa, Elizabeth M. Alexander recording in 2008 the reconstructed "Solar Calendar" by illegal tourists. Photo by R. Schild.

6. Elements of the Installation

A detailed recording of the elements of the installation took place in February 2008 after a special permit to remove the monument from its site and deposit it in the Nubia Museum in Aswan had been obtained from Dr. Zahi Hawas, then the director of The Supreme Council of Antiquities of Egypt. The Combined Prehistoric Expedition Foundation of Washington DC and the Institute of Archaeology and Ethnology, Polish Academy of Sciences agreed to finance the project. First of all, because of later additions to the site, it was necessary to decide which of the objects forming the "Calendar Circle" by 2008 were genuine. Field records made in 1992 and the subsequent publication (Applegate and Zedeño 2001b), although not very precise, helped in this chore as well as several photographs taken between 2004 and 2008.

In 2008, a new map of the structure at a scale of 1:20 was made with the help of a Total Station. The new map included only the pieces that seemed to be the original elements of the structure. It was found that most of the individual original stones had been disturbed and replaced following the structures' first discovery and mapping. Several had been moved, set up, and/or added to the structure by tourists visiting the site at least from 2004. Additional help in determining the authenticity of the elements comprising the "Calendar Circle" was the assessment of their prehistoric alteration. It was decided that the slabs that showed traces of shaping by knapping had been the original elements of the device and perhaps those which could be identified in the recording done in 1992.

As a result of this study and precise mapping (Fig. 11.5), nearly 40 items were selected for removal. The following description records the actual position of the stones directly before their removal from the site and includes all the deviations caused during interference with the structure by tourists. All the stones were photographed, described, and registered before being packed up and transported to the Museum. The removed pieces were replaced on the original site by similar slabs collected at modern sandstone outcrops in the vicinity of Nabta Playa.

Figure 11.5. Nabta Playa, Site E-92-9. Map of selected stones classified as originally belonging to the installation. Drawn by M. Puszkarski.

7. The Removed Stones

All of the removed elements are of quartzitic Nubian Sandstone:

1. Upright in 2008, collapsed in the 2002 and 2004 photos; probably western stone of the N-S sight ('gate'). Elongated, oval in cross-section, a light coloured quartzitic sandstone, cylindrical biofact with a porous surface structure, not worked, wind-eroded.

2. Upright in 2008, original position, the eastern stone of the N-S sight. Elongated, brown coloured, ferruginous quartzite sandstone chunk, chipped along the right upper, long edge.

3. Horizontal in 2008, original position in the 1992 map, a flat slab, brown in colour, not worked (?).

4. Upright in 2008, collapsed in the 2004 photo, the northern stone of the SW-NE sight. An elongated, light brown coloured block, square in cross-section, thinned along one of the long edges (Fig. 11.6).

Figure 11.6. Nabta Playa, elongated, retouched sandstone element of a "gate". Photo by R. Schild.

5. Upright in 2008 collapsed in the 2004 photo; the southern stone of the SW-NE sight. An elongated, block, rectangular in cross-section, brown in colour, partially flaked along two long edges, wind-eroded.

6. Upright in 2008, collapsed in the 2004 photo; the western stone of the N-S sight. An elongated block, brown in colour, wind-eroded, probably not worked.

7. Collapsed in 2008, also collapsed in the 2004 photo, perhaps the eastern stone of the N-S sight (?). A triangular block, brown in colour, not worked.

8. A horizontal part of the stone circle (?), A dark brown blocky slab, slightly flattened with two flake removals, highly wind-eroded.
9. Horizontal in 2008. A large, roundish block, dark brown in colour, worked along one edge.
10. Upright in 2008, also upright in the 2004 photo; deeply embedded, original position; northern stone (?) of the SW-NE sight. An elongated block, rectangular to square in cross-section, light brown, not worked, evident traces of embedding at the base.
11. Collapsed in 2008, perhaps also in the 2004 photo; probably northern stone of the SW-NE sight. An elongated, broken slab, rectangular in cross-section, dark brown, wind-eroded, not worked.
12. Upright in 2008, deeply embedded (light colouring in the photograph), original position in the 1992 plan and photo, the southern stone of the SW-NE sight. It is a flattish, elongated, unworked, dark brown block.
13. Collapsed in 2008, also collapsed in the 2004 photo, perhaps the southern stone of the SW-NE sight and the eastern stone of the N-S sight. A fragment of colossal flake, elongated, semi-rectangular in cross-section, not worked, dark brown.
14. Upright in 2008, this stone was not recognized in any photographs. It is an elongated, broken, dark brown block; stylistically fits the elongated specimens in the group.
15. Upright in 2008, also upright in the 2004 photo, the western stone of the N-S sight. An elongated block, rectangular in cross-section, base embedded, light brown in colour.
16. Horizontal in 2008, also horizontal in the 2004 photo and 1992 plan. Perhaps a part of the stone circle. A horseshoe-shaped, flat, thick, dark brown, thick slab, bifacially worked at the base.
17. Horizontal in 2008, also horizontal in the 2004 photo. It is an element of the circle. A triangular, thick slab showing a large flake removal scar at the base, dark brown.
18. Horizontal in 2008, also horizontal in the 1992 plan and the 2004 photo. Rhomboidal in shape slab, elongated, rectangular in cross-section, dark brown, not worked, a part of the circle.
19. Horizontal in 2008, also horizontal in the 1992 plan, A slightly elongated slab, rectangular in cross-section, wind-eroded, perhaps a large flake removed at the base, dark brown, a part of the circle.
20. Horizontal in 2008, also horizontal in the 1992 plan, a part of the circle. A small, thin slab, broken at the base, triangular in shape, dark brown, partially worked along the right edge, a part of the circle.
21. Horizontal in 2008, also horizontal in the 1992 plan, a part of the circle. Large slab, triangular in shape, perhaps a very large flake removed along the right edge of the piece, wind-eroded, dark brown.
22. Horizontal in 2008, also horizontal in the 1992 plan, a part of the circle (?) A thin slab, triangular in shape, dark brown.
23. Horizontal in 2008, also horizontal in the 1992 plan, a part of the circle. Probably a large flake, rectangular, dark brown, worked at the base and along the right edge.
24. Horizontal in 2008, also horizontal in the 1992 plan. A horseshoe-shaped slab, large, dark brown. A part of the circle.
25. Upright in 2008, also upright in the 2004 photo; embedded northern stone of the SW-NE sight. An elongated small block, tip slightly pointed, rectangular in cross-section. Note shallow traces of burying in the sand (Fig. 11.7, left).

26. Upright in 2008, also upright in the 2004 photo, the southern stone of the SW-NE sight. A large, elongated slab, rectangular in cross-section, pointed. Note shallow traces of burying in the sand (Fig. 11.7, right).

Figure 11.7. Nabta Playa, upright slabs 25 and 26 showing traces of shallow burying in the sediment. Photo by R. Schild.

27. Collapsed in 2008, also collapsed in the 2004 photo; the western stone of the N-S sight (?) Elongated, long block, rectangular in cross-section, dark brown, no traces of chipping.

28. Horizontal in 2008, also horizontal in the1992 plan; a part of the circle (?) a small triangular pointed chunk, a flake removed at the right side of the base, brown.

29. Horizontal in 2008, also horizontal in the 2004 photo. A part of the circle. A horseshoe-shaped slab worked at the tip (flaked) and base, dark brown.

30. Horizontal in 2008, also horizontal in the 1992 plan; northern stone of the SW-NE sight (?). Slightly elongated, pointed, oval slab with a flaked, rounded base, and a chipped right edge, natural pointed tip. Perhaps a part of the SW-NE sight (Fig. 11.8).

31. The piece, present in 2008, was not found in the 2004 and 2005 photos. Not removed from the site.

32. Collapsed in 2008, also collapsed in the 2004 photo, eastern stone of the N-S sight. Elongated, triangular in shape slab, rectangular in cross-section, base probably worked (flaked), wind-eroded and very dark brown.

33. Upright in 2008, embedded and truncated by aeolian erosion, the western stone of the N-S sight. A short basal part of an originally elongated slab, trapezoidal in outline, oval in cross-section, dark brown.

Figure 11.8. Nabta Playa, oval, aeolized slab of ferrougineous sandstone with flaked base. Photo by R. Schild.

34. Horizontal in 2008, also horizontal in the 2004 photo. It is a part of the circle (?). A small elongated slab, flattish, rectangular in cross-section, very dark brown, working not evident.
35. Horizontal in 2008, also horizontal in the 1992 plan. It is a part of the circle. A trapezoidal, slab, light brown (embedded part), otherwise dark brown, working not evident. The placement is very uncertain.
36. Horizontal in 2008, also horizontal in the 1992 plan, original position; a part of the circle (?), position unknown. A flat, thin slab, not worked, horseshoe-shaped, dark brown on the outside.
37. Horizontal in 2008. It is a flat, rectangular, thin, wind-eroded slab, unworked, light brown. Perhaps a part of the circle (?), original placement unknown.
38. Horizontal in 2008. A sub-triangular Nubian sandstone flake, dark brown; perhaps a part of the circle (?).
39. Horizontal in 2008, a subtriangular sandstone chunk; a part of the circle (?).

8. Astronomical Aging of the Installation

The four external pairs of elongated sandstone blocks together with the blocks in the central part of the device appear to be forming two lines of sights: the first defining a generally North-South axis and the second at about 65° – 70° and 245° – 250°. It has been hypothesized that the north line of sights indeed point to the approximate northernmost position of the rising sun at the time of summer solstice around 6000 years ago and indicates an approximate time of the beginning of the summer rainfall in the South-Western Desert (Mc Kim Malville *et al.* 1998; Applegate and Zedeño 2001b: 466).

As noted above, according to Brophy (2002), on the other hand, the device represents a star-viewing installation and a map of the stars of Orion and dates to about 16 500 BC. This interpretation, however, is at variance with the stratigraphic context of the monument itself as evidently later than the reddish 8.2 ka silt of post-*Al Jerar* Humid Interphase.

The major problem though is the linkage of the summer solstice with the summer rains. Recent palaeoclimatic research may indicate the importance of Atlantic circulation and the winter rains around 4000 BC (Linstädter and Kröpelin 2004; Railsback *et al.* 2018; Welc 2016: 283).

Later palaeoastronomic publications do not mention the linkage of the installation with the summer solstice, and even suggest a very recent age of the installation (e.g., McKim Malville *et al.* 2007: 21). Correspondingly, a relationship with the nearby C-Group houses cannot be unreservedly excluded.

9. The setting of the probable "Solar Calendar" in the Nubian Museum

The setting of the installations in the winter of 2009 began with the "Solar Calendar" (Schild and Wendorf 2015). The direction of the installation sights was copied from that recorded in the field where the first reconstruction of the device had been based (Applegate and Zedeño 2001b: fig. 14.3). The new analysis of the original field records and the mapping and inventory of stones taken in early February of 2008 suggested that the number of observation sights might have been slightly different from that proposed in the reconstructions made in 1992 and 1997, published in 1998 (McKim Malville *et al.* 1998: fig. 3b) and 2001 (Applegate and Zedeño 2001b: fig. 14.3; McKim Malville *et al.* 2007; 2008). Judging from the number of the elongated sandstone blocks present at the site before it had been vandalized, one may assume that the sights had initially been more numerous than those suggested in the 1992 reconstruction. The number of elongated sandstone blocks, on the other hand, has implied the presence of at least four pairs of gates (sights) in the centre of the device instead of two gates postulated in the first reconstruction published by Applegate and Zedeño (2001b: fig. 14.3). Therefore, a new reconstruction of the monument was recommended in 2009. In any case, the two elements of the reconstruction are of the most essential in this story: the physical presence of the sights and their direction.

Another element of the installation, although not as crucial as the sights, is the proposed ring enclosing them. Its presence has been postulated on the basis of the pattern of displaced slabs in the areas outside the sights (Applegate and Zedeño 2001b: fig. 14.3), but no clear-cut outlines of a ring have been preserved in the archaeological record. Many of the slabs were concentrated in the northwestern, highest section of the hillock, outside the sights (gates) – while several dispersed sandstone plates/slabs rested on the lower parts of the northeastern and eastern slopes of the hillock, suggesting that they had moved downslope.

A relatively large number of flat sandstone slabs around the device, in its immediate neighbourhood and at the foot of the hillock, upon which the "calendar" was placed, makes the hypothesis of a ring plausible, but not incontestable (Fig. 11.9). Therefore, the installation assembled in the Museum Gardens is a hypothetical proposal, perhaps the most likely under the circumstances. The most reliable parts of the reconstruction are the bearings of the sights. Details concerning the number of the sights and the existence of the external ring are the weakest parts of the hypothetical reconstruction.

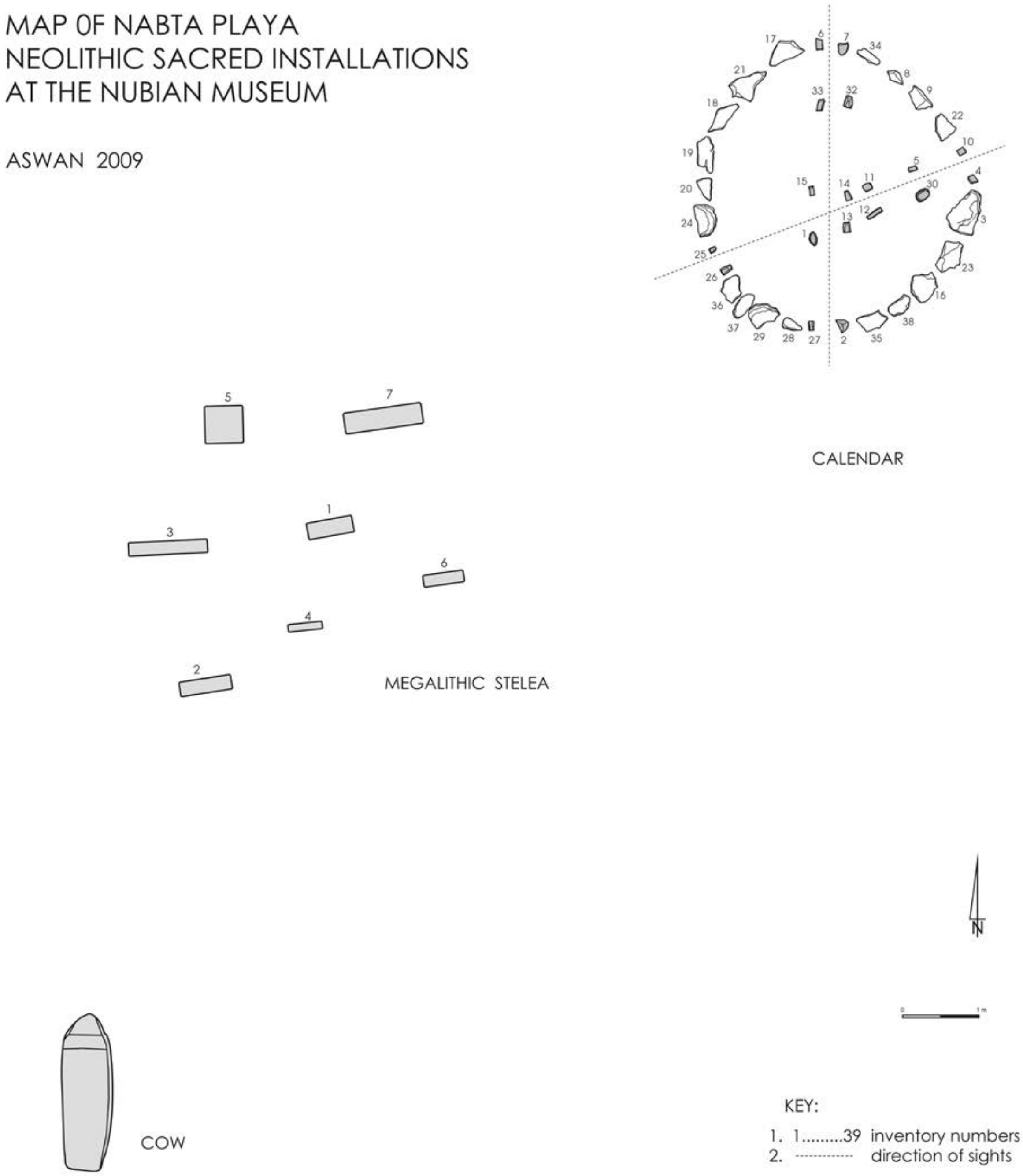


Figure 11.9. Map of Megalithic installations transferred to the gardens of the Nubia Museum in Aswan. Drawn by M. Puszkarski.

Part V. Synthesis

Chapter 12.

Settlement of the South-Western Desert of Egypt in the Holocene. An overview

Romuald Schild and Halina Królik

1. Introduction

The area covered in this essay is roughly equivalent to the Nubia Shab Pediplain (Issawi *et al.* 2009), which includes a significant portion of the Darb El Arbain Desert (Haynes 1982) and Amur El Kibeish Peneplain (Issawi 1981; Issawi and Hinnawi 1984; Issawi *et al.* 2009) in the west, where it reaches the maximal width. Up north, it extends to the Sin El Kaddab scarp of the Western Desert Plateau's southern tip and the Kiseiba escarpment in the north. In the south, it spreads into northern Sudan, and on the East, the pediplain is bordered by the Nile Valley.

Sandstones of Paleozoic and Mesozoic age cover the pediplain, with rare patches of volcanic and igneous rocks. The Quaternary, poorly represented, is mostly reduced to playa deposits. Of importance are deflational basins, often filled with playa deposits, carved at the feet of the escarpments, and remnant gebels. Wadis are shallow, while alluvial surface washes are somewhat frequent, particularly in the low areas surrounding internally drained basins. Recent dunes and extensive sand sheets are imminent.

Prominent mountains, such as Gebel El Fantas and Gebel Hamada, are seen in the southern, near-border section of the desert. Near Tushka, a depression below 180 m a.s.l. extends between the Korosko Upland and the Sin El Kaddab scarp.

To the northwest of the Nile, the pediplain is narrow and rolling, measuring from 30 to 50 km in width, and waning until the Eocene scarp touches the Nile Valley at Luxor. Farther south, past the cliffs of the Eocene scarps, the pediplain spreads to the west, merging into the Atmur El Kibeish Peneplain and becoming lower, with the elevations fluctuating from 285 m a.s.l. to 144 m a.s.l.

Nearly half a dozen uninhabited desert wells occur in the central western part of the pediplain with Bir Nakhlai, Bir Takhlis, Bir Dibis, Bir El Shab, Bir Kurayim, and Bir Kiseiba among the most important. Plant communities around the birs are similar and degraded (El Hadidi 1980). A few palms may appear in some of the oases, as well as tamarisks and acacias, usually associated with phytogenic dunes. Some of these small oases support limited grass communities, generally clustered near the closest source of water.

A scarcity of fauna parallels the impoverished vegetation of small oases. However, the quiet observer shall soon notice jumping kangaroo mice represented by four species. Occasional Dorcas gazelle will appear near the herbs that grow, as will the rare fox. Lizards, geckos, snakes are rarely seen, but are present near water spots. Small birds may be quite busy in the bushes and tamarisk stands, as may various beetles and occasional scorpions, too.

2. Socioeconomic development of the new settlers, the question of cattle domestication

The primary question haunting the interpretation of the palaeoeconomic status of the earliest settlers of the Eastern Sahara is the problem of domesticated cattle. An animated discussion on the domestication of *Bos primigenius* in North-Eastern Africa has been caused by the presence of the bones of large bovids in the oldest Holocene camp remains, particularly at Site E-79-8 (Gautier 1984; Connor 1984a) in El Adam Playa (e.g., Gautier 1984; 1987; 2001; 2007; Smith 1984; 1986; 1992; 2005; Close 1996; Clutton-Brock 1993; Marshall and Hildebrand 2002; Muzzolini 1993; Schild and Wendorf 2001a; 2010a; Wendorf *et al.*1987a; Wendorf and Schild 2004; 1994; 2003; Wengrow 2003; Gifford-Gonzales and Hanotte 2011; Gifford-Gonzales 2013; Stock and Gifford-Gonzales 2013). Notwithstanding an early support of the Northeast African origin hypothesis from the early mtDNA research (Bradley *et al.* 1996; Hanotte *et al.* 2002: 338; Edwards *et al.* 2004), it appears that the Levantine-derived haplogroups are present in African cattle today (Achilli *et al.* 2008), which presumably arrived in North-Eastern Africa via the Near East.

Current studies, which use the complete mtDNA sequence, suggest that the maternal antecedent of African cattle might have originated from the same area of domestication in the Near East as the European taurine population (Bonfiglio *et al*. 2012). On the other hand, there is also a strong indication on the side of Y-chromosomal DNA that the presence of the unique genetic background in African cattle might have derived from the local African wild male introgression (Pérez-Pardal *et al.* 2010; Decker *et al.* 2014; Smith 2013: 140).

In the first two decades of the 21st century, the view that the African taurine cattle had been domesticated in the Near East, even though showing often multiple paternal origins (ingressions), has grown in prevalence (e.g., Dadi *et al*. 2007; Achilli *et al*. 2008; Pérez-Pardal *et al*. 2010; Pitt *et al*. 2019). Correspondingly, multiple autonomous domestications are not considered to be out of the issue (Pérez-Pardal *et al*. 2010: 518).

Countless arguments for and against cattle domestication in Africa have been raised. Lately, those against Africa appear to be prevailing, although, despite extensive genetic research, it is still "unclear whether or not African cattle were domesticated on the African continent" (Mwai *et al.* 2015; Gifford-Gonzales 2011: 6). As Larson and Burger (2013: 202) recently stated: "there is not yet sufficient evidence to reject the null hypothesis of single domestication in the Near East". Furthermore, the same researchers have proposed that the domestication took place just once in each species, despite various cultural processes in different areas that influenced genomic structures of the species after the initial incident of domestication.

Looking at the problem from the North-East African perspective is to know when and where managed, and later, entirely controlled cattle occurred for the first time. Current archaeological data suggest that the auroch with a company of hartebeest occurs in the Nile Valley throughout the Late Pleistocene and, perhaps, at least the early Holocene. It is of importance to recall, at this juncture, that the Pleistocene and Early Holocene *Bos* in the Nile Valley always appear in association with the hartebeest. It is a duo which has never been reported from the Western Desert.

The pair was still hunted on the shores of Lake Qarun during the Qarunian (Gautier 1976: 379) at Site E-29-H1, Area B, dated at about 8550-8048 calBP (Wendorf and Schild 1976: 204). The pair is also seen in Upper Nubia, where, including Site Dibeira West 1, it is present at an *El Adam* Humid Interphase (cf. Table 3.3 in Chapter 3, this volume), formerly Shamarkian, at Site of Dibeira West 51, aged at about 10250-9600 calBP, at 2 σ (Schild *et al.* 1968; Wendorf *et al.* 1979) – and at Site El Kab II, near Edfu, also containing auroch and hartebeest remains (Gautier 1978). A series of radiocarbon estimates, on charcoal, from the Elkabian settlement, a stylistic cousin of the *El Ghorab* unit from the Western Desert (cf. Table 3.3 in Chapter 3, this volume), clusters around about 9300 to 8600 calBP (Vermeersch 1978). For the first time, the North-East African hypothesis had been signaled in 1976 (Wendorf and Schild 1976). In 1980 it was presented at the 1st Dymaczewo Symposium by Achilles Gautier and published in 1984. The hypothesis was based on two principal arguments. The first was ecological: that the environment in the Eastern Sahara during the Early Holocene was so dry that it could not sustain wild cattle, which needed considerable amounts of daily water and fodder and, therefore, had to be helped by men. The second, osteometric argument, centred on the size decrease resulting from the breeding of the population in isolation from the natural one (Wendorf and Schild 1984b; 1994). In short, the problem might have been solved by falsifying at least one of the two arguments: proving that the bones were misidentified and did not belong to cattle, whether wild or domesticated, or by the rejuvenating age of bovine bones found in the Early Holocene sites. Consequently, the current palaeoecological evaluation of the climates of South-Western Desert in the Early Holocene would have to be controverted.

Perhaps this is the appropriate place to recall the beginning of the introduction of cattle to the waterless Kalahari Dese by Basarwa Bushmen reported by Hitchcock and Ebert (1984: 330). In the beginning, the cattle had been driven for a short period to the water pans available only during the rainy season. This procedure ceased in the 1930s and 1940s when drilled wells become common.

It has been assumed that the first efforts at controlling auroch must have occured in its natural habitat, i.e., the Nile Valley, long before the Western Desert opened to human settlement (Gautier 2007: 82). If this was so, the first attempts might have taken place as early as the Arkinian cultural variant (Wendorf and Schild 2003: 149) in the First Greenland Stadial (GS 1a) time. One, therefore, might have presumed that the cattle enabled the *El Adam* people to enter the Western Desert (Close 1990; Schild and Wendorf 2010a: 120) by providing a stable source of protein, a walking larder. Very recently Michael Brass (2017) dedicated a long, well-researched essay to the problem. Two fundamental questions in this discussion are challenged by Brass: had the environmental conditions been preventing *Bos primigenius* from entering the Western Desert without human help? Had Achilles Gautier adequately shown that the physical (size) change recorded in the Western Desert *Bos* population indicates human manipulation? The answers to these questions were both negative.

The identifiable remains of the putative Early Neolithic *El Adam* cattle (large bovid) were found in a relatively large number in the Kiseiba Area in El Adam Playa at Sites E-79-8, and E-80-4. At Site E-79-8 all the finds were collected from the surface and subsurface in the field seasons of 1979 and 1990. In total, ten identified bones have been recovered. A minimal excavation at the site has not yielded any bovid bones. On the other hand, at the neighboring *El Adam* unit Site E-80-4, six identifiable bovid bones were excavated and collected from the surface (Close 1984a: 347; Gautier 2001: 611). The cultural layer at the site (Close 1984a: 347) yielded a single radiocarbon age of 9220 ± 120 BP (SMU-925), an age well embedded within the *El Adam* unit period. Later visits to Site E-79-8 in 2002 and 2003 generated a proximal metatarsus with co-articulating navicocuboid, a maxilla fragment with milk molars dP3 and dP4 as well as a fragment of the second phalanx of a large bovid (Gautier 2007: 78). At Site E-77-7, the subsurface and surface yielded two identifiable bones. A mixed *El Adam* and *El Ghorab* Site E-77-4 at El Kortain Playa produced one surface piece. Site E-75-9 at Nabta Playa showed two pieces in the sub-surface cultural horizon (Gautier, 2001: 611), and the most recently excavated, Site E-06-1 at Nabta Playa, gave 29 *Bos* fragments, mostly from the surface – however, four pieces were found in the infilling of Hut 4 (Jórdeczka *et al.* 2013: 278).

Large bovid remains associated with *El Ghorab* unit camps are extremely rare. There are only two sites which provided singularly identifiable bones: Lower Level at E-79-4 in El Ghorab Playa, Kiseiba Area, and Lower Level (*Hut*) at E-75-6 in Nabta Playa (Gautier 2001: 613).

Crucial in this discussion are the environmental conditions during the Early Holocene in the South-Western Desert between about 11.4 ka event, tentatively correlated with Preboreal Oscillation, and the 8.2 cold and dry event. This is the early phase of the appearance in the Western Desert of large bovids. Geomorphological studies, botanical materials, and radiocarbon dating results gathered by the members of the Combined Prehistoric Expedition (Barakat 2001: 592-600; Boulos *et al.* 2001: 582-587; Butler 2001: 601-602), as well as the multifaceted, in-depth studies of Selima Oasis, located some 200 km south of Nabta Playa and Kiseiba Area (Haynes *et al.* 1989), provide some information pertaining to the ecological conditions of Early Holocene colonization of the Nubia Shab Pediplain.

The environment of the Nabta/Kiseiba Areas and the Selima Oasis during the Early Holocene, Local Holocene Maximum, and Late Holocene are quite similar (Barakat 2001; Wasylikowa *et al.* 2001c). An exact chronological fitting of the climatic phases at both zones is challenging, an outcome of substantial standard deviations of the calibrated ages at climatic/ecological thresholds of the Selima core (e.g., Haynes *et al.* 1989: table 3). Nevertheless, the lower part of the sequence at Selima is coeval essentially with the lower Early Neolithic of Nabta/Kiseiba and the middle section of the sequence appears to be contemporaneous with the *El Nabta/Al Jerar* Holocene Maximum (cf. Table 3.3 in Chapter 3, this volume). The lower phase suggests a "semi-desert grassland-shrubland" (Haynes *et al.* 1989: 132).

On the other hand, Ramlah summary of the interpretation of palaeoecological data from Selima indicates an open scrub savanna characterized by thin open woodland and scrub interspaced with grasslands and sand sheets as the landscape present during the Holocene maximum. During the Holocene Maximum, the presence of more diversified arboreal flora is indicated in the Nabta Area as well as confined "oasis type vegetation with Sahelian elements" (Boulos *et al.* 2001). This northward displacement of the Sahelian belt is thought to reach 23° in eastern Africa, instigating biodiversity and introducing new species adapted to more humid ecosystems characterizing tropical and wooded grassland and producing phytocoenoses unparalleled today (Wotrin *et al.* 2009).

Current climatic evaluation of the biological data for the Early Holocene *El Adam* Humid Interphase for the period of about 10,500 ka to 9500 ka at Nabta/Bir Kiseiba zone implies a rather thin plant cover around the playa lakes and in the drainage areas. It is "characterized by localized desert vegetation in catchment areas" (Boulos *et al.* 2001) often compared to the contracted desert environment similar to that found around the small uninhabited oases in the Nabta Shab Pediplain (Barakat 2001; Boulos *et al.* 2001; Wasylikowa *et al*. 2001c).

Geomorphological data, on the other hand, suggest the presence of considerable sand sheets around the seasonal lakes often if not always drying up in the dry seasons. Contrary to the opinion of Michael Brass (2017) based on publications by Haynes (1980) and Issawi and Hinnawi (1984), there are no traces of permanent Holocene lakes at the locations of natural wells at the foot of Kiseiba scarp. Instead, except for Holocene playas, the area shows traces of considerable alluvial activity during the Middle Paleolithic (Schild and Wendorf 1984: 12), as well as lacustrine deposits of lower Late Pleistocene age at the foot of the Eocene scarp (Issawi *et al*. 2009: 467), which suggests that the depressions at the foot of the Sin El Kaddab Scarp had initially formed a channel of the Qena River, a part of the Radar River system, that later evolved into lakes and finally dissected into playas.

There are minimal indications as to the presence of permanent water bodies in the Early Holocene playas in the South-Western Desert. The small playas like El Adam and El Kortein show rich traces of occupation in their centres, suggesting lack of surface water in the dry seasons. However, the Lower Cultural Layer of *El Ghorab* unit attribution at Site E-79-4 yielded a single bone identified as helmeted guinea-fowl by Mrs. Matthiesen (Gautier 2001: 626). This was a resident bird dependent on drinking water (Bocheński and Tomek 2001: 647). Biological data relating to the Holocene Maximum may better indicate the presence of permanent surface water during the Holocene maximum (Bocheński and Tomek 2001; Boulos *et al.* 2001: 586).

Using the materials gathered by the botanists working with the Combined Prehistoric Expedition in the Nubia Shab Pediplain, Michael Brass challenges their interpretation of the data leading them to the conclusion that the pre-Holocene Maximum environment resembled that of today – namely, the contracted desert around small uninhabited oases in the South-Western Desert (Barakat 2001: 599) and/or localized desert vegetation in catchment areas (Boulos *et al.* 2001: 583). In the first place, he believes that the botanists generally downgraded the ecological signals based on fauna and floral macroremains from the South-Western Desert and that, in fact, the biomass of the area had a much higher carrying capacity and could be sufficient to support large mammals like elephants and giraffes. He argues that a desert environment similar to that of the Bayuda Desert would be sufficient to accommodate auroch – despite the lack of water (?).

As for the elephants and giraffes, their presence is conceivable during the Climatic Maximum of the Holocene; however, it has never been satisfactorily demonstrated. There is an elephant skull found at Nabta Playa embedded in the 8.2 ka mud flow silt overlapping a Neolithic pit at the "Elephant Site" (Gautier *et al.* 1994; Gautier 2001: 621), though it is highly fossiliferous and associated with Levallois debitage. The proboscidean tooth fragment was collected at Site E-79-4 at El Ghorab Playa tentatively assigned to the extant African elephant (Gautier 1984: 56). The tooth is believed to be derived from alluvial Middle Paleolithic deposits reported from the Kiseiba foot scarp (Schild and Wendorf 1984: 12).

During the 1998 season, a few fragments of aeolized elephant molars were found at Site E-91-1, Area A and Area 6. The pieces were similar, as regards preservation, to the fragment from the El Ghorab Playa (Gautier 2001: 621). They were probably derived from the Late Pleistocene deposits occurring there underneath the beds of Holocene age. No extant elephant finds have ever been reported from North-Western Sudan (Pöllath 2007).

Small remains of a tooth derived from a giraffe were found in Site E-75-8, Bed 10, at Nabta Playa, and attributed to the Final Neolithic. The same goes for several other sites in the western part of the Western Desert and North-Western Sudan (Gautier 2001: 622). This large and highly mobile ruminant was undoubtedly a part of the Holocene optimum in the Nubia Shab Pediplain.

Let us review, then, the latest evaluations of the data concerning the earliest appearance of bovid bones and animal watering installations among the initial Holocene settlers of the Eastern Sahara. The first ages were obtained come from El Adam Playa's Site E-79-8, located at the centre of the fossil lake. A dense scattering of bones, among them 12 "cattle" bones (Gautier 2001: 611; 2007: 78), occurred on the surface of the site. The scattering partially covered the excavated trench. The site yielded a sequence of seven ages spread over about 9800-8900 radiocarbon years BP (ca. 11,000 to 10,000 calBP, not counting the standard deviation). All but one show very significant standard deviations reaching nearly 400 years, particularly in the case of the oldest dates. Apart from the exception, the dates come from a stratigraphic trench that yielded the *El Adam* archaeological material, excluding bones, down to about 80 cm below the surface (Schild and Wendorf 1984: 33). An OSL sample at 50 cm below the surface gave a date of 9.12 ± 0.27 ka., overlapping within 2σ with most of the calibrated assays of the *El Adam* radiocarbon series from the same trench.

Some 20 m to the northeast of Site E-79-8 is an *El Adam* unit Site E-80-4 with a large playa sandy silt erosional window remnant (Bed 3) at the centre. An archaeologically sterile prehistoric walk-in well ca 3.5 m long, filled up with cemented clay and sand, cuts through cultural horizon into sandy Bed 3 and has been protecting the remains of the cultural layer from erosion (Close 1984a: fig. 15.3). The excavation of the cultural layer yielded a sizable archaeological collection including animal bones, among which the remains of a large bovid (Gautier 1984: 50), "probably Domestic Cattle" (Gautier 1984: 59), have been listed. Amid these, "two molars, fragments of a subadult first phalanx and a distal condyle of a subadult cannon bone" have been identified (Gautier 1984: 60). A charcoal sample from the same remnant with the cultural layer gave a radiocarbon date, on charcoal, of 9220 ± 120 (SMU-

925) years BP (Close, 1984a: 347), or about 10,720-10,180 calBP and 8770-8230 calBC (at 2σ) confirming the *El Adam* age of the remnant.

Large bovid remains are almost unknown from the *El Ghorab* unit camp sites, which, on the other hand, yielded only a few bones, except for Dorcas gazelle at Site E-79-4). One specimen has been reported from Site E-79-4, Lower Level (Gautier 2001: 611) at El Ghorab Playa, Kiseiba Area, however, it does not occur in the list published in 1984 (Gautier 1984: 50). The other has been found embedded in Level A, or Lower Cultural Level, 15-50 cm below the dune surface, of Site E-75-6 dated at 8290 ± 80 (SMU-257) radiocarbon years BP, (Schild and Wendorf 2001a, fig.2.6; Królik and Schild 2001: 111) or about 9470-9020 calBP and 7520-7080 calBC (at 2σ).

About 100 m to the northwest of Site E-79-8 is the Nabta variant Site E-80-1. A rich assemblage of stone chipped artifacts collected and excavated at the site in the Areas C and D affirmed to Angela Close its affiliation with the *El Nabta* type of Early Neolithic (Close 1984b: 296). Three radiocarbon ages measured, on charcoal and humate fraction, for Area C at Site E-80-1 ranged from 7920 ± 180 years BP (SMU-924) or 9280-8390 calBP to 8020 ± 90 years BP (SMU-926) or 9130-8590 calBP (at 2σ), ages well matching the *El Nabta* unit chronology at the classic Site of E-75-6 at Nabta Playa.

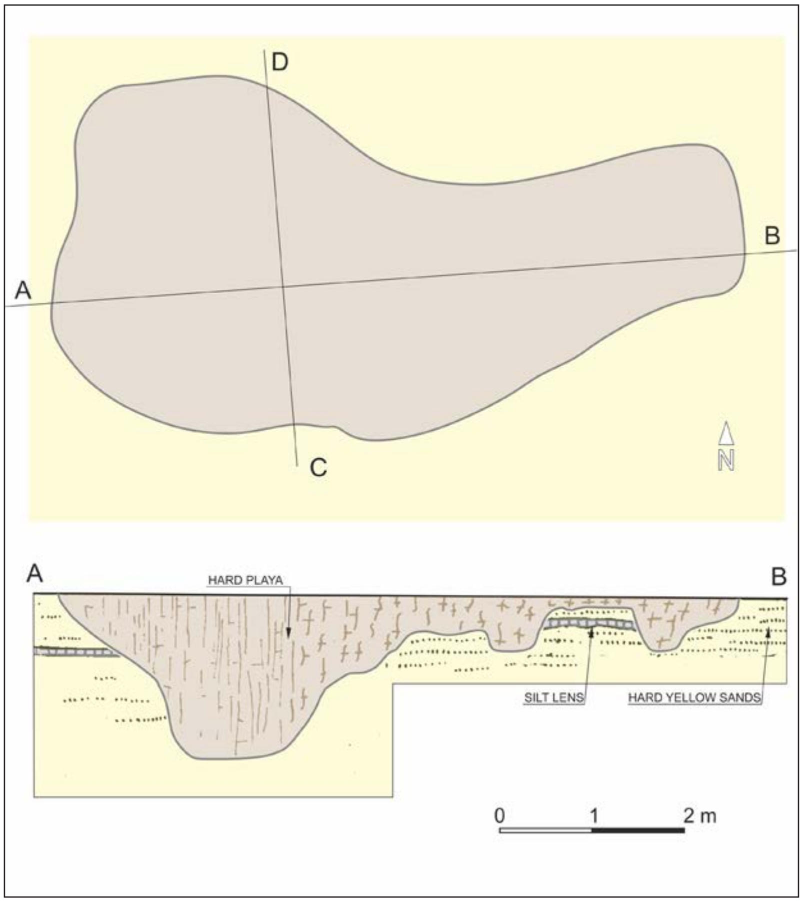
Three areas of the locus were studied. Archaeological materials at Area A were all in lag position. Area C yielded a cultural level rich in artifacts, bones, and charcoal embedded in the 5-15 cm thick horizon at the very top of the truncated playa sand. Area D contained scattered lag chipped artifacts as well as a series of 14 features cut into the silty lacustrine sand of Bed 3.

The archaeological beds of the *El Nabta* materials at E-80-1 are about 1.30 to 0.50 m below the level of the *El Adam* time beds at E-79-8. The vertical distance separating the *El Adam* and *El Nabta* archaeological beds is explained by the lowering of the playa deposits by wind erosion during the 9.2 ka event.

Site E-80-1 has also revealed an extensive series of various features in all the excavated areas. Of chief interest is Feature 1, a walk-in, vast well, about 7.5 m long, 5 m wide, and 1.8 m deep excavated at Area D (Fig. 12.1). It included two sub-basins, a larger and deeper one – and a small, *perched*, shallow and elongated one, in the form of a watering trough, ca. 2.5 m long and 0.5 m deep (Wendorf and Schild 2006: fig. 10). This is the construction of a well commonly used in the desert, one that facilitated the access of animals to water and prevented them from destroying the main well (Close 1984b: 252). The feature was filled with a strongly consolidated playa clay and secondary silty sand from early phases of the use**.** The well contained a rim sherd with vertical incisions of the rim and a woven mat motif of the body (Close 1984b: 292) eroding from the clay. The sherd exhibit a characteristic *El Nabta* unit motif (Gatto 2002: fig. 5.4). Another decorated potsherd of *El Nabta* stylistics (dotted wavy line features) was also found eroding from the clay of the nearby, huge walk-in well (Fig. 12.2) of Feature 2 (Close 1984b: 293). The well measured nearly 9 x 5 m (Close 1984b: fig. 12.4).

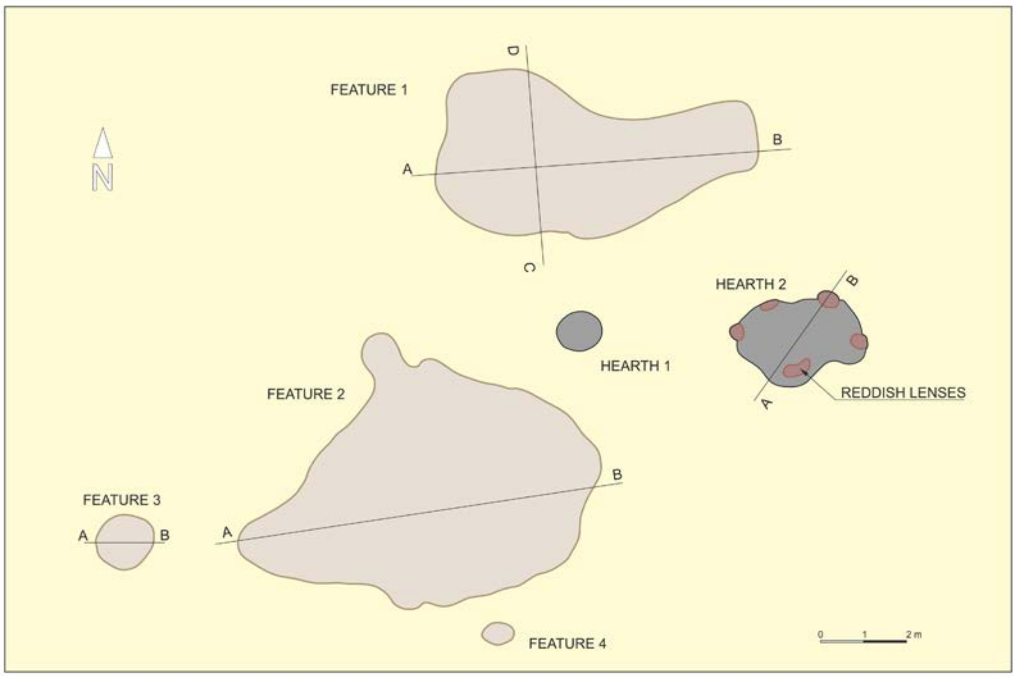
Both wells cut through the sandy silt from the already truncated surface of the erosional window only about 20 cm higher than the cultural horizon in Trench 2 at Area C of the site (Schild and Wendorf 1984: fig. 2.32). The same clays (Bed 5) that superimpose the sandy silt just a few meters south of Area D of Site E-80-1 had initially capped the sandy silt of Bed 3 before the latest deflation, as well as a smaller well at Site E-80-4 (Close 1984a: 327). Although none of the wells has been directly dated, the proxy geo-stratigraphic data, pottery and the measured age of the settlement strongly suggest a Nabta unit chronology of the wells at Site E-80-1. On the other hand, the clays which cap almost the entire El Adam Playa and form a seal over the wells represent the massive mud deposition of the 8.2 ka event so well known from Nabta Playa.

Similar large walk-in and cylindrical wells are known from several sites of Nubia Shab Pediplain from the Maximum of the Holocene or *El Nabta/Al Jerar* Humid Interphase (cf. Table 3.3 in Chapter 3, this volume). Among these is Feature 19 in Area 2 at Site E-91-1 on the West Bank of Nabta Playa (Nelson 2001a: 216). The well cuts through the Old Dune and probably Late Pleistocene alluvia down to the Nubia Sandstone and is filled up with a series of washed in beds of dune and playa shore sand. It is capped by a bed of laminated, washed in, silty sand. The suite was initially overlain by a bed of laminated, reddish brown playa silt deposited during the 8.2 event (Fig. 12.3).



◄ **Figure 12.1.** El Adam Playa, area D. Site E-80-1. Feature 1. Walk-in well. Based on drawing in Close 1984b. Drawn by M. Puszkarski.

▼ **Figure 12.2.** El Adam Playa, area D. Site E-80-1. Features 1 and 2. Walk-in wells 1 and 2. Based on drafts in Close 1984b. Drawn by M. Puszkarski.



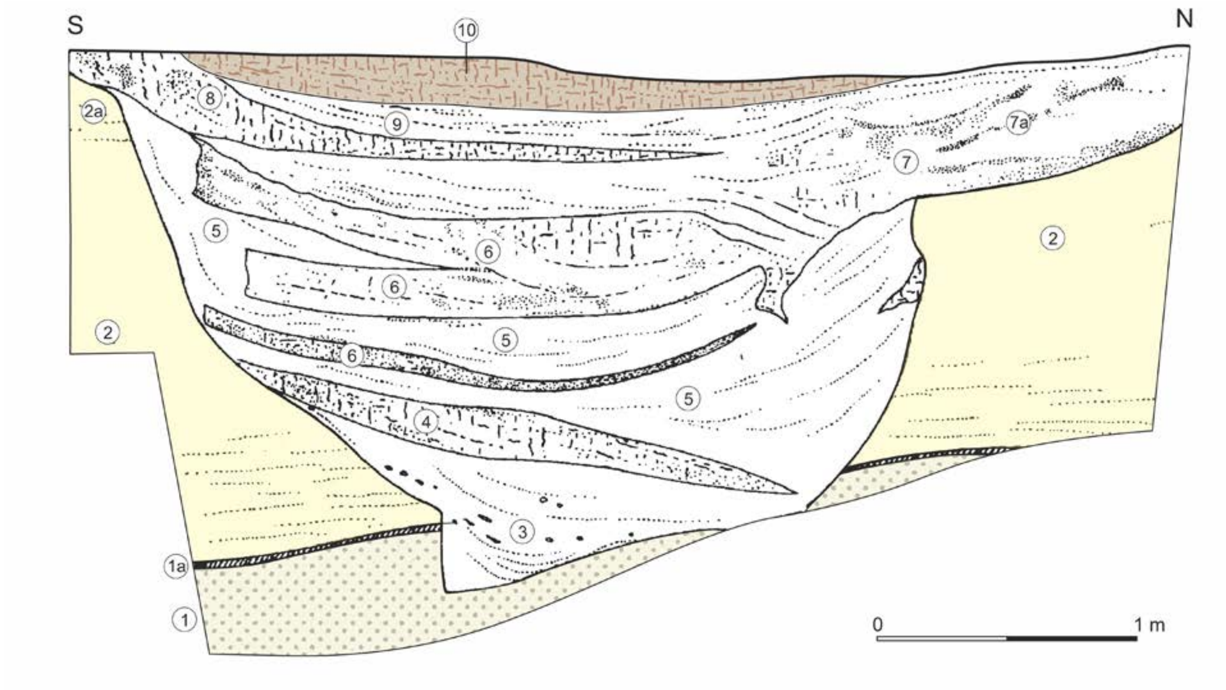


Figure 12.3. Nabta Playa, Site E-91-1, Feature 19. Area 2. Cross-section of a Walk-in well. Key: 1 – Nubia Formation sandstone, 1a – thin bed of quartzitic sandstone, 2 – dune sand, 2a – shore zone sand, 3 – redeposited dune with Nubia Sandstone pieces, 4 – silty sand with charcoal flecks, 5 – dune sand blown from a spoil heap, 6 – beds of gray shore sand derived from a spoil heap, 7 – laminated fine silty sand, 8 – washed-in shore sand from a spoil heap, 9 – washed-in silty sand with silty laminas and deoxidation staining, 10 – fine blocky reddish brown silt of 8.2 ka event. Profile by R. Schild, drawn by M. Puszkarski (based on a draft in Nelson 2001a).

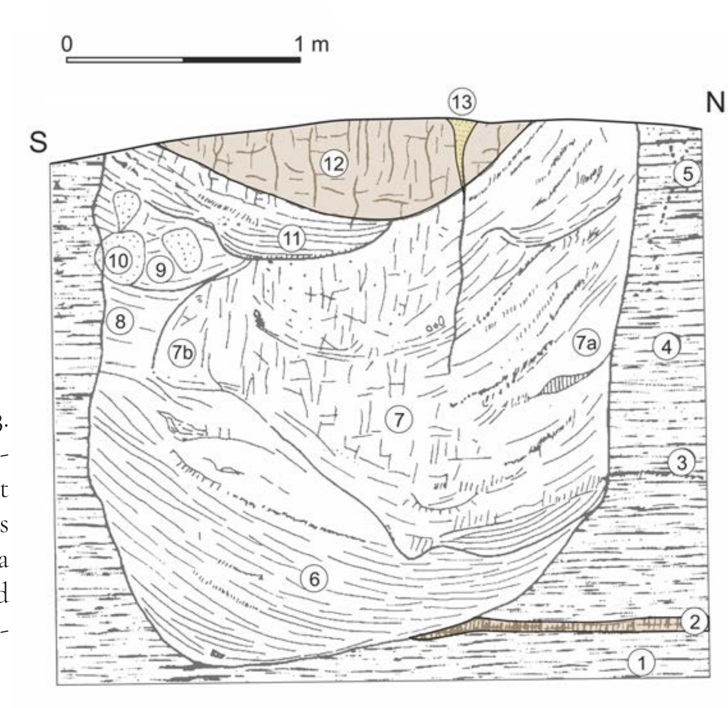


Figure 12.4. Nabta Playa, Site E-75-7. Pit 3. Cylindrical Well showing multi-seasonal sandy and silty deposits topped by brown silt (12) underlain by lacustrine sand with lenses of clay pellets (11) OSL dated at 8.52 (0.35) ka (GdTL-2816) confirming its 8.2 ka age. Based on a draft in Wendorf and Schild (1980). Profile by R. Schild, drawn by M. Puszkarski.

The well has not been directly dated; however, the neighboring Hut 4 (Nelson 2001a: 212), topped by a similar thin lens of the reddish playa silt, has yielded a date of 7735 ± 115 years BP (DRI-3526) or about 8980-8340 calBP and 7030-6390 calBC (at 2σ). Furthermore, Hearth 1 in Hut 1 in Area 2, also capped by a bed of silt, gave a radiocarbon date of 7610 ± 110 years BP (DRI-3548) or 8630-8180 calBP and 6690-6230 calBC (at 2σ). The dates indicate an *Al Jerar* association of the huts, as do the artifacts and pottery recovered from the features. Also, the sediments filling the features and the well suggest a lacustrine deposition in the shore zone of the El Nabta/Al Jerar Lake during its high, seasonal stage.

Large cylindrical and walk-in wells are common settlement features present at the *El Nabta/Al Jerar* sites of Nabta Playa: e.g., wells (Fig. 12.4) at Site E-75-7 (Wendorf and Schild 1980: fig. 3.15); (Fig. 12.5) at Site E-75-6 (Schild and Wendorf 2001a: fig. 2.11), as well as the wells at Site E-92-7 (Królik and Fiedorczuk 2001: figs 9.1, 9.5). They are also present at the Middle Neolithic of *Ru'at El Ghanam* camps at Site E-75-8 at Nabta Playa (Schild and Wendorf 2001a: fig. 2.24); and at the Late Neolithic of *Ru'at El Baqar* settlements of the same site (Schild and Wendorf 2001a; fig. 2.24) and Final Neolithic *Bunat El Asnam* ones (Kobusiewicz 2003) in Nab El Diep (Fig. 12.6) (cf. Table 3.3 in Chapter 3, this volume).

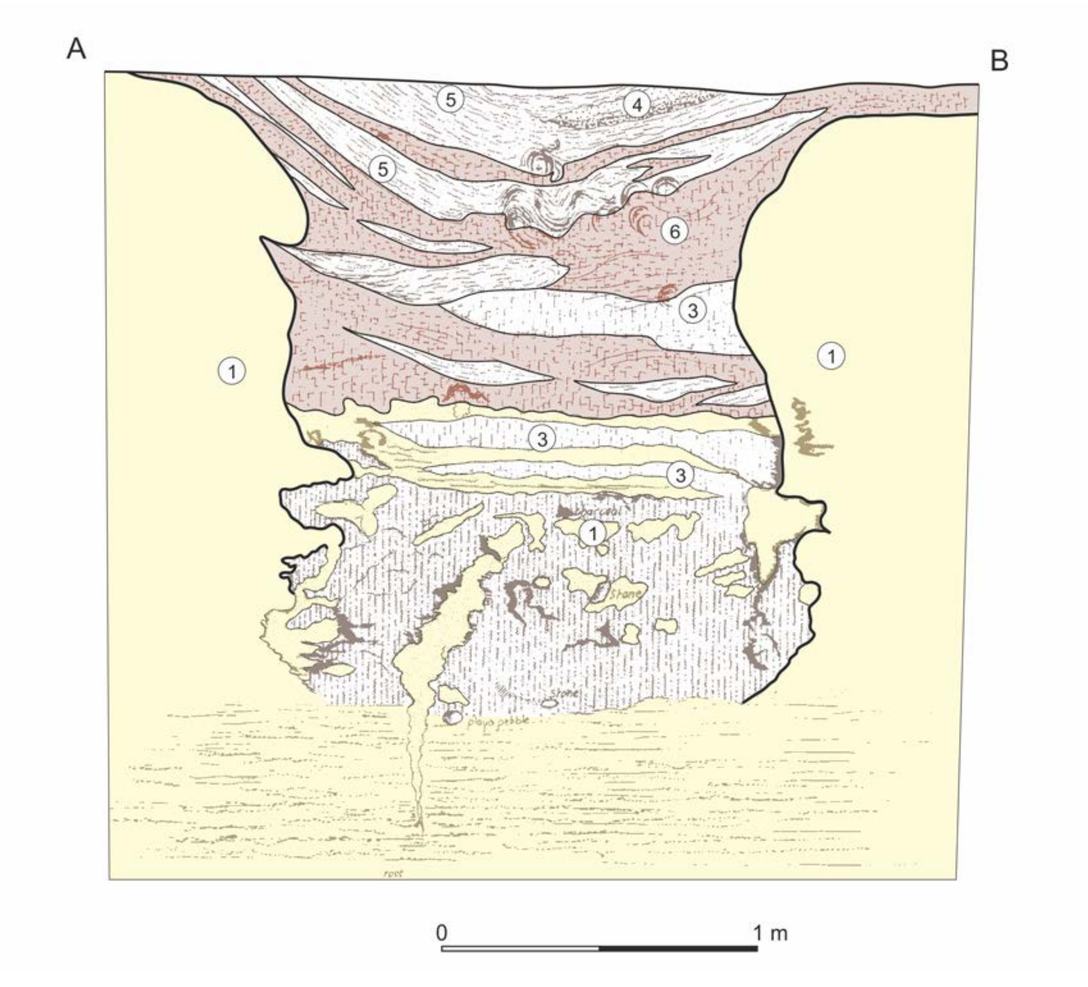


Figure 12.5. Nabta Playa, Site E-75-6. Cylindrical well showing multi-seasonal sandy and silty deposits topped by the 8.2 ka reddish brown silt interbedded with sandy washes. Based on a draft in Wendorf and Schild (1980). Section by R. Schild, drawn by M. Puszkarski.

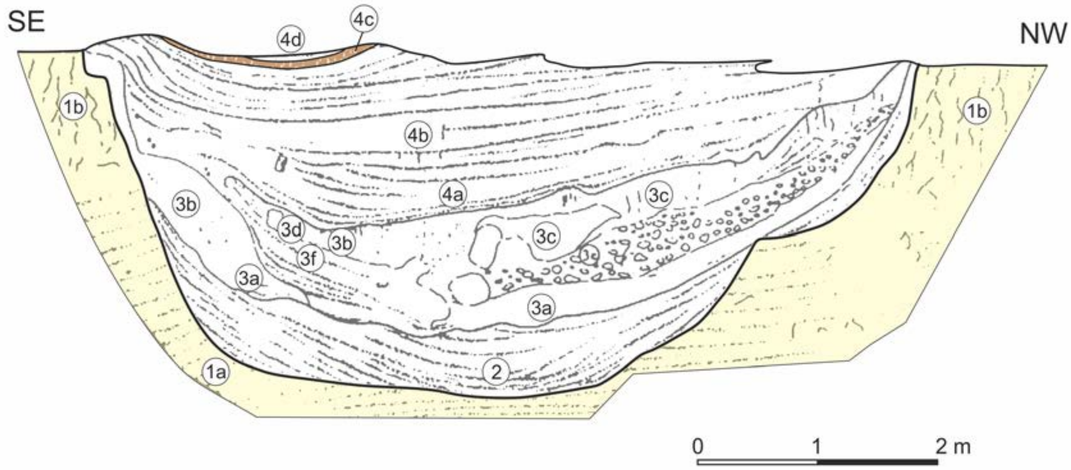


Figure 12.6. Nab El Diep Playa, Site E-00-1. Walk- in well. Based on a draft in Kobusiewicz 2003. Drawn by R. Schild and M. Puszkarski.

The appearance of early large bovid remains during the AHP in the Early Holocene *El Adam* and *El Ghorab* wet interphases preceding the 9.3 event seems to be sporadic, since there are no hard data indicating that the bovid bones at Site E-79-8 collected from the surface scattergram are indeed associated with the *El Adam* time occupations and not the *El Nabta* settlement. Their *in situ* presence, in the *El Adam* unit, however, appears to be the best verified at Site E-80-4 and E-06-1.

It seems quite likely that a large bovid, either wild or tamed, was present in the Nubia Shab Pediplain from the beginning of AHP. If not domesticated, it could be a seasonal visitor, entering the desert after the summer rains. Nevertheless, the lack of the elsewhere inseparable hartebeest is quite intriguing, as it strongly suggests that the local environment could not support very large ruminants. The presence of auroch and hartebeest in the Nile Valley, in the cultural remains of the late *El Adam* camp of Dibeira West 51 (labelled initially as Shamarkian) as well as in the mixed "Shamarkian" Site Dibeira West 53 (Gautier 1968: 98), radiocarbon dated (Wendorf *et al.* 1979) at 7910 ± 200 years BP (SMU-4), or 9400-8360 calBP (7450-6410 calBC at 2σ), is of big importance. It suggests that it was not an unusual hunting pattern that could have been responsible for the absence of the hartebeest bones among the foragers' waste in the desert some 170 km away from the Valley. The hartebeests simply did not make it there; the area was to dry.

Achilles Gautier (2007) in his ultimate statement on cattle domestication declares that although the identification of the large bovid cattle can be maintained, the incidence in the South-Western Desert of "people moving into the Sahara took small numbers of young wild cattle with them and tried to make them breed under their control" (Gautier 2007: 82). Nevertheless, he believes that the domestication took place independently in North Africa and the "experiments of controlled breeding of auroch may have had to be repeated quite often". A Frauke Stock and Diane Gifford Gonzales (2013: 59) have had an analogous inkling, visualizing the capture and taming of a few calves in the Nile Valley. According to Honegger and others (2015: 148), the presence of *early cattle* "prior to 8 kyr BP", whether "hunted or manipulated" had no influence on neighboring regions.

The idea is not to be discarded. It is well known that in the Nile Valley, the Late Paleolithic foragers lived for millennia in very close proximity to the wild cattle, putting their bucrania in the interments in the graveyard of Site 8905 at Tushka, Lower Nubia (Wendorf 1968: 875) or near the graves at Site 6B36 in Wadi Halfa (Green and Armelagos 1972).

The makeup of the settlements seems to abruptly change with the common and almost sudden appearance of large walk-in wells, some with shallow troughs, during the *El Nabta* stage of the local Holocene climatic Maximum. The newly appeared wells stand in remarkable contrast to small, narrow pits seen in the *El Adam* unit sites (Connor 1984a: 220; Wendorf and Schild 2001b: 103). The walk-in wells appear not only in the semi-organized settlements of *El Nabta* and *Al Jerar* entities with numerous huts and storage pits, like Site E-75-6 and E-91-1 at Nabta Playa. They are often placed outside the densely populated camps as those along the northern shores of Nabta Playa south of Site E-92-7 (Królik and Fiedorczuk 2001: 335), and in the northeastern corner of the Nab El Diep trough (Kobusiewicz 2003) suggesting purposely isolated cattle watering holes. The large walk-in wells suggest that from the early Maximum of the Holocene and the *El Nabta* unit settlement in the Nubia Shab Pediplain one may expect that managed cattle keeping was part of the human socio-economic adaptation package in the Eastern Sahara.

These changes are also seen in the share of *Bos* bones in the number of identified mammal bones, excluding rodents and hedgehogs, recovered from systematic archaeological excavations and surface collections. The following are the statistics of a few richer sites in chronological order (cf. Table 3.3 in Chapter 3, this volume):

El Adam Site E-80-4, Cultural Layer, c. 30 cm thick (El Adam Playa) – 18% (a relatively small sample)

El Adam Site E-79-8, Scattergram, Surface (El Adam Playa) – 3.2%

El Ghorab Cultural Level, Site E-75-6, (Nabta Playa) – 7.1% (a small sample)

El Nabta Site E-80-1, Surface (El Adam Playa) – 5.26%

El Nabta Site E-80-1, (Sub) Surface, 1981 Season (El Adam Playa) – 3%

El Nabta/Al Jerar E-75-6, 74, 75, 77 Seasons (Nabta Playa) – 0.35%

Middle Neolithic E-79-6, 0-30cm (Gebal El Feel Playa) – 2.53%

Middle Neolithic E-75-8, Spits 5-9 (Nabta Playa) – 6.4%

Middle Neolithic E-75-8, Spits 1-4 (Nabta Playa) – 13.4%

Late Neolithic mixed with the Final Neolithic E-75-8 Layers C to F – 8%

Final Neolithic E-75-8 Layer 10/99 (Nabta Playa) – 22.2%

After an unusually high percentage of large bovid presence in the preserved, relatively thick (Close 1984a: 325) *El Adam* cultural bed at Site E-80-4 at El Adam Playa, the indices of *Bos* bone stay at a low level during the *El Adam* and *El Ghorab* variants. It stays low during *El Nabta/Al Jerar* times showing occasional growths at Site E-80-1 in El Adam Playa and again a significant upturn during the Late Neolithic. The index remains high at the Final Neolithic repetitively used sites like E-75-8 on the western bank of Nabta Playa.

These significant adaptive changes appear shortly after the cold and dry 9.3 ka event at the beginning of *El Nabta/Al Jerar* Wet Interphase around about 9500-9000 calBP, or 7550-7050 calBC, most likely in the early 8th millennium BC.

3. Foragers

The *El Adam* Variant

If the *El Adam* and *El Ghorab* groups (cf. Table 3.3 in Chapter 3, this volume), the earliest (Fig. 12.7) occupants of the South-Western Desert, were accompanied by tamed or just manipulated cattle, their role, however, would not be significant. The cattle, according to Gautier's proposition (2001), could serve as providers of milk and blood (Gautier 2001: 634). On the other hand, small-animal hunting and gathering was undoubtedly essential. In the first place, it was small gazelle and hares with occasional larger gazelle. The hare and gazelle proportion indicate a strong dominance of the gazelle fluctuating between around 90 and 98% (Gautier 2001: 632-633). The gathering must have been of importance, although its traces are meager, except for the presence of grinding equipment. Of significance, though, is the universal lack of storage pits so widespread in the *El Nabta/Al Jerar* period.

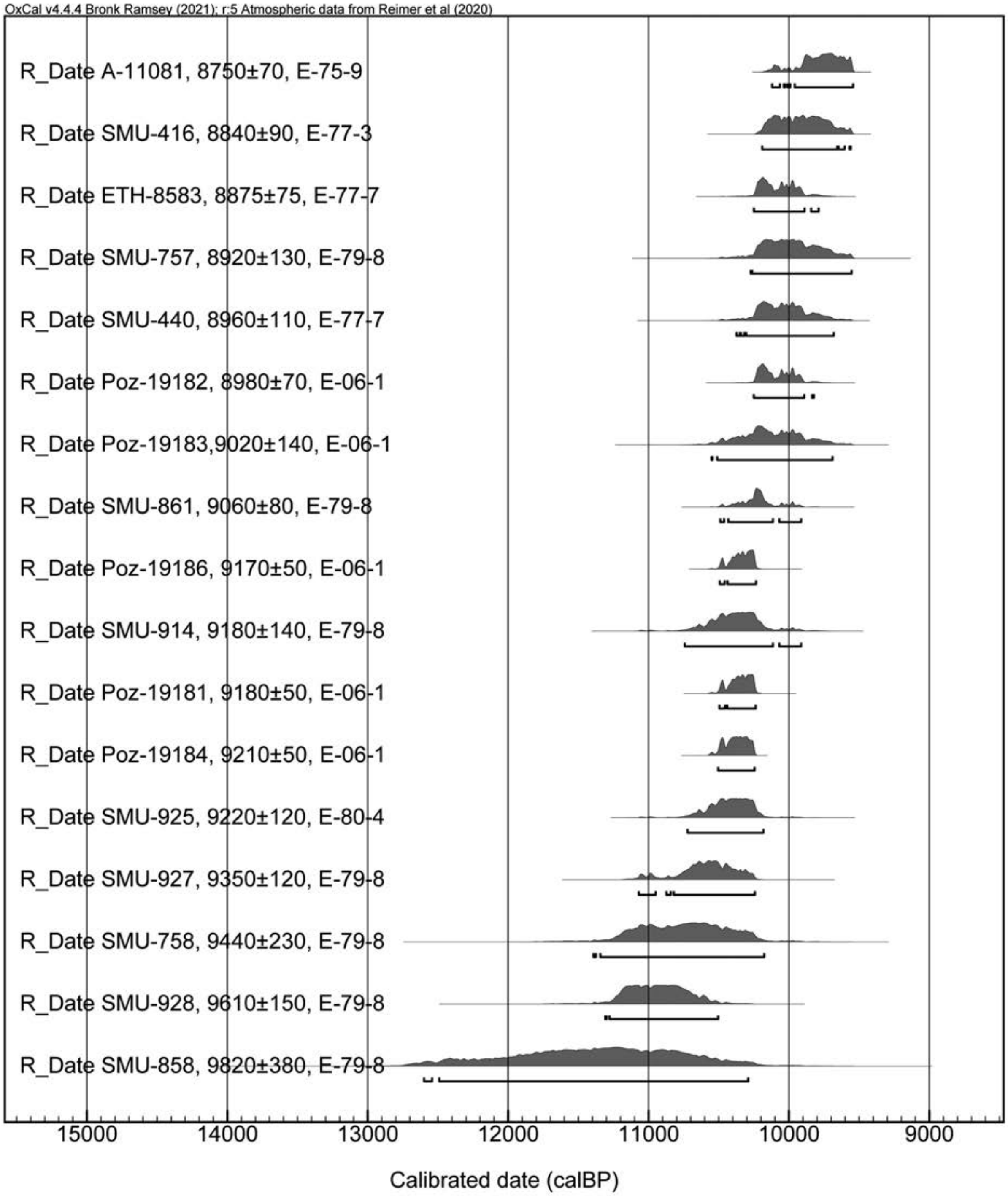


Figure 12.7. *El Adam* unit sites. Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

Nevertheless, the presence of some herbaceous plant seeds of the family *Poaceae* indet., as well as *Echinochloa colona*, *Setaria* type, Ziziphus sp. (probably Christ's Thorn Jujube) and *Schouwia* suggest their use. Because of relatively large seeds and the nutritional value of the herbs they could constitute a vital food sector. Ziziphus ripe fruits are edible, as are the leaves of *Schouwia* either cooked or dried (Wasylikowa 2001; Wasylikowa *et al.* 2001c; cf. Chapter 14, this volume).

The margins and the tributary wadis of the playas were the only places where the vegetation could sustain itself throughout the year. On the other hand, the areas beyond these small oases could support seasonal herbaceous plants and legumes after the summer rains. Seasonality therefore, must have been the name of the game during the *El Adam* and *El Ghorab* Humid Interphases. It is not without insignificance that the Early Holocene camps are located close to the centres of playas where the maximal groundwater recharge would take place. Most likely these are niches that would be used in the dry season. The only wells known from the Early Holocene camps are six small pits, found at the *El Adam* unit Site E-75-9 in Nabta Playa (Fig. 12.8) and an alleged well at the *El Adam* Site E-79-8 at El Adam Playa. Three of these were excavated at Site E-75-9 (Wendorf and Schild 2001b: 99, 103). The wells measured about 40 cm in width and ca. 80 to 100 cm in depth. Their lower fill consisted of redeposited dune sand, probably originating from the backdirt, and the top infilling consisting of thin interbedded layers of lacustrine silt and sand, perhaps marking the seasons of lake transgressions. There is no direct dating of these features. However, it appears that they had been sunk from a level at least 20 cm higher than the truncated surface of the old sandy playa with the *El Adam* artifacts on the surface, as suggested by the height of the cemented silt remnants of the wells' infill.

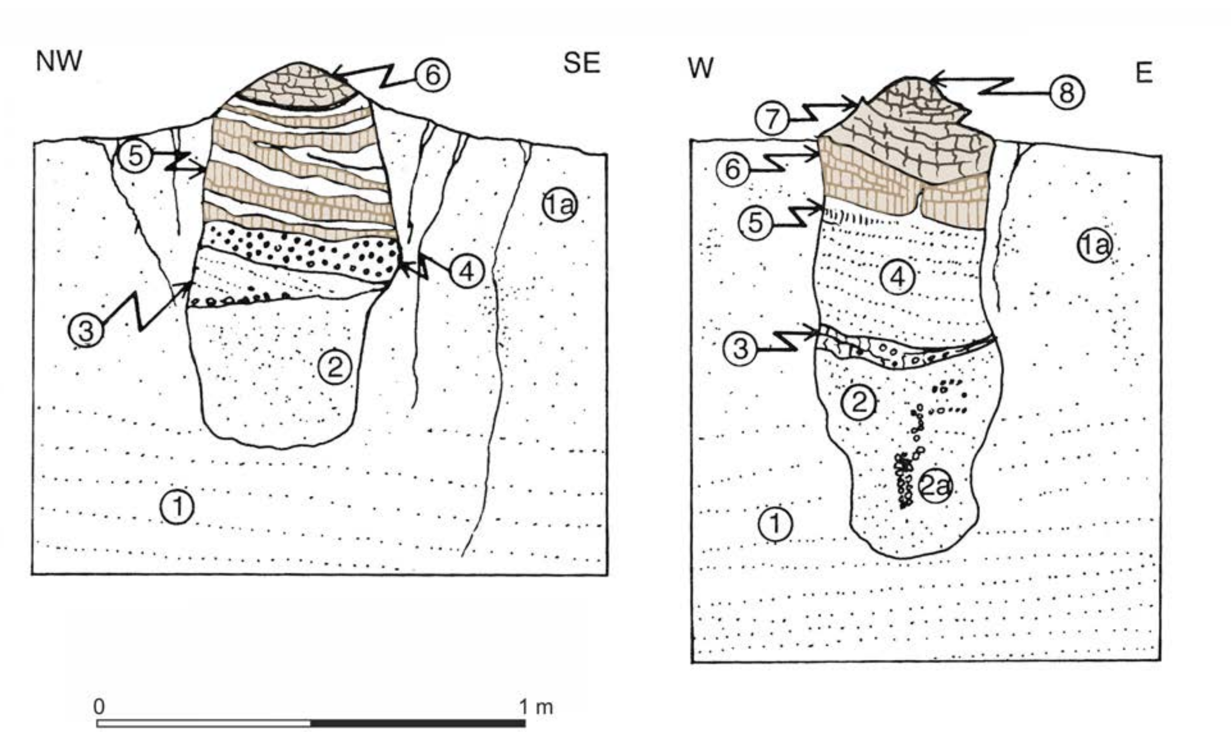


Figure 12.8. Nabta Playa, Site E-75-9. Small wells showing multi-seasonal infills of sand and silt. Based on a draft in Wendorf and Schild 2001. Drawn by R. Schild and M. Puszkarski.

The well at *El Adam* unit camp at Site E-79-8 is located about 10 m north of the main concentration of artifacts and measures about 150 cm in depth and about 75 cm in diameter. It shows a shallow, short step/trough at the top. Its infilling consist of several phases. The feature has not been dated nor did it contain artifacts (Connor 1984a: 218).

All of the known *El Adam* unit camps are small and seem to have been erected in the winter season because they are placed close to the centre of playas and within flooded shore zones. Traces of shallow basin huts are preserved at some sites (E-06-1) but do not form clusters like those during the Upper Early Neolithic. Contacts with the Nile Valley indicate the presence of *Soathopsis rubens* at some *El Adam* unit sites, as well as *Mutela* (Gautier 2001: 613).

Five sites of this variant were excavated in the Nabta Playa Basin: E-75-9 (Wendorf and Schild 2001: fig. 6.7); E-91-3 and E-91-4 (Close 2001a: figs 5.2, 5.9); E-06-1 (Jórdeczka a*t al.* 2013; Jórdeczka 2021); E-08-2 Jórdeczka *et al.* 2015) one, (E-77-3) at El Kortein Playa (Wendorf and Schild 1980: figs 3.32-3.40), mixed with Nabtan occupation remains and one (E-77-7) at Gebal El Beid Playa (Wendorf and Schild 1980: figs. 3.29-3.31; Close and Wendorf 2001: figs 4.5-4.7). Two other (E-79-8, E-80-4), rich sites were studied in the Bir Kiseiba Area, at El Adam Playa (Close 1984a; Connor 1984a).

The most popular raw materials in the desert sites are local cherts making up nearly 50% of the inventory, followed by cretaceous fossil wood and chalcedony. Sites close to the Eocene Scarp are dominated by Egyptian (Eocene) flint.

The lithic technology has been based on single and opposed platform cores for bladelets. The structure of retouched tools is dominated by backed bladelets, both straight-backed pointed, as well as pointed, arch-ended and arched specimens. This includes lunates, shouldered bladelets, and truncations on bladelets. The geometrics include elongated scalene triangles as well as short ones, and various trapezoids. Microburins are common.

Endscrapers are somewhat customary and every so often made on reused Middle Paleolithic large flakes, including Levallois ones. Perforators are present while burins, truncations, and denticulates are sporadic. Milling stones and hand stones are frequent. Ostrich eggshell calibrators occur at all the sites as well as very many eggshell beads and fragments of decorated ostrich eggshells.

Two time variants are defined (Fig. 12.9); an older one grouping the sites clustered around about 9220 BP, and a younger one assembled between 9000-8800 BP. The older group shows slightly smaller dimensions of cores. The backed elements are dominant and the geometrics numerous, including trapezes.

The prominent elements of the younger group are narrowly elongated, rather large, backed pieces (≥ 3 cm), segments, and truncations. Triangles and trapezoids are rare. The single or opposed platform cores are mostly for bladelets or blades production.

Pottery is standard, but very rare. It is made from alluvial and lacustrine local clays (Zedeño 2002; Nelson 2002a; 2002b). All the vessels are small to large bowls tightly decorated by repetitive, closely packed lines of impressions parallel to the rim, probably made with toothed rolling pottery discs (Jórdeczka *et al.* 2011). The paste of the *El Adam* unit pottery is tempered with granite, a rock easily available in the area. According to Maria Gatto (2002a: 72) the *El Adam* unit pottery "shows a unique character that defines it as a nuclear unit", despite attributes shared with other areas of early pottery occurrence in the Sahara.

The composition of the retouched tools package and technology of the *El Adam* taxonomic variant is close to those of the Arkinian known from the numerous settlement units at Dibeira West 1, near the former village of Arkin in the Second Cataract Area in the Nile Valley (Schild *et al.* 1968). The similarities are particularly visible in the group of backed bladelets and relatively large endscrapers on flakes. A visible difference is in the common presence in the Arkinian assemblages of bipolar flaking technique used in processing Nile chert and agate pebbles. Also, two new radiocarbon ages, on charcoal, obtained for samples from Dibeira West 1A and 1J gave ages of 10,580 ± 150 (SMU-600) and 10,670 ± 100 (SMU) years BP respectively (Wendorf *et al.* 1979: 221), or between 12,800-12,000 calBP (at 2σ). These are ages nearly one thousand years older than the oldest *El Adam* sites from El Adam Playa.

Another lithic assemblage, classified initially as Shamarkian, from Site Dibeira West 51 (Wendorf *et al*. 1979: 221), rich in pointed backed bladelets (Schild *et al.* 1968: 695), gave a revised radiocarbon date of 8860 ± 90 (SMU-582) years BP, or about 10,210-9600 calBP (at 2σ), and within one standard deviation with the youngest *El Adam* dates from Nabta and El Gebal El Beid playas. Thus, statistically, the date does not differ from the radiocarbon ages obtained at Site E-77-7 at Gebal El Beid Playa, Site E-75-9 and Site E-06-1 at Nabta Playa.

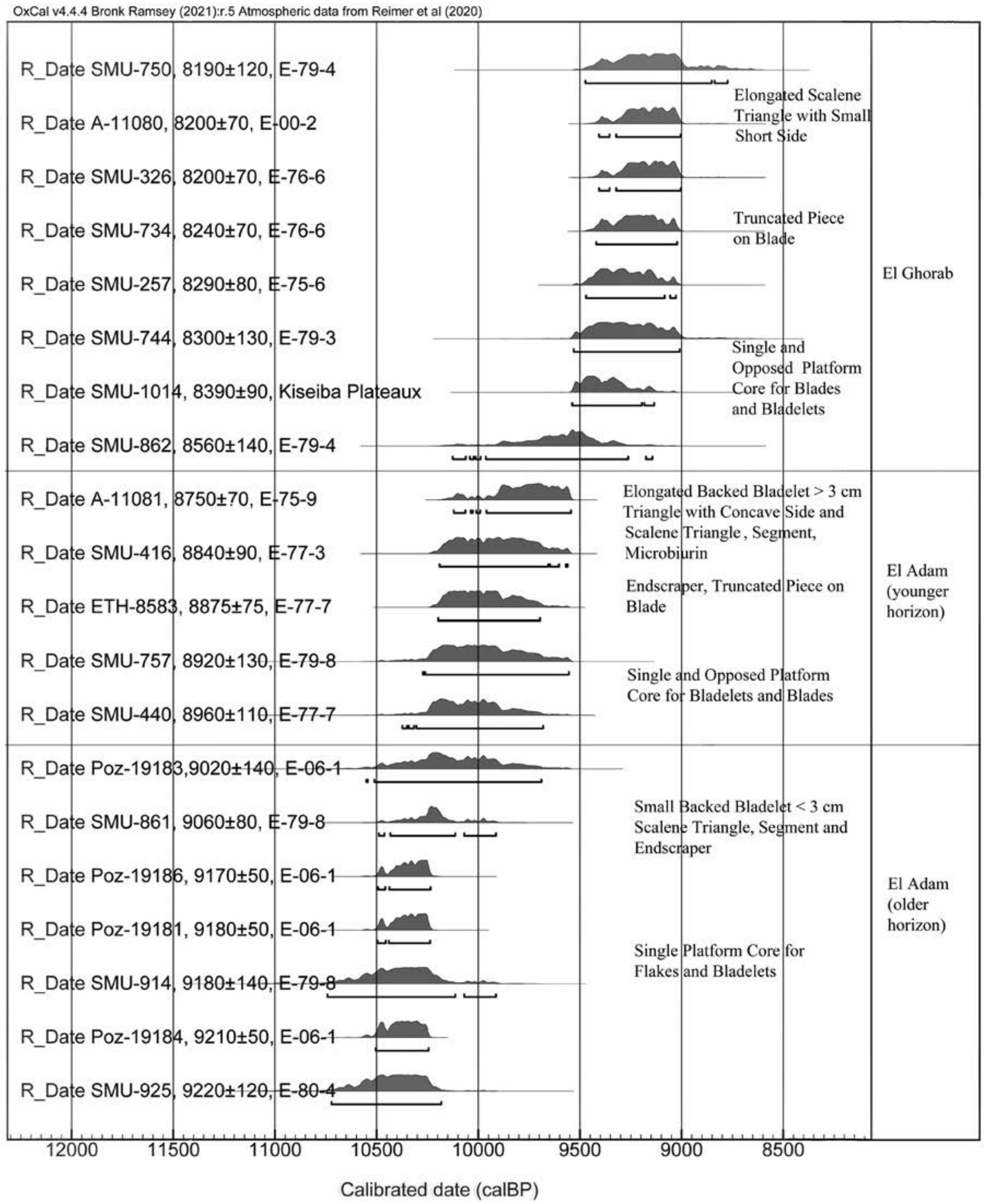


Figure 12.9. Characteristic types of retouched tools for older and younger *El Adam* and *El Ghorab* assemblages in connection with 14C dates (without the oldest age estimates from *El Adam*). OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

Qualitatively and quantitatively there is no difference between the assemblage from Arkin and those from Nabta and Gebal El Beid, except for a more diversified group of trapezoids in the desert assemblages. There is little doubt that the Dibeira West 51 is indeed a late *El Adam* assemblage the first and only one in the Nile Valley. It is of interest to note that the faunal material from Site Dibeira West-51 contains the remains of both the auroch (?) and hartebeest (Gautier 1968: 98). It seems legitimate to postulate that these occupations represent a relatively long-lived single technocomplex (see also Jórdeczka *et al.* 2015; Usai 2005; Garcea *et al.* 2016).

Quite recently Elena Garcea and others (Garcea *et al.* 2016), reported the discovery of an Arkinian site from Amara West (2-R-66) north of Sai Island containing pottery and artifacts reported as associated with the Arkinian context. Radiocarbon dates (on charcoal) obtained at the site range from 9363 to 9290 ± 40-35 years BP (Garcea *et al.* 2016: 92) and are about 1000 years significantly older (2 σ) than the purified charcoal samples from Dibeira West 1 (Wendorf *et al.* 1979). Considering two standard deviations of the results, the youngest date from Site 2-R-66 is only 170 years older than the date from Site Dibeira West-51.

El Ghorab Variant

Traces of the *El Ghorab* assemblage have been reported from Site E-75-6 at Nabta Playa (Królik and Schild 2001: 111) as well as from a deflated, unstudied area to the west of E-75-6. At El Ghorab Playa, in the Kiseiba Area, two horizons (?) of this variant occur at Site E-79-4. Another site (E-77-6) is on the El Kortein Playa (Wendorf and Schild 1980: 259). At El Adam Playa, the *El Ghorab* unit reworked materials occur in a buried wadi and Area X at Site E-79-8 (Connor 1984a: 235-238). There are four sites located in distant areas: Site E-72-5, in the Dyke Area, southwest of Dakhla (Schild and Wendorf 1977: 113-147; Site E-76-6, in Kharga Oasis (Wendorf and Schild 1980: 180-181); Site ML1 at Ayn-Manâwir, Kharga Oasis (Briois *et al.* 2008; Kuper 2015); El Kab, near Edfu (Vermeersch 1978), although Kuper (2015: 345) excludes the latter assemblage from the group.

The radiocarbon dates from El Kab, except for the oldest one (Lv-393), however, fall within an early range of the *El Nabta* chronologies (Vermeersch 1978: 14). On top of the mentioned localities, there is an assemblage, found in the Selima sandsheet in Sudan (Schuck 1993) and a faraway site of Dora 42/8 in Central Libya (Kuper 2015). Most of these sites are placed in Playa basins, usually at or near the centres. There are, however, camps that have been located on the Eocene Plateaux, like Locality I9540, A2/34 on the plateau beyond the Kiseiba Scarp aged at 8390 ± 90 (SMU-1014) years BP (Connor 1984b: 368; Wendorf and Schild 1984a: 412); or about 9540-9130 calBP and 7590-7180 calBC at 2σ); a locality placed on a sand ridge southwest of Bir Safsaf (Wendorf *et al.* 1987b: 49) and on the plateau near Naq Shushina north of Kharga (Wendorf and Schild 1990).

In the Dakhla Region certain stylistic features pointing to the *El Ghorab* entity has also been described from the sites of Masara A, B, and C units located in the Sheikh Muftah ridge area near Mut (McDonald 1991; 1996). The uncalibrated radiocarbon dates from these sites spread from about 8800 and 8100 BP (McDonald 1991: 100), an age corresponding to the late *El Adam* unit and an early *El Nabta* taxonomic entity. Appearing in the published Masara materials are pointed arch-backed bladelets and large endscrapers on Levallois flakes characteristic for the *El Adam* entity as well as tanged points common in the *El Nabta/Al Jerar* assemblages.

The lithic technology in the *El Ghorab* assemblages is based on exceptionally well prepared single and opposed platform cores for blades and bladelets exploited with a soft stone hammer or wooden billet. Elongated scalene triangles with a small short side are a very characteristic element of the tool kit. Pointed, straight-backed bladelets and shouldered bladelets are common as well as scalene triangles and microburins. Blades with continuous retouch, every so often denticulated or notched and truncated pieces are also a characteristic and common element. Endscrapers, burins, perforators, and backed or double-backed perforators are sporadic. Milling stones are frequent. Pottery associated with the *El Ghorab* camps is rare; bowls are universal, and Stem and Leaf, as well as the Wolftooth patterns, are the practiced body decorating impressions (Gatto 2002a: 72).

Traces of features are very rare and most of the sites are in lag situations. In Nabta Playa at Site E-75-6, two small and shallow basin huts were found (Schild and Wendorf 2001: fig. 2.6; Królik and Schild 2001: fig. 7.2). It seems that the *El Ghorab* variant is a short-lived phenomenon whose precise aging is hampered by the scarcity of reliable dates (Fig. 12.10).

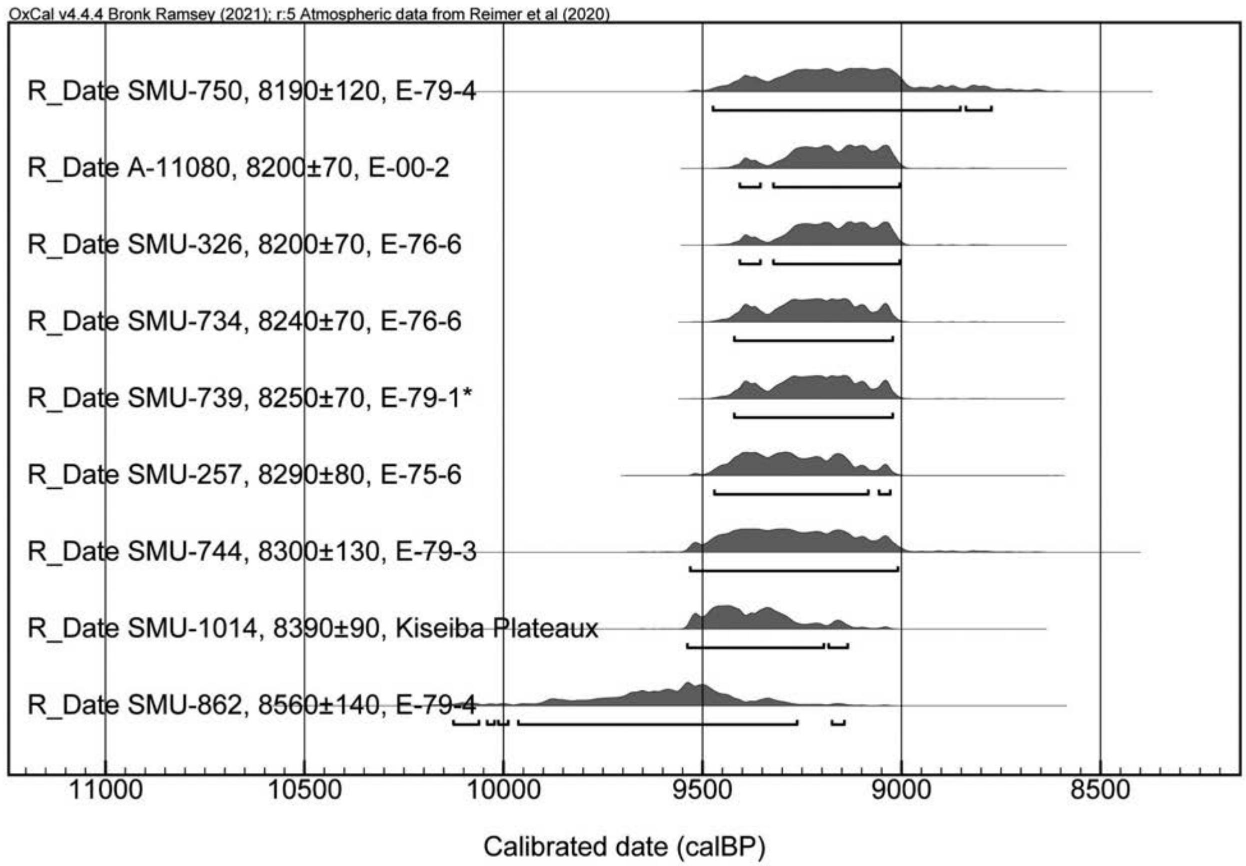


Figure 12.10. *El Ghorab* unit sites. Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

4. Intensive Foragers and/or Early Horticulturalists?

El Nabta and *Al Jerar* Units

This socio-economic phase in the history of South-Western Desert concurs with the local Holocene climatic maximum at about 9400-8300 calBP and the humid interphase of *El Nabta/Al Jerar* (Fig. 12.11-12.14; cf. Table 3.3. in Chapter 3, this volume).

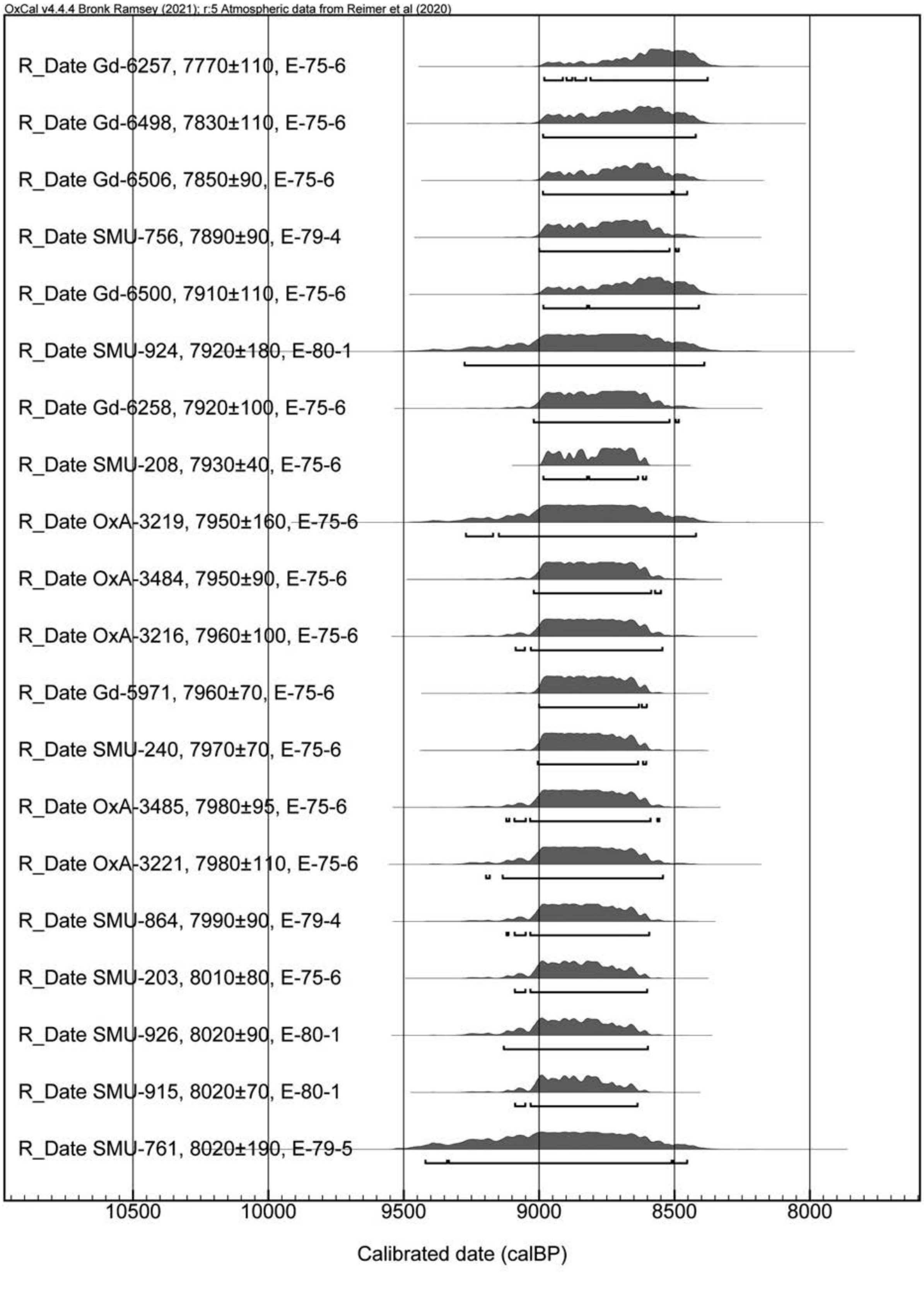


Figure 12.11. *El Nabta* unit sites (1). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

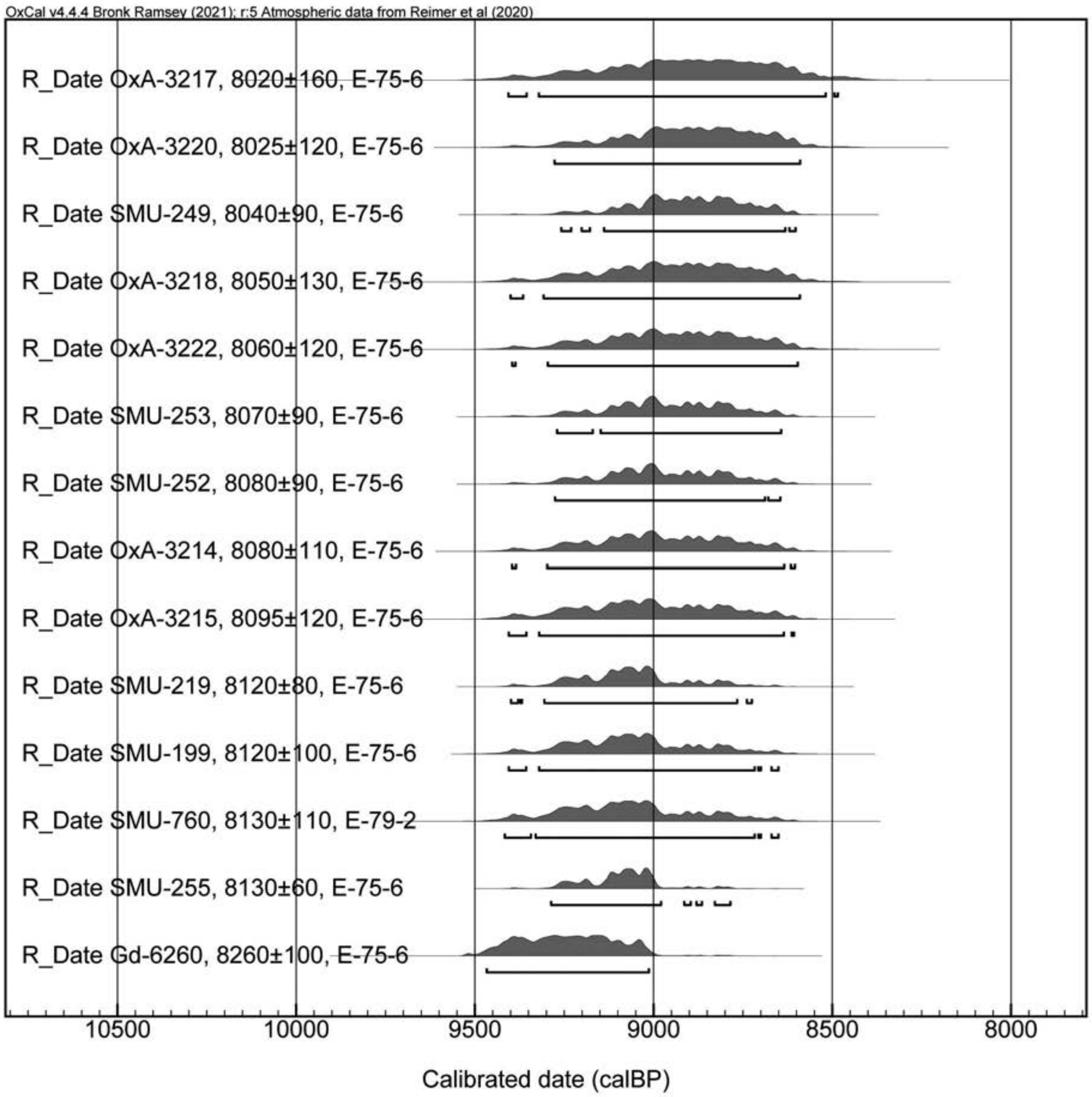


Figure 12.12. *El Nabta* unit sites (2). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

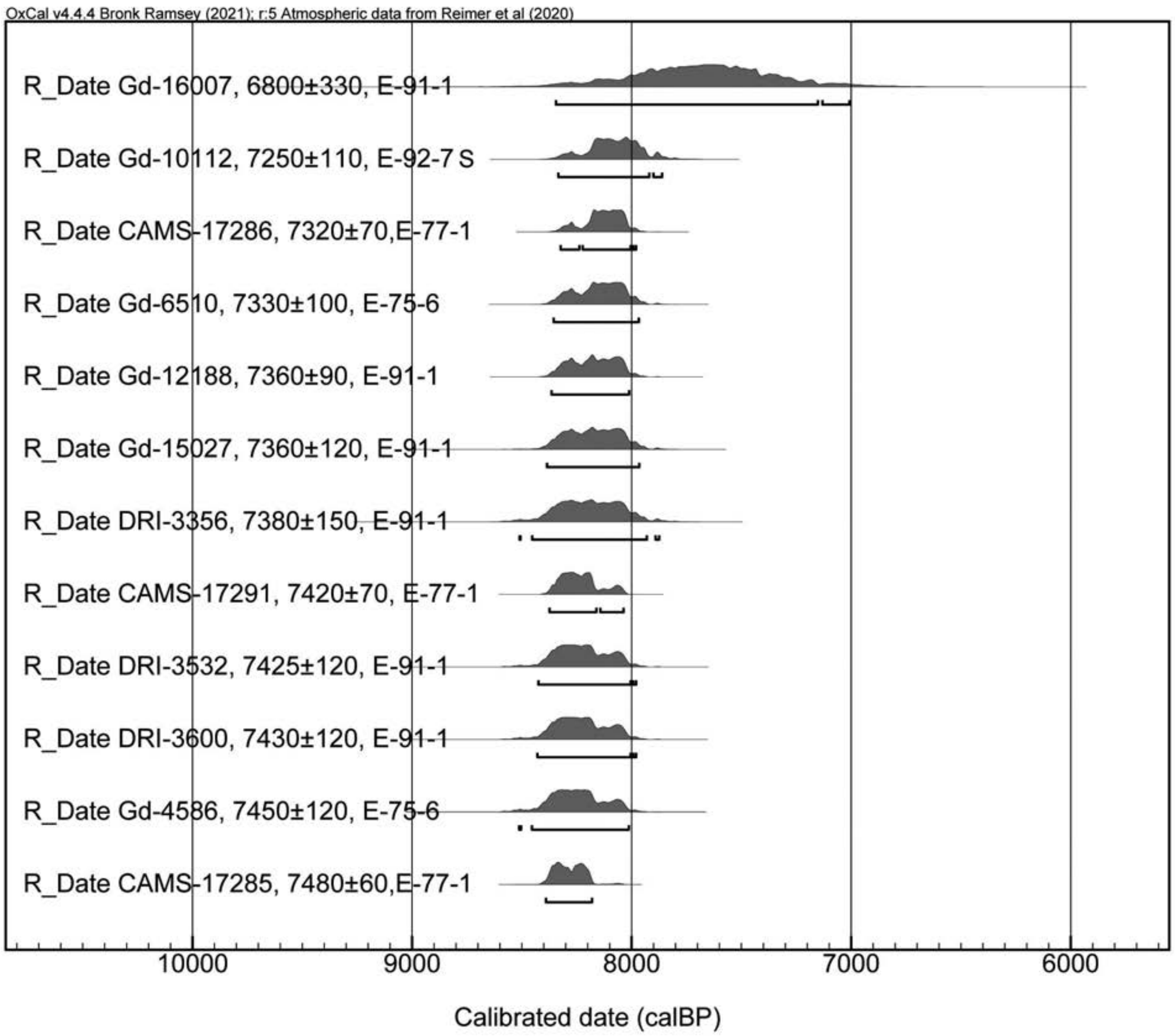


Figure 12.13. *Al Jerar* unit sites (1). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

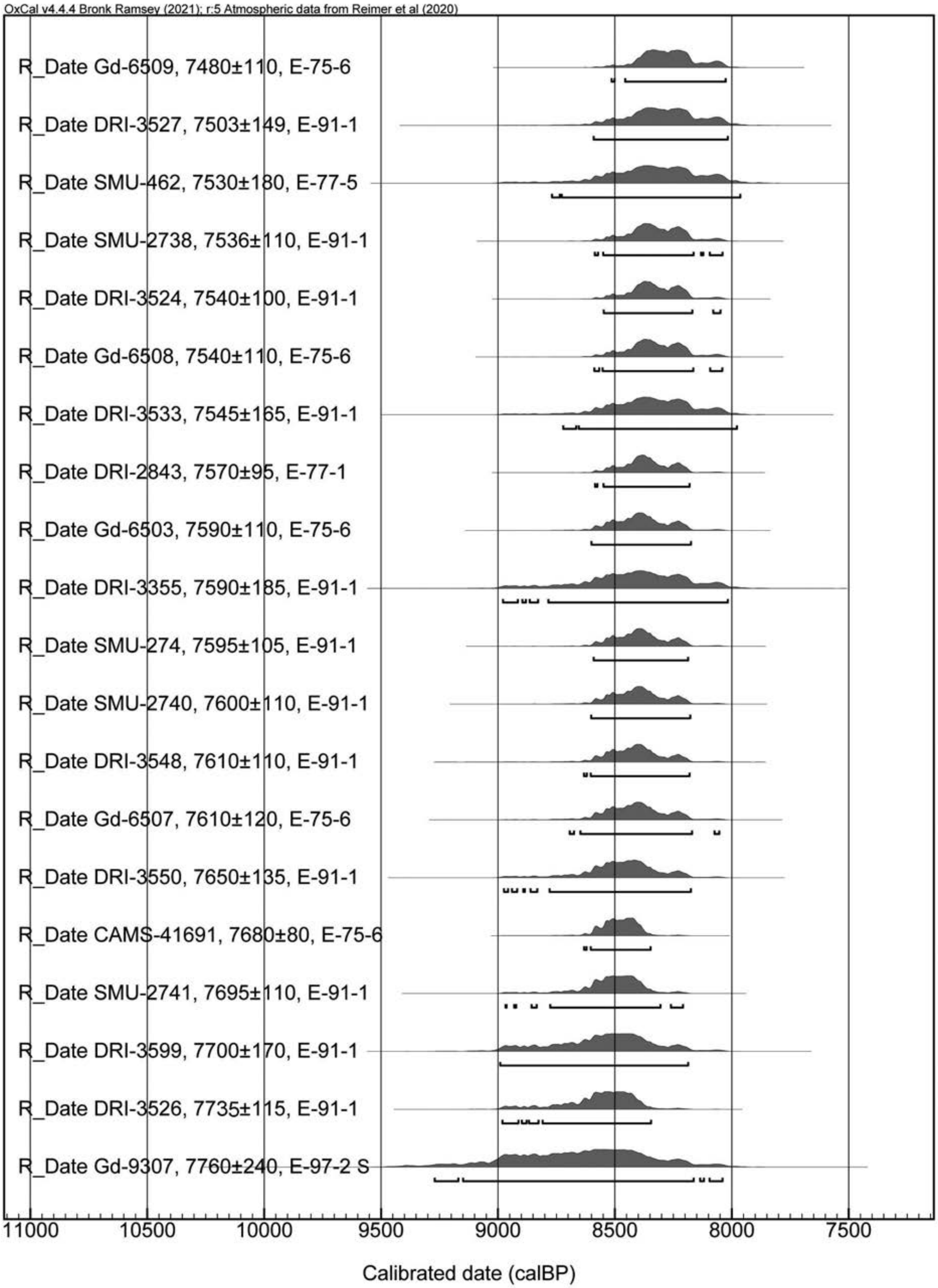


Figure 12.14. *Al Jerar* unit sites (2). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

Settlements

Except for a radical change in floral communities (cf. Chapter 14, this volume), there are striking new developments in the camp organization, planning, and installations. These are seen in the common and rapid appearance of bell-shaped storage pits, often with botanical macroremains of edible seeds and fruits, and semi-organized settlements with houses or huts. There are also numerous, deep and wide tube-shaped wells, as well as oval walk-in wells which have never been seen before. These unusually large, unique in the Nubia Shab Pediplain settlements occur along the eastern and western shores of Nabta Playa. On the eastern shore, it is the *El Nabta/Al Jerar* Site E-75-6 (Fig. 12.15), while a large portion of the western shore occupy the *Al Jerar* Sites E-75-7, E-91-1, and E-98-1. These megasites are part of an unbroken stretch of settlements that continue southward, under the dumped silt of the 8.2 event, for a distance of about one kilometer – from Site E-91-1 under Site E-75-8 through Site E-75-7, and until, at least, the Western Group of Megaliths. Here the belt occupied by various features, huts, and pits, is about 50 to 75 m wide. However, the features are not so compact as on the eastern shore (Wendorf (Asambler) 2001; Wendorf *et al.* 2001).

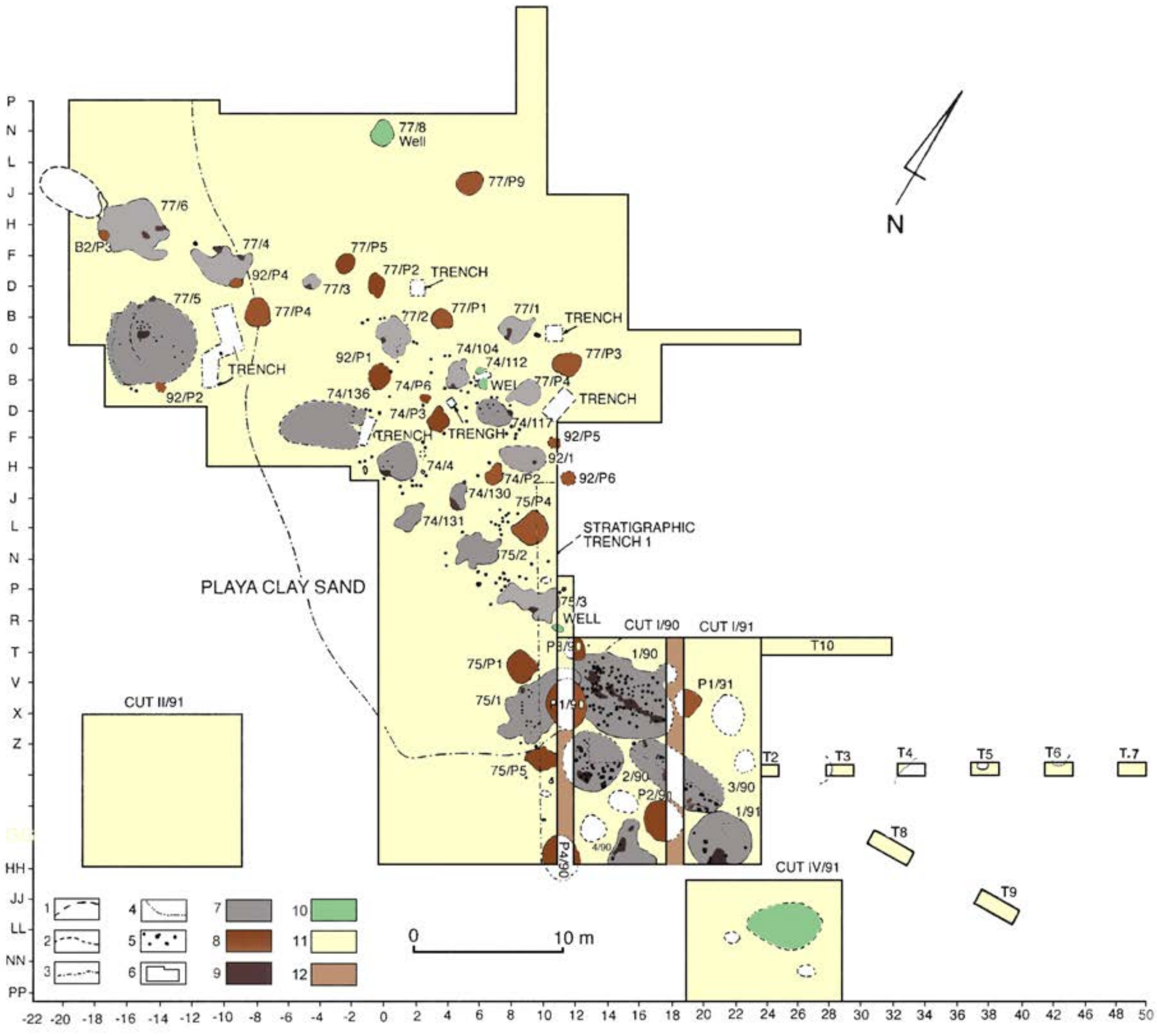


Figure 12.15. Nabta Playa, Site E75-6. Map of features. Key: 1 – boundary of 8.2 ka playa silt and shore sand, 2 – outlines of unexcavated features, 3 – additionally excavated sections, 4 – exposed silt in balks, 5 – post- and potholes, 6 – cuts and trenches, 7 – huts, 8 – bell-shaped pits, 9 – hearths / burned area, 10 – wells, 11 – cuts with removed silt, 12 - exposed silt in balks. Based on map drawn by F. Wendorf, R. Schild and H. Królik (Królik and Schild 2001). Drawn by M. Puszkarski.

On the east shore, at Site E-75-6, the exposed, continuous, double belt of densely packed mass of oval and round basin houses and semi-parallel spaced various storage pits extends in an arched belt over 80 m long and about 40 m wide (limits of the site unexposed), probably following the shoreline of the time (Królik and Schild 2001: fig. 7.3; Wendorf and Schild 1980: fig. 3.60). The deflation heavily truncated the western part of the belt and, therefore, severely curtailed the outlines of shallow features (basin huts), while the storage pits preserved most of their original outlines. In total, there are about 22 huts exposed, of which only three were intersecting. The best preserved were the huts in the eastern section of the exposed settlement.

On the west shore, the exposed cuts at Sites E-98-1 and E-91-1 revealed 24 huts of which at least four were overlapping (Wendorf (Asambler) 2001). Two small, stratified *Al Jerar* camps, on the other hand, are located on the northern shores of the El Nabta/Al Jerar Lake at Site E-92-7 (South) (Królik and Fiedorczuk 2001: fig. 9.1). The lower horizon of the site yielded traces of a roundish basin hut, 2 m in diameter and about 40 cm in depth. The cultural horizon produced a very simple chipped stone assemblage and one pottery sherd (Królik and Fiedorczuk 2001: fig. 9.16a). The upper camp contained a concentration of a few dozen hearth basins, often intersecting, and a large oxidized burned area as well as a chipped stone inventory of about 1000 pieces and some pottery sherds.

Several outlines of deep wells have been recorded in a low deflational window in the 8.2 event silt and overlaying sandy late Holocene alluvia. Two of these were excavated in the 1992 field season (Królik and Fiedorczuk 2001: fig. 9.5).

The neighbouring *Ru'at El Baqar* unit Site E-94-2 also yields some traces of *El Nabta/Al Jerar* occupations (Abu Bakr Mohamed 2001: fig. 12.8a) as well as at least three wells in a deflational window west of the site. The age of these wells has not been determined (Abu Bakr Mohamed 2001: 417).

Also, the relatively inadequately surveyed, and covered by a modern dune, southern shore of the Playa was witness to the presence of *El Nabta/Al Jerar* occupations. First of all, there is the storage pit underneath the 8.2 event reddish silt at the "Elephant Site" (Gautier *et al.* 1994), which, because of its stratigraphic position and size points to the *El Nabta/Al Jerar* association.

Outside the Nabta Playa Basin, large *El Nabta/Al Jerar* camps occur at most of the playas in the area. One (Site E-77-1), is on the playa at the southern foot of Gebel Nabta (Wendorf and Schild 2001d). Another large one with pits and wells (Site E-05-1) is at Berget El Shab Playa, some 20 km south of Nabta (Bobrowski *et al.* 2021). A few sites occur at El Adam Playa: Sites E-80-1, Areas A, C, and D and E-80-3 (Close 1984b; 1984c); E-80-2 (Wendorf and Schild 1984a), of which Areas C and D preserved walk-in wells. Many sites have been recorded at the foot of Kiseiba Scarp in El Ghorab Playa. Of these, Site E-79-4, Upper Layer, has shown nearly 40 storage pits (Kobusiewicz 1984: 136). All features were spread in an arc, probably following the shoreline. El Balaad Playa (Site E-79-5), has yielded rich traces of *El Nabta/Al Jerar* presence, however, lacking the company of stemmed points (Connor 1984c). *El Nabta/Al Jerar* features are also seen in a mixed Site E-79-1 (Więckowska 1984) and E-79-2 (Schild and Wendorf 1984) in the Kiseiba Trench Playa. Likewise, numerous traces of *Al Jerar* settlements are at Gebel Ramlah Playa, including a few burials at Site E-01-1 (Kobusiewicz *et al.* 2010; Schild and Wendorf 2010b).

In Atmur El Kibeish Peneplain, in the Bir Safsaf Area and above the Radar Paleo-Channel of Wadi Arid, at Dagdag Safsaf a survey of the radar detected channels revealed several small camps of *El Nabta/Al Jerar* complex. The campsites (E-85-1, E-85-3, E-85-4, and E-85-5) occurred on the surface of a deflated shallow and small playa basin (Wendorf *et al.* 1987b: 58).

Beyond the general Nabta Playa Area, very numerous traces of the *El Nabta/El Jerar* unexplored settlements have been spotted along northern shores of the playas at the foot of the Paleocene Sin El Kaddab Scarp, in front of Gebal El Beid. Elements of the *El Nabta/Al Jerar* are also seen in the assemblages classified by Mary McDonald (1991: 96) within the Masara A and C Complex in the Dakhla Area.

Camp Structure and Dwellings

Most of the large settlements located at big playas seem to have been inhabited during the dry season of the year. The storage pits along the eastern shores of Nabta Playa often contain lacustrine deposits, e.g., silt laminae in the infill – as do the infills of the basins of huts (Królik and Schild 2001: 122-125; Schild and Wendorf 2001a: 16-17). The western shore pits and dwellings located on a gentle slope towards the lake very often contain mud balls and freshwater snail shells (Królik 2001: 187-189; Schild and Wendorf 2001a: 29). It is evident that these encampments were within the reach of the maximal summer stands of the lake.

At this moment, there are no hard clues as to the full outward spread of the organized and planned character of the settlements that were erected over nearly one millennium, nor have their real dimensions and scatter patterns been firmly established. In the case of the western shores, they seem to be grouped in three or more clusters (e.g., Wendorf *et al.* 2001: 150; Królik 2001: 187).

The pattern differs on the opposite shore. There, the shore slopes are flat and extend for a substantial distance. The outlines of huts, although truncated by deflation, spread at least for about 80 meters in two parallel arches accompanied by three or more rows of storage pits, the best seen in earlier stages of excavations (Wendorf and Schild 1980: fig. 3.60). Both the pits and the dwellings show traces of reoccupations by intersecting outlines of features and hearths as deposits of upturned matates.

Two types of huts are evident: a rounded one and an elongated egg-shaped one (Fig. 12.16, 12.17). The latter may contain numerous potholes and hearths on the axis or slightly off the centre, often with the potholes in the hearths. Frequent, dense rows of small stick-holes have been found around the perimeters of the huts, suggesting the construction of walls and roofs based and sticks. The calibrated ages of the two variants frequently overlap within two σ suggesting that both forms of huts may date from the same taxonomic unit, as is the case at the *Al Jerar* camps on the western shore. A rare type of round or oval hut with a corridor entrance (Fig. 12.18) is also evident in both major groups of huts at Site E-91-1, Area A (Wendorf *et al.* 2001: fig. 8.2), and the westernmost hut on the eastern shore cluster (Wendorf and Schild 1980: fig. 3.60).

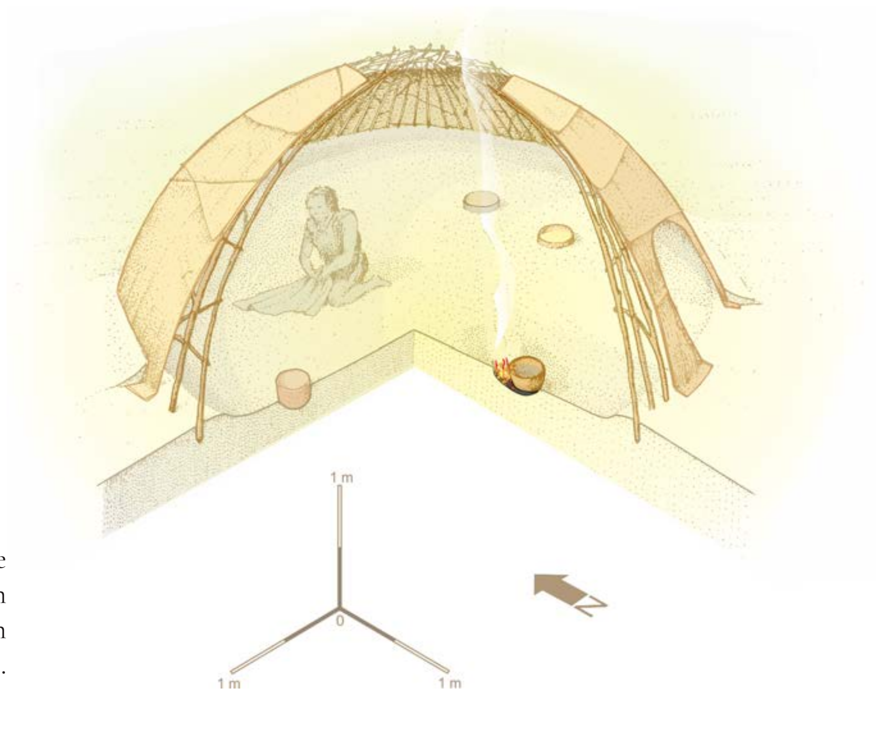


Figure 12.16. Nabta Playa, Site E-75-6. Round Hut. Based on Królik and Schild (2001). Drawn by M. Puszkarski.

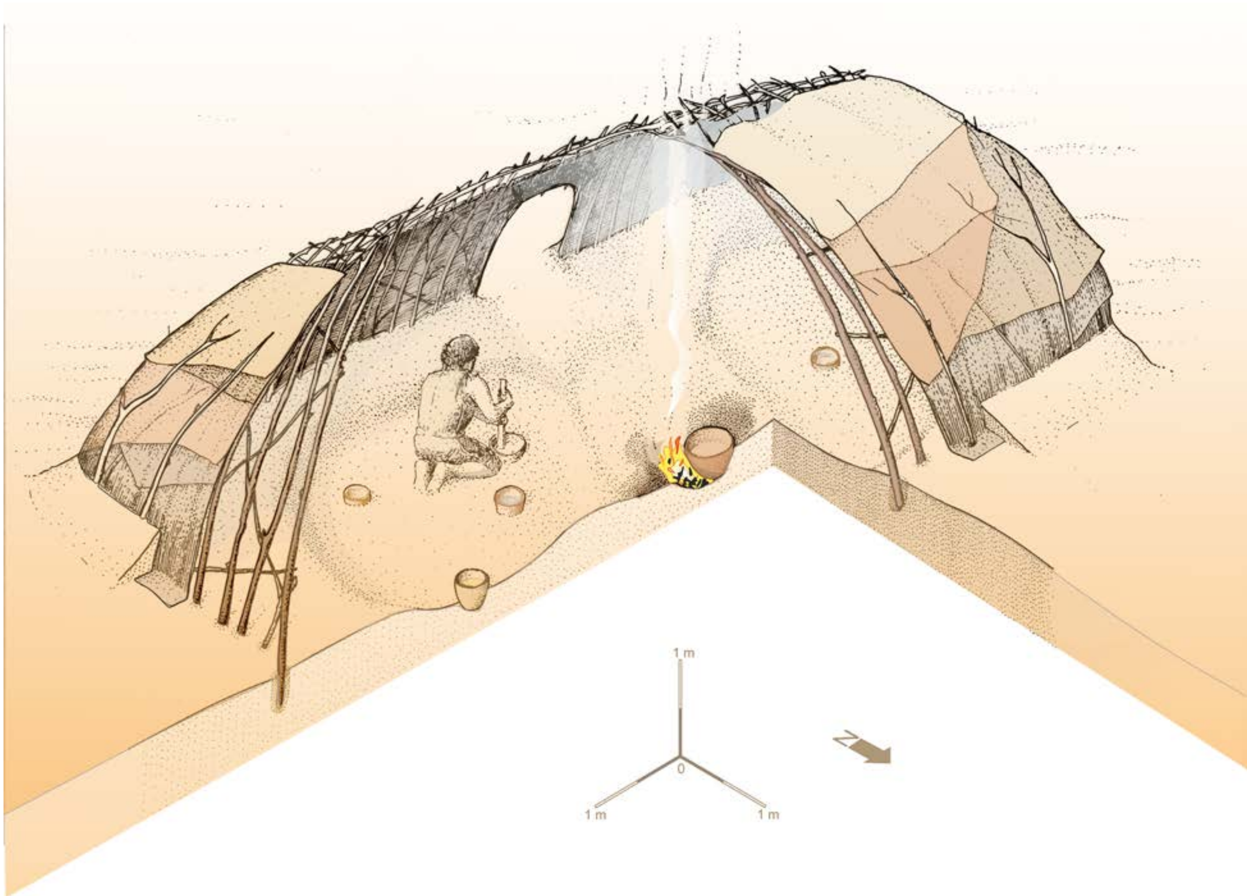


Figure 12.17. Nabta Playa. Site E-75-6. Oval Hut. Based on Królik and Schild (2001). Drawn by M. Puszkarski.

Most of the ovate huts, particularly on the west shore, were truncated by lake wave erosion and, therefore are reduced in size. The longest of these, and the best preserved, measured nearly 7.5 m in length and up to 5 m in width (Feature 1/90, at Site E-75-6). A row of at least six hearths runs along the east-west axis of the floor of the hut, all placed in a shallow trough dug in the sand. Many potholes surrounded the fireplaces. The other structures of similar shape are smaller and may measure about 5 x 3 m or even less.

Along the western shore, the most substantial roundish huts with a corridor entrance may measure around 4 m in diameter while the smaller ones without corridors measure about 3 m in diameter (e.g., Wendorf *et al.* 2001: 150). The location of the hearths may differ from hut to hut. However, it is very often off the centre.

It is hypothesized that the large, ovate huts may have accommodated an extended family, while the round dwellings served nuclear families. This structuring may mirror different forms of sacrifice markers observed among Gebel El Muqaddas installations.

The sites near the centres of the playas almost certainly were occupied during the harvest and dry seasons. The numerous storage pits suggest that the group remained in place after the harvest that probably took place in October and November. In the rainy season, the groups most probably dispersed, visiting higher plains and plateaus beyond the Sin El Kaddab Scarp, e.g., in the Dakhla Area where the new grasses benefited from the rains, attracting game and offering pastures for the cattle.

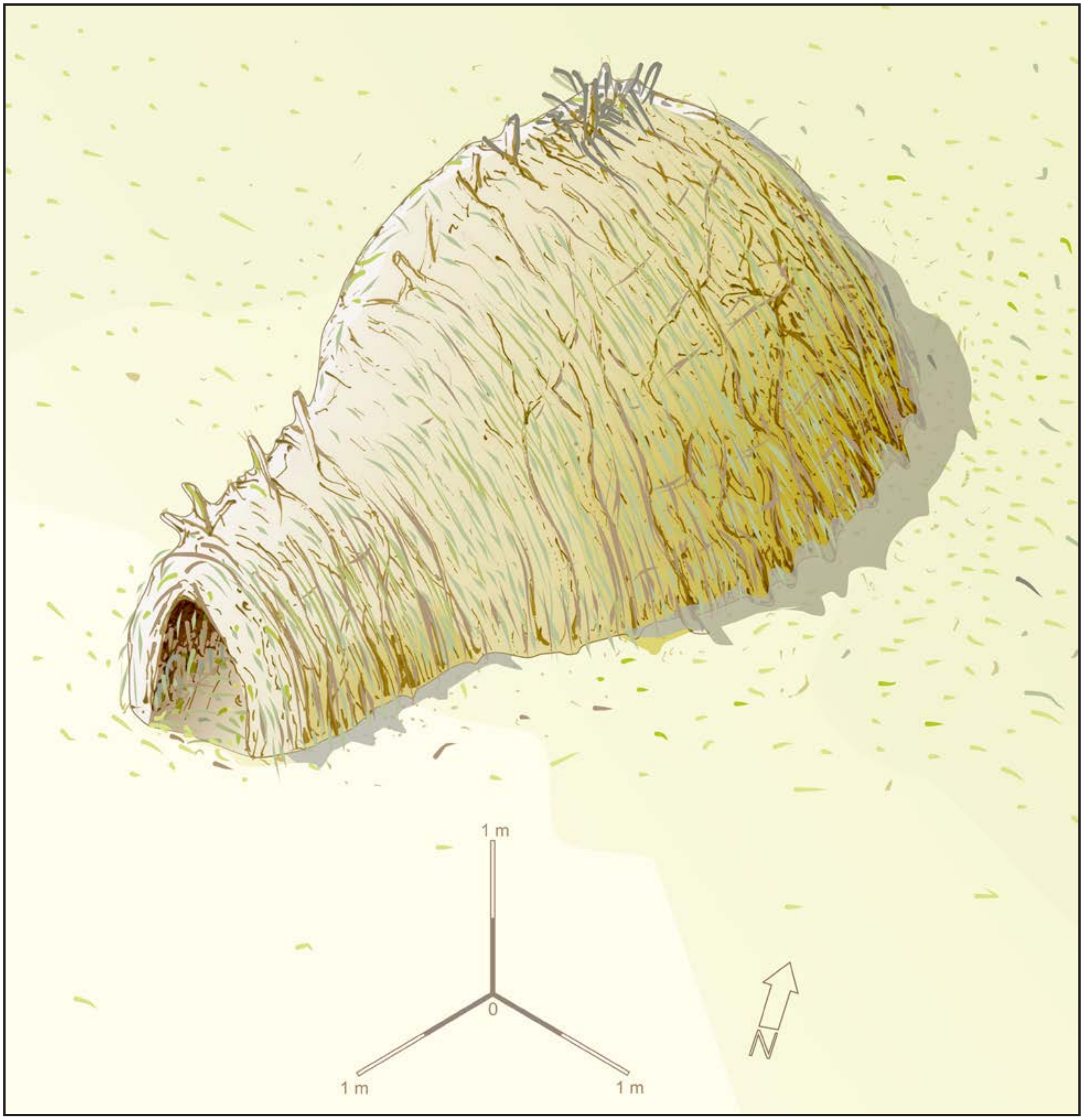


Figure 12.18. Nabta Playa, Site E-75-6. Oval Hut with corridor entrance. Drawn by M. Puszkarski.

The ecological conditions during the local climatic maximum allowed natural propagation of sorghum and millet or helped their spread by cultivation. Either way, harvest of the grasses and protecting them from birds required the cooperation of several hearth families forming a multi-unit opportunistic camp or hamlet around common resources like grasses, water, and the storage of gathered foodstuff – a hamlet level group or a local group like Johnson and Earle's Shoshone (1987: 19, 37) or Group 2 (Most Aggregated) of Binford (2001: 340). During the summer rainy season, the group would disseminate into family unit camps beyond playas (compare also Wendorf and Schild 2002; 2006).

Lithic Assemblages

The preferred raw lithic material was Eocene flint, however, in the Kiseiba Area also the locally available chert was used. Quartz was widely chosen, chiefly for the production of flakes, and seldom to produce retouched tools. The lithic technology is centred around a variety of cores of which prominent are single and opposed platform cores for bladelets, blades, and flakes. Change orientation cores are standard, and ninety-degree ones are also present.

Retouched tools included numerous burins, particularly in the Nabta unit. Retouched and notched blades were popular, as were perforators, including double backed ones. Geometrics are rare and comprise small scalene triangles and trapezoids. Backed pieces are present but sporadic.

Various tanged points are ubiquitous and remarkably variable. The group is very eclectic. Among these, at least five distinct categories are present: Ounan points (Tixier 1963: 149); Harif points (Marks 1973: 97; Phillips 1977: 202); Jordan-like tanged points (Kozłowski and Aurenche 2005: 112, 114); Abu Madi willow leaf points with inverse invasive basal retouch, (Bar-Yosef 1984: 117; Gopher 1994: 31); and Mushabi, or Shunera points with rounded base, and inverse invasive retouch (Phillips 1977: 209; Kozłowski and Aurenche 2005: 107).

The most common at Nabta sites seem to be Harif points, as, e.g., at Site E-80-1 in El Adam Playa (Close 1984b: 277) and Site E-85-1 at Dagdag Safsaf (Wendorf *et al.* 1987b: 59). The Harif points are characterized by "a stemmed to triangular shaped base" (Marks 1973: 97), and inverse, obverse, alternating and inverse invasive retouch of the base. The stem or tang, if well defined, is short and sides backed or truncated. In some instances, microburins were used as blanks for points (Phillips 1977: 202).

Ounan points defined first by Breuil (1930), and included in Tixier's list of Epipaleolithic tool types are exceedingly rare in the Maghreb (Tixier 1963: 149; 1967: 799; Wendorf and Schild 1980: fig. 3.45) and often atypical having a straight tang instead of a curved one, similar to a perforator's sting (point).

Except for Ounan points, all of the listed tanged projectiles are also characteristic for the Near Eastern and Sinai stone age complexes placed around the tenth millennium BC (Aurenche and Kozłowski 1999; Kozłowski and Aurenche 2005). These ages are quite earlier than the beginning of *El Nabta/Al Jerar* complex, dated to the mid-eighth millennium and lower seven millennium BC. The grinding set of tools is copious. It often includes large and very large basin-shaped lower milling stones (matates) made mostly of granite, but also of basalt or gneiss, as well as handstones (manos) of various sizes and stage of use. In several cases, both the matching pair of lower milling stone and a handstone have been found stored in a storage pit.

Bone tools are represented by rare, narrow, elongated bone points that are oval, round, and trapezoid in cross section, probably serving as projectiles (Wendorf and Schild 1980: fig. 3.46: i-l).

Ostrich eggshell bids are very common. Contrary to most of the preceding taxonomic units, except for the *El Adam* unit Nilotic site of Dibeira West 51 (Schild *et al.* 1968: fig. 34: 37-39), the blanks were first rounded and then drilled. Ostrich eggshell bottles were decorated with geometric engraving around the mouth.

Pottery assemblages

Pottery is a more common find in the *El Nabta* unit camps, although, it is not very abundant. All the vessels are simple bowls of various sizes and decorated over the entire body. The major types are: *dotted wavy line*, *spaced rocker* stamp, *Halina type*, *Wolftooth variant*, *Wolftooth*, *Stem and Leaf*, and *SM* type (Gatto 2002a: 68; Nelson 2001c: 535-538; 2002a: 10), all with various rim tops and band decoration as well as quite variable techniques and design (Gatto 2002a:71-72).

All the *Al Jerar* sites, except for small camps like those in Dagdag Safsaf, see a radical increase in the number of pottery sherds frequency; for instance, the excavation at Site E-91-1 during the 1991, 1997-1999 seasons yielded over 11,000 sherds (Nelson 2002b: 25). The growth in a number of pottery vessels does not accompany the growth of the quantity of styles and category of vessels. *Simple Rocker-Stamp* (Gatto 2002a: 70) and *Fishnet* (Nelson 2002a: 10) seem to fulfill the entire range of types of decoration. The pottery is produced from local playa clays and fired in camps (Zedeño 2002). The increased production of pottery vessels is usually associated with increased sedentism of societies.

There are, however, discernible overall differences separating the *El Nabta/Al Jerar* pottery assemblages. Three are of importance: the first concerns the placement of decoration on the vessel's body, which is zonal in the *El Nabta* unit and covering the entire body in the *Al Jerar* pottery assemblages. Also, according to Gatto (2002a: 78), the Al Jerar pottery shows a closer resemblance to Sudanese pottery than the *El Nabta* ceramics. However, a small number of Dotted Wavy Line potsherds of the *El Nabta* phase campsites in the Nabta/Kiseiba Area seems closely relating to the Wavy Line ceramics of Northern Sudan (Jesse 2002).

Subsistence

Our knowledge of the *El Nabta/Al Jerar* subsistence is founded mainly on two sources. The first is the information gathered at Site E-75-6 at Nabta Playa, and a few other sites in this area, where the systematic dry sieving of the cultural, dirt matrix yielded over 20,000 seeds, rhizomes, tubers, and fruit stones. These belonged to 127 taxa, among which 17 have been ascertained to the species level, and 21 to genus (Wasylikowa 2001; Wasylikowa *et al.* 2001a; 2001 b; 2001c; Wendorf and Schild 2001a; Butler 2001: 601; cf. Chapter 14, this volume). The other source of information is provided by archaeozoological analyses of fauna recovered from various *El Nabta/Al Jerar* sites completed by Achilles Gautier (2001).

The seeds of various grasses are present in more than 90% of the recovered samples. Sorghum and two species of millets: *Panicum turgidum* and *Echinochloa colona* were principal. Furthermore, the sorghum was dominant, suggesting a separate preparation from the supplementary grasses. This finding suggests to Wasylikowa that sorghum could have been cultivated using the *décrue* method of sowing. The importance of sorghum and millets is highlighted by the dozens of classic storage pits, often reaching over 2 m in diameter and 1.30 m in depth.

Conversely, the recent analyses of pottery sherds collected by the Southern Methodist University Butana Project at Site KG23 at Kashm El Girba, near Kassala in eastern Sudan during the 1980s (Winchel *et al.* 2017) revealed diagnostic chaff in which characteristics of both the domesticated and wild sorghum types were identified. The site belongs to the Butana Group and dates to around 3500 to 3000 BC. Nabta Playa sorghum has no morphological attributes suggesting domestication. However, some archaeobotanists argue that in contrast to the cereals mostly characterized by self-pollination, a lot of cross-pollination happens in the open panicle group represented, e.g., by wild sorghum. Such circumstances may prevent the isolation and thus the propagation of genetic changes (Dogget 1988: 84; Zohary 1996: 145; Rowley-Convy; Wendorf and Schild 2001a: 660). Recently, however, Winchel *et al.* (2018) following Allaby, Brown, and Fuller (2010), and Fuller (2007) argue that "there is no reason to regard cross-pollinating species as much harder or slower to domesticate than selfing species". The above opinion, however, does not dismiss the proposition that the sorghum in the Nabta Playa Basin was at an early stage of cultivation and that the plants were intentionally planted or sown. In the early rainy season (April or May), Kalahari Bushmen dig holes in the ground, drop in the seeds, and cover them with soil. After the planting, a large number of people is needed to protect the fields of sorghum, millet, and maize from flocks of birds until the harvest in July and August (Hitchcock and Ebert 1984: 342).

Pre-modification cultivation is recently postulated for a number of pre-pottery Neolithic A sites in the Near East region (e.g., Aranz-Otaegui *et al.* 2016a; 2016b; Kislev 1989; Weiss *et al.* 2006; White and Makarewicz 2012; Willcox 2013; Willcox *et al*. 2006; Tonno and Willcox 2006; Weiss *et al.* 2006). The decades-old remark by Eric Higgs that the absence of morphological change "cannot be used to demonstrate that a plant was not domesticated, that is, that it was not under cultivation" stands still valid (Higgs 1976: 33). Indeed, it takes but some proxy data to decide about a plant role in the process.

Four major taxonomic groups occur in various huts and pits of Site E-75-6. The first group includes grasses, Leguminosae, *Ziziphus, and Schouwia,* which was dominant and probably used for fuel. In the second groups, the grasses were more frequent, and a lower number of *Ziziphus* has been noted. A sedge was also present. Both groups are existent in pits and huts of *El Nabta/Al Jerar* units.

Two remaining groups of huts and pits taxonomically belong to the *El Nabta* entity. One contains mostly the millet and a sedge, while the last one predominantly yielded sorghum, an observation that suggests that the millets and sorghum were gathered independently and might have been cultivated. The seeds would be planted or sown in the early rainy season, from June to August and collected in the dry season sometime in December or January.

The hunted game spectrum (Gautier 2001) is dominated by the remains of Dorcas gazelle, making up more than 80% of the catch. Hares, on the other hand, account for a meager 10%. The remaining species consist of rare *Bos*, present at Nabta (Sites E-75-6 and E-91-1), *El Ghorab* (Site E-79-4), and *El Adam* (Site E-80-1), porcupines, hedgehogs, jackal, a murid, a ground squirrel, and a few birds.

All the recovered data suggest that plant food was central to the economy of the *El Nabta/Al Jerar* small societies. Its importance is corroborated by the extensive use of storage pits (Wendorf and Schild 2002) often still containing the seeds. They enjoyed success on a scale unparalleled by any other groups in the Eastern Sahara seen in the increase of population density and semi-sedentary way of life. Hunting, based on Dorcas gazelle was but subsidiary, and cattle keeping's contribution to the diet is difficult to judge because of the scarcity of remains and the possibility that the animals were used mainly for milk and blood.

People

Information concerning the human population linked with the *El Nabta/Al Jerar* complex is exceedingly scarce, as are all those preceding the Late Neolithic of the Western Desert. There are no cemeteries of this age known anywhere in the Western Desert. The only excavated inhumation of this period occurred at Site E-91-1, Area B in Nabta Playa. The grave was located 2 m away from a cluster of three huts and several pits of the *Al Jerar* settlement (Wendorf *at al.* 2001: fig. 8.2).

The skeleton of a young female, probably less than 25-30 years old, was resting in a flexed position on the right side, face to the northeast. The bones showed traces of scorching suggestive of a partially burned inhumation (Irish 2001: 522). The specific biological assignment of the skeleton based on dental and cranial traits "may be indicative between north and Sub-Saharan Africans"; however, a proper biological similarity needs a much larger sample size (Irish 2001: 528).

Lack of larger samples of human remains dating from Early and Middle Neolithic of the Western Desert prevents any firm conclusions regarding the biological relationship of the *El Nabta/Al Jerar* populations (Irish 2010: 224).

Gebel El Muqaddas, Site E-06-4

In the North-Western Nabta Playa Basin is a large, flat-topped roundish mountain, of about one km in diameter overlooking the entire Playa Basin (cf. Chapter 3, this volume). Its top and the southern footslope cirque are dotted by numerous small tumuli, minor sandstone plate pavements, and stone cairns. Detailed mapping revealed about 300 such structures. Several of these installations are deflated and scattered; particularly on the south side, however, most are in relatively good condition with stable superstructures. Agnieszka Czekaj-Zastawny and Przemysław Bobrowski excavated several of these structures in the 2007 and 2008 field seasons. The pavement covered small offering pits up to 1.5 m in depth. In some occasions, the pits contained constructions made of thin sandstone plates resembling a house of cards.

Two of these structures yielded the teeth of *Gazella Dorcas,* and another one a few long bones of a gazelle or antelope. In Tumulus 2 and one of the smaller structures the pit also contained geometric microliths and backed bladelets. Two pits under smaller structures yielded two radiocarbon dates of about 7050-6750 calBC (at 2σ) indicating the *El Nabta/Al Jerar* confines. Under the superstructure of the small tumulus (Tumulus 2) a two-meter deep pit covered by sandstone slabs contained charcoal of Tamarix, a Nile oyster, as well as a backed bladelet, and a triangle.

The architecture of the installation seems to have been designed in such a way as to facilitate easy access to the repository, implying that the structure was meant to be used on several occasions. Apparent differences in sizes of superstructures as well as the pits may reflect various family groupings, from nuclear to extended families.

The vast space on top of the "Sacred Mountain" overlooking the entire Nabta Playa Basin and solely dedicated to offerings is a phenomenon never observed in a prehistoric context. Individualized worship tied to the nuclear and extended families, on the other hand, may suggest an animalistic system of beliefs of the *El Nabta/Al Jerar* societies.

5. Middle Neolithic (*Ru'at El Ghanam*), the mixed pastoralist

Key to the post 8.2 ka event chronology of archaeological unit is with nearly 4 m deep strata of the Site E-75-8 in the West Bank of Nabta Playa (Fig. 12.19). The earliest Middle Neolithic of the *Ru'at El Ghanam* occupations in the Nubia Shab Peneplain begin after about 8136 ka (b2K) (Thomas *et al.* 2007: 75), or 8140 ka (Rasmussen *et al.* 2014: 22) when the 8.2 ka event comes to an end (cf. Table 3.3 in Chapter 3, this volume). Stratigraphically, the oldest is the date of 7220 ± 75 (SMU-2745) years BP (8190-7870 calBP and 6240-5920 calBC at 2 σ) from the Middle Neolithic cultural bed in Cut I/90, Spit 9, at Site E-75-8 in Nabta Playa (Close 2001b: 361). It marks the beginning of the settlement in the area. Of almost identical age is a radiocarbon assay from the Middle Neolithic Site E-79-6 in Gebal El Feel Playa in the Kiseiba Area of 7170 ± 80 (SMU-749) BP (8180-7840 calBP and 6230-5890 calBC at 2σ).

The stratigraphically latest dates of the Middle Neolithic *Ru'at El Ghanam* unit have been obtained at Site E-75-8 in Cut I/92, Spit 2, and in Connecting Trench, Bed 3. The first assay gave an age of 6430 ± 90 (SMU-2504) years BP (Close 2001b: 360) or at 2σ 7510-7160 calBP and 5560-5210 calBC. The second yielded a date of 6500 ± 80 (SMU-435) BP (Wendorf and Schild 1980: fig. 3.19), or 7570-7260 calBP and 5620-5310 calBC (at 2σ). The dates suggest a final episode of the Middle Neolithic taxonomic unit occupation and the beginning of the Post-Middle Neolithic Arid Phase (Fig. 12.20).

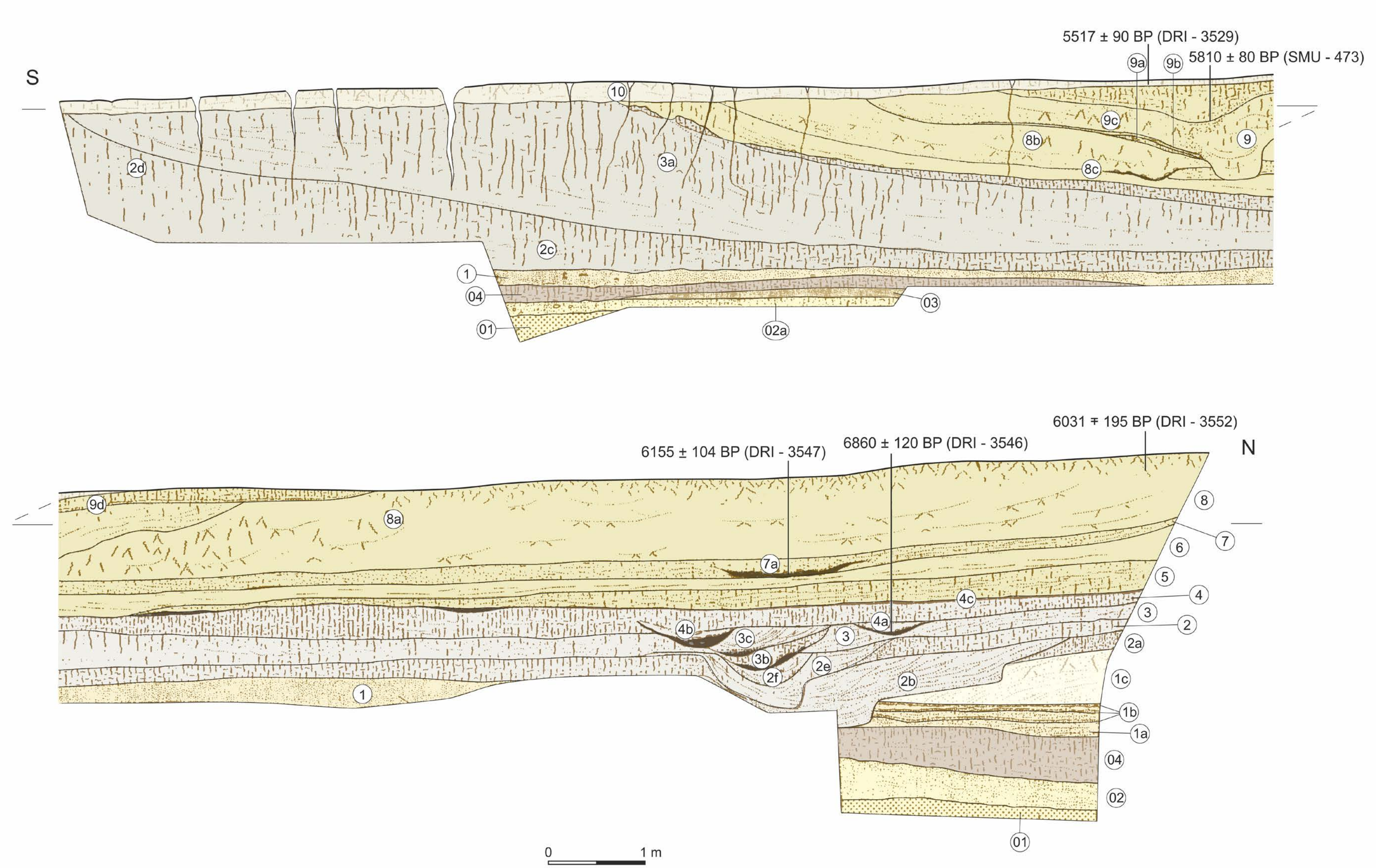


Figure 12.19. Nabta Playa, Site E-75-8. East Wall of South Trench. Simplified Key: 01 – Nubia Sandstone, 02 – Old Dune/weathered sandstone, 04 – 8.2 ka silt; 1 – Younger Dune, 1a – muddy sand wash, 1b – aeolian sand interbedded with silt lamiae, 1c – foreset beds of Yunger Dune; Beds 2-4 – the Middle Neolithic horizon, Beds 5-9 – the Late Neolithic horizon, Bed 10 – the Final Neolithic horizon. Cross-section by R. Schild, drawn by M. Puszkarski. Based on Schild and Wendorf (2001a).

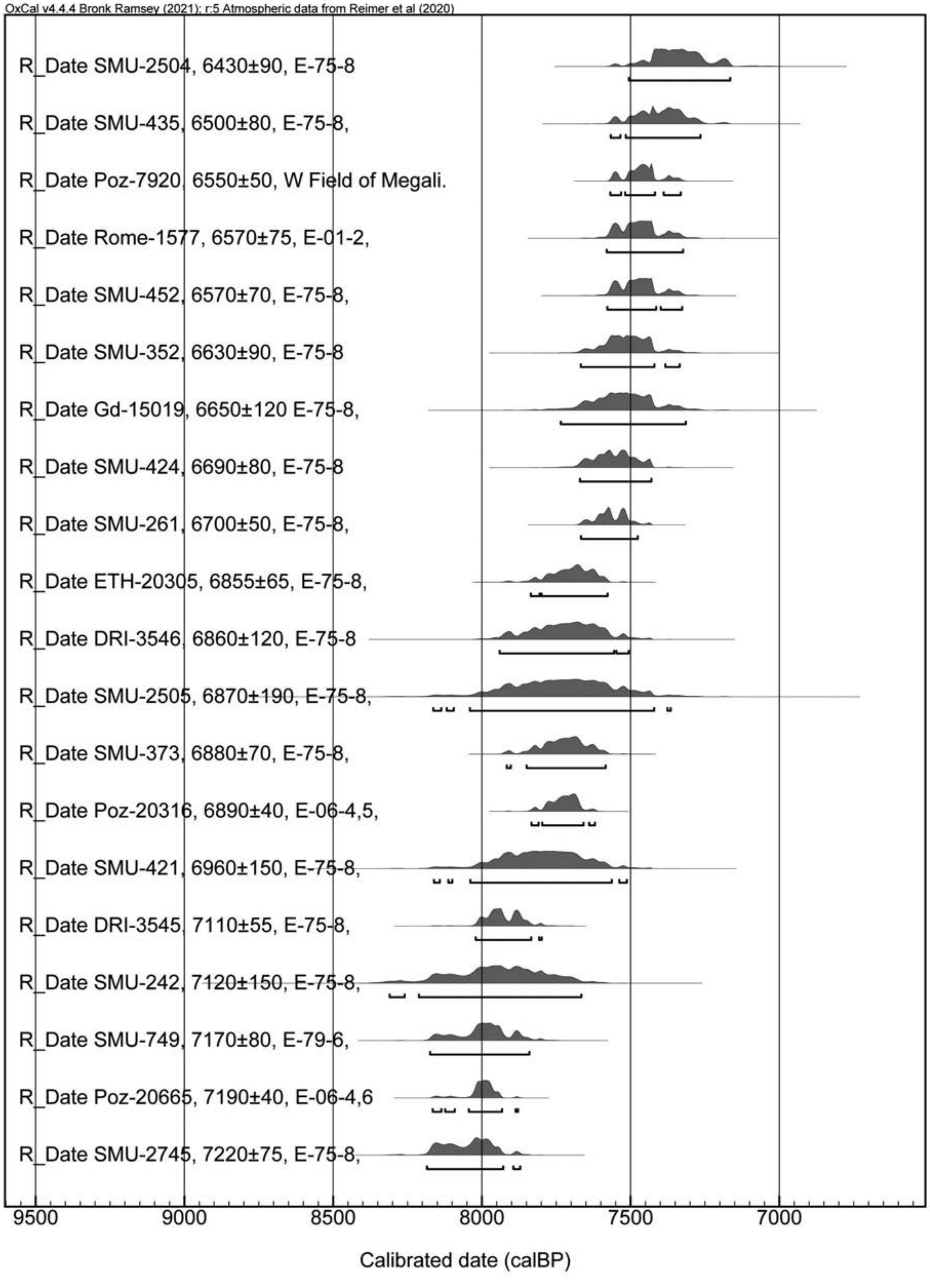


Figure 12.20. *Ru'at el Ghanam* unit (the Middle Neolithic) sites. Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

Settlements

The Middle Neolithic camps make a somewhat rare appearance in the sands of the Nubia Shab Peneplain. The beds of this horizon (Beds 2-4), at the Site E-75-8, perhaps make the largest settlement of the *Ru'at El Ghanam* variant in the Western Desert. It occupies nearly the entire mini plateau of the northern part of the West Bank rise of Nabta Playa. Owing to the pre-Quaternary erosion of the quartzitic sandstone beds a massive depression had been created underneath the Quaternary strata. In the Quaternary, the depression came to be a perched groundwater basin gathering seasonal rainwater. Numerous wells sunk into the basin (Schild and Wendorf 2001a: figs 2.21, 2.24) witness to the extensive use of this source of water during the dry seasons.

The original Middle Neolithic campsites in the northern part of the mini plateau of the West Bank of Nabta Playa have been entirely blown away by the ancient as well as recent deflation, which created a considerable furrow in its northern part extending from Site E-91-1 to the mouth of the "Wadi of the Sacrifices". Only the wind blasted the diagnostic points (e.g., Alexander 2001: fig. 8.48a; 2001b; Taylor 2001: fig. 8.50a), dotting here and there a truncated surface of the pre 8.2 ka event sandy playa beds, offer witness to the perished camps.

The camps may have also extended on the surface of the southern mini plateau, the seat of the Western Field of Stelae. Here too, later Quaternary beds have been blown away down to the surface of the 8.2 ka silt. A single bovine molar found washed into a pit formed under a fallen stela block about 4 thousand years ago yielded a radiocarbon estimate 6550± 50 years BP (Poz-7920) or about 7570-7330 calBP and 5620-5380 calBC (at 2σ), suggesting another Middle Neolithic link or an age on the brink of a next arid phase.

Site E-79-6 in Gebel El Feel Playa is perhaps the second largest settlement of the unit in the area. In its close vicinity is the small Middle Neolithic Site E-79-7 on a dune that yielded a minor collection of artifacts and a date matching the taxonomic assessment of the occurrence (Wendorf and Close 1984). Also, at Site E-01-2, Camp, of Gebel Ramlah Playa, a buried wadi gravelly bed (Bed 7) contained displaced *Ru'at El Ghanam* materials most probably postdating the 8.2 ka event (Schild and Wendorf 2010b: 171). At the same site, Hearth 10 gave a radiocarbon age indicating the possibility of these settlers' presence in the area (Bobrowski *et al*. 2007).

Scatter patterns of artifacts of the Middle Neolithic campsites as exemplified by maps of the pits of the 1990 excavations (Close 2001b) show the compact unpatterned arrangement of finds throughout the beds. The scatter pattern, together with the observations at Site E-79-6 at Gebel El Feel Playa (Wendorf and Close 1984), would suggest a palimpsest-like scenery of repetitive use of the loci. The pattern, as well as the geomorphic setting at Site E-79-6 close to the centre of the playa, and the presence of abundant wells in the E-75-8 complex of camps, strongly suggests winter base camps as the settlement system practiced at both of the complexes.

Numerous superimposed stone-lined and saucer-like hearths accompany the Middle Neolithic beds of Site E-75-8. The hearths, some up to 3 m in diameter, contain fire-cracked rocks and could be used for roasting. Several shallow, wide wells have been recorded in the South trench as well as beyond it in the southeastern section of the site.

At the Gebel El Feel site several ovoid to rectangular areas, some 5 m in diameter, and relatively clear of artifacts, suggested to Fred Wendorf and Angela Close (1984: 190-191) the presence of dwelling structures, particularly that the partially excavated structure contained a more substantial hearth and pieces of burned daub.

Of high importance is the discovery and dating of the "Field of Hearths", a large area of hearths in a central part of Gebel El Muqaddas, of which one gave a radiocarbon date on charcoal of 7190 ± 40 (Poz-20665) BP placing this phenomenon in the *Ru'at El Ghanam* time brackets (Bobrowski *et al.* 2012; 2014; cf. Chapter 3, this volume). The "Field of Hearths" has not, as yet, revealed any traces of offerings – nor artifacts. However, this vast, somewhat flat expanse is widely exposed to the westerly winds and deflation.

A nearly contemporaneous with both of the Middle Neolithic sites is the organized settlement in the Hidden Valley of Farafra Oasis in Northern Egypt (Barich *et al.* 2014). Despite the age, almost all the elements of material culture are different in Farafra. The dwellings have a stone slab foundation and were probably semi-permanently occupied. Stone assemblages are based on flake core technology and *bifacial technocomplex characteristic of the central and northern areas of the Egyptian Western Desert* (Lucarini 2014a: 282).

Lithic Assemblages

Lithic technology, typology, assemblage structures, and the raw material supply system are abruptly different from that of the earlier entities. The raw material economy indicates much more extensive use of various rocks with a preference for locally available resources of stones. Thus, quartz, quartzitic sandstone, ferruginous grit sandstone, Kiseiba chert, chalcedony, petrified wood, and Eocene flint (chert) usually form the range of rocks used. Of these the most popular seem to be flint quartz and Kiseiba chert. Cores are almost always heavily exhausted and reshaped during final reduction stages. There are some differences noted between two significant sites: E-75-8 at Nabta Playa and E-79-6 at Gebal El Feel Playa where quartz, sandstone, and petrified wood are the most popular.

Among flake cores, the single platform ones, followed by change orientation forms, are the most common. Cores for blades are rare, nearly always reshaped during the final stages of use, which thereby gives the impression of stinginess.

Retouched tools are dominated by the background forms: pieces with continuous retouch and notched and denticulated specimens. Endscrapers and perforators are present but not very numerous; burins are exceedingly rare. Backed bladelets are present and are mostly of arched variety. Truncations are very common among these small or short flakes, with basal truncation and sides converging to the distal point being quite distinctive. Of interest are the quite copious microlithic and short lunates. A sort of *fossil directeur* is a small to microlithic, backed triangular point on a flake or bladelet with straight or concave basal truncation vaguely resembling much older and slender *Salabiya points* of the Near East (Kozłowski and Aurenche 2005: 123) and *point de Columnata* (Tixier 1963: 152), of the Maghrebian Neolithic of Capsian Tradition (Vaufrey 1955: 342). This characteristic point of the Nubia Shab Pediplain certainly deserves its proper name of *Gebal El Feel Point*. Basally truncated small flakes and bladelets seem to be, in fact, offshoots of these points.

The Gebal El Feel points are well known from the not too distant Nile Valley in the general area of the Second Cataract. At the Shamarkian site of Dibeira West 53, these points make a considerable chunk of the inventory (Schild *et al*. 1968: fig. 42). The site yielded a significantly older radiocarbon age (7910 ± 120 (SMU-4) years BP than the oldest occurrence of the *Ru'at El Ghanam* units in the Nabta-Kiseiba Area (Wendorf *et al.*1979: 220). A closer look at the lithic inventory of the DIW-53 site reveals the presence of classic Harif points stemmed with the use of the microburin technique (Schild *et al.* 1968: fig. 42, 30, 31), a sign that the assemblage is mixed and contains elements of Nabtan occupation, a conclusion which would comfortably fit the ^{14}C results.

Components of the Middle Neolithic character are also seen in other, mixed late left bank sites of the Wadi Halfa Area in Dibeira West 3 (Schild *et al.* 1968: fig. 45, 5-8), and Dibeira West 6 (Schild *et al.* 1968: fig. 49, 5-14).

A new element in the assemblages of Nabta Playa is the first appearance of bifacial projectile points in the Nubia Shab Pediplain. The two known specimens are made from tabular flint and seem to be faulty, abandoned pieces (Close 2001b: 372). The bifacial projectile point has also been reported from Sit E-79-6 in Gebal El Feel Playa (Wendorf and Close 1984: fig. 10.5), however, it comes from the surface of the deflated site. The appearance of bifacial projectile points have long been thought to be coeval with the introduction of herding (e.g., Shirai 2013: 220; Lucarini 2014a: 282, where more similar opinions are quoted).

Grinding stones frequently occur at both sites. The lower stones, matates, are made of igneous rocks and sandstone, while quartzitic sandstone was mainly used for manos.

Pottery

Deep bowls made by coiling are the only pottery form recognized at the Middle Neolithic settlements. However, Kit Nelson (2002a; 2002b) defines two phases of the pottery making during this cultural variant. In the first and second phases, the interior is smoothed and rubbed while the exteriors are smoothed and rocker stamped in a spaced and random method or, additionally, the stamping is smoothed over. In the second phase, the bowls have straight walls, and the exteriors are roughened (Nelson 2002: 6, 7).

Appearance of Ovicaprids

Excavations at Site E-75-8 yielded for the first time mammal remains attributed to ovicaprids in the Nubia Shab Peneplain. All of them came from Middle to Final Neolithic beds as well as the surface of the complex. Three excavation units have provided the bulk of the osteological material: Connecting Trench, South Trench, Area A adjacent on the east to Southern Trench, and Pit 2/1990.

The ovicaprid bones are missing from Spits 9 and 8 of Pit 2/90. They appear in Spit 6 where they are more common than in Spit 7 (Close 2001b: 383). Spits 7 and 6 are located around the centre of the Middle Neolithic beds. In South Trench, 43% of caprovid bones come from around the middle of the beds (Gautier 1980: table A4.3), although they are also present, in minor number, in the lower section of Bed 2, the lowermost bed of the *Ru'at El Ghanam* presence. A few radiocarbon estimates from around the middle of these beds gave the following ages: 6870 ± 190 (SMU-2505); 6860 ± 120 (DRI-3546), and 6690 ± 80 (SMU-424) years BP, all overlapping within 2 σ. While calibrated, the age would fall within around 7940-7430 calBP (5990-5480 calBC) time brackets, not considering SMU sample 2505. These time brackets should be regarded as minimal ages for the introduction of the ovicaprids to the South-Western Desert of Egypt. One has to remember that a questionable caprid bone from the base of the oldest bed of the Middle Neolithic unit at Site E-75-8 and a few identified ones just above it (Gautier 1980: table A4.3) should closely postdate the 8.2 ka dry/cold event, as does the oldest ovicaprid bone at Sodmein Cave (Vermeersch *et al.* 2015: 496). At Farafra Oasis, in the Hidden Valley Village, the oldest caprid mandible from Layer IIIA dated at 7251 ± 67 (R-2456) years BP (Barich 2014: 206; Belluomini and Manfra 2014: 420; Gautier 2014: 373) is almost precisely of the same time as the start of the post 8.2 ka event deposition at Nabta Playa and Sodmein Cave. It is correlated with the beginning of the wet interphase, and the appearance of the putative, first ovicaprid bone in Bed 2 of South Trench of Site E-75-8. These ages quite well match the estimated result or the introduction of ovicaprids to the Eastern Desert.

In this respect, of interest is the absence of ovicaprids in the early complex settlement of *Ru'at El Ghanam* type at Gebal El Feel Playa (E-79-6) in spite of a relatively large amount (about 80 specimens) of identified bones (Gautier 1984: 50) a fact perhaps indicating a slightly later arrival of ovicaprids to the Nubia Shab Pediplain. Of importance in this case would be the association of both the Hidden Valley and the Sodmein Cave silicious assemblages to a different technocomplex than the *Ru'at El Ghanam* one.

Food Palaeoeconomy

Unfortunately, despite the effort directed to the recovery of plant macroremains from the Middle Neolithic beds of Site E-75-8, only 24 specimens have been recovered. Among the most numerous one can list *Ziziphus*, *Scripus* *maritimus,* and *Schouwia purpurea.* Among charcoal fragments tamarix, three kinds of acacia, and caper have been recognized. The copious grinding equipment present at this huge site indicates the processing of plant foodstuffs.

Of the mammals, Dorcas gazelle, hare, ovicaprids (including a few Barbary sheep, Dama gazelle, and cattle bones) are the most frequent (Gautier 2001). Both the recovered fauna and plant remains indicate mixed pastoralist-forager ways of life during the Middle Neolithic Humid Interphase. The apparent scarcity of storage pits at Site E-75-8 in comparison to the *El Nabta/Al Jerar* campsites suggest that seed and tuber collecting was less intensive than during the local Holocene Maximum.

People

An eroded interment presumably associated with the Middle Neolithic beds occurred on the surface of a deflated area in the northwest section of Site E-75-8. Because of its low position, it is presumed that it might have been related to the *Ru'at El Ghanam* beds of the site. The severely eroded skeleton surrounded by eight large sandstone slabs rested on the left side, facing north, hands to the face (Wendorf and Schild 1980: fig. 3.102). The leg bones were heavily weathered and deflated. The exact stratigraphic position of the inhumation has not been ascertained.

The examination of the mandible by Henneberg *et al.* (1980) indicated correspondence of the traits with modern sub-Saharan populations and clear dissimilarities with those of the so-called Mechtoids of the Prehistoric Maghreb, an opinion shared by Irish (2001: 525).

Complex Societies

At Site E-75-8 a truncation and essential change of texture of deposits from muddy and silty washes of Beds 2-4 to sandy washes and aeolian sand of Beds 5-8 signal a significant environmental turn towards dryer environmental conditions in the Nabta Playa area. There is also an important cultural shift from the *Ru'at El Ghanam* Middle Neolithic to *Ru'at El Baqar*, the Late Neolithic Cattle Herders of The Nubia Shab Pediplain. This happened around 5800 years BP.

6. Late Neolithic (*Ru'at El Baqar*), the cattle herders

Again, the shores of the Nabta Playa palaeolake are the zones of the most intensive occupations relating to the Late Neolithic *Ru'at El Baqar* pastoralists (cf. Table 3.3. in Chapter 3, this volume). The campsites in a palimpsest pattern concentrate in the nearly 1.5 m thick sandy beds at the southern end of Site E-75-8 and wedging out northward past Connecting Trench. Several features from this horizon were excavated in the 1998 and 1999 season in Areas A–E located at the southwestern end of the site. Small, temporary camps marked by dispersed, small, nest-like, and stone-paved hearths occur along high, northern shores of the basin at Sites E-94-2 and E-92-7 (North). Several tumuli in "Wadi of the Sacrifices" and beyond within the sandstone ridge badlands are assigned to the *Ru'at El Baqar* unit, despite a high standard deviation of their radiocarbon assays. It is also a place of the dense, but unpatterned occurrence of fire-cracked rocks and strangled tethering slabs.

At the southern foot of Gebel Nabta, hearths have been recorded at Sites E-77-1 and E-94-3. Several stratified hearths, on the other hand, occurred at E-01-2, Camp, as well as in Cut 3, Pit 1, 2 and 4, all located on the southern shore of Gebel Ramlah Playa.

Dated camps of the Late Neolithic units have also been recorded at El Ghorab Playa, Site E-79-4, Late Neolithic Area, Bir Mur, Site 1, and El Baalad Playa (Fig. 12.21-12.23).

Settlements

Excavations of Cut I/98-99, Areas A-E at Site E-75-8 of Nabta Playa (Nelson 2001b) yielded several new aspects of camp structures of the *Ru'at El Baqar* dwellers of the site as the opening of more extensive areas permitted a detailed observation of the floors of particular sedimentary beds defined in the previous stratigraphic analyses. The clearing of the excavated floors exposed several sparsely scattered pits, including the bell-shaped ones and hearths as well as a basin-shaped roasting specimen and a tight cluster of hearths. Of particular interest was an oval shallow basin hut, some 2.8 m in length, with a central hearth close to the south-central section, end traces of a central posthole as well as a few other postholes (Nelson 2001b: 390-391). The hut is cut into the dune sand of Bed 8 and topped by the truncated Bed 10 of Final Neolithic Age.

At Sites E-94-2 (Mohamed 2001) and at E-92-7 (North) (Królik and Fiedorczuk 2001) on the high northern bank of Nabta Playa, the Late Neolithic remains appear as large, loose groups of deflated hearths sometime lined with sandstone slabs and potholes almost always containing fire-cracked rock fragments and/or burnt grinding stones. The hearths are accompanied with random scatters of none too dense stone artifacts and occasional small clusters of pottery sherds and loosely scattered tethering stones. Similar campsites occur at the foot of Gebel Nabta at Sites E-77-1 and E-94-3 (Wendorf and Schild 2001d).

Extensive areas around these hearth clusters and relatively steep slope of the lake bank may contain rare pits and numerous lower grinding stones as well as tethering stones, often made from exhausted lower grinding stones.

Site E-79-5B at El Ballad Playa in the Kiseiba Area spread in two linear, long units on the edge of the playa beach for about 1000 sq.m. (Connor 1984c). The northern linear section of the site, stretching for about 120 m, contained 47 hearths, while the southern one, 85 m long, counted 49 hearths. The southern group contained 49 grinding stones and the northern one only six specimens. One of the hearts in the southern section yielded a radiocarbon date of 6180 ± 70 (SMU-965) years BP (at 2σ: 7260-6890 calBP and 5310-4940 calBC) confirming the Late Neolithic age of the site (Connor 1984c: 183-185).

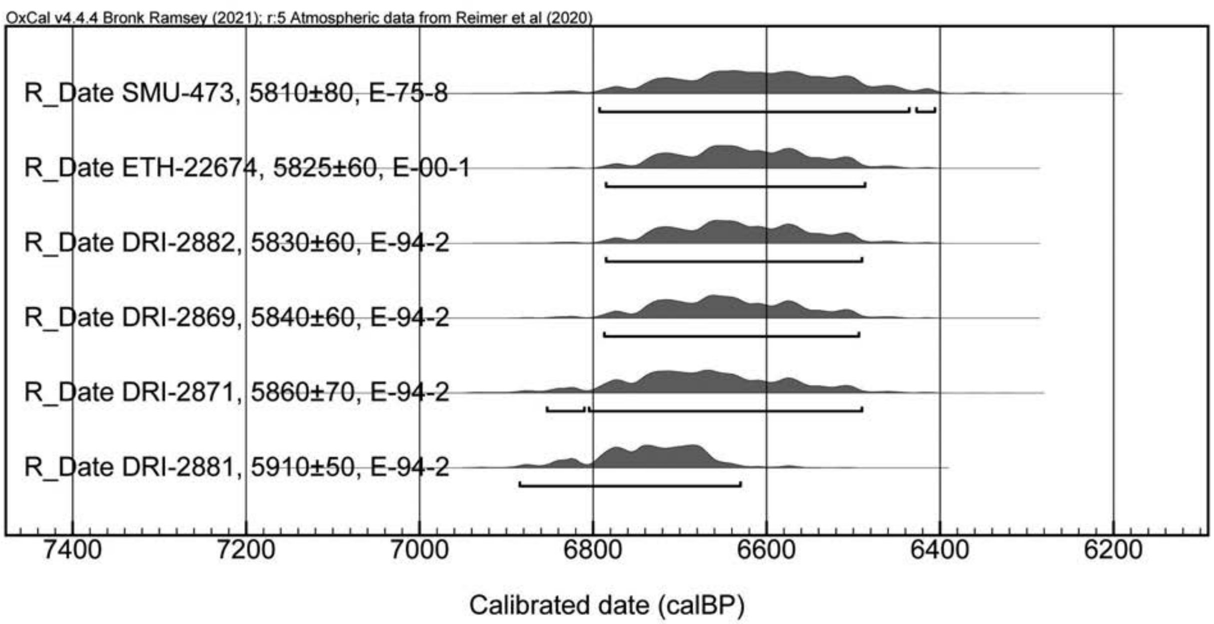


Figure 12.21. *Ru'at El Baqar* unit (the Late Neolithic) sites (1). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

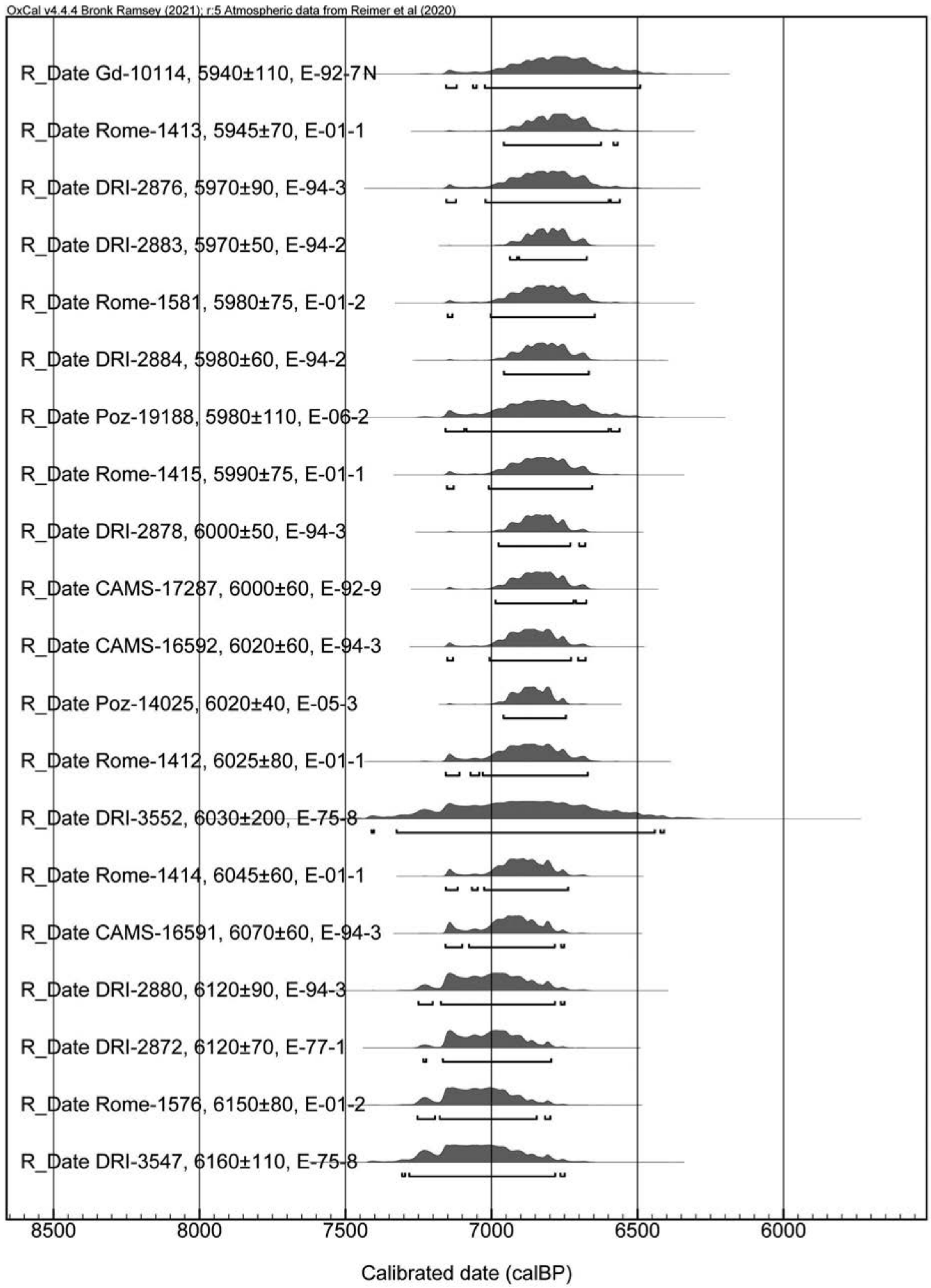


Figure 12.22. *Ru'at El Baqar* unit (the Late Neolithic) sites (2). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

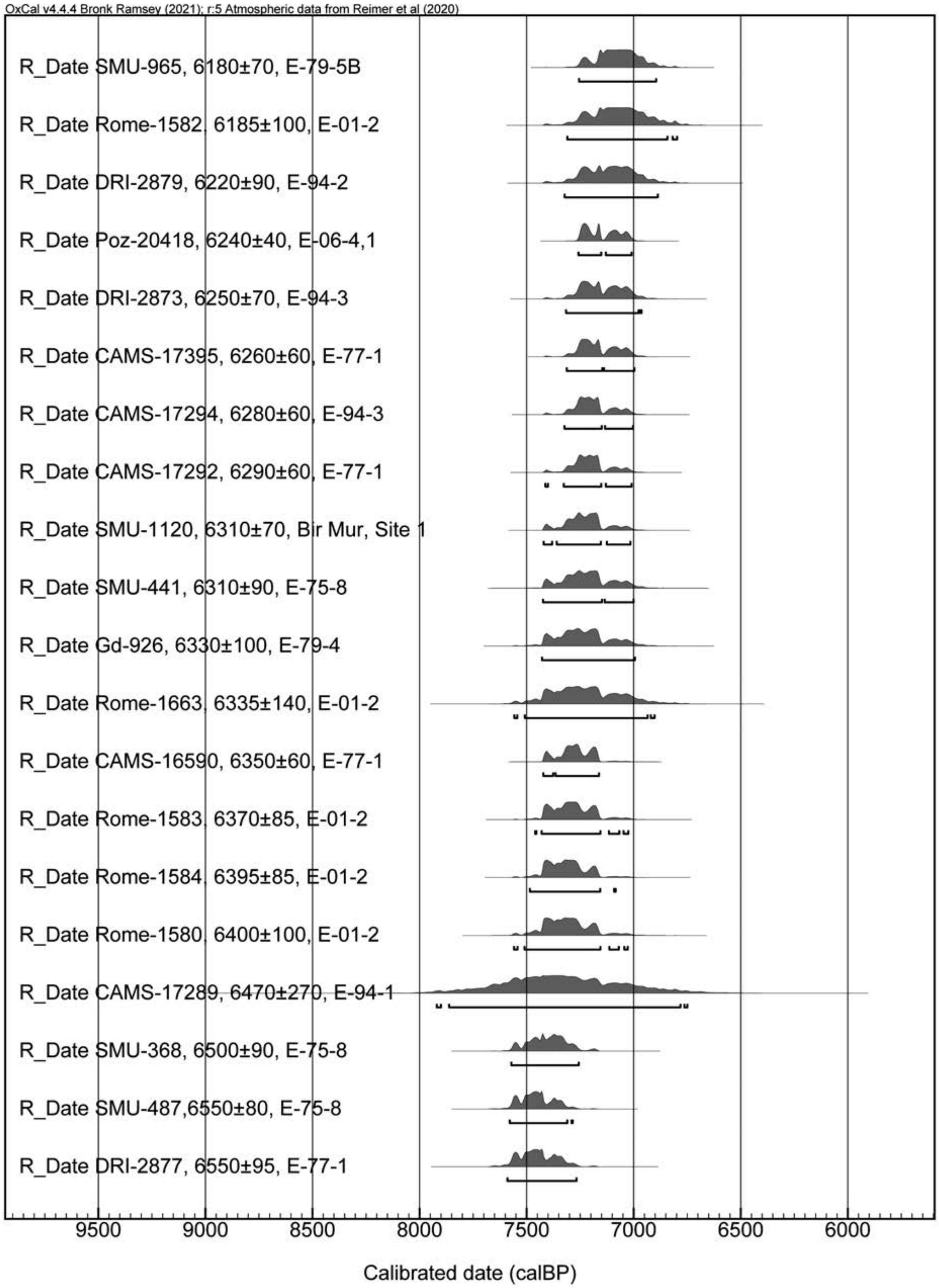


Figure 12.23. *Ru'at El Baqar* unit (the Late Neolithic) sites (3). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

Two large, similar to the El Balaad Playa sites occur at Bir Murr Playa located some 60 km north of Kiseiba scarp (Connor 1984b: fig. 16.1). Site Bir Murr I, -80/1 (Connor 1984b: 391-397) covers an elongated area of about 22.400 sq. m. on the northeastern shore of the basin, and probably follows the southeastern shoreline of the lake. The deflated surface of the site displayed 90 hearths and a large number of artifacts on the surface. One of the tested hearths gave a radiocarbon age of 6310 ± 70 (SMU-1120) years BP or 7420-7010 calBP and 5470-5060 calBC (at 2σ), confirming the Late Neolithic age of the locality. Site Bir Murr II, 80/2 (Connor, 1984b: Fig.397-402), on the central east shore, is a roundish cluster of deflated hearths and artifacts covering an area of about 42.600 sq. m. It enclosed 91 hearths and 37 grinding stones.

Most of the studied sites represent aggregations of hearths along the banks of large playas; each of the hearths probably marks nuclear family camping spaces. More or less associated artifacts accompany the hearths. The camps may represent repetitive seasonal camping or/and aggregations of families most probably after the peak of the rainy season when there was enough underground moisture to sustain vegetation. The frequent presence of lower grinding stones suggests that it was the time when the herded animals were present near the camps and the plant food, grain, etc., was processed, but not necessarily stored.

A different pattern is seen along the northern shores of the Nabta Playa Basin. There, somewhat randomly dispersed small hearths dot the area that also contains numerous tethering stones of various sizes, suggesting a pasture ground for cattle and ovicaprids.

The excavated Areas D and F at Site E-75-8 expose a different picture yet. There, a basin hut with a hearth located off the centre of the feature and a few accompanying pits, suggest the winter and dry season dwelling of a nuclear family unit. Quite similar is the pattern at the Gebel Nabta Area at Sites E-77-1 and E-94-3 (Wendorf and Schild 2001d: 428).

The settlement sample studied in the Nubia Shab Pediplain failed to expose permanent or semi-permanent villages like loci present during the *El Nabta/Al Jerar* wet interphase. The camps seem to be highly temporary, cyclically used, small, and probably limited to the nuclear family of hunting pastoralists supported by gathering. Perhaps similar to recent Baggara and Habana of Darfur (Seligman and Seligman 1918) or Gura'an of Chad and Sudan (Nicolaisen 1968).

Lithic assemblages

The raw materials employed by the Late Neolithic settlers were based on very similar sources to those explored in the previous period. Quartz, chert, quartz crystal, and petrified wood, were used for simpler products, while Eocene flint (chert) was reserved for retouched tool manufacturing. Production of blanks was based on flake cores reduced with soft-hard hammer technique. Multiple platform flake cores are most common. Often, they represent exhausted forms of single platform cores reshaped during reduction. Multiple platforms or changed orientation flake cores are usually most common. Blade cores are very rare and somewhat accidental, passing into the category of elongated flake cores. Side blow cores are extremely rare, produced from tabular Eocene flint.

Most of the Late Neolithic tools of the came from surface collections or subsurface excavations of beds, whose stratigraphic assignment had not been firmly established at the time of diggings, a factor that might have influenced the precision of the following characteristic. The range of tools is monotonous and dominated by background forms, mostly various denticulates on flakes and continuously retouched blades and flakes. Endscrapers on flakes and retouched flakes are present but rare; perforators are present. There are some geometrics and backed pieces, short lunates, and convex flake sidescrapers. Scrapers on a side blow flake are quite characteristic, although not common. The latter may occur in caches with blanks and preforms (e.g., Wendorf and Schild 1980: 161). Of importance is a group of biface foliates and short, bifacial tanged arrowheads, similar to certain forms from Jericho, Nizzanim, and Qatif Y-3 (Gopher 1994). There are also unifacial tanged points on blades/bladelets with a long stem, and occasionally backed flakes. Flaked stone celts made on flakes, some with a polished cutting distal edge are present, as are pecked and ground stone gouges. Rare *herminettes* have been noted, too. Grinding equipment, including lower grinding stones, occurs frequently.

Pottery

The pottery associated with the Late Neolithic unit at Nabta Playa dramatically differs from the production of all the former groups. There is no more rocker stamp decoration nor rough exterior surface. The new assemblage of vessels contains very thin bowls of various sizes with rounded bases and flaring walls and beakers with straight walls. These were red slipped burnished, red polished as well as black topped, and black and brown smoothed. The vessels are made from locally available clays. The new technique applied for finishing the vessels included slipping and burnishing. Changes in firing techniques involved the increase of temperature and use of smudging. The pottery assemblage seems to be a part of a larger entity embracing the Badarian, Tasian, and A-Group complex (Nelson and Khalifa 2011: 698) except, perhaps, for the lack of tulip beakers in the *Ru'at El Baqar* unit. The earliest appearance of the black topped pottery in Nabta Playa is associated with Bed 8 of Site E-75-8 whose age is restricted by the date for Bed 7 of 6160 ± 110 (DRI-3547) years BP (7310-6740 calBP) and 6030 ± 200 (DRI-3552) years BP (7410-6410 calBP) for the top of Bed 8, and 5810 ± 80 (SMU-473) years BP (6790-6400 calBP at 2σ), for the top of a walk-in well (Bed 9e) cutting into the top of Bed 8 (cf. Tabular summary of the Combined Prehistoric Expedition's Holocene Radiocarbon Dates, this volume). Of radiocarbon dates for the Badarian, the oldest are from Site 3400 near Deir Tasa in Badari Area and Hammamieh spreading from about 5580 to 5259 BP. On the other hand, Site Dibeira West 50 on the Nile River in Lower Nubia containing a thin-walled red and black pottery gave a radiocarbon date of 5600 ± 200 (WSU-174) BP (Schild *et al.* 1968: 756). Considering the rather large standard deviations of the ages, one regards these differences in age as statistically insignificant.

Food Paleoeconomy

Practically no plant macroremains have been recovered from the Late Neolithic sites, except for charcoal from the beds at Site E-75-8 limited to three species of acacia, tamarisk, and caper. In radiocarbon dated hearths at Site E-92-7, only one taxon of acacia has been identified as well as tamaris, caper *Ziziphus*, and *Cassia* sp. At E-94-2, tamaris, caper and *Salvadora persica* have been identified. At Site E-94-3 at the Gebel Nabta Area imprints in the pottery revealed the presence of wild millet and Setaria grass (Magid 2001), both used as food and the grass as fodder in the sub-Saharan Sahel. The dental wear (Irish 2001: 523) of the individual from the E-97-17 inhumation, on the other hand, suggests an essential share of the ground food in the diet.

The faunal spectrum from Site E-75-8, the largest Late Neolithic assemblage recovered (Gautier 2001: 610), is dominated mainly by Dorcas gazelle and ovicaprids followed by Dama gazelle, cattle, and hare. In other beds, the hare may be an only slightly dominant prey.

Offering Tumuli

Although the randomly covered stone tumuli also occur on the Gebel El Muqaddas (E-06-4), the excavated ones located in "Wadi of the Sacrifices" and the adjacent rocky ridge, all except two (E-96-2 and E-97-12) included various animal bones as well as a human interment, witnessing to the offerings. Tumulus E-94-1N) enclosed an articulating, complete young cow skeleton in a taped up chamber and semi-articulated bones of a Dorcas gazelle or a sheep/goat interspaced between sandstone blocks of the superstructure. Tumulus E-94-1-S held at least three disarticulated cattle whose meat was removed before the deposition. Tumulus E-96-4 put down on a sandstone outcrop, contained numerous bones and teeth of a young cattle and the remains of at least four other individuals (4 MNI). Tumulus E-97-4 contained a juvenile and an adult cattle; Tumulus E-97-5, placed on top of a sandstone hillock, contained a decapitated flexed human skeleton, probably male; Tumulus E-97-6 yielded a few cattle and small stock bones; Tumulus E-97-16 provided a few bones of subadult cattle.

There are only two radiocarbon dates directly relating to these tumuli – 6470 ± 270 (CAMS-17289) years BP (7920-6750 calBP) and 5500 ± 160 (DRI-3354) years BP (6640-5930 calBP, at 2σ). At face value, the ages fall within the Late Neolithic time brackets. However, both show considerable standard deviations of the counts; therefore the chronological assignment of "Wadi of the Sacrifices" tumuli cannot be statistically significant. Similar deposition of a gazelle offering at the Site E-06-4, Structure 21 recalls that of E-96-4. It is deposited on a flattish outcrop of sandstone overlooking the headwaters of "Wadi of the Sacrifices". A few sandstone slabs originally covered the offering. Carbonate fraction of the bones gave an age of 6240 ± 40 (Poz-20418) years BP (cf. Chapter 3, this volume). This is the age falling within the time range of the Late Neolithic unit.

Cattle burials of "Wadi of the Sacrifices" are probably the oldest known in Africa, despite some doubts as to the precision of their aging. Savino di Lernia (2006: 59) in his fascinating essay on the spread of the Cattle Cult from the Nubia Shab Peneplain across North Africa to Libya and Niger in an early VIIth radiocarbon millennium BP (confines of VIII/VIIth millennia BC, at 2σ) described such cases.

In the 1980s, Paris and Roset excavated two small tumuli containing entombments of cattle at Site 1 in Adrar Bous, Niger. The older gave a radiocarbon date of 6325 ± 300 (Pa 330) BP, while the younger yielded the result (on bone collagen) of 6200 ± 250 (Pa 753) BP (di Lernia 2006: 53). Savino di Lernia ties this cultural, ideological change to the increasing aridification of the Sahara in the upper AHP stimulating population movement and adaptation to the changing environment. He also debates the problem, whether the cattle tumuli are offerings or burials of "sacred animals".

During this time, aridification increased compared to the previous moist interphase. The change is quite well recorded in the deposits of Site E-75-8. In short, this is the time of dry Sahelian savanna. As to the question of burials versus offerings, "Wadi of the Sacrifices" gives a mixed answer. Of all the tumuli in the Wadi, the young cattle burial has been given special treatment as to the preparation, architecture, and location of the internment. The cow was being prepared for travel to the outer world. The remaining ones, except for the beheaded man, are just dumped pieces of the corps, sometimes defleshed, of cattle and other animals (Applegate *et al.* 2001). One would instead classify them as offerings to the spirits responsible for the seasonal rejuvenation of the Playa lake. Similar objectives can be assigned to the small tumuli, cairns, and sandstone pavements with individual underground containers and pits of repetitive use under the superstructures in the Gebel El Muqaddas constructed in the late VIIIth millennium BC.

People

Very little is known about the physical appearance of the *Ru'at El Baqar* population. There is probably a poorly preserved female grave at Site E-97-17, buried in a sandy ridge remnant at the mouth of "Wadi of the Sacrifices". The surface of the ridge is nearly covered by a dense scatter of fire-cracked sandstone with occasional pottery sherds and chipped artifacts relating to the Late Neolithic. A not too distant hearth, close to the "Calendar Circle" gave a radiocarbon date of 6000 ± 60 (CAMS-17287) BP (List of Radiocarbon determinations, this volume). Dental morphology analysis of the individual implies a Sub-Saharan affinity of the individual from E-97-7 (Irish 2001: 525). Other supposedly Late Neolithic human remains like the decapitated man in Tumulus E-97-5 and a 4-5-year-old child in the Late Neolithic Settlement of Site E-79-4 (Henneberg 1984: 138) could not be ascribed to a specified human population.

7. Final Neolithic (*Bunat El Asnam*), megalith builders

The beginning of the Final Neolithic postdates a pronounced aeolian truncation separating Unit 9 (walk-in well) from Bed 10 including this kind of materials. A hearth placed in the upper part of the abandoned well (Bed 9e) gave a date of 5810 ± 80 (SMU-473) years BP (E-75-8). Bed 10 overlaying Bed 9 is a relatively thin muddy sand wash. It has been dated at 5515 ± 90 (DRI-3529) years BP in the South Tench and 5750 ± 80 (Gd-12185) years BP in Cut I/99, Area D. Two of the dates, SMU-473 and Gd-12185 overlap within one σ suggesting a radiocarbon date for the event at about 5800-5700 BP or around 6800-6350 calBP (at 2σ), or c. 4850-4400 calBC.

In the Final Neolithic Site E-02-3 at Nab El Diep Playa, five discrete hearths have been radiocarbon dated, of which two produced large standard errors. Of the remaining ones, the oldest (Poz-73341) showed the age about 6560-6310 calBP at nearly 2 σ and the youngest (Poz-73391) about 6270 -5990 calBP also at 2σ. Probably the youngest feature at the Nabta Area, a walk-in well in the Nab El Diep Playa, on charcoal, produced a radiocarbon assay (A-11082) of c. 6190-5730 calBP at nearly 2σ (cf. Chapter 17, this volume; Fig. 12.24 and 12.25).

Archaeological materials connected the *Megalith Builders* are relatively plentiful. However, most of them are directly related to the erection of megalithic installations. On the whole, remains of camps at Nabta Playa have mainly been deflated and only one bed (Bed 10) at Site E-75-8 has been spared from destruction. The same fate met small camps on the northern shores of Nabta Playa, as well as clusters of camps at the foot of Gebal Nabta (Sites E-77-1 and E-94-3). A relatively better setting was observed at Site E-02-3 in Nab El Diep, where the artifact-bearing bed of the site was partially buried in the sandy surface wash (compare Królik and Ibrahim, this volume). On the other hand, remains of several worker camps have been found unharmed, covered up by the blown-in-sand in the sandstone quarries near the Western Field of Menhirs. Thus, as a result of post-depositional alterations of the camp remains, a large share of our knowledge of the material culture of Megalith builders is based on the artefacts collected from deflated surfaces and recovered objects from the graves of the Gebel Ramlah cemeteries: E-01-2, E-03-1, and E-03-2 (Kobusiewicz and Kabaciński 2010a).

Settlements

Very little is known about the Final Neolithic camps. The best example is a multiple use, temporary, small encampment at Site E-02-3 in Nab El Diep with intersecting hearths suggesting repetitive camping events. Other examples of short-lived camping are on the northeastern bank of Nabta Playa (Site E-94-2, E-92-7 part N) and at the foot of Gebel Nabta (Sites E-77-1 and E-94-3). An excellent example of a well of the time is the deep walk-in well at Site E- 01-1 at Nab El Diep Playa (Kobusiewicz 2003). Of interest are quarry diggers' camps set up in the exploited quarry pits near the Western Field of stelae. All are characterized by traces of hearths, debitage debris, occasional gazelle bones, and potsherd (cf. Chapter 5, this volume). Essentially, there are no significant differences between Late and Final Neolithic camps. Camp organization practiced in both groups implies the high seasonal mobility of pastoralist-foragers.

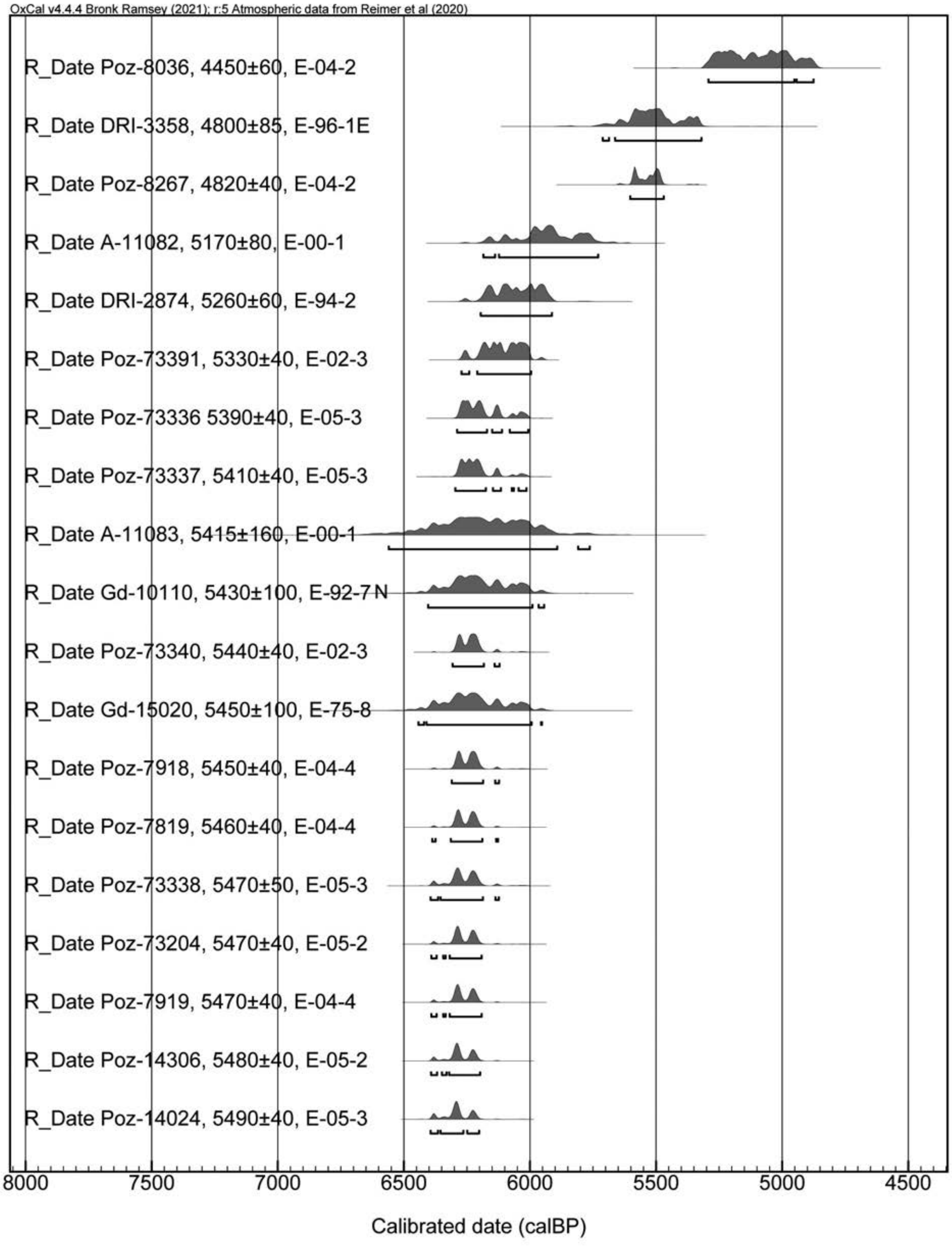


Figure 12.24. *Bunat el Asnam* unit (the Final Neolithic) sites (1). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

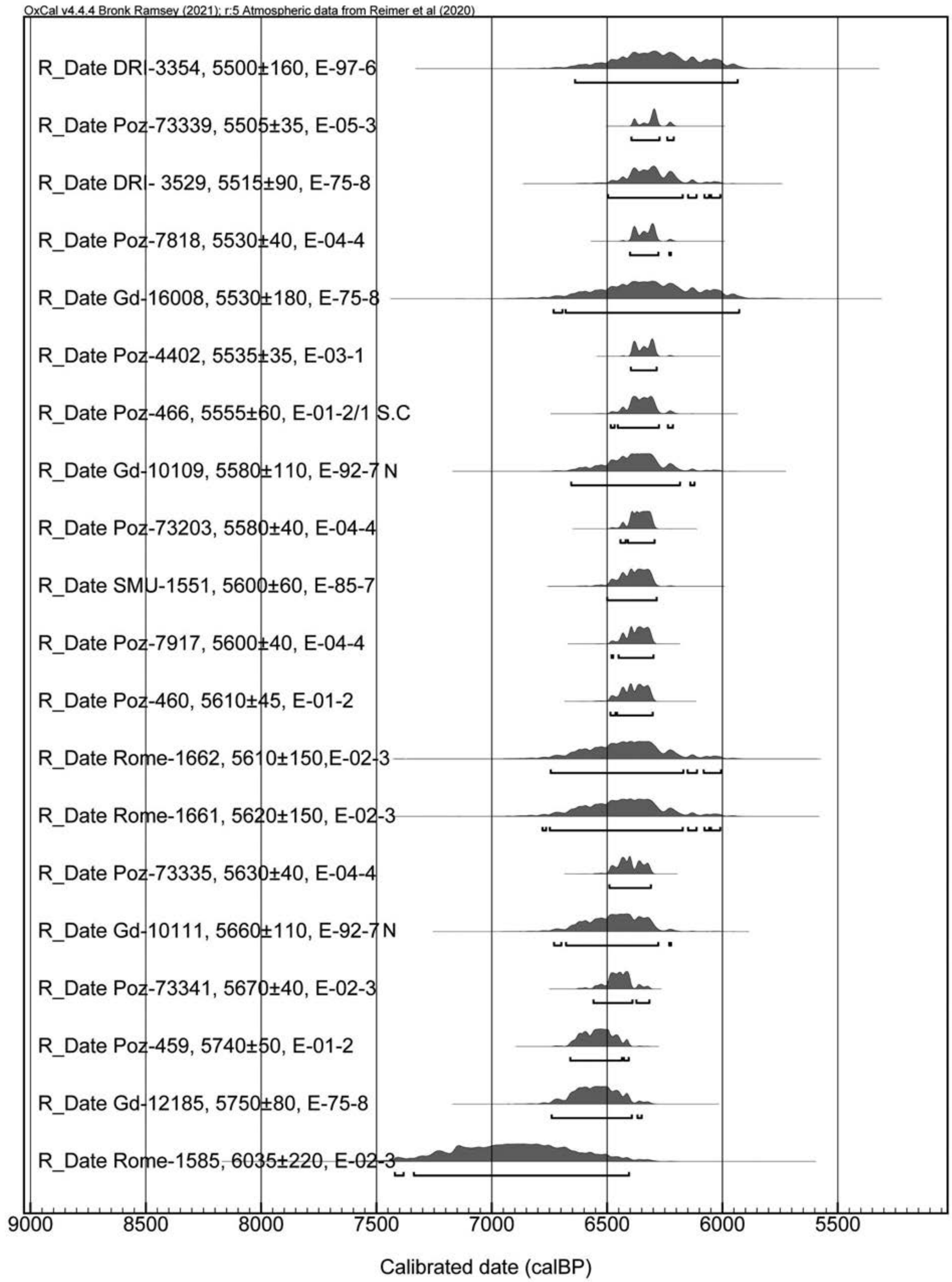


Figure 12.25. *Bunat el Asnam* unit (the Final Neolithic) sites (2). Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

Lithic and Stone Assemblages

Collected surface assemblages linked to the Final Neolithic are quite humble and potentially mixed or contaminated by older elements. Thus, an unusually rich source for the description of tool variability of the unit are the inventories of Gebel Ramlah Playa cemeteries.

The most popular raw material was the Eocene (*Egyptian*) flint followed by agate, of Nilotic origin, and chalcedony. Kiseiba chert (?) is also present. The knapping method is mainly based on single platform cores for flakes and short blades obtained with a hard hammer technique. A single long blade with small butt and bulb probably indicate the use of soft stone hammer percussion. Changed orientation cores are also present. The range of retouched tools is limited. Lunates, small to microlithic, elongated and short, often with the retouch *sure enclume* are most numerous. Microlithic isosceles triangles are rare, but present, as are the Heluan points. Denticulates on flakes and blades seem to be standard, as well as retouched pieces. Sidescrapers are rare and bifacial pieces scarce. Ground stone equipment is very well represented containing axes, celts, and gauges, as are palettes. There is also a point of polished limestone, a pestle, grinders, hammerstones, retouchers, and a vessel made of gneiss.

Surface collections made in 1975 and 1977 from the highly deflated sands of topset Holocene beds in the northern section of Site E-75-8 yielded several selected bifacial pieces in all probability associated with the Final Neolithic. Among these is an elongated bifacial point with diagonal invasive retouch, a very large Heluan backed piece with denticulated opposite edge, a *herminette* adze and a large stemmed point with a long tang on a blade (Wendorf and Schild 1980: 159).

Bone Tools, Shells, and Jewels

A wide range of items was produced from bone. The most common were needles made of bird and mammal bones. However, there are also containers for dyes made of cattle horns, ivory, sandstone, and shells. Bone points (*daggers*), mostly of worked cattle bone are relatively common. Of particular interest is the presence of the so-called mica mirrors and an image of tilapia cut out of a thick sheet of mica.

Twenty-two specimens of shells have been recovered. Of these, most are Nilotic bivalves, and a few are cowrie shells. Jewels are handsomely represented. The most numerous are beads (over 500 pieces). They are made of black stone, a white, hard stone, and carnelian, *Nerita* shells and a few of agate and turquoise; singular ones are of sandstone, limestone, and petrified wood as well as gneiss, diorite, hematite, shell, and burnt clay. Nose and lip plugs and pendants are also present. Bracelets made of Red Sea shells and ivory are well represented (Kobusiewicz and Kabaciński 2010a). Imported shells, ivory, turquoise, and mica indicate exchange contacts with Sinai, the Red Sea, Nile Valley, East Africa, and Sub-Saharan Africa (Kobusiewicz and Kabaciński 2010a).

Pottery Assemblages

Kit Nelson in her synthesis (Nelson 2002a: 10) of the Kiseiba/Nabta Playa pottery recognizes five main groups of pottery assigned to the Late and Final Neolithic units: Qusseir Clastic Ware; Red Ware; Ripple Ware; Olive Ware, and Black Topped Ware. Of the five groups, three are representative for the Late Neolithic entity, the Qusseir, Ripple, and Black Top wares. The shapes of the vessels are limited to bowls with rounded bases and rare jars. Excavations of the Gebel Ramlah cemeteries have enriched the array of vessel forms by including spouted and flat-based bowls and beakers. Also, the range of decorations and tempers have expanded with rim tops decorated by "milled or notched impressions and plain rocker zigzags". Bodies, on the other hand, are ornamented with rippled zigzag, incisions, geometric design, and black topping (Gatto 2010: 148). Maria Gatto includes Late Neolithic and Final Neolithic in the same cultural tradition, or *Nubian Group* (Gatto 2002a; 2002b; 2006a; 2006b) with, e.g., A-Group included. The Group would extend from Lower to Upper Nubia.

Of interest is the time of the appearance of the Qusseir Clastic Ware in the Final Neolithic inventories. Although these are reported at Site E-00-1 in Nab El Diep Playa as being part of pottery assemblages of the Late Neolithic unit, there is no direct association of radiocarbon dates with this unit. The only dated archaeological feature containing this pottery of that playa, a walk-in well of Final Neolithic age at Area G gave a date of 5170 ± 80 (A-11082) BP or about 6190-5730 calBP and 4240-3780 calBC (at 2σ). Furthermore, the sandstone quarries near the Western Field of Stelae at Nabta Playa yielded a dozen sherds made of Qusseir clay (cf. Chapter 5, this volume). The oldest ages measured at these pits cluster around 4610-4360 calBC (at 2σ), placing the time of the adoption of the technique in the mid-Vth millennium BC (Gatto 2016: 70).

Food Palaeoeconomy

Despite intensive matrix processing, there are only singular edible seeds of sorghum and schouwia recovered from the Final Neolithic sandstone quarries diggers' camps. The presence of grinding equipment, mainly manos, signals that grinding was practiced at the camps and among the plants used were sorghum and schouwia. However, observations arising from the study of the dentition of the skeletons recovered from the cemeteries of Gebel Ramlah Playa lead to interesting conjectures. Attrition of the teeth of the Final Neolithic population of the Gebel Ramlah cemeteries, as measured by wear angles, is above the average found among some agriculturalists (Irish 2010: 203, 204), an observation suggesting the importance of ground grain foods. On the other hand, a noted low rate of caries may indicate consumption of low carbohydrate food. It is possible that the pastoralist diet was similar to that of Masai based on dairy products and cattle blood, supported by gathering and hunting.

People

It is due to the discovery of the Gebel Ramlah cemeteries that a detailed picture of the Final Neolithic *Bunat El Asnam* population has been unveiled. The cemeteries have provided 67 lots of human skeletons and, therefore, made possible an in-depth physical characteristic of the population possible. As it is now, it is the most extensive collection of Holocene human remains in the Nubia Shab Pediplain.

Based on craniometric and dental morphological data, Joel Irish (2010: 223) postulates that the people of the Gebel Ramlah cemeteries represent an *intermediate* population "in the expression of craniodental features relative to various Egyptian and Nubian samples", as well as to those from the Mediterranean and sub-Saharan regions (Irish 2005). Recent discoveries of neonatal graveyards, close to the cemeteries at Sites E-01-2, E-03-1, and E -03-2, indicated that the funeral practices applied to the newborns were similar to those thought to be appropriate for adults, unlike the many contrasting African examples, grounded in the beliefs that the newborn are not yet members of the community (Kabaciński *et al*. 2018). Cemeteries are not the only place where the deceased members of the society have rested for eternity. An isolated couple found a place in the topmost sand of northern part of Site E-75-8 of Nabta Playa (Wendorf and Schild 1980: 163-164). Although not directly dated, the presence of a minuscule calciform beaker pendant in the grave links it with the Final Neolithic.

Spatial structuring of the graves grouped in three discrete clusters suggests a kinship-regulated sorting of the dead. It may be interpreted as a scatter similar to that presented by the structuring of the Fields of Remembrance or Fields of Stelae, presumably mirroring extended families and the clans' places in the outer world.

A better place than a cemetery for commons and a spot close to a "sacred area" was reserved for hereditary peers like the "Little Lord of Nabta Playa", who was worth a tumulus on top of a flat-topped hill overlooking the Fields of Stelae in Nabta Playa.

Fields of Stelae and Alignments of Stelae

The most distinctive, overriding trait of the Final Neolithic megaliths builders' presence in the Eastern Sahara is the installation of the Fields of Stelae and Alignments of Stelae along the northern shores of the playa lake. The stelae are the most recent addition to small symbolic architectural installations known from the time of the Mid-Holocene *El Nabta/Al Jerar* annexation of the Western Desert. Most of the stelae are anthropomorphic, although the stelae making a hub-like, raised cluster of menhirs installed on a flattish low knoll (E-96-1A) are worked, but not anthropomorphic. The particular fields of stelae are placed on discrete low hills and are clustered in smaller units comprising from several pieces to a few dozens (Site E-96-1A). The grouping of stelae may mirror the structuring of the society of the *Bunat El Asnam* unit, symbolizing departed members of extended families and groups of extended families (*clans*) respectively. The presence of the large tumulus with a small boy in the chamber (Site E-04-2) may categorize a hereditary ruler of the society. What's more, there is little doubt that the alignments of stelae, particularly alignment A, attest to a complex cosmology and cosmogony that may have developed in the desert where the celestial navigation is a survival must and where the sky is always open to observation.

Most probably the stelae of Nabta Playa are the oldest in Africa. However, their massive appearance in a confined area is a unique and short-lived phenomenon. Their gradual installation took approximately 500 hundred years. Close, although basically different phenomena have been reported recently from Libya by Savino di Lernia (2006). At Habater IIIa site in Messak Settafet singular, unshaped (?) stelae marked ritual depositions of mammal bones including *Bos*. The site is dated to 5213 ± 80 (GX-19108-AMS) BP. A complex stone structure with three engraved small stelae and deposition of cattle and other mammal bones is also reported from Site 556 at Tin Einessnis, Messak Settafet, Libya. It yielded two dates (di Lerinia, 2006: 57-8) of 5150 ± 110 (GX 28446) BP (on burned bones) and 5290 ± 40 (GX 28447-AMS). The oldest of the two dates is barely within 2σ of the youngest of the radiocarbon dates from the Nabta quartzitic quarries. Despite the chronological closeness of the stelae from Messak Settafet and Nabta Playa, their symbolic characters seem to be quite different. While the anthropomorphic stelae of Nabta seem to be effigies of the departed members of society, the Libyan ones appear to be symbolically interrelated with offerings to some spirits/gods.

With the *Bunat El Asnam* demise, the megalith builders end the semi-continuous peopling of the Nubia Shab pediplain. This is the real end of the African Humid Period and its Nabtan Phase. A relatively short humid pulsation coeval with the C-Group appearance is very poorly represented in the area, and probably limited to seasonal camping at Nabta Playa, and more permanent occupations at the Dungul Area (Hester and Hoebler 1969: 51-56).

Examples of unstratified Camp Remains in Nabta and Nab El Diep Playas

Three prehistoric sites have been selected as examples of specific taphonomic changes following the deposition of sediments. The first E-04-3, located in Nabta Playa (cf. Chapter 18, this volume) and two Sites at Nab El Diep: E-00-2; E-03-2 (cf. Chapters 16 and 17, this volume).

8. The C-Group

A definite signal of a wetting episode and a new occupation in the South-Western Desert comes from the southern Dungul Area, at the foot of the Sin El Kaddab scarp, in the northern Nubia Shab Pediplain. There a few C-Group sites were located and examined by the Combined Prehistoric Expedition in the early UNESCO Nubian Campaign. Only one of the sites (8773) was radiocarbon dated. The sample gave a date of 3625 ± 180 (laboratory number unknown) BP (Hester and Hoebler 1969: 51), or about 4430-3480 calBP and 2480-1530 calBC (at 2σ).

C-Group settlement is also represented in the Nabta Playa Basin, where a three-roomed structure built against a high and wide table rock of Nubia Sandstone was discovered and investigated at Site E-92-8 (Applegate and Zedeño 2001a: figs 19.1, 2). The structure had been erected using several dozen large vertical sandstone plates and blocks, making three oval rooms with the table rock wall behind. The artefact-bearing floor of the house is made up of friable aeolian sand capping a suite of colluvial deposits (Applegate and Zedeño 2001a: 529). The floor sand (Bed 1) of the rooms yielded a relatively rich assemblage of chipped quartz artefacts as well as potsherds and faunal remains. A slim, tall vertical sandstone block embedded in the desert floor several dozen metres to the east of the house is probably a signpost leading to the dwelling from far away. Another stone house of the C-Group at the western side of the Gebel El Muqaddas have been reported by A. Czekaj-Zastawny and P. Bobrowski in Chapter 3, this volume.

The C-Group small camps in the Nubia-Shab Pediplain are located far away from the main C-Group settlement area in Lower Nubia's Nile Valley (Hafsaas 2005). They give the impression of small seasonal camps of herdsman parties driving mobile fallow herds. Their small three-roomed dwelling on the left bank of Nabta Playa at Site E-92-8 (Applegate and Zedeño 2001a) and a structure at the western slope of Gebel El Muqaddas were erected using a characteristic C-Group technique of wall construction. It consists of stone slabs standing on end (Hafsaas 2005: 61). A tall and narrow vertical slab on a slight ground rise in front of Site E-92-8 mark the dwelling's location.

Two radiocarbon age estimates of 3860 ± 40 (DRI-3357) and 3130 ± 110 (Gd-6746) years BP, or about 4410-4150 calBP (2460-2200 BC) and 3580-3000 cal BP (1630-1050 BC), both at 2σ respectively, related to the slab houses at Nabta Playa (Fig. 12.26). It is assessed that the C-Group existed between about 2200 and 1500 BC (Anderson 1966), although the precise chronology of the group is debatable and, more recently, dates between 2500-2400-1500 BC are also given (Hafsaas 2005; Hafsaas-Isakos 2010).

At 2 σ they fall within the time brackets of early (2500-2160 BCE) C-Group (Phase Ia), while the calibrated radiocarbon date from Dungul and the older sample from Nabta Playa cover (at 2 σ) the entire time span of the C-Group. The younger sample from the Nabta Playa house, on the other hand, better fits a late C-Group chronology (1650-1550 BCE) of Phase IIb (Hafsaas-Isakos 2010).

The raw material found in the house is limited to quartz and lithics consist of single and changed orientation cores and flakes. The well-fired pottery has a fine-grained paste and contains dung or grass. Flaring rim jar fired to a red or gray colour is the dominant vessel form. Incised design located around the neck occurs on some vessels. The recovered remains of fauna are limited to cattle and had no traces of fossilization.

The C-Group occurrence at Dungul Playa is much better represented than around Nabta Playa. The Combined Prehistoric Expedition recorded in the area 17 sites. The sites contain dry masonry dwellings, and some of the structures are grouped into multi-unit hamlets. (Hester and Hoebler 1969).

Figure 12.26. Nabta Playa, C-Group Houses. Looking West. Photo by R. Schild.

9. Significant events and chronological placements of archaeological taxonomic units in the Atmur El Kibeish Peneplain, Nubia Shab Pediplain, and Adjacent Nile

Events & Units	Ages	Places
Oldowan	?	Nabped, Gebel Nabta Eastern Pediment
Early Acheulean	?	Nabash, E-06-4, Western Pediment
Middle Acheulean	MIS 11	Dag Dag Safsaf E-85-2; *Acheulean Surface*, Kiseiba
Late Acheulean	MIS 9 c-e? (>330ka) BT	Acheulean Lakes/Springs, DagDag Safsaf; E-85-2
Early MP Lakes	MIS 9a? (ca. 330ka)	BS – 11
Middle MP Sandy Playa (Sand Pan)	MIS 7	BT-B: Sites E-86-1, E-87-1, E-87-4
Last Interstadial MP Lakes BT-A	MIS 5e, 5c, 5a	the connection with the Nile
Late Middle Paleolithic Nile Aggradation	MIS 4	Wadi Kubbaniya Nile

Events & Units	Ages	Places
Downcutting	MIS 3	Wadi Kubbaniya Nile
Minor Wadi activity	ca. 50ka	Nabta Playa, E-91-1
Gebel Nabta Wet Event	ca. 39ka	Gebel Nabta Playa, Site E-77-1; BS E-88-2
Late Paleolithic Nile Aggradation	LGM+Late Planiglacial	Wadi Kubbaniya Nile
Late Glacial Accretion Pulse	Greenland Interstadial 1d (Older Dryas)	Wadi Kubbaniya Nile
Birbet Downcutting	Greenland Interstadial – 1e-1c, a	Wadi Kubbaniya Nile, El Kilh, Site
Nab El Diep Wet Event	Greenland Interstadial 1e	Nab El Diep Playa
Kiseiba Wet Event	Greenland Interstadial 1c (Early Allerød)	El Adam Playa
Arkin Aggradation	Younger Dryas	Arkin Nile
11.4 ka (11.520-11.400 ka) Even	Preboreal Oscillation	
Beginning Of rains in Lowe Nubia	> 9.94 (0.55) ka	Naga Tawfik El Oligate Nile
El Adam Humid Interphase	10.5 ka	Nabta, El Adam & El Kortein playas
Post-*El Adam* Arid Phase	Post *El Adam* Arid Phase	Nabta & El Ghorab playas
El Ghorab Humid Interphase	9.5ka	El Ghorab & El Kortein playas
El Ghorab Arid Phase	9.3ka (9.3 ka Event – 9.35-9.24 ka)	El Kortein Playa
El Nabta/Al Jerar Humid Interphase	9.25ka	Nabta & El Adam playas
El Nabta/Al Jerar Arid Phase	8.2ka (8.2 Event – 8.25-8.145ka)	Nabta & El Adam playas
Middle Neolithic Humid Interphase	8ka	Nabta, El Feel playas
Middle Neolithic Arid Phase	7.5ka	Nabta Playa
Late Neolithic Humid Interphase	7.45ka	Nabta Playa
Late Neolithic Arid Phase	6.55ka	Nabta Playa
Final Neolithic Humid Interpase	6.5ka	Nabta Playa
Termination of Final Neolithic Humid Interphase	6.0-6,2ka	Nabta Playa
C-Group Humid Event	4.2ka Event	Nabta Playa

Chapter 13.

Epilogue

Romuald Schild

1. Introduction

The two oldest Holocene cultural variants, *El Adam* and *El Ghorab* (cf. Table 3.3) are typical hunter-gatherer units characterized by small, repetitive use campsites, basing their subsistence on small game hunting and plant, fruit, and seed gathering. Several excavated early sites contain *Bos* remains whose status as to its taming versus hunting has not been firmly resolved. Some reverberations of these discussions may be found in the pages of this book.

However, the primary mission of these writings is to present to gracious readers a long series of data concerning the spiritual life of Holocene hunter-gatherers and cattle and small stock herders. Nowhere in Africa is there another place where a series of highly different prehistoric cultural entities erected cult and remembrance installations of megalithic scale between some 9000 and 6200 years ago. The only such place is Nabta Playa and its immediate surroundings.

The oldest of the holy places of Nabta Playa is the Site E-06-4 – Gebel El Muqaddas (or "Sacred Mountain"), a flattish mount some 2 km to the N-NW of the lake on the left bank of the shallow "Wadi of the Sacrifices" (cf. Chapter 4, this volume). The mount is a specific geomorphic phenomenon. Its somewhat horizontal top is dotted with numerous low pyramidal, tumuli-like erosional Nubia sandstone dark features formed by weathering. The space between these features is filled with yellowish aeolian sand. Seen here and there are rare real Early Neolithic tumuli of *El Nabta/Al Jerar* age (cf. Table 3.3) with blocky superstructures and relatively numerous pavements and stone cairns.

Only rare pits under the superstructures contained some visible offerings of pieces of meat and tools, suggesting that most could hold perishable foodstuff, e.g., grain, broth, etc. Small offering pits constructed under the superstructures, marked by cairns, tumuli, and sandstone plate pavements, with offering pits beneath, indicate that the installations were built to last and were possibly used by individual families at a specific time. Of interest is the presence of several small multiple-usage tumuli suggestive of an emerging structuring of the society.

The architecture of the installations facilitates easy access to the depository, an indication that the fixtures might have been used on several occasions. Differences in the sizes and forms of surface structures and underground receptacles may point to their role as offering places of various family lineages (?).

The immense offering field on the top of the Site E-06-4 (Gebel El Muqaddas), overlooking the entire Nabta Playa Basin, is a spectacular experience never observed in a prehistoric African context before the Holocene climatic Maximum. Individualized worship linked to nuclear and family lineages, on the other hand, may suggest an animalistic system of beliefs practised in the *El Nabta/Al Jerar* social environment.

The offering fields at the Site E-06-4 are contemporary to the climatic maximum in the South-Western Desert and booming semi-organized settlements of *El Nabta/Al Jerar* groups in the Nabta Playa Basin and elsewhere in the desert. The groups practised intensive collection (cultivation?) of sorghum and millet and perhaps controlled tamed *Bos*, as suggested by large walk-in wells that appeared already at the beginning of the *El Nabta/Al Jerar* Humid Interphase (cf. Table 3.3). The catastrophic end to this realm was brought by the cold and dry 8.2 ka event around 8300-8130 ka.

The world that emerged after the 8.2ka dramatic event in the South-Western Desert (Schild and Wendorf 2001a, 2001c, 2013) brought about immense environmental, social, and economic transformations. The desert became drier, rainfall diminished, and surface water was not, or rarely, accessible. Consequently, the biomass was severely reduced, and a similar environmental situation endured throughout the later African Humid Period. The population, as seen in the number of discovered settlements, diminished. The economy was founded on mixed pastoralism based on cattle and ovicaprids. Cattle and ovicaprid breeding was supplemented by hunting and gathering. It was the time of the *Ru'at El Ghanam* Unit (Middle Neolithic Humid Interphase; cf. Table 3.3).

A radiocarbon date from the hearths area on top of the Site E-06-4 (Gebel El Muqaddas) link it with the Middle Neolithic Humid Interphase settlement and suggest that it may serve some spiritual observances, perhaps offerings similar to those at Structure 21.

The formation of the "Wadi of the Sacrifices" marks a new development in the geomorphic history of Nabta Playa. It formed after the landscape remodeling changes in the hyper-arid Post-*Al Jerar* 8.2 ka event and during Post-Middle Neolithic Arid Phase. The "Wadi of the Sacrifices" provided the first considerable influx of water to the highly seasonal and reduced lake, draining the footslopes of the Eocene Plateau at the beginning of the rainy season. That seems to be the reason for the appearance of numerous offering tumuli and cairns in the Valley and along its right, western raised sandstone bank used by sacrificers of the *Ru'at El Baqar* in the Late Neolithic (cf. Table 3.3).

A few dozen small (ca. 6 to 3 meters in diameter), flattish (up to about 1 m in height) tumuli built of loose, broken sandstone blocks dote the west sandstone bank. Only a few have been placed on its alluvial sandy bed, e.g., the largest tumulus of Site E-94-1N; some are resting on flat tops of sandstone knolls or low rises as, e.g., Tumuli E-97-4 and E-97-5 (Applegate e*t al.* 2001b).

There are three major types of tumuli. The first is epitomized by a single mound (Site 94-1N) containing the interment of an articulated entire heifer deposited in a prepared, closed grave chamber covered by a superstructure of loose sandstone blocks, including interspersed ruminant bones in the basal section of the tumulus (Applegate *et al.* 2001: 473), and presumably representing an offering.

The second category embraces the tumuli build of sandstone blocks over disarticulated cattle, small stock, and a beheaded (?) human. The fragments of carcasses have been placed in rock depressions or on a bare rock surface, and no grave pits have been observed. The third category comprises empty tumuli and cairns conceivably originally containing perishable offerings.

The quartzitic sandstone blocks used to erect the tumuli's superstructures might have been quarried on the western shores of Nabta Playa. Most likely at Quarries E-05-3 and E-06-2, Sector C, as suggested by the Poz-19188 and Poz-14025 radiocarbon assays (cf. Chapter 5, this volume).

2. "Fields of Menhirs"

Except for isolated stelae dispersed mainly within the Western Field, there are four major fields of stelae or groups of megalithic structures along the western shores of the Nabta Playa Basin: the Western, Eastern, South-Eastern, and Southern Groups (or Fields). All dot the gentle, erosional clay mounds and hummocks surrounding the centre of Nabta Playa. Each group contains several to more than twenty tight clusters of shaped and sometimes unshaped megalithic blocks and slabs and single, isolated stones. Today, except for a dozen or so monuments still standing upright, the megalithic slabs, although often broken or tilted, lie flat on the surface of the 8.2 k event Neolithic playa silt. There are isolated stelae and small clusters located upon the "Salt Hill", an erosional isolated playa-silt rise lying to the north of the South-Eastern Group. Several dozen stelae clusters containing several hundred individual stelae have been recognized thus far along the western shores of the ancient Lake Nabta.

The Combined Prehistoric Expedition (CPE) excavated three clusters of collapsed and broken megalithic stelae designated as Structures A, B, and E at Site E-96-1, located in the Western Field of Stelae. In all instances, the excavations revealed vast pits dug into the lake silt underneath the stelae. The holes were sunk to the depth of mushroom-like sandstone bedrock rises, i.e., table rocks. These table rocks rose above the continuous bed of Cretaceous bedrock and had been carved by wind erosion well before deposition of the silt. At Structures A and B, the table rocks were slightly worked by knapping to form a crude nose-like projecting point on the northern side of the stone. The pits were filled again with the previously removed silt.

An augur sounding of the bedrock under five of the stelae cluster in the northern section of the Western Field indicated rises in the bedrock under the central area of the clusters. An electro-resistivity survey of several collapsed stelae clusters in the northeastern section of the same field showed that most individual sets had erosional mushroom rocks underneath (cf. Chapter 8, this volume).

This was not, however, a general architectural canon. In the South-Eastern Group of Stelae, Site E-04-1, one cluster of collapsed whole and broken menhirs (*Concentration A*) revealed relatively small pits, which served as receptacles for the bases of the stelae.

The infill of the deep pits usually contained sandstone flakes and chunks resulting from shaping the stelae, hoes made of sandstone flakes, and occasional flint artefacts. The deep hole under Structure A, Sector C, centrally placed over a small hillock, had a large block of sandstone placed at its upper section. It weighs over a ton and is only slightly shaped and possibly polished into a form resembling a cow (to a very inspired observer).

Cross-sectioning of the upper part of the lacustrine clay/silt beds upon which the blocks rested, and studying the dispersal of the broken fragments of menhirs has led to the refitting and reconstruction of the original arrangement of individual megaliths and their groups. In many instances, the cross-sections revealed the shallow wind-eroded eroded basins upon which the blocks collapsed. The prevailing northerly desert winds carved the basins in front of the megaliths, weakening their footings. A series of OSL ages defined the time of collapse as a contemporary within 2σ to Phase Ia (2500-2160 BC) of the C-Group. It seems that the C-Group cattle herders annihilated the spiritual presence of foreign rulers of the area. The findings have helped to define the reasons for the fall and the kinetics of collapse. That is how we know that most of the stelae were facing general north, or rather the area of the night skies occupied by the circumpolar stars (Schild and Wendorf 2004).

All blocks within a cluster are shaped by crude knapping into stelae-like forms with rounded, ogival, or anthropomorphic tops (head and head and shoulders) and rounded, pointed, or flat bases. They also differ in size and weight, ranging from blocks measuring a few meters in length and weighing several tons to small ones less than a meter in length and a few dozen kilograms in weight. Several upright or tilted, broken bases are still submerged in the playa silts, confirming that the megaliths were initially set vertically. The fact that so many megaliths are shaped into anthropomorphic shouldered figures strongly suggested that they served as stelae commemorating the deceased members of particular social groups (Figs 5.1 – 5.9).

3. The Tumulus from the Site E-04-2 ("Little Lord of Nabta Playa")

Almost 500 hundred meters to the west of the Western Field of Stelae, a double ring of stones rests upon a flat-topped, prominent hill overlooking the Nabta Playa Basin. This feature marks the remains of an ancient tumulus. The construction rests upon white shale leveled before the erection of the tumulus. The inner ring, composed of quartzitic sandstone slabs and blocks, forms a dry masonry chamber. The outer ring, made of 22 large, flat sandstone slabs, closes the construction. Inside the chamber is a small, oval grave shaft sunk into the shale, filled with patches of an ancient, cemented, almost completely removed, grave backfill and loose sub-recent aeolian sand. Half of a brown, black-topped, smoothed deep bowl with a conical base was found lying on the shaft floor together with the skull of a two- to four-year-old boy with North African physical features (determination by Joel D, Irish; cf. Chapter 10, this volume). A radiocarbon assay on structural carbonates of the skull yielded: minimum age (at 2σ) of about 3660-3520 calBC; and a minimum age (small sample), on the collagen, (at 2σ) of about 3350-2920 calBC). A Qusseir Clastic Yellow Ware potsherd found on the tumulus' floor has been firmly associated with the Final Neolithic archaeology of the South-Western Desert (Nelson and Associates 2002: 45) and fits the age of the El Asnam cultural variant.

4. Significance of the Megaliths of Nabta Playa

The Megalith Builders of the Final Neolithic (*Bunat El Asnam*; cf. Table 3.3) put an unprecedented lot of time and effort into building and constructing the megaliths and astronomical devices that helped control life in the surrounding world and other worlds. Organized labor and knowledge were spent to build not only the megaliths. These were complex and structured societies, with dominating families whose power was inherited. The discrete groups of menhirs at Nabta Playa probably suggest lineages of such families. The archaeology of the Late Neolithic Cattle Herders (*Ru'at El Baqar*) and the Final Neolithic Megalith Builders (*Bunat El Asnam*; cf. Table 3.3) show that both societies were nomadic pastoralists whose economy was dependent on cattle and small stock husbandry. The erection of the tumuli and fields of menhirs imply that both groups represented an elaborate package of religious beliefs and rich social structuring seemingly unparalleled in Africa. To all appearances similar, although much later, regional ceremonial centres with megalith alignments, tumuli, and stone circles are reported from the Sahelian and Sub-Saharan parts of the continent such as Habana, Beni Helba Baggara, and Gura'an. However, their spiritual meaning seems utterly different (Wendorf and Schild 2001a: 671-674).

The late pastoralist of the South-Western Desert apparently lived in a close relationship with their agricultural counterparts in the Upper Nile Valley. These bonds are seen in the presence of many imported goods from the Nile Valley in the graves of the Gebel Ramlah cemeteries (Kobusiewicz and Kabaciński 2010a), perhaps also in the multiethnic character of the desert population (Irish 2010: 219).

Utmost intriguing, however, are the ties that seem to link the Megalith Builders of Nabta Playa with the roots of at least some of the ancient Egyptian beliefs, myths, magic, and religion.

At Nabta Playa, most of the menhirs face the northern, circumpolar region of the heavens. Following the early Egyptian mortuary texts known as Pyramid Texts, this is a heavenly section where the stars never die, and there is no death. It is the Area of Dāt (Duat), the objective of the departed, the "Field of Offerings", and "the abode of the gods and the dead" (David 2002: 82), in which the deceased will live as an 'effective' spirit (Frankfort *et al.* 1961: 57). It is here that the spirits encounter their northern emergence into the world (Allen 2005: 10), and here that the king would become a circumpolar star (Spencer 1982: 140). One cannot exclude the mushroom rocks under the stelae and their possible role in this myth. They may have been considered to be the launching pads sending the deceased, symbolized by their effigies menhirs, to Dāt.

The social structuring of the Final Neolithic *Bunat El Asnam* societies appears to have been echoed by the dramatic difference in the character of interments, the imposing tumuli of paramount chiefs, on the one hand, and the tightly-packed family graves at Gebel Ramlah Playa showing no social differentiation (Kobusiewicz and Kabaciński 2010c: 256; Kabaciński *et al.* 2018), on the other. It is more likely that the clusters of stelae should be viewed as symbols of the deceased members of families grouped in separate hills reserved for extended lineages or clans, all erected at an important regional ceremonial centre (also compare Brass, 2019). The world of Megalith Builders of the South-Western Desert most probably ended around 6200-6000 years ago with the return of the hyper-arid condition in the Nubia-Shab Peneplain with a short pause during the C-Group herders presence in the area.

In the Nile Valley, in Upper Egypt, it was Menes, the king of Upper Egypt, the first king of Dynasty I, who around 3100 BC unified Upper and Lower Egyptian kingdoms. Unknown, earlier kings of Upper Egypt must have preceded Menes or Nermer. One of these, known under the name of Scorpion, apparently tried to overpower the north. But earlier, a prehistoric leader of Upper Egypt must have begun to unify late Predynastic chiefdoms or poleis linked to the prehistoric Buto and Hieraconpolis. The time of this threshold in the history of Ancient Egypt has never been established; it might have preceded the unification of Egypt by several or a few centuries. At around 4250-4000 BC (second half of the Final Neolithic Humid Interphase; cf. Table 3.3), the *Bunat El Asnam* disappeared from the South-Western Desert. This was also when the prehistories of Upper Egypt and the South-Western Desert might have met, at about the time of the birth of the Nagada complex (Ciałowicz 2001), and the remarkable transformation of Egyptian socio-economic structures (Wenke 2009: 189).

The usually well-organized and worrisome desert herders, probably speaking the same or similar language as the Predynastic people in the Nile Valley, when forced into the relatively crowded Valley, could have served as catalysts for these processes. Intensification of the intragroup competition and the merger of poleis seen in the Upper Egypt in later Predynastic time may herald the future unification (Savage 1997).

5. Installation of Nabta Playa Monuments in the Nubia Museum

During the 2004 field season, the Combined Prehistoric Expedition began to notice alarming traces of deep incursions by "tourists" into the antiquities of Nabta Playa. The number and character of these dangerous interventions have increased with time. The "tourists" mainly concentrated on the "Calendar Circle"; a prehistoric road marker indicating the location of a C-Group slab house; the C-Group house itself; and the northern stele of Megalithic Alignment A (Schild and Wendorf 2015). Unfortunately, the Supreme Council of Antiquities was not aware of these visits and indeed has never issued permits to tour the Nabta Playa monuments.

In the years 2004-2007, the illegal tourists in Nabta Playa made a "complete reconstruction" of the "Calendar Circle" by erecting all of the sandstone blocks that lay inside the feature and adding several new ones to fit their ideas about how the object should appear. The "reconstruction" by illegal tourists destroyed the original circle of stones. By 2006, it had become clear that the feature was endangered and needed to be moved to a safe place. The Combined Prehistoric Expedition Foundation in Washington and the Institute of Archaeology and Ethnology, Polish Academy of Sciences, agreed to finance the project. Upon acquiring the necessary permits from the Supreme Council of Antiquities in 2007, the Expedition began preparation to move the selected monuments to the Nubia Museum in Aswan, Egypt. In the 2008 season, the CPE precisely mapped the altered "Calendar Circle" using a total station electronic theodolite.

Field records made in 1992 and the subsequent publication (Applegate and Zedeño 2001b), although not very precise, helped determine the associated stones and their placement. Additional help in choosing the authenticity of the artifacts making up the installation was based on prehistoric alterations on rocks used to construct the "Calendar Circle". It was evident that the slabs showing traces of shaping by knapping were the original elements of the design. Nearly 40 objects were selected for removal. The pieces were photographed, described, and registered before being packed up and transported. The removed objects have been replaced by similar slabs collected at modern sandstone outcrops in the vicinity of Nabta Playa.

The packing and removal of the specimens were completed in the presence of a committee appointed by the Supreme Council of Antiquities headed by Mr. Attia M. Radwan, Undersecretary of State for Upper Egypt. Finally, in February 2008, with the assistance of the police, the artefacts were moved to the stores of the Nubia Museum in Aswan.

In February 2009, in the garden of Nubia Museum, the sandstone blocks forming parts of the "Solar Calendar" were placed in a similar scatter pattern recorded in 1992 and the removal in 2007-2008. However, the new analysis of the original field records suggested that the number and placement of the gates were slightly different than the reconstructions drawn in 1992 and 1997 and published in 1998 (McKim Malville *et al.* 1998: fig. 3b) and 2001 (Applegate and Zedeño 2001b: fig. 14.3). The shaped slabs, creating the sight lines based on the 2008 map of the feature, point to at least four pairs of gates inside the circle, which differs from the two gates noted in the original analysis. The device's ring was reconstructed based on the location of its dispersed elements, also observed in 1992 because no clear-cut outline of a circle was preserved in the archaeological record. The distribution of slabs also indicates substantial downslope creep of the possible elements of the ring. A relatively large number of flat sandstone slabs around the device and its immediate neighborhood make the ring's hypothesis entirely plausible. The resulting installation assembled in the museum is a hypothesized reconstruction of the device based on the various detail maps and a close examination of the types of stones present, their distribution, and the possible effects of erosional processes.

The second installation of the Nabta monuments in the Nubia Museum Western Gardens represents a composition of seven upright, shaped stelae of various sizes. The stelae face north and have been selected from a range of clusters of Nabta megaliths. The installation gives the visitor an idea of a group of stelae memorial monuments as they might have looked after their erection during the Final Neolithic.

In February 2010, the third and last element was added to the two previous groups. The rough, cattle-like shaped sandstone block recovered by Fred Wendorf during the 1996 season excavations from the pit under the collapsed stelae of Megalithic Structure A at Site E-96-1 (Wendorf and Królik 2001: 510). The *sculpture* has been erected in the southern section of the Pharaonic granite quarry shelf. The head of the 'cow' faces north and is in a similar position as during its discovery in 1996.

The group of three installations in the Nubian Museum is the first such exhibition in the history of Egyptian museology. It brings to the Egyptians and ordinary tourists the unusual depth and grandeur of the late prehistory of Ancient Egypt buried in the remote parts of the Western Desert of Nubia.

6. Parting Words

Seventeen years (1992-1994; 1996-2009) of the work with the megaliths of Nabta Playa fulfilled but just the first stage of the research and led to a fairly accurate recording of the monuments and installations as to their chronological placement in Egyptian prehistory. The phenomenon of Nabta Playa's "Ceremonial Centre" has no parallel in Egypt nor Africa. It demonstrates the unexpected complexity of ancient Egyptian beliefs, the scale of social complexity of the Late and Final Neolithic desert settlers, and the possible roots of Early Kingdom cosmogony. These unique monuments have survived to our times only because of the remoteness of the Western Desert for almost the entire Upper Holocene. Unfortunately, the recent desert reclamation projects, as well as the massive intrusion of illegal tourists, could wipe out the whole of megalithic heritage preserved down to our times. A considerable section of the work on the megaliths of Nabta Playa was done by Fred Wendorf in 1992-1998, similarly as a sizable portion of the subsequent article writing. Many of the thoughts expressed in the presented account can be found in the papers jointly written by Fred and myself.

Chapter 14.

Plants used by Neolithic nomads in the Western Desert in Egypt. The results of archaeobotanical research from sites near Nabta Playa

Maria Lityńska-Zając

1. Introduction

In the Western Desert in southern Egypt, there is a comparatively large number of archaeological sites located in the Nabta Playa area about 40 km north of the border with Sudan and about 100 km west of the Nile Valley near Abu Simbel (Wendorf and Schild 1980). Today this is the driest part of the Eastern Sahara Desert, where irregular rainfall occurs only once every few years (Zahran and Willis 1992, 15-116). Due to its climatic qualities (humidity and temperature), this area is classified as the 'subtropical desert climate zone' (Griffiths 1987; Kindermann *et al*. 2006). As a consequence of the atmospheric and edaphic conditions currently prevailing in the area the vegetation is extremely poor. This consists of single trees (Fig. 14.1) and a few herbaceous plants found in the vicinity of springs or in oases where groundwater is available (e.g., El Hadidi 1980; Mitka and Wasylikowa 1995; Wasylikowa and Mitka 1998; Wasylikowa 1997; Boulos 2008). At present, about 20 km southwest of Nabta Playa, Bir Nakhlai (Fig. 14.2) is home to only a few species of angiosperms, and the water sources are surrounded by *Phragmites australis* (El Hadidi 1980). Bornkamm (1986) described 14 species of plants in this region of the Western desert.

The natural situation of this region was different at the beginning of the Holocene. During the Neolithic period, the Saharan climate was characterized by alternating dry and more humid periods (Wendorf and Schild 1980; 2001; 2001a; Wendorf *et al*. 1991; 2001; Boulos and Barakat 1998; Bobrowski *et al.* 2021 and literature cited there). In this period, the investigated area lay in the transitional zone between the semi-desert and the desert (e.g., Wasylikowa and Mitka 1998). These conclusions were based on studies of charcoal and pollen from Egyptian and Sudanese sites and the analysis of pollen in deposits in northern Sudan (Barakat 1995b; Neumann 1989a; 1989b). Much more favourable conditions of humidity in the Holocene of Egypt are confirmed by analysis of the water level in the Qarun Lake in the Fayum depression (Hasan 2000). Other evidence is provided by modeling of the Nile's flow in the vicinity of Aswan, based on the Macrophysical Climate Modeling (CMCM) method developed in the 1990s by R.A. and R.U. Bryson (Bryson and Bryson 1997; Bryson 1985; 2007). According to this model, the flow of the river changed and was greatest at about 6250 BP (Bryson 2007, 112, fig. 17.1), which indicates the intensity of precipitation during the period.

Figure 14.1. Present-day single *Tamarix* near Nabta Playa Camp. Photo by M. Lityńska-Zając.

Figure 14.2. Bir Nakhlai (Western Desert, Egypt) – today's vegetation around a small water source. Photo by M. Lityńska-Zając.

The geomorphology and geological structure in the vicinity of Gebel Nabta created favourable conditions for the periodic accumulation of water in depressions. As a consequence, a type of oasis was formed, surrounded by rich vegetation that grew especially after the rainy season. Human groups came here with their animals and stayed periodically, finding in this place plenty of plant food and water supplies.

The traces of intense settlement left by the nomads are mainly located in the basin and on the edges of the Holocene fossil lake. Nomads periodically set up camps and settlements where traces of huts, fireplaces, hearths, and various types of pits can be identified. They also established cemeteries and erected a number of sacred structures and a huge ceremonial complex (e.g, Wendorf and Schild 2001c; Kobusiewicz *et al.* 2010; Bobrowski *et al.* 2012).

Archaeobotanical studies have been carried out as part of the archaeological research in several sites near Nabta Playa, and these were an important element of interdisciplinary projects implemented in the area, for they have resulted in the preparation of several specialist studies. The first taxonomic identification of macroscopic plant remains was presented by El Hadidi (1980). This was continued on several sites of the region by various authors who focused o macroscopic plant remains preserved in the form of fruits, seeds, wood, tubers, and impressions in pottery (Wasylikowa 1992; 1994; 1997; 2001; Barakat 2001; Butler 2001; Hather 2001; Magid 2001; Wasylikowa and Lityńska-Zając 2010; 2012; Lityńska-Zając 2010; Lityńska-Zając and Wasylikowa 2018). The most valuable and abundant plant material was found in huts, pits, postholes, vessel settings, and in the hearths and fillings of wells explored at Site E-75-6 in Nabta Playa where remains belonging to 128 plant taxons were found, 85 of them identified from seeds of fruits (among others, Wasylikowa *et al.* 1993; 1995; 1997; Kubiak-Martens and Wasylikowa 1994; Wasylikowa 1992; 1994; 1997; 2001; Barakat 1995a; 1995b; 2001; Wasylikowa *et al.* 2001a; 2001c; Mitka and Wasylikowa 1995; Wendorf *et al.* 1992; 1998). Separate publications concern the charcoal and other plant remains preserved at sites E-01-2, E-03-1 and E-03-2 in Gebel Ramlah (Lityńska-Zając 2010) and Barqat El Shab (Bobrowski *et al.* 2020; Lityńska-Zając and Skrzyński 2021; Lityńska-Zając and Bobrowski 2021-2022; Bobrowski *et al.* 2021; Lityńska-Zając *et al.* 2024).

The present study is devoted to plant residues preserved on other sites in Nabta Playa, Nab El Deep and Gebel El Muqaddas explored in the years 2001-2008 and 2011-2012. The plant material presented here is dated to the Neolithic period in general (cf. Chapter 12, this volume).

2. The Material and Method of Study

The archaeobotanical research accompanying archaeological fieldwork was conducted in 2001-2008, by the Combined Prehistoric Expedition (CPE) and in 2011-2012 by the Institute of Archaeology and Ethnology Polish Academy of Science under the direction of prof. dr. hab. Romuald Schild and prof. dr. Fred Wendorf, then prof. dr. hab. Michał Kobusiewicz and prof. dr. hab. Jacek Kabaciński. This concerned various sites in Nabta Playa, Gebel Ramlah, Nab El Deep, Gebel El Muqaddas and Barqat El Shab. Samples intended for archaeobotanical investigations were taken from excavated features such as huts, pits, hearths, postholes, and graves. They came from 10 sites (E-00-1, E-03-4, E-04-4, E-05-2, E-05-3, E-06-1, E-06-2, E-07-3, E-08-1 and E-92-7) and two isolated hearths (1/2004 and 2/2004) in Nabta Playa, sites E-09-3 in Gebel Ramlah, E-06-4 in Gebel El Muqaddas and E-02-3 in the Nab El Deep Area. The volume of each of the collected samples was measured, and this ranged from about 0.25 do about 6000 cm^3. As shown by the experimental rinsing of the material, there was no attempt to wet-sieve because the burnt plant material disintegrated into dust on contact with water. Almost every sample was sifted in the field with sieves with mesh diameters 1.0 and 0.5 mm. The two fractions of material obtained by this method were then examined dry, in a laboratory organized in a tent, using a magnifying glass (enlargement 3.5× and 5.5×). Samples were also taken from the site known as "The Tumulus of the Little Lord of Nabta Playa", which were not sieved, but were collected in their entirety. All plant residues, such as the several seeds and fruits and the much more frequent fragments of charcoal, were segregated, extracted, and packaged. In addition, fragments of snail shells were removed, including *Zoothecus* sp. (R. Schild, oral information), oyster shell fragments, and minor fragments of bones and teeth for archaeological analyses.

The selected plant material almost completely comprised charred material. The presence of burnt remains in archaeological material is the result of intentional and accidental human activity (Lityńska-Zając and Wasylikowa 2005, 42). The carbonization of plants occurs: 1. in all types of fireplaces in which is used the fuel of plant origin (wood, straw and ear of grass, or whole plants of other species), during the preparation of food, or when a structure (for example a storage) is burnt down.

There were also single uncharred specimens that looked fresh, like pieces of straw and spikelets and caryopses of grasses, Poaceae indet. (syn. Gramineae), the seeds of Brassicaceae (syn. Cruciferae), or fruits of *Taraxacum* sp. still with remnants of fluff. These specimens are likely to be modern intrusions, probably due to their transport by wind or with food imported to the archaeological camp. Some of the screened and searched samples from the filling of features did not contain any plant material.

In addition to the soil samples, charcoal fragments were collected using the naked eye in places where there were concentrations of fragments. Such samples include those from Tumulus 2 explored at E-06-4 in Gebel El Muqaddas.

In the identification of fruits and seeds, specialized literature and atlases were used (Cope and Hosni 1991; Cappers *et al.* 2005; 2009; Nesbitt 2006; Boulos and Fahmy 2007; Neef *et al.* 2011), along with literature containing descriptions of plant remains preserved in Egyptian sites (Wasylikowa 1997). Each time the results were compared with a comparative set of modern and fossil specimens collected in two comparative collections (in the Archaeological Laboratory of the Institute of Archaeology and Ethnology of the Polish Academy of Sciences in Igołomia and in the Palaeobotany Department of the W. Szafer Institute of Botany of the Polish Academy of Sciences in Kraków). A major source for comparison was the collection of determined material from Site E-75-6 in Nabta Playa. In the laboratory work, use was made of a Nikon binocular microscope of magnification of 10× to 40×. Certain specimens were measured using a Brünell magnifying glass. The results of the analyses are presented in tables, where qualitative and quantitative data are included. Each diaspore, preserved in whole or in fragments, was counted as one specimen.

Burnt wood was identified on the basis of anatomical structure. Each charcoal fragment was prepared for microscopic observation by making fresh breaks in the three anatomical sections characteristic of botanical material: transverse, longitudinal tangential, and radial longitudinal and the results of observation were compared with the literature related to plant anatomy. The analyses were carried out with a Nikon metallographic microscope in reflected light at magnifications of 100× to 500×. Use was made of comparative anatomical preparations of various species of trees and shrubs characteristic of the flora of Egypt and its surroundings, some of them obtained from prof. dr. Katharine Neumann (*J. W. Goethe-Universit*ät, Seminar für Vor- und Frühgeschichte Archäologie und *Archaeobotanik Afrikas, Frankfurt*). In addition, descriptions of the atlases and keys for the determination of wood were used (Couvert 1977; Barakat 1995b; Neumann *et al.* 2001); and in studies discussing the results of charcoal samples from various archaeological sites, including Nabta Playa (Neumann 1993; Barakat 2001). In addition, a comparative collection was used. The results of the quantitative analysis show the actual number of identified fragments. Only in the case of numerous and very crushed specimens was their volume given.

In this work, studies on the present day Egyptian flora have been taken into account (Boulos 1995; 1999; 2000; 2002; 2005; Täckholm 1974). Plant names are given following those used by L. Boulos (1995), and for *Sorghum* according to J.M.J. de Wet (1978).

3. General Characteristics of the Material

As already mentioned, the plant remains at the Nabta Playa sites have been preserved in a charred state. In addition to the specific changes (swelling of the specimens and cracks in the surface) caused by charring (e.g., Wilson 1984; Kislev and Rosenzweig 1991), part of the material had traces of mechanical damage. This consisted of the abrasion of surface features characteristic for particular fruits or seeds. Some of the material was more or less badly fragmented. The charcoal pieces were of varying size, some of them were the size of about 0.5 to 0.6 cm. Single examples were larger and (independently of the anatomical structure of the specimen) reached sizes of 1 to 1.5 cm. The majority of the fragments however were of a maximum size of 0.4 to 0.5 cm. It should be borne in mind that in order to observe all the anatomical details characteristic of the respective species, it is recommended to examine fragments larger than 4 mm^3, but smaller specimens are usually also determinable (Chabal *et al.* 1999). There were copious fragments of much smaller size, but it was impossible to identify these fragments, often smaller than 2 mm. It was also not possible to assign to taxons material that was heavily distorted by heating. The anatomical structure of a certain percentage of the material was so weakly visible or illegible that it could not be identified. This may have been due to changes taking place in the burning, or it might have been due to the use of 'dead' and thus partly decomposed material as fuel (Barakat 1995b, 65; Théry-Parisot 2001; 2002).

4. Results

The taxonomic diversity of plant residues and the number of preserved specimens of particular taxa at these sites were significantly lower than those recovered from settlement E-75-6 at Nabta Playa. The concentration of plant remains in individual samples was also relatively small. This situation could be explained by less interest in plants because the presence of debris "in archaeological features reflects (...) the intensity of the use of plants, and in the case of burnt remains, also the frequency of use of fire during their exploitation" (see Wasylikowa and Mitka 1998, 13 and literature cited there). This argument, however, seems not fully justified in the case of material from the newly presented sites at Nabta Playa. It should be assumed that the nutritional requirements of ancient communities were dependent, on the one hand, on the size of the human communities and, on the other, on the availability of specific species of plants surrounded by their settlements. Since the dynamics of settlement in this region depends on environmental conditions (cf. Chapter 12, this volume), the poor representation of plant remains at the sites around Nabta Playa should be explained by the state of preservation of subfossil materials resulting from deposition processes. It is not without significance that the plant materials studied are derived from the oldest and the youngest Neolithic phases, i.e., the most dry periods not favourable to the development of lush vegetation, as in the climatic optimum of the Holocene (e.g., Barakat 1995a; 2001; Wendorf and Schild 2001a).

On the basis of the collected material (fruits, seeds, and charcoal), only 12 plant taxons were identified, including 8 to the species level and 4 to the genus level. Among the remains were also those of plants from the goosefoot family (Chenopodiaceae indet.), grasses (Poaceae indet.), the caper family (Capparaceae indet.), and the sedge family (Cyperaceae indet.). In addition, individual fragments of fruit or seeds cannot be assigned to any taxonomic division.

Among the charcoal remains from trees and bushes, the most frequent were the remnants of *Tamarix* sp. Another taxon relatively frequently noted was acacia, *Acacia* sp., including *A. nilotica* and *A.* cf. *ehrenbergiana*. There were also a few examples of material belonging to the caper family (Capparaceae indet.), including specimens of *Capparis decidua* and *Salvadora persica*, but also *Ziziphus* sp**.** Some of the poorly preserved charcoal has been included in unidentified deciduous trees or shrubs, but their percentage remains undefined. The taxonomy of the bark fragments was also not determined.

For a portion of the determined specimens, descriptive and graphic documentation has been prepared (Fig. 14.3). Their ecological characteristics are given and the places of their occurrence in the present flora of Egypt are given. Based on data from the subject literature, the manner of use of specific taxa are presented. Results from individual sites are summarized in tables (Tables 14.1-14.13). A separate table (Table 14.15) summarizes the data for the separate Neolithic chronological phases. Part of the results are presented as graphs (Fig. 14.4-5).

Figure 14.3. Nabta Playa, examples of identified macroremains: 1 – *Capparis* cf. *decidua*, 2 – *Sorghum bicolor* subsp. *arundinaceum*, caryopsis (a) ventral and (b) dorsal side, 3 – *Schouwia* cf. *purpurea*, 4-5 – *Echinochloa colona*, caryopsis (4) dorsal and (5) ventral side, 6 – Cyperaceae indet., 7 – *Ziziphus* sp. Photo by K. Stachowicz.

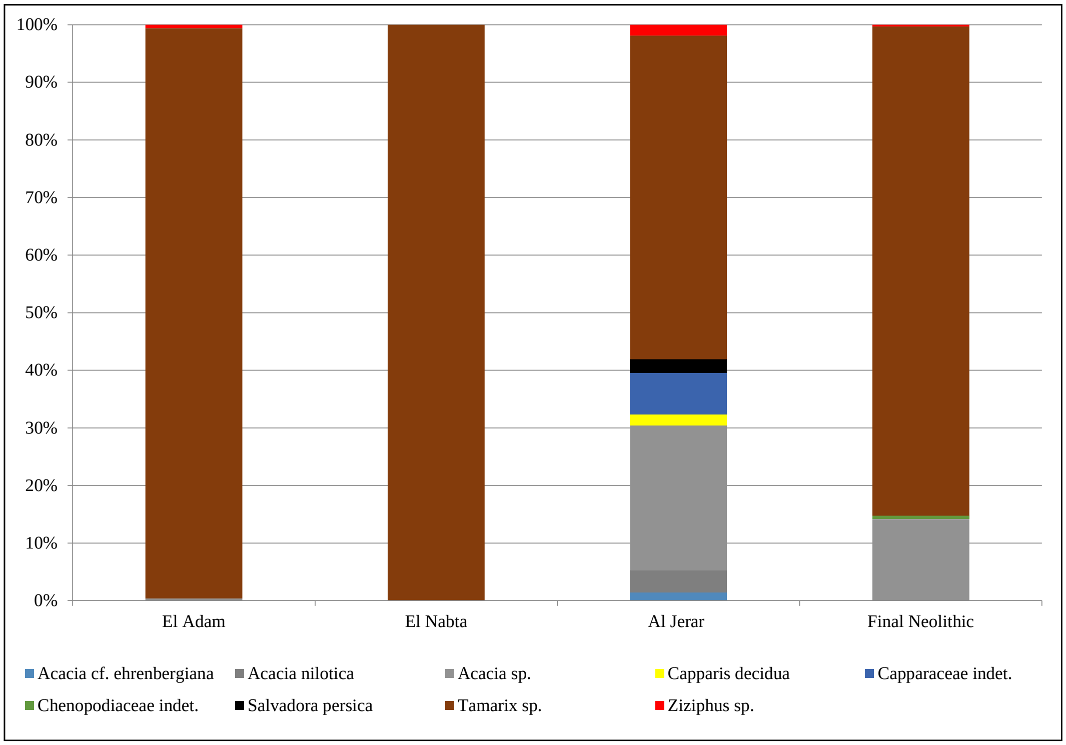


Figure 14.4. The percentage number of charcoal fragments in relation to the total number of fragments from different chronological phases (*El Adam* unit N=1867=100%; *El Nabta* unit N=37=100%; *Al Jerar* unit N=210=100%; Final Neolithic N=339=100%).

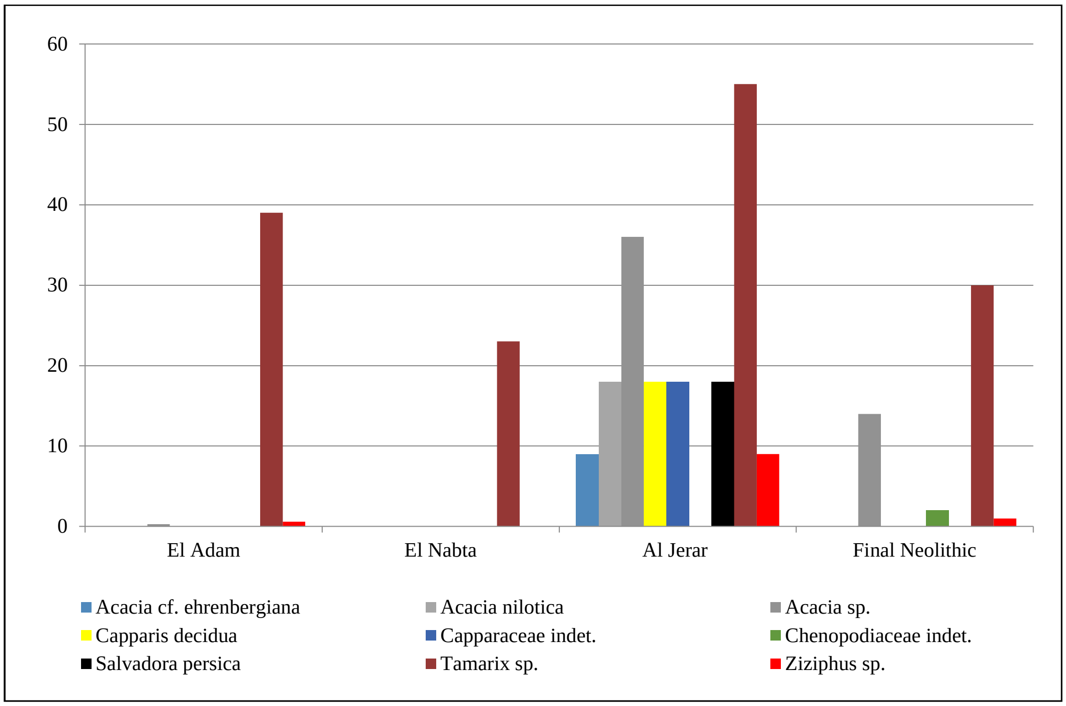


Figure 14.5. Frequency of charcoal fragments in percentage calculated in relation to the total number of samples from different chronological phases (*El Adam* unit N=305=100%; *El Nabta* unit N=17=100%; *Al Jerar* unit N=11=100%; Final Neolithic N=80=100%).

Table 14.1. Nabta Playa, plant remains from sites E-06-1, E-06-1/B, E-06-1/C and E-06-1/D.

Key for Tables14-1-14.13: state of preservation: unch – uncharred specimens, numbers without qualification denote charred specimens; vol. – volume of samples in cm^3.

site E-06-1									
squ.	**depth**	**feature type**	**feature no**	**desc.**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
14/C	0-10				1	250	charcoal	*Tamarix* sp.	26
								undet.	15
5-6/F				Top of cultural leyer	2	3200	empty		
17/G				yell. sand	3	1000	bark	undet.	9
							charcoal	*Tamarix* sp.	16
								undet.	37
7/G				Top of cult. leyer bellow recent sand	4	1100	charcoal	*Tamarix* sp.	85
								undet.	33
11/C-D				sand between recent sand	5		charcoal	*Tamarix* sp.	22
								undet.	25
							seed	undet.	1
7/F				Top of cult. leyer bellow recent sand	6	80	empty		
7/F				Top of cultural leyer	7	2500	empty		
14/E	0-10	Hearth	14,16		8		charcoal	undet.	69
16/C	45-55cm	Hearth	35		9	700	charcoal	*Tamarix* sp.	27
								undet.	21
							grain	Poaceae indet.	1
14/D	0-10cm			yell. sand	10		charcoal	*Tamarix* sp.	18
4/G				Top of cultural leyer	11	3200	empty		
14/D	0-10cm	Hearth	16		12		charcoal	*Tamarix* sp.	23
12/F				Top of cultural leyer	13		charcoal	undet.	12
7/E				Top of cult. Leyer bellow recent sand	14	50	empty		
15/D		Hearth	15	fill	15	2800	charcoal	*Tamarix* sp.	22
								undet.	2
15-16/D		Hearth		redish sand	16	180	charcoal	undet.	18
15/E		Hearth		fill	17	3000	charcoal	*Tamarix* sp.	22
								undet.	18
16/C	0-10cm				18		charcoal	*Tamarix* sp.	62
15/C		Hearth	16	fill	19	2300	empty		
15/C		Hearth	30		20		charcoal	*Tamarix* sp.	11
14/C	0-10cm	Hearth			21		charcoal	undet.	8
15/C	40cm	Hearth	31		22		charcoal	undet.	4
14/C	0-10cm	Hearth	14-16	fill	23	2400	empty		
11-12/E				yell. sand between	24		charcoal	*Tamarix* sp.	9

site E-06-1									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
14/E	10-15cm	Hearth	14,16	fill	25	1800	charcoal	*Acacia* sp.	7
					26			*Tamarix* sp.	8
12/C	0-10cm			SE	27		charcoal	undet.	5
15/C	40-50cm	Feature			28		charcoal	*Tamarix* sp.	4
15/E		Hearth	15	fill	29	1000	charcoal	undet.	5
13/D				yell. Sand	30		charcoal	undet.	4
15/C	40cm				31	1000	charcoal	*Tamarix* sp.	22
								undet.	12
	0-10cm	Hearth	8		32	2400	empty		
14/E		Hearth	16		33	100	charcoal	*Tamarix* sp.	3
								undet.	1
14/D	15-25cm	Pit	22		34		charcoal	undet.	5
5/E		Hearth	8		35	2500	empty		
14/D	10-20cm	Pit	24		36		charcoal	undet.	8
3-4/F		Hearth			37		charcoal	undet.	25
							bark	undet.	4
4/E	0-10cm	Hearth	5		38		charcoal	undet.	26
9/E	0-10cm	Hearth	8		39	1900	empty		
10/D		Hearth	9		40		charcoal	*Tamarix* sp.	32
14/D	0-10cm	Hearth	?		42	1000	charcoal	*Tamarix* sp.	11
16/C	40-50cm	Hearth			43	1000	charcoal	*Tamarix* sp.	9
								undet.	4
							bark	undet.	2
13/C	0-10cm	Hearth	13		44	2300	charcoal	*Tamarix* sp.	3
14/C		Hearth	36		45		charcoal	*Tamarix* sp.	2
9/E	0-10cm	Hearth	8		46	2300	empty		
13/C	0-10cm	Hearth	13		47	2400	empty		
16/C	40-50cm	Hearth	38		48		charcoal	undet.	21
14/D		Hearth	16		49	1800	charcoal	undet.	17
15/C	40-50cm	Hearth	34	SW corner	50		charcoal	undet.	22
14/D		Hearth	18		51	2300	charcoal	*Tamarix* sp.	82
								undet.	39
							spikelet fr.	Poaceae indet.	2 (unch)
14/D		Hearth	18		52	300	empty		
13/C	10-20cm	Hearth	17		53	1350	seed	cf. *Citrulus colocynthis*	1
							charcoal	*Tamarix* sp.	1
								undet.	1
13/C	10-20cm	Hearth	17		54	2300	bark	undet.	4
							charcoal	*Tamarix* sp.	2
								undet.	12
15/C		Hearth	21		55	1500	empty		

site E-06-1									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
15/C	10-20cm			souther wall	56	500	charcoal	undet.	2
							grain	Poaceae indet.	1
15c		Hearth	17a	NW corner	57	1500	charcoal	*Tamarix* sp.	26
								undet.	22
14/D	15-25cm	Pit	22		58	3000	empty		
14/D	10-20cm	Pit	24	bellow recent sand	59	3600	charcoal	undet.	5
15/C	15-20cm	Hearth	26		60	200	empty		
15/C	20-30	Hearth	25	bellow recent sand	61	1200	charcoal	undet.	9
13/C	20-30 cm	Hearth	17a	fill	62	600	empty		
15/C	20-30cm	Hearth	28		63	600	?	undet.	8
15/C	30-40cm	Hearth	30	bellow recent sand	64	1750	empty		
	10-25cm	Hearth	27	fill	65	2300	empty		
	10-25cm	Hearth	27		66	1100	charcoal	undet.	9
6/C	10-25cm	Hearth	27		67	1250	charcoal	undet.	11
6/C	10-25cm	Hearth	27		68	1250	grain	*Echinochola colona*	1
6/C	20-25cm	Hearth	27		69	2800	empty		
6/C	10-25cm	Hearth	27		70	1300	grain	*Echinochola colona*	1
6/C	10-25cm	Hearth	27		71	1300	chaff	Poaceae indet.	2
14/C	40-50cm	Feature	40		72	2000	charcoal	undet.	11
15/C	40-50cm	Hearth		NE corner	73	2000	charcoal	undet.	23
16/C	40-50cm	Hearth	35		74	1750	empty		
16/C	40-50cm	Hearth	35		75	2650	charcoal	undet.	9
							grain	*Echinochola colona*	2
							grain	*Setaria* type	3
16/C	45-55cm	Hearth	35		76	1000	charcoal	undet.	11
15/C	40-50cm	Hearth	34		77	2100	charcoal	undet.	26
10/D	0-10cm	Hearth	9		78	2300	empty		
14C	10-20cm	Hearth	17a		79	1400	charcoal	*Tamarix* sp.	21
								undet.	41
							bark	undet.	3
							fruit	*Ziziphus* sp.	1
16/C	40-55cm	Potthole			80	2100	charcoal	undet.	6
14c	10-20cm		17a			2150	charcoal	*Tamarix* sp.	5
								undet.	1
15,16/C	40-50cm	Feature			82	1600	charcoal	*Tamarix* sp.	5
15/16/C	40-50cm	Feature			83	2100	charcoal	*Tamarix* sp.	2
							fruit	*Ziziphus* sp.	3
							grain	Poaceae indet.	1

site E-06-1									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
16/C	40-50cm	Hearth	35		84	2100	bark	undet.	9
16/C	40-50cm	Hearth	35		84	2100	charcoal	*Tamarix* sp.	31
16/C	40-50cm	Hearth	35		84	2100	charcoal	undet.	8
4/C	0-15cm	Hearth	1		85	3200	empty		
4/F	0-10cm	Hearth	3		86	1950	empty		
4/E	0-15cm	Hearth	5		87	1800	charcoal	*Tamarix* sp.	2
4/E	0-15cm	Hearth	5		88	2900	charcoal	undet.	28
14/C	30-40cm	Hearth	17b	red fill below hearth	89	700	empty		
14/C	30-40cm	Feature	40		90	2500	charcoal	undet.	22
14/C	30-40cm	Feature	40		91	1950	empty		
14/D		Hearth	29		92	2300	charcoal	undet.	7
14/D				red pit	93	450	charcoal	*Tamarix* sp.	5
					94		charcoal	undet.	22
14/C	50cm			bellow recent sand	95	350	charcoal	undet.	46
14/C					96	1250	charcoal	*Tamarix* sp.	22
14/C					96	1250	seed	*Schouwia* sp.	1
					97	150	empty		
15/C	50-60cm	Hearth	34	bottom of the feature	98	700	charcoal	undet.	29
					99	600	empty		
4/G	21-23cm	Feature	2		100		charcoal	*Tamarix* sp.	1
4/G	21-23cm	Feature	2		100		charcoal	undet.	8
14/C	30cm	Hearth	17a		101		charcoal	*Tamarix* sp.	5
14/C	30cm	Hearth	17a		101		charcoal	undet.	5
14/C	30cm	Hearth	17a		101		bark	undet.	3
13/C	30-40cm	Pit		pit below heart 17a	102	700	charcoal	*Tamarix* sp.	16
13/C	30-40cm	Pit		pit below heart 17a	102	700	charcoal	undet.	2
13/C	30-40cm	Pit		pit below heart 17a	102	700	seed	undet.	1
14/E				red sand top	103		charcoal	*Tamarix* sp.	21
14/E				red sand top	103		charcoal	undet.	18
14/E				red sand top	103		bark	undet.	18
15/C	50cm	Hearth		C14a	104		charcoal	*Tamarix* sp.	17
15/C	50cm	Hearth		C14a	104		charcoal	undet.	5
15/C	50cm	Hearth		C14a	104		bark	undet.	1
15/C	50cm	Hearth		C14a	104		fruit	*Ziziphus* sp.	2
14/C	0-10cm	Hearth			105		grain	Poaceae indet.	5
14/A	10-20cm				106	650	charcoal	*Tamarix* sp.	11
14/A	10-20cm				106	650	charcoal	undet.	7
17/A	20-30cm	Hearth	53		107	25	charcoal	undet.	5
13/B	10-20cm			top of cult. layer	108	650	charcoal	*Tamarix* sp.	22
13/B	10-20cm			top of cult. layer	108	650	charcoal	undet.	9
15/AA	10-15cm	Hearth	44		109	80	charcoal	undet.	9

site E-06-1									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of spe-cimens
16/A	40cm			sand above cultural layer	110	200	charcoal	undet.	4
14/B	10-20cm			top of cult. layer	111	500	charcoal	*Tamarix* sp.	22
16/A	40cm			sand above cultural layer	112	120	charcoal	*Tamarix* sp.	8
16/A	40cm			sand/cultural layer	113	125	charcoal	*Tamarix* sp.	11
16/A	40cm			sand/cultural layer	114	150	charcoal	*Tamarix* sp.	2
16/A	40cm			sand/cultural layer	115	25	charcoal	undet.	1
16/A	40cm			sand/cultural layer	116	175	charcoal	*Tamarix* sp.	1
17/BB	40cm			sand/cultural layer	117	180	charcoal	*Tamarix* sp.	3
15-16/AA	40cm			sand/cultural layer	118	70	charcoal	*Tamarix* sp.	17
15/A	40cm			sand/cultural layer	119	50	charcoal	*Tamarix* sp.	2
15/AA	40cm			sand/cultural layer	120	75	charcoal	*Tamarix* sp.	3
17/A	45cm	Hearth		lower cultural layer	121	50	charcoal	*Tamarix* sp.	26
								undet.	8
							bark	undet.	3
							spikelet fr.	Poaceae indet.	1 (unch)
15/AA	40-45cm			lower cultural layer	122	200	charcoal	*Tamarix* sp.	21
15/A				lower cultural layer	123	300	charcoal	*Tamarix* sp.	18
17/AA	45cm			sand/cultural layer	124	75	empty		
16/A	45cm			sand above or around cultural layer	125	170	charcoal	*Tamarix* sp.	21
17/B	35cm	Hearth			126	1950	empty		
13/AA	10-15cm	Hearth	45	upper cultural layer	127	1500	charcoal	*Tamarix* sp.	76
14/A	10-15cm			upper cultural layer	128	1900	charcoal	*Tamarix* sp.	16
								undet.	11
13/AA	10-15cm	Hearth	45,45a	upper cultural layer	129	1000	charcoal	undet.	1
								Tamarix sp.	2
14/B	20-25cm			sand near the cultural layer	130	125	charcoal	*Tamarix* sp.	11
								undet.	4
13/B	10-15cm			upper cultural layer	131	25	charcoal	undet.	21
17/AA	30-40 cm			sand above or around cultural layer	132	150	charcoal	*Tamarix* sp.	29
								undet.	2
14/AA	10cm			upper cultural layer	133	170	charcoal	*Tamarix* sp.	1
								undet.	1
16/A				lower cultural layer	134	25	charcoal	*Tamarix* sp.	11
13/AA	10-15cm	Hearth		upper layer	135	5	charcoal	undet.	1
15-16/A-AA	40-50cm	Feature		lower cultural layer	136	250	charcoal	undet.	39
13/AA	10-15cm			upper cultural layer	137	5	charcoal	undet.	2
17/A	45cm			lower cultural layer	138	5	charcoal	undet.	7
14/A	10-15cm			upper cultural layer	138	100	empty		

site E-06-1									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
13/A	10-20cm			upper cultural layer	140	30	charcoal	undet.	4
								Tamarix sp.	2
14/B-A	10cm			top of cultural layer	141	100	charcoal	*Tamarix* sp.	11
15/A	10cm	Hearth		sand above cultural layer	142	1700	charcoal	*Tamarix* sp.	8
								undet.	4
15-17/B-BB	40-45cm			lower cultural layer	143	700	charcoal	*Tamarix* sp.	19
	45-50cm	Feature		lower cultural layer	144	2	charcoal	undet.	8
A/14	15-20cm	Hearth	55		145	1100	charcoal	*Tamarix* sp.	7
								undet.	4
							bark	undet.	1
13/AA	15-20cm	Hearth	56	upper layer	146	400	empty		
13/AA	15-20cm	Hearth	57	upper layer	147	25	charcoal	undet.	2
A/14	15-20cm	Hearth	58	upper layer	148	10	charcoal	*Tamarix* sp.	1
								undet.	3
14/B	15-20cm	Hearth	5		149	75	charcoal	*Tamarix* sp.	9
A-B/14	20-25cm	Hearth	55	upper layer	150	100	charcoal	*Tamarix* sp.	4
A/14	20-25cm	Hearth	60	upper layer	151	20	charcoal	undet.	11
A/14	20-25cm	Feature		upper layer	152	50	charcoal	*Tamarix* sp.	19
B/14	20-25cm	Hearth	55		153	90	charcoal	*Tamarix* sp.	3
AA/13	25cm	Feature		upper layer	154	200	charcoal	*Tamarix* sp.	9
								undet.	4
A/14	25-30cm	Hearth	55a		155	1300	charcoal	*Tamarix* sp.	5
A/14	25-30cm	Hearth	58a	upper layer	156	130	charcoal	*Tamarix* sp.	12
B/14	25-30cm	Hearth	59a	upper layer	157	1000	charcoal	undet.	22
AA/13	25-30cm	Hearth		upper layer	158	550	charcoal	*Tamarix* sp.	3
BB/B	20-25cm			upper cultural layer	159	40	charcoal	*Tamarix* sp.	17
AA/B	30-35cm	Feature		upper layer	160	80	empty		
B/14	30-35cm	Hearth	59		161	90	charcoal	*Tamarix* sp.	1
B/14	30-35cm			upper layer	162	800	charcoal	*Tamarix* sp.	9
A/14	30-35m			upper layer; SE corner	163	50	charcoal	*Tamarix* sp.	12
								undet.	2
A/14	30cm	Hearth	55a		164	100	charcoal	undet.	8
A/14/NW	25-30cm			upper layer	165	60	charcoal	undet.	2
A-14	35-40cm				166	10	charcoal	undet.	18
B/14/SW corner	40cm	Hearth	65	bottom o cultural layer	167	10	charcoal	undet.	7
A-14	35-40cm	Hearth	62		168	200	charcoal	*Tamarix* sp.	6
	35-40cm	Hearth	63		169	250	charcoal	*Tamarix* sp.	7
							seed	*Ziziphus* sp.	1
A/14	40cm	Hearth	64		170	110	charcoal	*Tamarix* sp.	5
B/14	40cm	Hearth		fill of the feature	171	5	charcoal	*Tamarix* sp.	4

site E-06-1									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
A-14	40-45cm	Feature	1/Hearth 66		172	25	charcoal	undet.	1
								Tamarix sp.	2
A-14	40-45cm	Feature	1/Hearth 64		173	170	charcoal	*Tamarix* sp.	7
B/14	40-45cm	Hearth	67		174	600	charcoal	*Tamarix* sp.	19
AB/14	40-45cm	Hearth	62		175	15	charcoal	undet.	27
A-14	45cm	Hearth	62	bottom	176	5	charcoal	undet.	7
A-14	45cm	Feature	1	NW corner	177	5	charcoal	undet.	11
15/B/SE corner	45-50cm	Hearth			178	10	empty		
B/14	40-45cm	Hearth		near eastern wall	179	175	charcoal	*Tamarix* sp.	16
15/B		Feature		lower layer	180	800	charcoal	*Tamarix* sp.	2
B/12	20cm	Hearth	6		181	220	empty		
A-14	45-50cm	Hearth	68		182	100	charcoal	*Tamarix* sp.	6
								undet.	8
							seed	*Ziziphus* sp.	2
A/12	20-25cm	Hearth	67		183	220	charcoal	*Tamarix* sp.	4
B/15-16	50-55cm	Feature			184	800	empty		
A/15	50-55cm	Hearth	69		185	100	charcoal	*Tamarix* sp.	9
B/15	50-55cm	Hearth	70		186	15	charcoal	*Tamarix* sp.	2
14/AA	20cm	Hearth	57		187	15	charcoal	undet.	8
AA/14	20-25cm	Hearth	57		188	60	charcoal	*Tamarix* sp.	5
AA/14	20-25cm	Hearth	56		189	10	charcoal	*Tamarix* sp.	3
A/13	15-20cm	Hearth	73		190	25	charcoal	undet.	9
17/AA	45-50cm	Hearth			191	25	charcoal	undet.	21
B/13	15-20cm	Feature		fill of the feature	192	100	charcoal	undet.	1
A/17	45-50cm	Hearth		in feature	193	175	empty		
AA/14	20-25cm	Hearth	71		194	250	charcoal	*Tamarix* sp.	12
								undet.	4
AA/14	20-25cm	Hearth	72	in feature	195	50	empty		
A/13	15-20cm	Hearth	55	in feature	196	100	charcoal	undet.	8
14/B	10-20cm				197	30	charcoal	undet.	6
TRENCH									
FF/14	30cm	Hearth	69		198	5	empty		
HH/14	50-55cm	?			199	500	charcoal	undet.	3
AA/17	60cm	Hearth	E		200	700	charcoal	undet.	7
A/16	50cm	hut		bottom	201	1100	charcoal	undet.	2
HH/14	50-55cm	?			202	200	empty		
AA/16	60cm	Hearth			203	250	charcoal	*Tamarix* sp.	6
AA/23	0-10cm	Hearth			204	200	charcoal	*Tamarix* sp.	2
AA/16-17		Hearth			205	500	charcoal	undet.	4

site E-06-1									
squ.	**depth**	**feature type**	**feature no**	**desc.**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
HH/14		?		sand bellow silt	206	1100	charcoal	undet.	2
							chaff	Poaceae indet	2 unch
							grain	Poaceae indet	1 unch
HH/13	95cm				207	5	charcoal	*Tamarix* sp.	5
AA/17	65-75cm			near the hearth	208	500	charcoal	*Tamarix* sp.	2
								undet.	21
16/A	60-65cm	hut	2		209	100	charcoal	undet.	3
BB--AA/16-17	65-70cm	Feature	4		210	300	charcoal	undet.	8
BB/A	55-60cm	Hearth			211	600	charcoal	undet.	6
HH/13	80cm	hut		the lovest	212	10	charcoal	undet.	10
AA/17	70-75cm	Hearth		in feature3/4	213	600	charcoal	undet.	8
AA-BB/17	65-75cm	Hearth			214	500	charcoal	undet.	1
	level IV				215	0,2	charcoal	undet.	2
	level III				216	1	charcoal	undet.	2
BB/17	70-75cm			cultural layer	217	1000	charcoal	undet.	8
B/15				upper layer	218	600	charcoal	undet.	8
A-B/15	40-45cm			level IV?	219	500	charcoal	*Tamarix* sp.	2
AB/15	40-45cm				220	50	charcoal	undet.	8
15C	50-60cm	Hearth	39	bellow recent sand	221	100	charcoal	*Tamarix* sp.	10
								undet.	10
13C	0-10cm	Hearth	13	bellow recent sand	222	125	charcoal	undet.	14
TRENCH	85 cm			lower layer	223	100	charcoal	undet.	5
TRENCH				upper layer	224	80	charcoal	undet.	21
15C	50cm			bellow recent sand	225	200	charcoal	undet.	5
6C	10-20cm	Hearth	27		226	100	empty		
9E	0-10cm	Hearth	8		227	100	empty		
14c	10-20cm	Hearth	17a		228	100	charcoal	undet.	0,1cm
16C	45-55cm	Hearth	35	bellow recent sand	229	100	charcoal	undet.	10
							spikelet fr.	Poaceae indet.	2 (unch)
							fruit	Asteracea indet.	1 (unch)
4/E		Hearth	5		230	80	empty		
15c		Pothole		big	231	100	empty		
15c		Pothole		small	232	100	empty		
E-06-1/B									
AA/23	5-10cm	Hearth	50		1	50	charcoal	undet.	2
AA/21	10cm				2	400	charcoal	undet.	8
AA/21		Hearth	10		3	125	charcoal	undet.	1
HH/14	60cm	?			4	900	empty		
HH/14	50cm	?			5	900	empty		
E-06-1/C									
B/2	10-20cm	hut			40	1000	empty		
A/2	10cm	hut			36	250	charcoal	undet.	29

site E-06-1									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
A/2	0-10cm	hut		fill of the hut	34	75	charcoal	undet.	1
B/2	0-10cm	hut		fill of the hut	34	50	charcoal	undet.	8
E-06-1/D									
	0-5 cm	Faeture?		bellow recent sand	1	2200	empty		
A/9-8	0-5 cm	Heart	1		2	1300	charcoal	undet.	14
							seed	*Citrullus colocynthis*	2
							grain	*Echinochola colona*	1
	5-10 cm	Heart	1		3	1200	charcoal	*Tamarix* sp.	25
								undet.	6
							grain	Poaceae indet.	3
B/10	5-10 cm	Feature			4	150	empty		
A/10	5-10 cm			fill of the feature	5	150	charcoal	undet.	14
A/9	5-10 cm			fill of the feature	6	1200	charcoal	undet.	7
B/9	5-10 cm				7	100	charcoal	undet.	11
A/8-9	10-15 cm	Heart	1		8	300	empty		
A/8	15cm			fill of the feature	9	350	seed	Brassicaceae indet.	3 (unch)
A/8-9	15cm	Heart	1		10	170	charcoal	undet.	5
	15-20 cm	Heart	2		11	1200	charcoal	undet.	14
A/9	15-20 cm			fill of the feature	12	60	charcoal	undet.	5
A/10	15-20 cm			fill of the feature	13	400	charcoal	undet.	8
AA/8	10-15 cm	Heart	3		14	600	empty		
B/9	20-25 cm	Posthole			15	150	empty		
B/9	25-30 cm	Posthole			16	100	empty		
AA/8	15-20 cm	NW corner			17	100	empty		

Table 14.2. Nabta Playa, plant remains from site E-07-3.

site: E-07-3						
feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
2	feature	1	200	charcoal	*Tamarix* sp.	9
					undet.	4
1	North 1/2	2	2300	charcoal	*Tamarix* sp.	19
					undet.	9
1	Pit, South 1/2	3	2300	empty		
9	feature	4	1100	charcoal	*Tamarix* sp.	1
					undet.	2
3	feature	5	2000	charcoal	*Tamarix* sp.	5

<table>
<tr><th colspan="7">site: E-07-3</th></tr>
<tr><th>feature no</th><th>desc.</th><th>sample no</th><th>vol.</th><th>kind of remains</th><th>taxa name</th><th>number of specimens</th></tr>
<tr><td>4</td><td>feature</td><td>6</td><td>1100</td><td>empty</td><td></td><td></td></tr>
<tr><td>6</td><td>feature</td><td>7</td><td>3300</td><td>empty</td><td></td><td></td></tr>
<tr><td>6</td><td></td><td>8</td><td>700</td><td>empty</td><td></td><td></td></tr>
<tr><td>1</td><td>South 1/2; bag 2</td><td>9</td><td>1500</td><td>empty</td><td></td><td></td></tr>
<tr><td>1</td><td>North 1/2; bag 2</td><td>10</td><td>1600</td><td>empty</td><td></td><td></td></tr>
<tr><td>3</td><td></td><td>11</td><td>2200</td><td>empty</td><td></td><td></td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">E 1/2</td><td rowspan="3">12</td><td rowspan="3">2300</td><td rowspan="2">charcoal</td><td>Tamarix sp.</td><td>23</td></tr>
<tr><td>undet.</td><td>2</td></tr>
<tr><td>bark</td><td>undet.</td><td>1</td></tr>
<tr><td>1</td><td>AII-LVL3</td><td>13</td><td>150</td><td>charcoal</td><td>undet.</td><td>8</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Hearth</td><td rowspan="3">14</td><td rowspan="3">200</td><td rowspan="2">charcoal</td><td>Tamarix sp.</td><td>8</td></tr>
<tr><td>undet.</td><td>9</td></tr>
<tr><td>bark</td><td>undet.</td><td>1</td></tr>
<tr><td>5</td><td>BB6</td><td>15</td><td>200</td><td>charcoal</td><td>undet.</td><td>11</td></tr>
<tr><td>4</td><td>Hearth</td><td>16</td><td>200</td><td>charcoal</td><td>undet.</td><td>2</td></tr>
<tr><td>3</td><td>feature</td><td>17</td><td>150</td><td>charcoal</td><td>undet.</td><td>25</td></tr>
<tr><td>2</td><td>South 1/2</td><td>18</td><td>2000</td><td>charcoal</td><td>undet.</td><td>31</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">South 1/2</td><td rowspan="3">19</td><td rowspan="3">2300</td><td rowspan="3">charcoal</td><td>Tamarix sp.</td><td>36</td></tr>
<tr><td>Ziziphus sp.</td><td>9</td></tr>
<tr><td>undet.</td><td>11</td></tr>
<tr><td>3</td><td></td><td>20</td><td>700</td><td>charcoal</td><td>undet.</td><td>2</td></tr>
<tr><td>1</td><td>AII-LVL3</td><td>21</td><td>1200</td><td>charcoal</td><td>undet.</td><td>35</td></tr>
<tr><td>4</td><td>Hearth AII</td><td>22</td><td>1000</td><td>empty</td><td></td><td></td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">feature</td><td rowspan="2">23</td><td rowspan="2">200</td><td rowspan="2">charcoal</td><td>Tamarix sp.</td><td>5</td></tr>
<tr><td>undet.</td><td>3</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">feature</td><td rowspan="3">24</td><td rowspan="3">100</td><td rowspan="3">charcoal</td><td>Tamarix sp.</td><td>7</td></tr>
<tr><td>Ziziphus sp.</td><td>2</td></tr>
<tr><td>undet.</td><td>8</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">feature</td><td rowspan="2">25</td><td rowspan="2">250</td><td rowspan="2">charcoal</td><td>Tamarix sp.</td><td>18</td></tr>
<tr><td>undet.</td><td>11</td></tr>
</table>

Table 14.3. Nabta Playa, plant remains from site E-08-1.

site E-08-1									
cut	squ.	depth	feature type	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
1	18/D7		Hearth 7		1/2008	450	charcoal	undet.	12
1	A18;mE9;H3	0-5 cm		North 1/2	2/2008	250	charcoal	undet.	4
1	18/F8		Hearth 4		3/2008	50	empty		
1	18/E10		Hearth 3		4/2008	50	empty		
1	18/E7	0-5cm			5/2008	100	charcoal	undet.	11
2	D/2-3		Hearth 1		6/2008	450	charcoal	undet.	6
2	D/2-3		Hearth 1	profile	7/2008	1500	charcoal	undet.	29
2	D/2-3		Hearth 1		8/2008	500	charcoal	undet.	22
2	D/2-3		Hearth 1		9/2008	1000	charcoal	undet.	32
2	D/2-3		Hearth		1/2009	2900	empty		
2	D/2-3		Hearth		2/2009	2300	charcoal	*Tamarix* sp.	6
2	D/2-3		Hearth		3	2100	charcoal	*Tamarix* sp.	22
2		15-20 cm	Hearth		4	1300	charcoal	*Tamarix* sp.	4
2	C/C3	20-25 cm	Hearth	bellow playa	5	900	charcoal	undet.	12
2		25-30 cm	Hearth	bellow playa	6	100	charcoal	undet.	3
2	C/2-3	25-30 cm	Hearth	bellow playa	7	1300	charcoal	*Tamarix* sp.	89
2	C/2	25-30 cm	Hearth	bellow playa	8	600	charcoal	*Tamarix* sp.	58
2		25-30 cm	Hearth	bellow playa	9	1450	charcoal	undet.	19
2	C/2-3	30-35 cm	Hearth	bellow playa, bottom of the hearth	10	1300	charcoal	*Tamarix* sp.	176
2	C/3	20-25 cm	Hearth	bellow playa	11	1200	charcoal	*Tamarix* sp.	9
								undet.	27
2	C/3	20-25 cm	Hearth	bellow playa	12	800	charcoal	*Tamarix* sp.	7
2		25-30 cm	Hearth	bellow playa	13	450	empty		

Table 14.4. Nabta Playa, plant remains from site E-06-4.

site: E-06-4						
feature	level	vol.	number of sample	kind of remains	taxa name	number of speciemens
tumulus 2						
Feature 1	level VI, over stone	2300	5	charcoal	*Tamarix* sp.	12
					undet.	6
Hearth 1	0-5cm	2300	10	charcoal	*Tamarix* sp.	2
					undet.	27
Featue 3	part 2	4000	13	charcoal	*Tamarix* sp.	18
Feature 1	level VI, under stone	2300	6	charcoal	undet.	6
Hearth 1	level 0-I (01-10cm)	1000	8	charcoal	undet.	10
Hearth 1	0-5cm	2200	9	charcoal	undet.	21
				bark	undet.	2
		900	1	empty		
	over pit level	1800	2	empty		
	under stone	1500	3	empty		
part N	under scrabs	1200	4	empty		
Profil A-B		2000	7	empty		
Feature 21	altar	2300	11	empty		
Featue 3	under stone	5200	12	empty		
tumulus 2/3						
N part	40-60	2000	17	charcoal	*Tamarix* sp.	5
	under stone	2880	14	empty		
	90-100	2300	15	empty		
	120-130cm	1600	16	empty		
other samples						
Hearth 2	10-20cm	2200		charcoal	undet.	3
Hearth 2	1-10cm	2600		empty		
Hearth 2	1-10cm	2400		empty		
Hearth 2	1-10cm	2200		empty		
Hearth 2	1-10cm	2400		empty		
2/5	under stone	5600		empty		
2/5	under stone, level X-XII	3200		empty		
2/5	under stone, level I/II	2100		empty		
2/7	STR, part B	2100		empty		
2/7	STR, part B, bottom	1800		empty		
2/3	holl in the bottom	1800		charcoal	undet.	1
5	hearth	3600		empty		
	under stone, level I/II	2200		empty		
9	hearth, SW quater	13000		empty		

site: E-06-4						
feature	level	vol.	number of sample	kind of remains	taxa name	number of speciemens
9	hearth, NE	7300		empty		
26B	VII-VIII	2100		empty		
26B	level I/II	2500		empty		
26B	bottom	2400		empty		
28/N	bottom	2300		empty		
30	top of tumulus, 0-10cm	2400		charcoal	undet.	1
30B	top of tumulus	2400		empty		

Table 14.5. Nabta Playa, plant remains from site E-92-7.

site E-92-7						
feature (heart) no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
I	wall	6	3050	seed	*Capparis* sp.	4
				charcoal	*Tamarix* sp.	9
					Salvadora persica	1
					Capparis decidua	2
II	wall	4	950	charcoal	*Tamarix* sp.	5
				grain	Poaceae indet.	2
					Sorghum bicolor var. *arundinaceum*	2
II		10	1800	charcoal	*Acacia* sp.	18
					Tamarix sp.	61
III	wall	9	1800	grain	*Setaria* typ	1
				charcoal	*Tamarix* sp.	35
					Acacia nilotica	4
					undet.	7,6cm
IV	wall	7	780	seed	*Schouwia purpurea*	5
				grain	*Setaria* typ	2
					Echinochloa colona	1
					Poaceae indet.	1
				charcoal	*Tamarix* sp.	9
					Capparaceae indet.	11
					Capparis decidua	2
					Salvadora persica	4
					undet.	16

site E-92-7						
feature (heart) no	**desc.**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
IV	bottom	11	6650	fruit	*Ziziphus* indet.	3
				charcoal	undet.	9
V	top	1	4750	charcoal	*Acacia nilotica*	4
					Acacia sp.	9
					undet.	28
V	wall	8	2000	charcoal	*Acacia* sp.	17
VI	wall	2	2750	charcoal	undet.	11cm
VI	bottom	3	6350	charcoal	undet.	21
VI	wall	5	5600	fruit	*Ziziphus* sp.	2
				grain	Poaceae	1
				fruit	Cyperaceae indet.	3
				charcoal	*Tamarix* sp.	8 cm
					Ziziphus sp.	4
					Capparacea indet.	4
					Acacia sp.	9
					Acacia cf. *ehrenbergiana*	3

Table 14.6. Nabta Playa, plant remains from the site E-00-1.

site E-00-1								
feature no	**area**	**feature type**	**dept**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
Feature 3	K	house		1	150 cm	tubers	undet.	1
						charcoal	undet.	1,5 cm
						fruit	*Ziziphus* sp.	2
	B			2	250 cm	charcoal	*Tamarix* sp.	5
							Acacia sp.	6
							Chenopodiaceae indet.	1
							undet.	12 cm
Feature 2	E	E/2		3	100 cm	charcoal	undet.	25
Feature 1	N	maybe lower feat.	10-20 cm	4	450 cm	fruit	*Ziziphus* sp.	1
						charcoal	*Tamarix* sp.	3
							Acacia sp.	2
							undet.	2 cm
Hearth	C			5	150 cm	charcoal	undet.	2 cm
Feature	F			6	150 cm	charcoal	*Tamarix* sp.	12
							undet.	3 cm
Feature 1	N (SW'4)			7	150 cm	charcoal	*Ziziphus* sp.	1
							undet.	0,5 cm

site E-00-1								
feature no	area	feature type	dept	sample no	vol.	kind of remains	taxa name	number of specimens
	K		0-10 cm	8	200 cm	charcoal	undet.	1,5 cm
Feature 1	N (SE1/2)			9	150 cm	charcoal	undet.	0,5 cm
Feature 5	K			10	150 cm	charcoal	undet.	0,5 cm
	L	hearth		11	250 cm	charcoal	*Tamarix* sp.	3
							undet.	2,7 cm
Feature 1	K (S1/2)			12	150 cm	charcoal	undet.	50
Feature 1	E			13	150 cm	charcoal	*Tamarix* sp.	7
							Acacia sp.	4
							undet.	3 cm

Table 14.7. Nabta Playa, plant remains from site E-04-4.

site E-04-4									
squ.	depth	feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
A13					45	50	charcoal	undet.	0,1cm
A12		Hearth			52	55	charcoal	undet.	0,1cm
A12	0-5	Hearth		E part	35	2600	charcoal	undet.	25 cm
A12	0-5	Hearth		E part	34	3500	charcoal	undet.	0,2cm
A9	50			cult. leyer	43	250	charcoal	*Tamarix* sp.	1
								undet.	8
		Hearth	1	NW	55	3000	charcoal	undet.	12cm
		Hearth	1	SW	32	1500	charcoal	undet.	7cm
		Hearth	1	SW	53	2600	charcoal	undet.	2cm
							charcoal	*Tamarix* sp.	18
		Hearth	1	NW	54	2750	charcoal	undet.	0,6cm
								Tamarix sp.	3
		Hearth	1	SW	58	750	charcoal	*Tamarix* sp.	21
								undet.	0,5cm
		Hearth	1	SW	56	1200	charcoal	undet.	0,2cm
	bottom	Hearth	1	SW	57	2000	charcoal	undet.	4cm
A12	10-20cm	Hearth		SE	41	2650	charcoal	undet.	2cm
A12	0-5cm			E	36	1600	charcoal	undet.	5cm
A12	5-10cm	Hearth		SE	34	2500	charcoal	undet.	2,5cm
AB12-14				top of playa	46	2650	charcoal	*Acacia* sp.	1
								undet.	12
				SW	44	1900	charcoal	undet.	2,5

site E-04-4									
squ.	**depth**	**feature type**	**feature no**	**desc.**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
A12	5-10cm	Hearth		NE	38	2100	charcoal	*Tamarix* sp.	16
								Acacia sp.	4
								undet.	2cm
TRENCH 2	50-60cm				59	25	charcoal	*Tamarix* sp.	2
								undet.	0,7cm
A12		Hearth		SW	39	2400	charcoal	undet.	1,2cm
A12	upper part	Hearth			33	1900	charcoal	undet.	0,5cm
A12	bottom	Hearth			42	650	charcoal	undet.	1
A12		Hearth	1	SW	51	2100	charcoal	undet.	0,5cm
		Hearth	2		47	1850	charcoal	undet.	0,5cm
A12	5-10cm	Hearth		NE	40	2700	charcoal	undet.	0,5cm
TRENCH 2		Hearth	4		61	250	charcoal	*Tamarix* sp.	1
								undet.	0,3cm
TRENCH 2		Hearth	3		60	250	charcoal	undet.	1,5cm
		Hearth	1		49	6450	charcoal	*Tamarix* sp.	22
								undet.	65
		Hearth	1	SW	50	2100	charcoal	undet.	1,2cm
		Hearth	1	SW	48	2000	charcoal	undet.	2cm

Table 14.8. Nabta Playa, plant remains from site E-05-2.

site E-05-2								
squ.	depth	feature type	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
9/B	10		below eolishen sand	1	100	charcoal	undet.	30
13B	10-15cm		below eolishen sand	2	600	charcoal	undet.	5
12B			cemented sand	3	1	empty		
26B	5		below eolishen sand	4	50	charcoal	undet.	16
15B	15-20cm	Hearth	below eolishen sand	5	510	charcoal	undet.	4

site E-05-2								
squ.	depth	feature type	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
12A	20-25cm	Hearth	silty sand bellow eaolishen sand	6	150	charcoal	*Tamarix* sp.	12
							decidous	2
						bark	undet.	1
						seed	*Schouwia* sp.	1
22B	5-15cm		washed sand	7	50	charcoal	undet.	9
26A	5-10cm		below eolishen sand	8	750	charcoal	undet.	5

Table 14.9. Nabta Playa, plant remains from site E-05-3.

site E-05-3								
cut	**depth**	**feature type**	**desc.**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
11A	0-5cm		below eolishen sand	9	1700	charcoal	*Tamarix* sp.	21
11A	0-5cm	pit	below eolishen sand	10	2100	charcoal	undet.	8
						grain	*Sorghum bicolor* var. *arundinaceum*	1
4-5A	5	pit 2	below eolishen sand	11	25	charcoal	undet.	7
8B	5	Hearth	washed sand	12	450	charcoal	undet.	11
9B	5		below eolishen sand	13	140	charcoal	undet.	9
9-10A		Hearth	below of washed sand	14	400	empty		
3A	10cm		washed sand	15	50	charcoal	undet.	1
11A	15cm	pit	washed sand	16	300	charcoal	*Tamarix* sp.	1
							undet.	12
11-12B	10-15cm	pit	fill	20	240	charcoal	*Tamarix* sp.	8
							Acacia	6
							undet.	12
12A	25-35cm	pit	fill	21	10	charcoal	undet.	14
11/12B	10-15cm	pit	fill	22	450	charcoal	*Tamarix* sp.	22
							decidous	5

site E-05-3								
cut	**depth**	**feature type**	**desc.**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
12A		pit		23	10	charcoal	undet.	13
12B	35cm	Hearth	bottom	24	350	charcoal	undet.	21
						bark	undet.	4
13B	35cm	edge of pit	recent sand	25	5	charcoal	undet.	4

Table 14.10. Nabta Playa, plant remains from site E-06-2.

site E-06-2							
no feature	type of feature	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
1	Hearth		1	100	charcoal	undet.	5
					chaff	Poaceae indet.	2 (unch)
1	Hearth		14	100	charcoal	*Tamarix* sp.	10
						Acacia sp.	18
						undet.	50
1	Hearth		15	250	charcoal	undet.	50
14/b		10 cm	16	135	empty		
2	Hearth 2		17	75	charcoal	undet.	3
2	Hearth 2		18	120	charcoal	undet.	5
2	Hearth 2		19	270	empty		
13b		floor	20	100	empty		

Table 14.11. Nabta Playa, plant remains from the two hearths (1/2004 and 2/2004).

feature (heart) no	**part**	**sample no**	**desc.**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
1_04	W	12	top	15100	empty		
1_04	W	13	top	8500	seed	*Schouwia purpurea*	1
					fruit	*Ziziphus* sp.	1
					charcoal	*Tamarix* sp.	26
						undet.	11cm
1_04	E	14	top	3100	seed	*Schouwia purpurea*	2
					charcoal	*Tamarix* sp.	88
						undet.	2,5 cm
1_04	E	15	bottom	14800	charcoal	*Tamarix* sp.	17
						undet.	1,9
					bark	undet.	3

feature (he-art) no	part	sample no	desc.	vol.	kind of remains	taxa name	number of specimens
2_04	E	17		4750	charcoal	undet.	22
					seed	undet.	4
2_04	W	16		3000	charcoal	undet.	37

Table 14.12. Nab El Diep Area, plant remains from site E-02-3.

Nab el Deep Area E-02-3						
feature no	**desc.**	**sample no**	**vol.**	**kind of remains**	**taxa name**	**number of specimens**
Hearths 2, 3		1	1000	charcoal	*Tamarix* sp.	18
					undet.	20 cm
Hearth 3	squ. S/14	2	1200	charcoal	*Acaia* sp.	2
					Tamarix sp.	9
					undet.	40 cm
Hearth 4	squ. N/13	3	700	charcoal	undet.	25 cm3
Hearth 5	squ. N/10	4	1300	charcoal	*Tamarix* sp.	17
					Acaia sp.	1
					Chenopodiaceae indet.	1
					Acaia sp.	1
					undet.	88 cm
Hearth 7	squ. Q/11	5	700	charcoal	undet.	20 cm
Hearth 8	squ. Q-P/12	6	1200	charcoal	*Tamarix* sp.	11
					Acaia sp.	3
					undet.	35 cm
Hearth 11	squ. Q/12	7	500	charcoal	*Tamarix* sp.	45
					undet.	14 cm3

Table 14.13. Gebel Ramlah, plant remains from site E-09-3.

site E-09-3							
feature type	feature no	desc.	sample no	vol.	kind of remains	taxa name	number of specimens
grave	1	between legs and blades	1	2400	empty		
grave	1	under sceleton, blade part	2	1700	charcoal	undet.	18
grave	1	under sceleton, legs part	3	2300	charcoal	undet.	15

Table 14.14. List of archaeobotanical samples from the "Triple ring stone" site.

Triple stone ring					
Sector	**feature type**	**feature no**	**desc.**	**sample no**	**vol.**
SE	Hearth			1	1600
SE	Hearth	3		2	2100
	Hearth	2		3	1250
S	Hearth	3SE		4	180
	pit		bottom	8	900
NE	grave		bellow pit	9	3000
NE	grave		bellow pit	10	2750
NE	grave		bellow pit	11	2500
NE	grave			12	900
SE	grave		bellow pit	13	2650
NE	grave		bellow pit	14	2600
NE	grave		bellow pit	15	3100
NE	grave		bellow pit	16	2200
SW	grave		bellow pit	17	2900
SW	grave		bellow pit	18	2900
SW	grave		bellow pit	19	2100
NW	grave		bellow pit	21	2650
	grave		floor	22	2300

5. Results of Analyses from Individual Sites

The most abundant plant material, as discussed above, was collected in the years 2006-2009, from E-06-1, E-06-1/B, E-06-1/C and E-06-1/D in Nabta Playa. The site is situated on the southeast edge of the silts of the Nabta Playa basin. Here were found several residential features, several hearths, and a rich assemblage of artefacts, fragments of pottery, and cattle bones. These contexts are related to the Early Holocene stage of the settlement of the Western Desert and the *El Adam* culture (Jórdeczka *et al.* 2011; 2012; 2013; Jórdeczka 2021; cf. Chapter 12, this volume). A total of 258 archaeobotanical samples taken from hearths and pits were examined from these sites (Table 14.1), some of which did not contain plant material. Among the remains of wild herbaceous plants that were found in them, there were a few caryopses and fragments of straw of grasses (Poaceae indet.) which could not be more closely identified, and also *Echinochloa colona* and *Setaria* type as well as one specimen of *Schouwia* sp.. There were also preserved pieces of the woody endocarp of jujube *Ziziphus* sp. in various states of fragmentation. Among the charcoal of wood from trees and bushes there were remains of the *Tamarix* sp. Part of the wood charcoal and fragments of bark remained unidentified. Alongside this material were also found uncharred seeds, fruits, and fragments of spikelets (Asteracea indet., Poaceae indet. and Brassicaceae indet.), which probably, as described above, were modern intrusions.

Slightly less information was also obtained from 25 archaeobotanical samples taken from Site E-07-3 in Nabta Playa (Table 14.2). This material probably should be assigned to the use of the site related to the *El Adam* unit. The features studied contained only charcoal and pieces of bark. The highest proportion of charred wood belonged to *Tamarix* sp. In addition, single specimens representing the genus *Ziziphus* sp. were identified. Eight samples did not contain any plant material.

From Site E-08-1, dated to *El Adam* time in 22 samples, only remains of wood charcoal were found, including some belonging to *Tamarix* sp. (Table 14.3). A considerable percentage of the remains could not be identified. In four samples there were no plant remains. The site is located on the southeast edge of the silts of the Nabta Playa basin.

Seventeen archaeobotanical samples were examined from Site E-06-4 in Gebel El Muqaddas, situated about 4 km to the north of Nabta Playa (Table 14.4). This site is characterized by the concentration of tumuli and stone structures with sacrificial features. It is dated to the end of the Early Neolithic in the Western Desert (cf. Chapter 3). Samples were taken from different types of features as well as cultural layers revealed within the site. These produced only charcoal remains, some of which were assigned to the genus *Tamarix* sp. Other specimens, including bark residues, remained unidentified because of their state of preservation. Radiocarbon dates have been obtained for two clusters of charcoal: Tumulus 2 - 6882 ± 113 BC (Poz-20288: 7960 ± 50) and structure 2/3 - 6922 ± 89 BC (Poz-20315: 7990 ± 40 BP) from the El Nabta culture, which allows the material from that site to be linked correlated with the Holocene climatic optimum (cf. Chapter 12, this volume).

From Site E-92-7 in Nabta Playa, assigned to the *Al Jerar* phase of the Neolithic (cf. Chapter 12, this volume), 11 samples taken from different parts of six excavated hearths were examined (Table 14.5). These contained relatively numerous plant residues both in terms of quantity and quality. Among the herbaceous plants were noted remains of various grasses (Poaceae), including wild sorghum *Sorghum bicolor* var. *arundinaceum* and *Setaria* type. Besides that, there were also present seeds of *Schouwia*, fragments of the fruits of *Ziziphus* and nuts of an unidentified species of the Cyperaceae family. Among the charcoal samples, a preponderance of tamarisk *Tamarix* sp. was noted There was also a relatively high proportion of acacia *Acacia* sp., including single fragments assigned to the level of species, such as *A. nilotica* and *A.* cf. *ehrenbergiana*. Besides this, there were also fragments of charred wood of the Capparidaceae family, including *Capparis decidua* and *Salvadora persica*, as well as charcoal of *Ziziphus* sp.

At the Site E-00-1 in Nab El Diep Playa, dated to the Final Neolithic in 13 samples (Table 14.6) only fragments of charcoal were preserved. Most of them were remains of *Tamarix* sp. Besides this, identifications included charcoal of *Acacia* sp., Chenopodiaceae indet. and burnt wood and fragments of the fruits of *Ziziphus* sp.

The material from Nabta Playa Site E-04-4 has a similar date. Here 30 samples were examined (Table 14.7), but contained mainly small and poorly preserved fragments of charcoal, which remained unidentified. There were also a few specimens of *Tamarix* sp. and a few of *Acacia* sp.

Eight samples were taken from Site E-05-2 in Nabta Playa, with a similar chronology as those previously discussed the material from them (Table 14.8) there were few plant remains. Worth noting, apart from burned wood, is the presence of *Schouwia* seeds.

A slightly larger number of samples -14 (Table 14.9) were taken from Site E-05-3 in Nabta Playa, dated to the Final Neolithic (cf. Chapter 12, this volume). In the material examined were preserved the charcoal of tamarisk and one caryopsis of *Sorghum bicolor* var. *arundinaceum*. One sample taken was completely empty.

Site E-06-2 in Nabta Playa is dated to the Final Neolithic. Eight samples were collected (Table 14.10), but they contained relatively few plants remains. These consisted of charcoal of *Tamarix* sp. and *Acacia* sp. but the majority of the charcoal present could not be identified. There were also fragments of the straw of unidentified grasses that occurred in uncharred form. Three samples did not contain any plant residues.

Six archaeobotanical samples were taken from two isolated hearths 1/2004 and 2/2004 (Table 14.11). The preserved charcoal fragments here were relatively large (about 0.5-0.7 cm). In addition to unidentified specimens, they belonged to *Tamarix* sp. In addition, *Schouwia purpurea* seeds and *Ziziphus* sp. fruits were identified.

In 2009, one sample of 600 cm^3 volume was taken from a pit (cut C/1, depth 0-10 cm) containing animal bones on Site E-03-4 in Nabta Playa. It contained no plant remains. Also from the Site E-04-3B, at a depth of 0-10 cm, one sample was taken containing a fragment of the poorly preserved, indeterminate charred wood.

Seven samples from the Nab El Diep Area site labelled E-02-3, dated to Final Neolithic (cf. Chapter 17, this volume), contained relatively large numbers of charcoal remains (Table 14.12). Unfortunately, the taxonomic diversity of the analyzed material was small. The remains of tamarisk, acacia, and one specimen assigned to the Chenopodiaceae family were identified.

In 2004, from one of the graves on Site E-04-4 in Gebel Ramlah were taken three samples from three different places (Table 14.13). The chronology of these samples are datable in general terms to the Late/Final Neolithic (Kobusiewicz *et al.* 2010). The samples contained only unidentified fragments of burnt wood.

In the eighteen samples taken from the Tumulus of the Little Lord (cf. Chapter 9, this volume) no plant remains at all were preserved (Table 14.14).

6. Description of the Identified Forms

Sorghum bicoclor (L.) Moench. subsp**. *arundinaceum*** (Desv.) de Wet. & Harlan of the Poaceae family (Fig. 14.3: 2a, b). There were three specimens preserved in two samples at Site E-92-7 and E-05-3. Sorghum caryopses have a broad oval or inversely ovate shape and are asymmetrically flattened dorso-ventrally. The trace of the embryo, visible on the dorsal side, is large, oval, reaching over half the length of the specimen. On the ventral side, near the base of the caryopsis there is a small inversely ovate or circular hilum. On preserved specimens, significant traces of destruction (cracks and perforations) of the fruit resulting from combustion were noted. Dimensions [length x breadth x thickness]: 2.3 x 1.6 x 1.1; 2.5 x 1.9 x 1.3; 2.6 x 1.7 x 1.4 mm.

Echinochloa colona (L.). P. Beauv. of the Poaceae family (Fig. 14.3: 4-5). The naked caryopsis are broad-ovular in outline, the ventral surface is flat and the dorsal surface slightly convex. On the dorsal side a large oval embryo reaches about half the length of the caryopsis. As the base of the ventral surface is a weakly visible obovate hilum. There were six specimens preserved in two samples. Dimensions [length x breadth x thickness]: 1.7 x 1.2 x 1.2; 1.5 x 1.2 x 1.1; 1.8x1.1x1.2; 1.6 x 1.1 x 1.2; 1.7 x 1.0 x 1.2; 1.5 x 1.1 x 1.2 mm.

***Setaria* type** of the Poaceae family. In the analyzed material, six specimens were preserved in three samples. The caryopses are severely damaged, almost oval, they are at their widest just below the middle, while the upper part is slightly sharpened. The dorsal surface is irregularly convex, and the ventral side is flat. On the dorsal side, a poorly expressed large, oval embryo trace, reaching up to 3/4 of the length of the kernel, is present. On the ventral side of one specimen the outline of a narrow oval hilum (on the other fruits this feature is not visible) is located just above the basal part of the caryopsis. In cross section, the flat ventral side is divided from the dorsal side by a noticeable and rather sharp edge. Dimensions [length x breadth]:1.3 x 1.0 mm.

Schouwia* cf. *purpurea (Forrsk.) Schweinf. of the Brassicaceae family (Fig. 14.3: 3). In the investigated material, ten seeds were preserved in five samples. The seeds have a spherical outline, with a smooth surface. The testa is locally damaged, the hilum is visible on the surface. Diameter of seeds: from 1.3 to 1.5 mm.

Capparis* cf. *decidua (Forsk.) Edgew. of the Capparidaceae family (Fig. 14.3: 1). The preserved seeds are asymmetrical, reniform in shape, laterally flattened, with a curved radicle. Wide-oval cross section. The surface of the diaspore is frequently heavily mechanically damaged. A smooth surface is visible on undamaged specimens. There were four specimens from one sample, and there was also charcoal present assignable to the Capparaceae family, including several fragments identified as *Capparis decidua*.

Citrulus colocynthis (L.) Schrad. (and cf. *Citrulus colocynthis*) of the Cucurbitaceae family. Three seeds have been preserved, in two samples, from the site at E-06-1 in Nabta Playa. One specimen was identified as probably belonging to the mentioned species. The narrow seeds, ovate in outline, with a rounded top, converge conically downwards. Longitudinal grooves located at its narrow end, running almost parallel to the edges of the seed, do not reach the tip of the diaspore. The surface of the specimen is smooth, with traces of damage. Dimensions [length x breadth]: 5.9 x 3.2; 5.9 x 3.1; 6.1 x 3.1 mm.

***Ziziphus* sp.** of the Rhamnaceae family. The material contains 15 differently sized pieces of pips found in eight samples and three seeds from two samples from Site E-06-1. The whole pip is two- or three-chambered containing a single seed. The surface of the stone is rough. Seeds are flattened and oval in shape. Dimensions [length x breadth]: 3.8 x 2.9; 3.9 x 2.7; 3.5 x 2.4 mm. No pieces of pips were measured. Charcoal of this genus also preserved in the examined samples.

Poaceae indet. There are 15 caryopses occurring in eight samples from two sites. In one sample there were two fragments of straw. The grains are inverted ovular in shape, individually almost parallel-sided with a flat ventral face and a slightly convex dorsal face. On the dorsal side is a more or less pronounced trace of the embryo. The grain surface is severely distorted due to combustion or mechanical damage so that the hilum is not visible (ventral side).

Cyperaceae indet. (Fig. 14.3: 6) Three burnt fruits are present in one sample from Site E-92-7 in Nabta Playa. The specimens are damaged and have a damaged surface. Their section is triangular, with one wall wider than the other two. The surface of the fruit is smooth.

7. Ecological characteristics of Identified Taxa

The *Sorghum* genus, depending on the systematic approach used, contains several species or subspecies of wild and cultivated grasses. These are annual or perennial plants. The wild form, according to the adopted taxonomy (de Wet 1978), in the rank of subspecies, identified on several sites in Nabta Playa (Wasylikowa 2001; Wasylikowa *et al.* 2001a) and Barqat el Shab (Lityńska-Zając and Skrzyński 2021), is *Sorghum bicoclor* (L.) Moench. subsp. *arundinaceum* (Desv.) de Wet & Harlan. Described as a separate species (*S. arundinaceum*), it is not confirmed in the flora of present-day Egypt (Boulos 2005, 329). It is a species now extensively spread across the African savanna (Wasylikowa and Dahlberg 1998).

In today's flora of Egypt, there are four species of the genus *Echinochloa*: *E. crus-galli* (L.) P. Beauv., *E. colona*, *E. piramidalis* (Lam.) Hitche & Chase and *E. stagnina* (Retz.) P. Beauv. (Boulos 2005, 290-291). *E. colona* occurs in tropical and subtropical zones. It is an annual plant, sporadically perennial. In today's Egypt, it grows most often on the Nile and canal banks, the Mediterranean coast, and in the oases of the Western Desert (Boulos 2005, 291). It is part of the plant communities found in wet and salty marshes (Zahran and Willis 1992, 89). It is also an annual segetal weed recorded in gardens and in cultivated fields (Cope and Hosni 1991, 48; Boulos and El Hadidi 1994, 288).

Setaria species are common in tropical and subtropical areas. There are about 100 species known from these regions, of which five or six are recorded in Egypt (Cope and Hosni 1991; Boulos 1995, 2005). These are nowadays arable crops (*S. italica* as bird feed or cereals and *S. megaphylla* as an ornamental plant) or weeds (*S. pumila, S. verticillata* and *S. viridis*) occurring in the cultivated fields of other species. Favourable conditions for the growth of the various species of the species in question are found in the Nile Valley, the Eastern Desert and in the oases of the Western Desert (Boulos 2005, 302).

The only representative of *Citrullus* in the flora of present-day Egypt is *C. colocynthis* (L.) Schrad. This plant is a perennial growing on sandy soils and in desert wadis and on the edge of cultivated fields. It occurs in various regions of Egypt, and thus in the desert, in the Nile Valley, and on the Mediterranean and Red Sea coasts (Boulos 2000, 140).

The genus *Capparis* includes three species of small trees or bushes characteristic of the flora of Egypt. *C. deciduas* (Forssk.) Edgew is a bush or tree growing up to 4 m in height, which is widespread in tropical northeastern

Africa. It grows along the Nile as well as in the deserts, wadis, and alluvial plains. The second species *C. sinaica* Veill. is a shrub reaching only 1 to 2.5 m. It is found in the Western Desert in stony wadis. Differing varieties of *C. spinosa* L. are bushes of 30-80 cm height, appearing in rocky deserts, on coastal cliffs, and in oases and wadis (Boulos 1999, 171-173).

Two varieties of the single species of *Salvadora persica* L. are found in Egypt. These are evergreen trees or shrubs, with a height of 2 to 5 m. The first of them is *S. persica* var. *persica*, which grows in the Nile Valley, on the Red Sea coast, and in Sinai, in desert oases, and in sandy inland plains. *S. persica* var. *pubescens* prefers similar areas, but is not found on the Nile (Boulos 2000, 80-82). *S. persica* grows in areas where groundwater is relatively readily available. These may be places with seasonally increased humidity. It is able to tolerate a very dry environment with an average annual rainfall less than 100 mm. It also is a plant that is highly resistant to salinity of the substrate (Marinova *et al.* 2008; Zahran and Willis 1992, 211; Kassas and Girgis 1970).

The genus *Tamarix* includes six species of trees or bushes occurring in the flora of Egypt (Boulos 2000, 126-130). *T. aphylla* (L.) H. Karst. is a tree with a height of 3 to 12 m. It is found, among other places, in the Nile Valley, deserts, and oases. Today it is also commonly grown in Egypt. *T. tetragyna* Ehrenb. is a bush with a height of 1-3 m, growing in similar regions as the previous species. *T. nilotica* (Ehrenb.) Bunge is a bush or tree growing up to 5m. It grows both in the Western and Eastern Desert, in the Nile Valley, and on the shores of the Mediterranean and the Red Sea. *T. amplexicaulis* Ehrenb. and *T. passerinoides* Delile ex. Desv. are small shrubs (1-2 m high) occurring in both deserts, in oases and on the banks of the Nile. The first of these species grows also on the Red Sea coast and the other by the Mediterranean. *T. macrocarpa* (Ehrenb.) Bunge appears, in addition to the Nile Valley, also in oases and deserts.

Tamarisk is a plant tolerant of drought and soil salinity. They can grow in the desert, and in oases and wadis. In addition to these sites, *T. tetragyna* and *T. nilotica* grow in swamps and on the edges of saline wetlands.

In the modern flora of Egypt, there are ten species of trees and shrubs in the genus *Acacia* (Boulos 1999, 364-371). *A. asak* (Forssk.) Willd. and *A. oerfota* (Forssk.) Schweinf. have a very limited range, growing on the rocky soil of Gebel Elba and the mountainous terrain in its surroundings. *A. pachyceras* O. Schwartz grows only on the Sinai peninsula in dry valleys. *A. mellifera* (Vahl) Bent. and *A. etbaica* Scheinf., prefer rocky soil and occur in the Eastern Desert, on the coast of the Red Sea and in the mountains of Gebel Elba. A further species, *A. seyal* Delile has a very limited occurrence, appearing on the banks of the Nile and on its islands on the stretch between Qena and Aswan. The Nile valley, the Eastern and Western deserts, especially the oases and wadis, and the Sinai peninsula are the places where *A. ehrenbergiana* Hayne grows on the sandy and rocky substrate. The next species, *A. laeta* R. Br. es Benth, grows on rocky slopes of mountains, volcanic soils, and open steppe, in the Nile Valley, oases, and on Gebel Elba. *A. tortilis* (Forks.) Hayne has two subspecies. The first of them *A. tortilis* subsp. *tortilis* grows in the Eastern Desert, on the Red Sea coast, on Gebel Elba, and Sinai. Its growth needs sandy habitats most often in the water catchment area. The second subspecies *A. tortilis* subsp. *radianna*, in addition to the aforementioned places, also appears in the Western Desert, on the sandy plains and in the wadis. *A. nilotica* (L.) Delile also has two subspecies with different territorial spread in Egypt. *A. nilotica* subsp. *nilotica* occurs on damp substrates, along the Nile and channel edges. It also appears in the oases of the Western Desert. *A. nilotica* subsp. *tomentosa* is a tree that today grows in the Nile Valley, but only in the area south of Aswan.

In today's flora of Egypt there are three species of the genus *Ziziphus*: Z. *spina-christi* (L.) Desf., *Z. lotus* (L.) Lam. and *Z. nummularia* (Burm. F.) Wight & Walk. *Ziziphus spina-christi* is an evergreen tree, up to 4 or even 8 m tall. It is a sub-tropical plant and is present today both on the Mediterranean and Red Sea coasts and in the Nile delta and in oases. It is also found in the Western and Eastern Deserts in depressions in the terrain (e.g., wadis). It grows in semi-dry and dry climates, with an average annual temperature of over 14 º C. Today it is also a cultivated plant grown in the Nile Valley and in oases (Boulos 2000, 84). This species is a natural element of the flora of Sudan (Jafri 1977). As a result of human activity it was introduced in the Sahara in the Neolithic (Marinova 2008), because its seeds were transported by humans and animals (Bakarat 2001). *Z. lotus* is a shrub growing up to a height of 1-3 m with deciduous leaves dropping in the winter. It appears on rocky and sandy habitats in North Africa. *Z. nummularia* is a small shrub reaching a height of 1 to 2.5 m. In Egypt it is known only from Ka-el-Nabg, about 15 km northwest of Taba (Boulos 2000, 85-86). According to some authors (Barakat 1995b), it is a pioneer plant.

8. Discussion of the Results

Interpretation of plant materials preserved at the sites is severely hampered by the small taxonomic diversity and poor quantitative representation of the remains, especially herbaceous plants, in the materials studied. The analysis can be based by analogy on the findings made for the neighbouring Site E-75-6 in Nabta Playa, where a very rich subfossil flora was recorded (e.g., Wasylikowa 1997; 2001).

9. Use of Plants

One of the major issues of the study of elements of prehistoric lifeways is the definition of the strategies that they used to meet their basic food needs (Van der Veen 2006; López-Dóriga 2011). Essential information on how food was obtained is provided by the plant remains preserved on archaeological sites in various regions of Egypt and from different chronological periods. Some of the plants found could have been collected as food supplies or for other uses (e.g., El Hadidi 1985; Wasylikowa 1997; Barakat and Fahmy 1999; Thanheiser 2011; Fahmy 2014; Lucarini 2014b). The collection, processing, and preparation of plants growing in the natural environment played a very important role in human diet (Ayerdi *et al.* 2016). This concerns nomadic peoples in general. Based on subfossil material, it is difficult to assess the quantitative importance of individual species of plants collected by nomads. However, the repetitive assemblage of such material in the archaeological material from various sites in Nabta Playa (although relatively small in the numbers of some taxons) indicates the well-established position of particular species in the human economy of the period of their use. It should be emphasized that on the discussed sites the plant remains are burnt and are usually fruits, seeds, and much less frequently bulbs (Hather 2001). This state of preservation of the subfossil material means that some species that use the 'green' parts of plants, such as leaves and stems or flowers, are not likely to be fully represented in archaeological sources (Colledge and Conolly 2014; cf. also López-Dóriga 2011). The green parts of many species, such as grasses, could have been used not only as food for humans, but also for animal feed. In addition to the plant remains, the gathering of food from the wild is confirmed by analyzing the various stone tools preserved at the archaeological sites used for the processing and preparation of plant food (Lucarini and Radini 2015). Querns for processing of plant foods have been found on many sites in Nabta Playa (Abu Bakr Mohamed 2001, 422-423).

Food gathering was a seasonal activity and dependent on the rhythms of nature. Summer floods and the subsequent winter months were the periods when activities involving the gathering of food from the herbaceous plants were minimalized due to the lack of available edible fruit and seeds. During this period, the collection of green foodstuff could have been replaced by the accumulation of the ripening fruit of trees and shrubs (El Hadidi 1985). Grinding equipment is common at nearly all the Holocene sites of Nabta Playa.

Among the plants found at the site near Nabta Playa are the remains of grasses – namely, the wild sorghum *Sorghum bicolor* var. *arundinaceum*, *Echinochloa colona* and *Setaria* type and undefined specimens of the Poaceae family.

The grains of wild grasses are relatively large and their floury caryopses containing large amounts of starch, as well as carbohydrates, protein, fats, and fibre. They also contain numerous vitamins especially from group B and vitamin E, as well as micronutrients: iron, magnesium, manganese, zinc, and calcium. They are suitable for making groats and grinding into flour. Grains of different grass species could be collected and consumed on their own or as mixtures (Wasylikowa and Mitka 1998; Fahmy 2001). Ethnographic research shows that wild grasses are collected in the Sahara to this day (Harlan 1989).

As was shown by the examination of the plant remains from Site E-75-6 in Nabta Playa, grains of sorghum *Sorghum bicolor* var. *arundinaceum*, were collected and consumed by Neolithic communities (Wasylikowa and Mitka 1998; Mitka and Wasylikowa 1995). In the light of the qualitative and quantitative analyses of plant remains from Site E-75-6 in Nabta Playa, it has been suggested (Wasylikowa and Mitka 1998, 27) that "nomads seasonally resident on the investigated site could have sown sorghum caryopses brought from the areas where they spent the remainder of the year" (for example, from the Nile Valley to the south or east of Playa Nabta). This research also confirmed that "the separation of sorghum from the other plants, including grasses, suggests that sorghum was viewed as a plant of special importance" (Wasylikowa and Dahlberg 1998, 22). Sorghum serves as food for humans to this day. From its stems sorghum honey and syrup are made. It is also a plant used for fodder and its stalks can be used as a fuel (Kubiak-Martens and Wasylikowa 1994; Wasylikowa 1997, 2001; Boulos 2005). The above conclusions can also be applied to other archaeological sites uncovered in the vicinity of Nabta Playa.

Caryopses of *Echinochloa colona* were probably collected and used to make flour and groats, "This grass is used as summer fodder in Egypt" (Boulos and El Hadidi 1994, 288). Today young plants and leaves of the jungle rice are collected in Sudan during periods of famine, for example. This grass is also used as animal feed (Wasylikowa 1997).

Caryopses of *Setaria* are considered very tasty and can be eaten raw or cooked. One of the possible uses of this plant is to make tortillas of the flour from the grains of these grasses (Łuczaj 2004, 245). They could be made into a kind of porridge (e.g., Magid 2001). The remains of this species occurred on several archaeological sites in Egypt, including Nabta Playa and Farafra oasis (Wasylikowa 1997; Barakat and Fahmy 1999; Fahmy 2014), where they were also considered to have been among the utilised plants.

The character of the finds of *Citrullus colocinthis* is unclear. As mentioned previously, only three specimens belonging to the species in question were preserved. All parts of this plant are very bitter. The colocynth fruit can be used for medical purposes as a laxative (Boulos 2000, 140), with higher doses being poisonous (Włodarczyk 2011). The whole plant, its leaves, roots, and fruits have a diuretic effect. They can also be used as an anticoagulant and antiepileptic (Mahmoud and Gairola 2013). According to ethnographic data, *Citrullus colocinthis* seeds are eaten in northern Africa (Podbielkowski 1989). They contain oil and can be eaten after baking or cooking or ground into flour (Nicolaisen 1963; Wasylikowa and Van der Veen 2004). An interesting manner of use of the plant has been described from India, where oil extracted from its seeds is utilized in lighting (Podbielkowski 1989).

The ripe, fleshy fruits of *Ziziphus* are edible and can be eaten fresh, without any pre-treatment – or consumed after drying (Wasylikowa 1997, 133). They can be used as a component of various foods (Tenberg 2003). A coarse flour can be made from the dried fruit which can be used for baking and preparing a kind of porridge (Wasylikowa 1997, 133). They can also serve to produce a thick paste used for spreading on bread. The crown of young twigs of this species of tree was also suitable for consumption (El Hadidi 1985). Crushed pips also indicate that seeds have been extracted from them, though it cannot be excluded, of course, that after eating the fruit, the seeds were thrown into the fire and thus fragmented without human intervention (Wasylikowa 1997; Lityńska-Zając and Wasylikowa 2018). *Ziziphus spina-christi* could have been used as a medicinal plant. The leaves of jujube have a wide range of applications, as a means of lowering blood pressure, as an astringent, and for its anti-diarrhoea properties (Mahmoud and Gairola 2013). Pods and leaves could be fed to animals (Wasylikowa 1997). Branches and pieces of the wood of *Ziziphus spina-christi* can be used for fuel and for the production of high quality charcoal (Dafni *et al.* 2005).

The fruits of different species of *Capparis* could have been eaten raw without special preparation (Boulos 1995; Wasylikowa 1997). The spicy fruit of *Capparis decidua* is used as a condiment to prepare vegetables, curries, and pickles (Kaul 1963). This plant is also used in folk medicine and herbal medicine (Boulos 1983; Rathee *et al.* 2010). Currently *Capparis decidua* trees are used for afforestation of semi-arid areas because they secure the soil against soil erosion (Kaul 1963).

The fruits of *Salvadora persica* are sweet and suitable for consumption. The pulp made of them contains sugars: glucose, fructose, and sucrose. It is also a rich source of calcium. The leaves of *S. persica* can be used as animal feed, due to their relatively high (15-36%) water content (Linseele *et al.* 2010 and literature cited there). There is also an interesting medical use of the wood of the species in question. Its fibrous branches can be used as toothbrushes (El-Batanouny *et al.* 1999; Ahmed *et al.* 2008; Mahmoud and Gairola 2013). Due to the content of chemically active substances it has an oral disinfecting effect. The leaves have a diuretic and analgesic effect for urinary tract infections (Mahmoud and Gairola 2013).

Most of the charcoal found on these archaeological sites is probably a residue of plant material used by the residents of the ancient settlements as fuel (Asouti and Austin 2005). Both in seasonal dry periods as well as in more favourable climatic conditions during the Neolithic period, wood could be collected in the immediate surroundings of the human settlements on the shores of the palaeolake or some other depressions where there were suitable conditions for the growth of woody plants. The wood could also have been brought from larger distances. It cannot be ruled out that some of the wood preserved on the various sites in Nabta Playa is the remains of material deriving from equipment of everyday use – either produced on site, or brought in by the nomads from somewhere else. The wood of *Ziziphus spina-christi* would be especially suitable for this purpose (Dafni *et al.* 2005). No clear examples however of any wooden objects were found on any of the studied sites.

The residues of charcoal preserved from the sites listed above (Table 14.1-14.12) indicate the use of wood of mainly *Tamarix* sp. In addition, *Acacia* sp. and *Ziziphus* were also utilised. There was also sporadic use of the wood from trees of *Acacia ehrenbergiana* and *A. nolotica*, but also *Capparis decidua* and *Salvadora persica*, as well as unidentified species of trees or shrubs of the Capparidaceae and Chenopodiaceae families as fuel. Another source of fuel intentionally added to the fires and hearths could have been the stems of some grasses, including sorghum, jungle rice, and sedge (Kubiak-Martens and Wasylikova 1994; Wasylikowa 1997; 2001; Boulos 2005). Perhaps, during periods of wood shortage, humans sought alternative materials suitable for combustion, a feature that has been observed on other archaeological sites (Smith 1998).

10. Vegetation in the Nabta Playa Region in the Neolithic Period

In addition to information on potential crop use by prehistoric communities, plant remains also carry valuable palaeoecological data (e.g., Pearsal 2015). Reconstruction of past vegetation is based on the principles of geological uniformitarianism. Its foundation is the knowledge of today's occurrence of plants in nature on the basis of phytosociological and autecological factors. This allows the reconstruction of ancient plant assemblages or the indication of the types of habitat in which specific species found in subfossil plant material could have developed in the past. This procedure is based on the assumption that the ecological requirements of the plants and the systems they created in the past were similar to those of today. It should be borne in mind, however, that this is an assumption that is only more or less likely. As a consequence, it creates the possibility of committing a number of interpretative errors, particularly for older prehistoric periods (Lityńska-Zając and Wasylikowa 2005, 441).

Table 14.15. Frequency of charred plant remains from archaeological sites at Nabta Playa, Gebel Ramlah, Gebel El Muqaddas and Nab El Diep Area. Explanation NSP – number of specimens, NSA – number of samplesA

taxa name	chronology	El Adam						El Nabta		Al Jerar		Final Neolithic														Middle/Late Neolithic		?	
	sites	E-06-1	E-06-1	E-07-3	E-07-3	E-08-1	E-08-1	E-06-4	E-06-4	E-92-7	E-92-7	E-00-1	E-00-1	E-04-4	E-04-4	E-05-2	E-05-2	E-05-3	E-05-3	E-06-2	E-06-2	E-02-3	E-02-3	E-09-3	E-09-3	Hearths 1 and 2	
	kind of remains	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA
Citrullus colocynthis	seed	3	2																								
Echinochola colona	grain	5	4							1	1																
Sorghum bicolor var. *arundinaceum*	grain									2	1							1	1								
Schouwia sp.	seed	1	1							5	1					1	1									3	2
Setaria typ	grain	3	1							3	2																
Cyperacea indet.	fruit									3	1																
Poaceae indet.	grain	11	5							4	3																
Poaceae indet.	chaff	2	1																								
undet.	seed or fruit fr.	2	2																							4	1
Acacia cf. *ehrenbergiana*	charcoal									3	1																

taxa name	chronology	El Adam						El Nabta		Al Jerar		Final Neolithic												Middle/Late Neolithic		?	
	sites	E-06-1	E-06-1	E-07-3	E-07-3	E-08-1	E-08-1	E-06-4	E-06-4	E-92-7	E-92-7	E-00-1	E-00-1	E-04-4	E-04-4	E-05-2	E-05-2	E-05-3	E-05-3	E-06-2	E-06-2	E-02-3	E-02-3	E-09-3	E-09-3	Hearths 1 and 2	
	kind of remains	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA	NSP	NSA
Acacia nilotica	charcoal									8	2																
Acacia sp.	charcoal	7	1							53	4	12	3	5	2			6	1	18	1	7	4				
Capparis decidua	charcoal									4	2																
Capparis cf. *decidua*	seed									4	1																
Capparaceae indet.	charcoal									15	2																
Chenopodiaceae indet.	charcoal											1	1									1	1				
Salvadora persica	charcoal									5	2																
Tamarix sp.	charcoal	1347	101	131	11	371	8	37	4	118; 18cm	6	30	5	84	8	12	1	52	4	10	1	100	5			131	3
Ziziphus sp.	seed	3	2																								
Ziziphus sp.	fruit fr.	6	3							5	2	3	2													1	1
Ziziphus sp.	charcoal			11	2					4	1	1	1														
undet.	charcoal	1498; 0,1cm	136	173	16	177	11	75	8	74; 18,6cm	4	76; 29,2cm	14	86; 74,6cm	30	69	6	112	11	113	5	242 cm	7	33	2	59; 15,4cm	5
undet.	bark	11	57	2	2			2	1							1	1	4	1							3	1
decidous	charcoal															1	1	5	1								

Palaeoecological reconstruction can refer both to the remains of herbaceous plants and to trees and shrubs and is a relatively good tool for the reconstruction of local vegetation (e.g., Barakat 1995a; 2001; Neuman 1989a; 1989b). Charcoal is a specific type of sample of local vegetation, as it was harvested almost daily as fuel. The wood used was that most readily available, easy to collect, and transport to the settlement. It must nevertheless be borne in mind that the qualitative composition of charcoal assemblages does not necessarily represent all species used by humans in the past as fuel (Smart and Hoffman 1988; Neuman 1989a; 1989b; Barakat 2001), nor all taxa occurring in the local flora.

The taxonomic composition of the herbaceous remains, despite the presence of only small numbers of specimens preserved in the layers of the archaeological sites near Nabta Playa, indicates a typical range of vegetation characteristic of desert wadis and depressions in hollows in the terrain, where water is available for the growth of annual, biennial, or perennial plants with a relatively deep root system. (e.g., Wasylikowa 1997; Marinova *et al.* 2008; Walter 1990). Such plants as *Echinochloa colona*, *Setaria,* and other unidentified species of the Poaceae family came from grassland communities. Probably sorghum appeared there too, not only as a sown species. Single fruits of the Cyperaceae family indicate the presence of damp mudflats and swampy habitats located on the edge of the palaeolake or wadis where specific species may have favourable conditions for growth. The *Schouwia* were probably from the herbaceous vegetation growing on dry and sandy habitats. Remains of the species mentioned above were also recorded in the layers of the *El Adam* and *Al Jerar* phases (Tab. 15).

From the charcoal samples, we detect the presence of wood of the following taxons: *Acacia* cf. *ehrenbergiana*, *A. nilotica*, *Acacia* sp., *Capparis decidua*, *Salvadora persica*, *Tamarix* sp. as well as some unidentifiable specimens from the Capparaceae and Chenopodiaceae families. The proportions of these taxons varied throughout the chronology of the settlement in the region (Table 14.15; cf. Fig. 14.1-2), which could be related to changes in the climate or the water table.

Remains of tamarisk dominate the plant assemblages from the samples of all of the distinguished phases of the Nabta Basin, both in terms of the number of specimens (cf. Fig. 14.4) and frequency of occurrence in the sample (cf. Fig. 14.5). Tamarisk is a plant adapted to unfavourable and dry climatic conditions. They are plants tolerant of drought and soil salinity and can occur in desert areas (Boulos 2000, 126-130; Barakat 1995a). Single specimens of this kind of tree are found today in extremely unfavourable climatic conditions (see Lityńska-Zając 2010, fig. 7.3).

The second taxon that is relatively common in the examined material is *Acacia* (cf. Table 14.15; cf. Fig.14.4-5). Remains of this genera of tree occurred in the spectra connected with the following chronological phases: *El Adam*, *Al Jerar*, and Final Neolithic. In the *Al Jerar* phase, there was charcoal of wood of two species of this genera: *A. nilotica* and *A.* cf. *ehrenbergiana*. Acacia requires more moisture for growth than tamarisk and grows today mainly in semi-arid and savannah areas (Neumann 1989a). In Egypt, these trees are now found in the Nile valley and along canals and in desert oases in stony and sandy wadis (Boulos 1999, 364-371). They are also important elements of the desert flora, and occur in plant communities characteristic of wadis cut in gravel (Barakat 1995a). Acacia species are typical of the Sahara and Sahel; the exception is *A. nilotica*, which belongs to the typical Saharan flora. Acacia is a component of the sahelo-sahara, sahelo-sudan, and Sudanese floras and for growth requires an increase in humidity and precipitation over the summer range of 250-750 mm (Barakat 1995a and cited there; 2001). The presence of this species in the subfossil material indicates that the water in the Nabta Lake was permanently fed by the abundant summer rainfall.

In plant communities built by *Acacia*, *Capparis decidua* and *Ziziphus* could also be present. The remains of the first taxon are preserved in a small number in the *Al Jerar* phase. *Ziziphus* was noted more frequently in the three phases of settlement of the area (cf. Table 14.15; cf. Fig. 14.4-5). The presence of *Salvadora persica*, recorded only during the climatic optimum (*Al Jerar* Phase), may indicate more frequent, but not torrential rains.

The concentration of archaeological sites in the Nabta Playa region clearly indicates that this was a place that was eagerly inhabited by epipalaeolithic and Neolithic nomadic populations. The main factor enabling many years of settlement was access to fresh drinking water. The conditions on the banks of the lake and the river beds were favourable for the growth of the relatively lush vegetation that provided food and fuel to these communities. Particularly favourable conditions prevailed in the damp periods resulting from the monsoon rains in the summer. The flora and vegetation of Nabta Playa and its dynamics during the Holocene have been described many times (among others, Wendorf and Schild 2001a; Barakat 1995a; 2001; Wasylikowa 1997, 2001). The plant remains recovered from sites E-00-1, E-03-4, E-04-4, E-05-2, E-05-3, E-06-1, E-06-2, E-07-3, E-08-1 and E-92-7 and two isolated hearths (1/2004 and 2/2004) in Nabta Playa, Site E-09-3 in Gebel Ramlah, E-06-4 in Gebel El Muqaddas and E-02-3 in Nab El Deep Area, did not, unfortunately, produce many archaeobotanical data, despite the relatively large number of samples examined. The results obtained therefore significantly reduce the interpretive value of the material.

In the earliest settlement phase, the *El Adam* Humid Interphase (cf. Table 3.3), the presence of several taxons of herbaceous vegetation were noted, such as *Echinochola colona*, *Schouwia* and unidentified species of the Poaceae family and *Citrullus colocynthis* (Table 14.15). In addition to the herbaceous vegetation, conditions were favourable for the growth of tamarisk, which is confirmed by significant quantities of its charcoal preserved at three sites. This type of wood was also found in the material from E-77-7 in Nabta Playa (Barakat 2001) and was associated with pioneering colonization by plants of the shores of the lake. At Site E-06-1, in one sample, there were also a few fragments of acacia wood charcoal. Whether they indicate the local presence of this tree is hard to assess unequivocally. The significance of the presence of *Ziziphus* also remains ambiguous. While the fruits of this tree could have been collected and brought to the site by nomads as a supply of food (Wasylikowa 1997), traces of charred wood suggest its local origins. Both trees probably indicate the more advanced phase of the development of the ecosystem as plant communities found favourable habitats on the shores of the lake or periodic rivers. Of course, it cannot be ruled out that charcoal of the wood of both *Acacia* and *Ziziphus* is in fact contamination of the layers of the *El Adam* Humid Interphase by the intrusion of younger material.

The next settlement phase falls in El Nabta's climatic optimum. Unfortunately, in the plant materials collected from one site (E-06-4) of sacral character (cf. Chapter 3, this volume), only a few samples of tamarisk wood (cf. Table 14.15) occurred in a small number of samples. The poor fossil flora of this period may be explained by the nature of the site.

The plant remains preserved from Site E-92-7 in Nabta Playa, while being relatively diverse taxonomically, are usually represented by small numbers of specimens (cf. Table 14.15). This material is related to the *Al Jerar* settlement phase (cf. Table 3.3), thus with the climatic optimum phase of the Holocene. Favourable conditions for growth occurred for herbaceous vegetation, not only grasses but also the sedges that grew in wet habitats. The charcoal spectrum is dominated by tamarisk, but its percentages (cf. Fig. 14.4) and frequency in the samples (cf. Fig. 14.5) are significantly lower than in the earlier periods. The presence of several species of trees, among them acacia, including *A. nilotica* and *A.* cf. *ehrenbergiana* as well as *Salvadora persica* correspond very well with the humidity conditions associated with this period (see above). In features of this phase were found caryopses of *Sorghum bicolor* var. *arundinaceum*. As mentioned above, this grass could have grown naturally in suitable habitats, but it could also have been specially protected or sown by humans (Wasylikowa 1997).

The fourth chronological phase is related to the Final Neolithic (cf. Table 3.3), characterized by intense summer precipitation. *Tamarix* sp., *Acacia* sp., *Ziziphus* sp. and unidentified members of the Chenopodiacea family are found in the charcoal spectrum of this period. The proportion of tamarisk reaches over 80% (cf. Fig. 14.4) and it appears in 30% of the samples (cf. Fig. 14.5). This image may suggest a gradual recession of savanna vegetation and infiltration of new desert elements, such as trees or bushes from the Chenopodiacea family.

11. Concluding Remarks

Under dry desert conditions, plant life is restricted to areas where access to water provides sufficient moisture for the growth of particular species. Such conditions prevailed, at least temporarily, in the various phases of the Neolithic in the vicinity of the lake located in the depression of the area near Nabta Playa. This situation created favourable conditions for the periodic existence of human groups. Nomads collected many species of herbaceous plants such as grasses, including wild sorghum *Sorghum bicolor* var. *arundinaceum*, *Echinochloa colona* and *Setaria* type. Caryopses of grasses could have been ground into flour or crushed into groats. This manner of preparing food at the site is confirmed by the presence of fragments of querns and grinders. Other fruits and seeds, and leaves of other species (e.g., *Ziziphus* and *Capparis decidua*), were also available for consumption. Many plants found on these sites until recently have been the subject of mass gathering activities in Africa, and they may have played a similar role in the nomadic Neolithic economy. Some of them could have been used occasionally, and treated as medications.

In addition to consumable plants, people gathered fuel by collecting the wood of various types of trees and shrubs. Most commonly it was tamarisk (*Tamarix* sp.) wood that was collected, which probably resulted from its widespread presence in the vicinity of human settlements. Other species were also used as fuel, such as acacia (*Acacia* sp., *Ziziphus*, as well as various species of the family Capparaceae). Wood could also have been used to make small tools for everyday use.

The taxonomic composition of the plant remains preserved at the sites near Nabta Playa indicates that various plant communities had developed in the vicinity of former human settlements. They could occur individually, in an isolated form, or create mosaics corresponding to the edaphic diversity of the habitats. Thus, for example, *Echinochloa colona* could come from the grasslands. The presence of remains of the Cyperaceae family indicates that various species were found in damp habitats, on mudflats and swamps located on the banks of the palaeolake or wadi. *Schouwia* probably came from herbaceous plant communities growing on dry and sandy habitats.

Of great interest is the occurrence of *Citrullus colocinthis* from the *El Adam* phase Site E-06-1 in Nabta Playa. The remains of this species in the region have not previously been referred to in the literature. It is therefore a new element of the Neolithic flora of the region.

Chapter 15.

The Combined Prehistoric Expedition's Optical Luminescence Dates from the South-Western Desert of Egypt

Andrzej Bluszcz

1. The basis of luminescence dating

Luminescence dating typically refers to a suite of radiometric dating techniques whereby the time elapsed from the last exposure of some silicate minerals to light or heat can be measured. In the luminescence process, when naturally occurring minerals are exposed to low level, ambient, ionizing radiation emissions associated with the decay of U, Th, and K, electrons become stored and collected within defects in crystal lattices referred to as 'trapping centres' or 'traps'. When dosed minerals are then exposed to light or heat, they release the stored electrons, emitting photons of light that is referred to as luminescence. This 'bleaching' process empties the electrons stored in the traps and resets or 'zeroes' the signal.

The dating of sediments by usage of optically stimulated luminescence (OSL) signals in mineral grains was first proposed in 1985 (Huntley *et al.* 1985). This technique can be applied to dating sediments up to 200,000 years or more (Wang *et al.* 2006a; 2006b) and has rapidly expanded during the last decade. Applications cover many areas of Earth and environmental sciences as well as archaeological and anthropological contexts (Aitken 1985; 1998). Luminescence dating is based upon the premise that several naturally occurring minerals (e.g., quartz or feldspar) can be used as dosimeters, recording the amount of radiation to which they have been exposed (Aitken 1985). OSL dating is based on specific properties of quartz and feldspars that depend on the existence of defects within mineral crystals and the interaction of electrons with these defects. When the mineral is exposed to ionizing radiation, some electrons are ejected from their usual states and some of these subsequently become trapped at specific defects referred to as traps. This is a metastable state, but it is possible for the lifetime of a trapped electron to exceed 10^8 years at ambient temperatures. This trapped-charge population increases with burial time in a measurable and predictable way. As a result, the time elapsed since sediment grains were buried can be determined by measuring both the OSL signal from a sample of sediment, and the dose rate to which it has been exposed since burial. The process resetting the luminescence 'clock' is the last exposure of quartz or feldspar mineral grains to daylight (Fig. 15.1), a process which is likely to occur while sediments are eroded, transported, and deposited. For aeolian sediments usually occurs sufficient exposure to daylight to reset the luminescence signal (Hilgers *et al.* 2001).

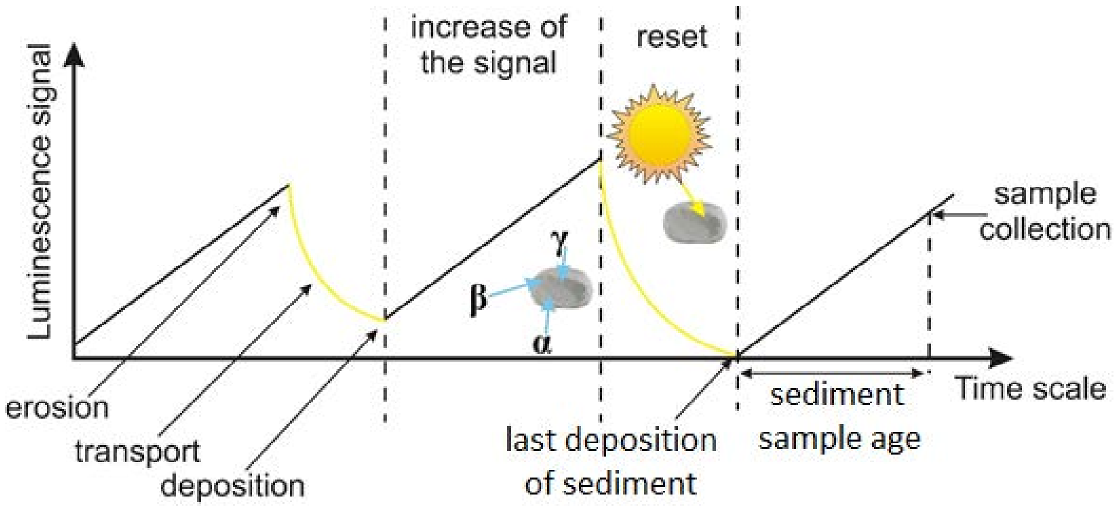


Figure 15.1. Basic concepts of luminescence dating. Number of stored electrons, and thus luminescence signal, versus sample history.

Establishing the OSL age of depositions requires a number of measurements of different kinds. The effective dose rate and equivalent dose (*De*) have to be determined. The effective dose rate depends on the sample's radioactivity and water content, on the grain size, and on the amount of grain material removed during etching (Aitken 1985). Cosmic rays also contribute to the dose received by grains, and this contribution depends on geographic co-ordinates, altitude, and burial depth (Prescott and Stephan 1982). The concentrations of the radionuclides in uranium and thorium decay chains and that of ^{40}K isotope are usually measured using a high-resolution gamma HPGe detector, but other techniques may be used as feasible. The dose rate is expressed in Gy/ky. The equivalent dose is estimated from luminescence measurements on quartz or feldspar extracts that are calibrated by means of a series of luminescence measurements after irradiation with known laboratory doses.

An important assumption in OSL and TL dating techniques is that the luminescence signal of the mineral grains was bleached and reset to zero or near zero before deposition. The results of luminescence dating are strongly dependent on the conditions of sediment deposition and the technique of equivalent dose determination. The obtained dating results can be consistent with geologic interpretation only if the exposure to sunlight has been sufficiently long to bleach the luminescence accumulated in mineral grains during their earlier history to the residual level, and this particular issue constitutes the basic practical difference between TL and OSL techniques. The bleaching of TL signal is much less effective than the bleaching of OSL signal, and more – TL residual level (after bleaching) is always significantly above zero. This is illustrated schematically in Fig. 15.2. In OSL dating a several-minute exposure to sun-light is sufficient to erase the signal while in TL dating the long light-exposure (minimum several hours) is required to remove the light-sensitive TL signal, and the fact is that a residual, unbleachable, TL signal remains after this time. Assessing the size of this unbleachable signal, left after exposure to sunlight prior to deposition and re-burial, may be difficult, but it is particularly important to determine this residual signal for young sediments, otherwise the calculated TL ages will be overestimated.

The much greater efficiency of light in reducing OSL than TL signals was demonstrated for quartz and feldspar by Godfrey-Smith *et al.* (1988). Figure 15.3 shows the reduction in quartz and feldspar OSL as a function of sunlight, with the quartz OSL being reduced to about 1 % of the initial value by 20 s exposure to direct bright sunlight. The feldspar OSL bleached less rapidly under the same conditions, taking about 6 min to reach that level of reduction. Weak OSL signals could still be observed after several hours of sunlight exposure, but in the case of quartz were less than 0.01 % of the initial value and close to the measuring equipment background. In the same time the quartz TL signal measured at 375 °C had reduced only to 10 % of its initial value and appeared to be reaching a finite residual level. This phenomena is the most significant advantage offered by optical dating. The second one is that all repeated luminescence measurements can be made on the same aliquot using short light exposures and they allow the determination of an equivalent dose for each individual aliquot examined – hence, they yield age determinations of higher precision (e.g., 5 %) than those from multiple-aliquot techniques (e.g., 10–15 %); where measurements are made on many aliquots and combined to calculate one equivalent dose.

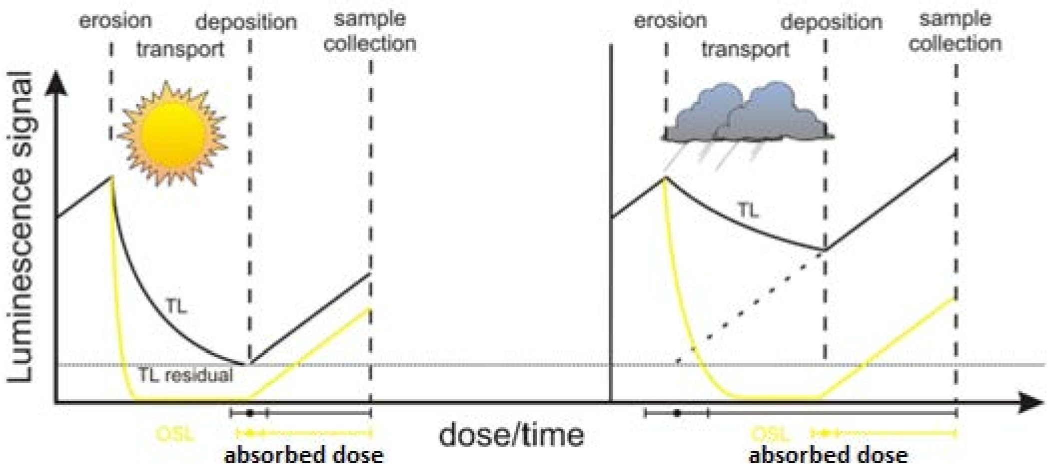


Figure 15.2. The main differences between the effectiveness of bleaching the OSL and TL signals in the natural environment (without heating to high temperatures).

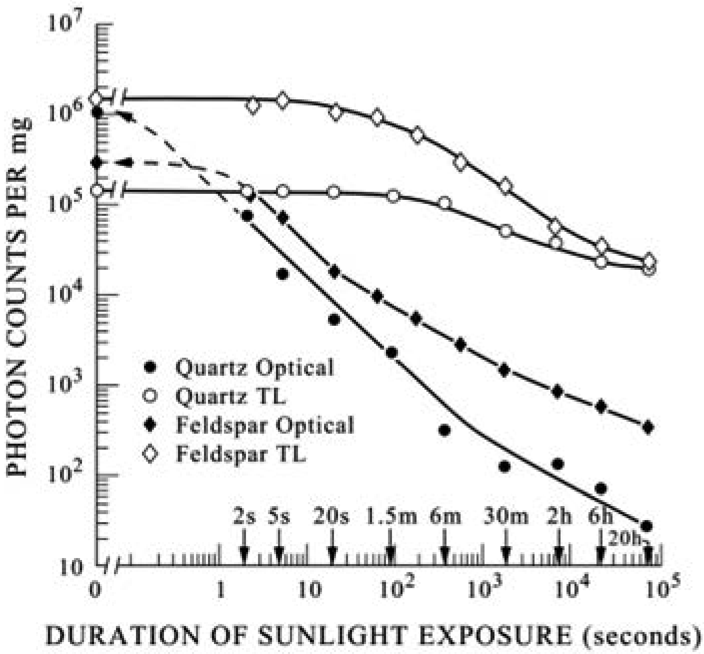


Figure 15.3. Reduction of natural OSL and TL signals from samples of quartz and feldspar when exposed to sunlight. The OSL signals are reduced both more rapidly and more completely than the TL from the same sample (Godfrey-Smith *et al.* 1988).

In the 1980s and 1990s, in all luminescence laboratories on the world TL technique was applied but no standard measurement protocol was developed for TL dating, and a variety of light sources, laboratory bleaching times, and preheat temperatures and durations were employed (Aitken 1985; Wintle 1990; 1997). This means that reporting of the exact measurement procedure and conditions is essential if the quality of published ages is to be assessed and age determinations between different laboratories compared (Roberts 2008). Nevertheless, up to the end of 1996 most of the age determinations of loess were still by TL. However this was changed as facilities for optical dating become more widely available and new single-aliquot regenerative dose protocol (SAR) for OSL dating was developed (Murray and Roberts 1998; Murray and Wintle 2000). SAR protocol has been developed for samples displaying a fast component, generally correlated to the 325 °C TL peak in quartz. This is the 'rapidly bleaching peak', and many efforts have been made in the past for enhancing the detection of this peak through the use of appropriate detection filters.

Recent developments in dating technology have seen application above all on quartz. Optically stimulated luminescence (OSL) dating was applied to fine silt-sized (4÷11 μm) quartz (Watanuki *et al.* 2003; Wang *et al.* 2006a; 2006b; Timar *et al.* 2010), coarse silt-sized (45÷63 μm) quartz (Roberts 2006; Moska *et al.* 2017; 2018), fine sand-sized (63÷90 μm) quartz (Buylaert *et al.* 2007; 2008) and coarse grains (Moska *et al.* 2011; 2012). It is widely accepted that quartz OSL dating using the SAR procedure gives reliable ages, but may suffer from saturation effects for sediments older than 100 ka (Buylaert *et al.* 2007; 2008; Lowick *et al.* 2010; Timar *et al.* 2010; Timar-Gabor *et al.* 2011).

2. Sampling

Samples were taken mostly from vertical walls of artificial exposures (trench walls), seldom from natural exposures, using a small hand-driven corer. Exposure walls were cleaned before sampling, i.e., the surface layer was removed. A corer was used to extract 100-140 cm3 of sediment material from a 20-30 cm depth in the wall. The sampled material was then quickly transferred to small light-proof cylindrical containers and labeled. The sampling place was always protected from direct sunlight. These precautions were necessary to protect sediment samples from light exposure that could alter the luminescence signal before further laboratory treatment. In the laboratory the containers were opened in the dark-room and prepared for chemical pre-treatment.

3. Experimental details

Chemical pre-treatment

For OSL measurements coarse grains of quartz (90–125 μm) were extracted from the sediment samples by the routine treatment with 20 % hydrochloric acid (HCl) and 20 % hydrogen peroxide (H_2O_2). The quartz grains were separated using density separation with the application of sodium polytungstate solutions leaving grains of densities between 2.62 g/cm3 and 2.75 g/cm^3, followed by sieving and 60 min of etching with a concentrated hydrofluoric acid (HF).

Luminescence measurements

All OSL measurements were made using an automated Daybreak 2200 TL/OSL reader (Bortolot 2000). This reader uses blue diodes (470±4 nm) delivering about 60 mW/cm^2 at sample position and a 6 mm Hoya U-340 filter was used to detect emitted luminescence. Laboratory irradiations were performed using a calibrated $^{90}Sr/^{90}Y$ beta source mounted onto the reader delivering a dose rate of 2.87 Gy/min.

The activity measurement and dose rate calculation

Before the activity measurement, all samples were dried, placed in the measurement containers, and stored for a minimum three weeks to ensure radioactive equilibrium in decay series.

The activities of ^{137}Cs and ^{210}Pb as well as other isotopes such as ^{238}U series, ^{232}Th series and ^{40}K were measured by means of a low-background high-resolution gamma spectrometry analysis. The detector resolution (FWHM) is 1.8 keV and the relative efficiency 40 % at 1332 keV photon energy. The counting time was usually 80 ks and standards manufactured by IAEA (RGU, RGTh, RGK) were used for instrument calibration. A reference material IAEA-385 was used to check the quality of efficiency calibration.

To calculate ^{238}U content in sediment the following gamma lines were taken: 295.1 keV (^{214}Pb), 352.0 keV (^{214}Pb), 609.3 keV (^{214}Pb) and 1120.3 keV (^{214}Bi). In the case of ^{232}Th decay chain the following gamma lines were considered: 583.0 keV (^{208}Tl), 911.2 keV (^{228}Ac) and 2614.4 keV (^{208}Tl). To calculate ^{40}K content the 1460.8 keV gamma line was taken.

The obtained activities of radioisotopes in the sediment were converted into effective dose rates by using the conversion factors described by Guerin *et al.* (2011). The dry dose rates (Adamiec and Aitken 1998; Guerin *et al.* 2011) were adjusted for water content, following Aitken (1985). The current humidity of samples was measured in the laboratory and the obtained average water content was no higher than 10 % and consequently a value of 7±3 % was used for further calculations (Bluszcz 2000). The cosmic ray dose-rate to the site followed the calculations suggested by Prescott and Hutton (1994). Beta dose attenuation due to HF etching was calculated using Mejdahl (1979). Based on these data, the average dose rates were calculated.

Luminescence procedures and *De* (equivalent dose) calculation

For the coarse quartz grain-size fraction, equivalent doses were determined using the single-aliquot regenerative-dose (SAR) protocol (Murray and Wintle 2000). The OSL SAR protocol that was used in laboratory measurements consisted of the following steps:

1. Irradiation with the regenerative beta dose D_i
2. Preheat at the temperature 260 ºC for 10 s
3. Blue light stimulation at the temperature 125 ºC for 100 s
4. Irradiation with a test dose D_t (ca. 10 % of the natural dose)
5. Cut-heat at the temperature 220 ºC
6. Blue light stimulation at the temperature 125 ºC for 100 s.

A preheat plateau test was performed for sample GdTL-2740. Those measurements were necessary to establish the most appropriate preheat temperature. The preheat temperatures were increased from 160 ºC to 300 ºC in 20 ºC steps. No systematic variation in *De* with preheat temperature was observed (Fig. 15.4). This is good evidence that thermal transfer from incompletely emptied traps is not a problem in this sample, and therefore a 260 ºC preheat was chosen for all subsequent measurements.

Figure 15.4. Preheat plateau graph for sample GdTL-2740.

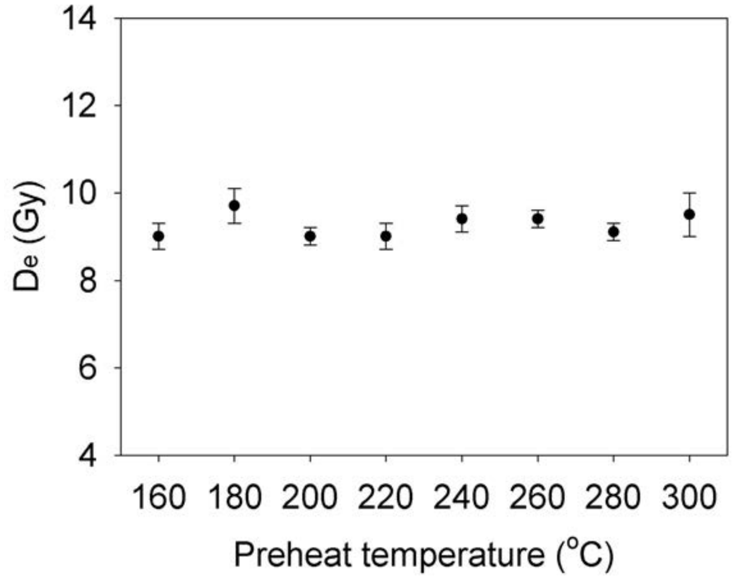
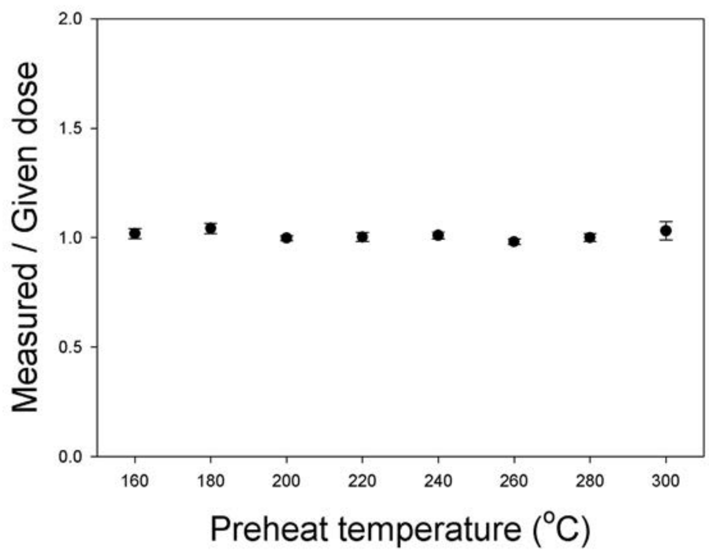


Figure 15.5. Dose recovery test for sample GdTL-2740.



In the SAR protocol, sensitivity changes which may occur from one measurement cycle to another are measured by the OSL response to a small test dose (Murray and Wintle 2000). The corrected OSL ratio (regenerated OSL response/OSL response to the fixed test dose) should be independent of prior dose or thermal treatment. This is tested by repeating a particular regenerative dose after various larger values have been used and comparing the ratio of the two regenerated sensitivity-corrected OSL responses (known as a recycling ratio); this ratio should ideally be close to unity (Murray and Wintle 2000). The recycling ratios for all measured samples were close to unity (between 0.95 to 1.05). Preheating the sample can also cause recuperation of the OSL signal (Aitken 1985). To test this, a 0 Gy regenerative dose step is incorporated into the SAR protocol (Murray and Wintle 2000). The luminescence signal should then be zero (this is known as the 'recuperated' luminescence signal). Any grains for which this sensitivity-corrected recuperated signal is more than 5 % of the corresponding natural signal are rejected (Murray and Olley 2002). The recuperation for all measured multiple grain aliquots was much lower than 5 %. An example outcome of a dose recovery test (Wallinga *et al.* 2000) run on of the sample GdTL-2740 is presented in Figure 15.5.

The aliquots used in this test were first bleached with blue light for 40 s (at an ambient temperature) and after a pause of 10 ks were bleached for another 40 s. Then a laboratory dose of about 8 Gy was given and measured using the SAR protocol. The ratios between the given and measured doses are shown in Figure 15.4 as a function of preheat temperature. The measured dose reproduces the known given dose at all preheat temperatures from 160 ºC to 300 ºC (average measure to given dose ratio of 1.01±0.02). Based on the results of the preheat plateau and dose recovery tests, a preheat at 260 ºC for 10 s and a cut-heat at 220 ºC were chosen for all further samples.

For the SAR protocol, to determine *De* the dose response curves were built up to 400 Gy for the oldest samples and were fitted with a single saturating exponential function. A standard procedure was the use of three regeneration doses bracketing the *De*. In this case, a fit by a single saturating exponential function is sufficient to obtain the *De* through interpolation. For OSL intensities measured in steps 3 and 6 were used for equivalent dose determination. In the measurements, the first second of the decay was used as a measure of the signal, while the background was estimated using the last 10 seconds of the OSL decay. The SAR dose response curves were best represented by a single saturating exponential. Example of growth and decay curves are presented in Figure 15.6 for sample GdTL-2740.

Ages were calculated using the Central Age Model (CAM) (Galbraith *et al.* 1999). They are presented below (see the List of Combined Prehistoric Expedition OSL age estimates in the 2003-2005, and 2007 field seasons) and example in Figure 15.7 where the relative probability density function (Berger 2010) is presented for GdTL-2740 sample.

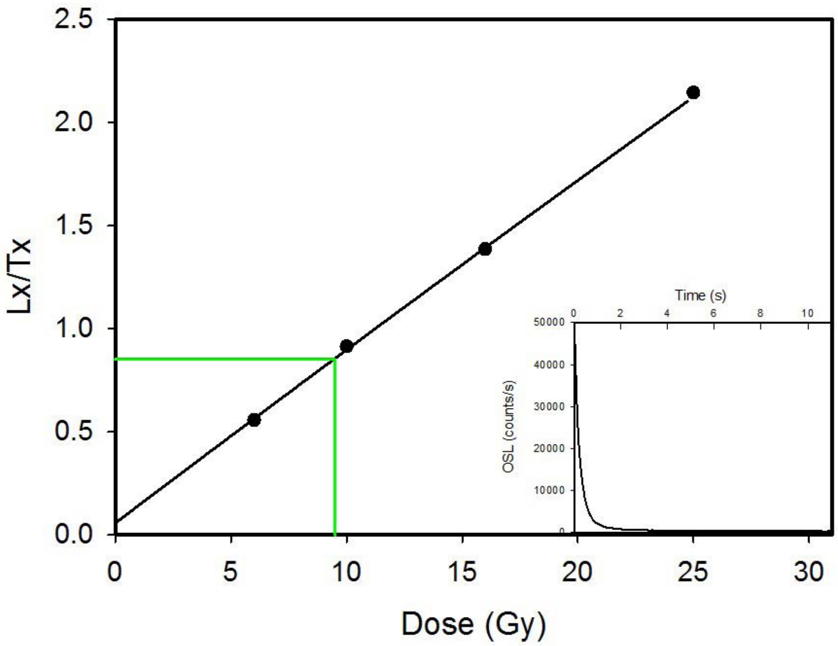


Figure 15.6. Example of growth and decay curves for sample GdTL-2740. Uncertainties were small and within the size of the dot symbol.

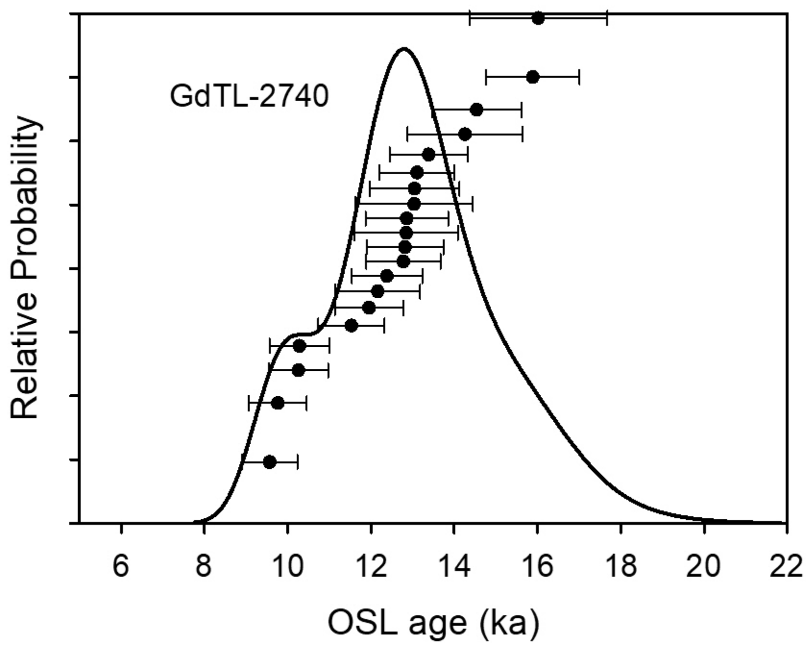


Figure 15.7. Example of relative probability density functions for sample GdTL-2740.

List of Combined Prehistoric Expedition OSL age estimates in the 2003-2005 and 2007 field seasons:

1/2003 Nabta Playa E-75-6, T. 2, Fig. 3.8, Sahara, Base of Bed 2a – 10.40 (39) ka, GdTL-2732

2/2003 Nabta Playa E-75-6, T. 2 Fig. 3.8, Sahara, Top of Bed 1 – 38.5 (30) ka, GdTL-2733

3/2003 Nabta Playa E-75-6, T.2, Middle of Bed 1 – 72.0 (70) ka, GdTL-2334

4/2003, Nabta Playa E-91-1, T 10, Bed 2, Basal alluvial gravel, oldest bed of three – 50.7 (33) ka, GdTL-2735

5/2005, Road east of Nab El Diep – 4.56 (28) ka, GdTL-2736

6/2003 Nab El Diep, Site E-00-1, T B, Base – 14.31 (78) ka, GdTL-2737

7/2003 Gebel Nabta, E-77-1 Lower Bed 4 – 10.16 (52) ka, GdTL-2738

8/2003, Gebel Nabta, E-77-1,Upper Bed 2 – 38.8 (33) ka GdTL-2739

9/2003, Gebel Nabta, E-77-1, Base of Bed 4 – 12.42 (61) ka GdTL-2740

10/2003, Gebel Ramlah, E-01-2, Bed 3, Middle, silt – 99.2 (65) ka GdTL-2741

11/2003, Gebel Ramlah, E-01-2, Bed 2, Middle, – 185.4 (14) ka GdTL-2742

12/2003, Gebel Ramlah, E-01-2, Bed 2, Lower – 133 (10) ka GdTL-2743

13/2003, Gebel Ramlah, E-01-2, T 4, Bed 5, Base – 18.0 (16) ka GdTL-2744

14/2003, Gebel Ramlah, E-01-2, Bed 4, 250 cm, Top – 76.1 (48) ka GdTL-2745

15/2003, Gebel Ramlah, E-01-2, Bed 4, Middle, aeolian gravel - 141 (10) ka GdTL-2746

16/2003, Bir Tarfawi, E-86-1, Bed 7 Base – 192 (11) ka GdTL-2747

17/2003, Bir Tarfawi, E-87-1 Bed 8 – 132.0 (81) ka GdTL-2748

18/2003, Bir Sahara E-88-1, T2, Bed 3d – 122.8 (70) ka GdTL-2749

19/2003, Bir Sahara 14, Coarse sand just below calcareous cap of the spring vent – 210 (18) ka GdTL-2750

20/2003 El Adam Playa, E-79-8, Trench inside Collected Area50 cm from surface, Bed 3 – 9.95 (43) ka GdTL-2751

21/2003, El Adam Playa, Bore Hole, 185 cm – 10.15 (62) ka GdTL-2752

22/2003, El Adam Playa, Bore Hole, 210 cm, clay – 8.02 (47) ka GdTL-2753

23/2003, El Adam Playa, Bore Hole , 300 cm, aeolian sand, top – 13.85 (60) ka GdTL-2754

OSL 2004

1/2004, Nabta Playa, Western Field, Sector C, Square f/10 – 4.18 (45) ka GdTL-2810

2/2004, Nabta Playa, Eastern Field, stele* – 4.33 (26) ka GdTL-2811

3/2004, Nabta Playa, Northeastern Field E-04-1, Bed 3*

4/2004, Nabta Playa, E-97-2, Bed 3 – 8.56 (37) ka – GdTL-2812

5/2004, White Lake, T/10/86, Bed 2 – 109.3 (63) ka GdTL-2755

7/2004, White Lake West Slope, Bed 1, Dune (foredune? or basin alluvium) – 499 (31) ka GdTL-2756

8/2004, North-Western Basin, T 9/86, Bed 11 – 82.9 (42) ka GdTL-2757

9/2004, Pool Trench 4/86, Bed 4a – 86.7 (66) ka GdTL-2758

10/2004, Pool Trench 5/87, Bed 8 – 84.7 (36) ka GdTL-2759

11/2004, Site E-86-2, Bed 7 – 115.5 (79) ka GdTL-2760

12/2004, Site E-86-2, Bed 8 – 82.4 (47 (ka) GdTL-2761

13/2004, Site E-87-2, Main Cut, East Wall, Bed 6 – 73.8 (60) ka GdTL-2762

14/2004, Site E-87-2, T 14/87, Bed 4 – 158.9 (91) ka GdTL-2763

15/2004, Site E-87-2, T4, Bed 3 – 147.0 (80) ka GdTL-2764

16/2004, Site E-87-5, East Wall, Cut, Bed 3a – 97.2 (51) ka GdTL-2765

17/2004, Nabta Playa, Eastern Field, Sector C, Square j/19N, Stela South – 4.50 (36) ka GdTL-2813

18/2004, Nabta Playa, Eastern Field, Sector C, Square j/19E, Stela South – 4.62 (38) ka GdTL-2814

19/2004, Nabta Playa, Eastern Field, Sector C, Square j/19S, Stela South – 4.45 (64) ka GdTL-2815

20/2004, Nabta Playa, Site E-75-9, T 1, Bed 1, 100 cm – 8.28 (36 ka) GdTL-2766

21/2004, Nabta Playa, Site E-75-7, Bed 1, 50 cm, near well – 8.52 (35) ka GdTL-2816

22/2004, Nabta Playa, Western Field, "Store" Under slab, Sector C, Square o/12 – 4.08 (16) ka GdTL-2817

23/2004 Nabta Playa, as above – 8.01 (35) ka GdTL-2818

24/2004 Nabta Playa, as above – 4.23 (17) ka GdTL-2767

OSL 2005

1/2005 Site - Berget El Shab, E-05-1/1, depth 120 cm b.g.l. Cut 1, Trench, IV/13, Bed 2, dune (sand sheet) below playa silt – 11.93 (57)ka GdTL-2768

2/2005, BS-1/E-88-11, Bed 4 – 203.2 (93) ka GdTL-2769

3/2005, E-88-1, Bed 5 – 310 (18) ka GdTL-2770

4/2005, E-88-1, Bed 18 – 129.6 (75) ka GdTL-2771

5/2005, E-88-1, Bed 15 – 86.1 (36) ka GdTL-2772

OSL 2007

2/2007, Naga Tawfik El Ogilate. Old Silts, Dune below silt, 0.5 m below top – 11.97 (75) ka GdTL-2773

3/2007, Naga Tawfik El Ogilate, Old Silts, about 20 cm above Sample 2 – 8.67 (64) ka GdTL-2774

4/2007, Naga Tawfik El Ogilate, Alluvium above truncated silt – 9.24 (55) ka GdTL-2775

8/2007, Site 06-4, Tumulus 2, Part 2, sandy infill of the pit, base of the pit, 80-90 cm below surface of the pit in the slopewash 14.70 (92) ka GdTL-2776

10/2007, Site 06-4, Hearth Area, Trench 1/07, Dune sand 47 cm from surface – 32.0 (24) ka GdTL-2777

11/2007, Site 06-4,Tumulus 2/3, sandy infill of the shaft, 85 cm, 35 cm above the base of shaft – 13.5 (10) ka GdTL-2778

12/2007 Site E-06-01, Trench 1, Southern Wall Old Dune Sand, Lower Cultural Level, burned sand from a hearth, 85 cm below surface – 10.57 (41) ka GDTL-2819

Part VI. Examples of unstratified Camp Remains in Nabta and Nab El Diep Playas

Chapter 16.

Site E-00-2 – Early Neolithic Occupation at the Nab El Diep Playa

Halina Królik and HebatAllah A.A. Ibrahim

1. Introduction

The site was found during the field school in Saharan Prehistory organized for Egyptian Antiquities Inspectors in 2000 by the Combined Prehistoric Expedition (CPE). A concentration of pottery sherds, decorated with "wolf-tooth" design and an elongated triangle with small short sides were found, identified the site as belonging to the El Ghorab variant of the Early Neolithic. An ostrich eggshell fragment from this place gave data of around 8200±70 years BP (A-11080), or about (at 2σ) 9410-9000 calBP and 7460-7050 calBC .

The site was excavated in 2002, during the second field school by Halina Królik and Egyptian Antiquities Inspectors: HebatAllah A.A. Ibrahim, Ahmed Gaber Salama Nour Eldin, Hassan Kamal Ahmed, and Omar Mahmoud Mohamed Zaky.

The site lies on the eastern edge of the small internally drained basin between dunes, fed entirely by local rainfall (cf. Fig.1.5). The human occupation was concentrated near this restricted water resource. Mixed Early Neolithic material occurred on the surface (Fig. 16.1) and was also embedded in the recent sandsheet covering the eroded Old Dune (Fig. 16.2). It extended over an area about 70 m long (S-N) and 40 wide (E-W). The site is heavily deflated and many lithics were weathered. The western part of the site has been completely removed.

The archaeological material was collected from 40 square meters and seems to be associated with two hearths; however, the distribution of finds is random (Fig. 16.3, 16.4). The hearths were marked by slabs of dispersed rocks over an area of ca 2 square meters. At the time of the investigation, they formed a very small hill and were cut into the dune (the result of deflation). Only the lower parts of the hearths were preserved, without any charcoal pieces. Both were in an oval shallow basin ca. 70 cm in diameter filled with greyish-yellowish sand. Only a few lithics were found in the fill of the hearths.

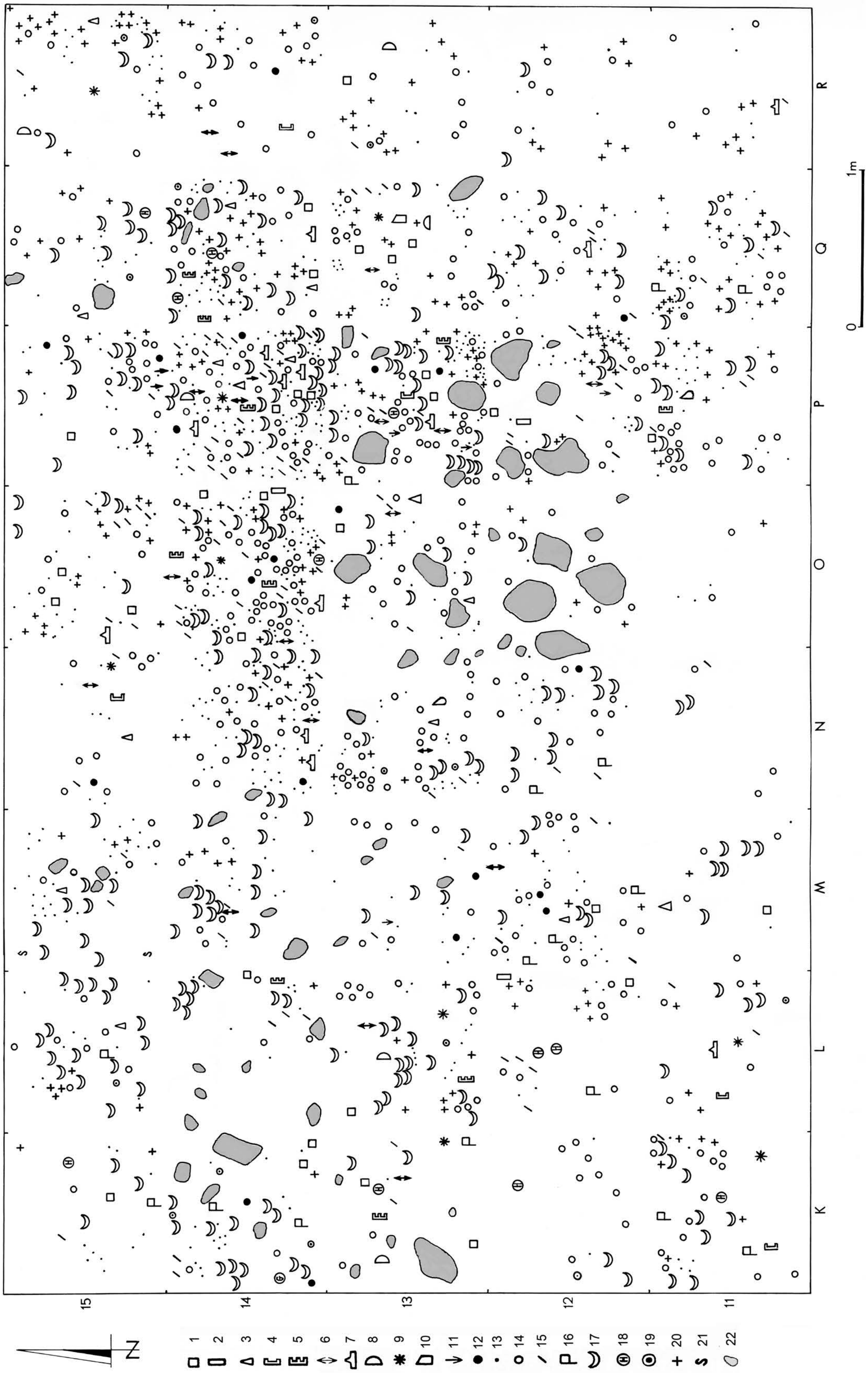


Figure 16.1. Nab El Diep Area, Site E-00-2. Map Showing Distribution of Artefacts on the Surface. Key: 1 – core, 2 – backed pieces and lunate, 3 – triangle, 4 – notch, 5 – denticulate, 6 – burin, 7 – perforator, 8 – sidescraper, 9 – continuously retouch ed pieces, 10 – truncation, 11 – burin spall, 12 – varia, 13 – chip and chunk, 14 – flake, 15 – blade, 16 – pottery sherd, 17 – ostrich egg shell, 18 – handstone, 19 – bead, 20 – bone fragment, 21 – snail shell, 22 – a slab of rock. Map by H. Królik, H.A. Ibrahim, drawn by M. Puszkarski and E. Gumińska.

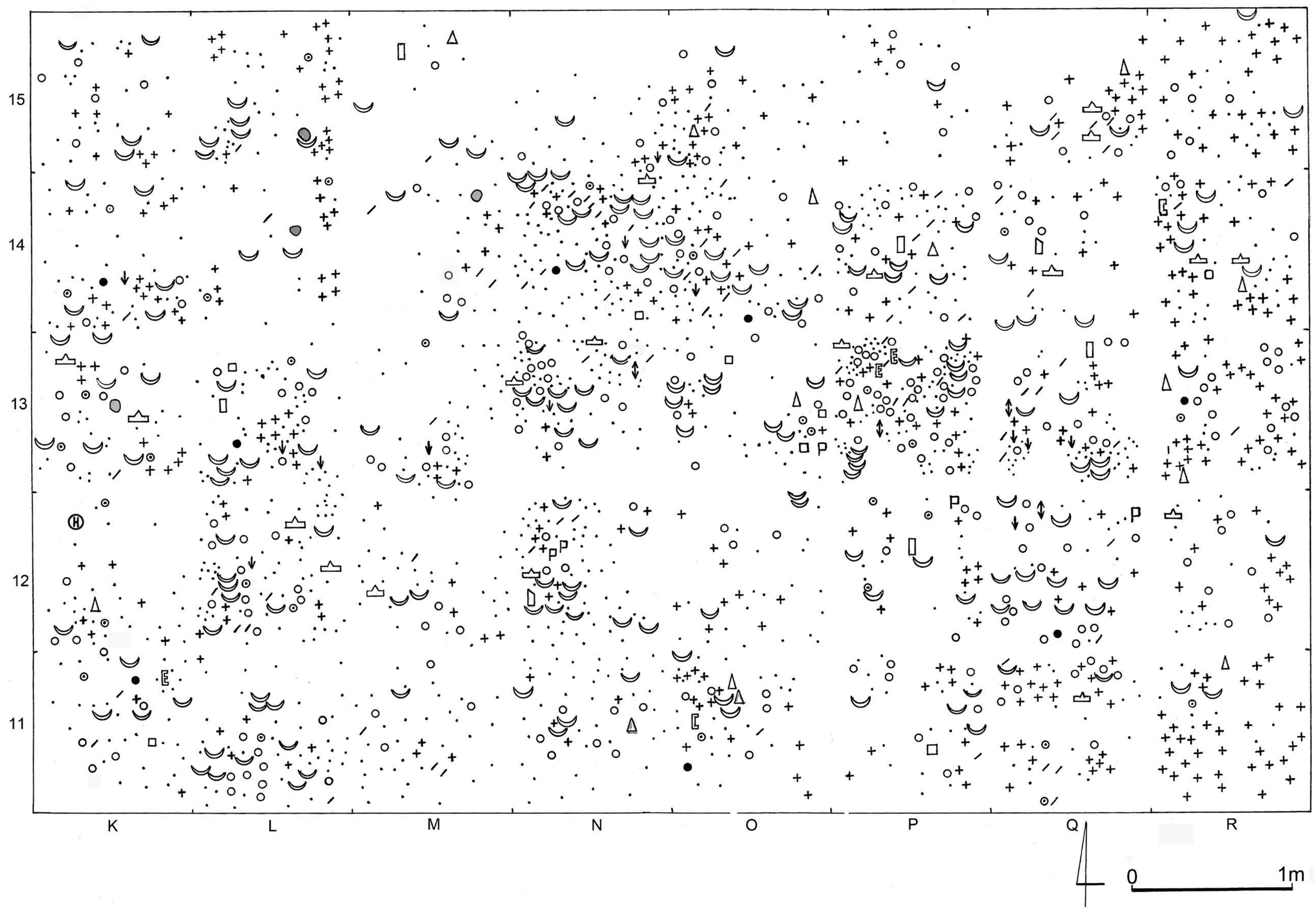


Figure 16.2. Nab El Diep Area, Site E-00-2. Map Showing Distribution of Artefacts from Level 0-10 cm below the Surface (recent sandsheet and slightly washed sand). Key as on Fig. 1. Map by H. Królik, H.A. Ibrahim, drawn by M. Puszkarski and E. Gumińska.

Figure 16.3. Nab El Diep Area, Site E-00-2. Collecting artefacts from the surface. Photo by H. Królik.

Figure 16.4. Nab El Diep Area, Site E-00-2. The Hearth Observed on the Surface. Photo by H. Królik.

2. Archaeological material

A total of 3309 pieces of debitage and waste, 32 cores, 153 retouched tools, 27 burin spalls, 9 handstones, 55 ostrich eggshell beads and 26 pottery sherds were collected from the gridded area.

Lithics

Debitage: The types of debitage and their frequencies are given in Table 16.1. Excluding the unidentifiable flakes, blades and chips or chunks, the assemblage is dominated by flakes (38.2%) and bladelets, rarely blades (26.4 %) struck from single platform cores.

Table 16.1. Nab El Diep Area, Site E-00-2, Surface and Level 0-10 cm below the Surface. Absolute and percentage frequencies of debitage types by raw materials.

Debitage Types	**Flint No.**	**Quartz No.**	**Quartzitic Sandst.No.**	**Granit No.**	**Basalt No.**	**Chert No.**	**Agat No.**	**Total No.**	**%**
Primary flake	13	42						**55**	9.3
Primary blade	3	1						**4**	**0.7**
Flake from single plat. core	124	100	1	1				**226**	**38.2**
Flake from opposed plat. core	4	1						**5**	**0.8**
Flake from ninety degree olat. core	23	27	1					**51**	**8.6**
Flake from multi plat. core	19	56					1	**76**	**12.9**
Unidentifiable flake	13*	230*	3*	2*	2*			**250***	
Blade from single plat. core	148	7				1		**156**	**26.4**
Blade from opposed plat. core	7							**7**	**1.2**
Blade fro ninety degree plat. core	2							**2**	**0.3**
Unidentifiable blade	7*	11*						**18***	
Core-trimming element	9							**9**	**1.5**
Chips and chunks	729*	1706*	10*	2*	1*		2*	**2450***	
Subtotal*	352	234	2	1		1	1	**591***	**100**
Total	**1101 (34.3%)**	**2181(65.9%)**	**15 (0.4%)**	**5(0,1%)**	**3(0.1%)**	**1**	**3(0.1%)**	3309	100

The majority of them are tertiary with lisse platform. Flakes from opposed and ninety degree or multiplatform cores are also present, but their number varies from 0.8% to 12.9%. As before, they are mostly tertiary with lisse platform. Cortical, pointed dihedral or faceted platform are present, but not common. The quantity of primary flakes is relatively high (9.3%) and this indicates that all stages of preparation took place at the site. The flakes are mostly made from quartz 68.8% (among all flakes) and flint (29.6). Only a few are quartzitic sandstone, sandstone, basalt, granite, and agate. More than 90% of the blades and core trimming elements are flint. Metrical data for debitage are given in Table 16.2.

Table 16.2. Nab El Diep Area, Site E-00-2, Surface and Level 0-10 cm below the Surface. Metrical data for debitage and cores (measurements in mm).

	Sample	Mean	Standard Deviation	Minim.	Maxim.	Mode	Sample in Mode
Cortex flakes							
Length	47	21.17	6.73	6	39	0-20	25
Width	47	17.23	4.96	9	28	0-20	35
Thicness	47	6.66	4.02	2	23	0-5	22
Unidirectional flakes							
Length	175	19.97	6.32	6	44	0-20	98
Width	175	17.40	5.85	9	61	0-20	137
Thicness	175	4.70	1.90	1	10	0-5	119
Multidirectional flakes							
Length	47	23.28	9.16	11	68	0-20	23
						21-40	23
Width	47	18.11	8.60	8	67	0-20	33
Thickness	47	5.60	3.21	2	20	0-5	28
Unidirectional blades							
Length	96	26.34	7.97	13	52	21-40	63
Width	96	8.58	2.69	3	17	6-10.	66
Thickness	96	3.46	1.48	1	9	0-5	86
Cores (All)							
Length	29	28.17	7.72	16	47	21-40	24
Width	29	28.13	10.80	12	62	21-40	20
Thickness	29	22.20	12.93	8	81	0-20	17
Angle 1	29	88.27	11.59	63°	106°	80°-100°	18
Angle 2	21	87.91	8.75	74°	104°	80°-100°	14

Cores: In total, 32 cores were recovered from the gridded area (Fig. 16.5: 1-5, 16.6: 4). The types are recorded in Table 16.3. The sample is dominated by ninety degree platform (10 pieces) and multiple platform cores (7 pieces). Single platform (6 pieces) and opposed platform variety (5 pieces) are also present. The cores are made from quartz (59.4%) and flint (34.4%), rarely from chalcedony (6.2%). Almost all of the opposed platform variety are made of flint, only one has traces of preparation. The cores were for flakes and bladelets or blade production.

Single platform cores. They are small, with lengths varying from 31 to 36 mm, width 23 to 62 mm, thickness 19 to 81 mm. All are without any preparation with cortical (3), lisse (2) and faceted (1) platforms.

Opposed platform cores. All, except one, are flint. Their length ranges between 24-47 mm, width 12-44 mm, thickness 19-31 mm.

Ninety degree platform cores. Most of them are of quartz, only two pieces are flint or chalcedony. Their platforms are lisse (5), cortex (3) or faceted (2). Their length ranges between 16 and 40 mm, width 16-35 mm and thickness between 8 and 25 mm. The striking platform is not prepared.

Multiple platform cores. They are flint (4) and quartz (3), not prepared, with lisse or cortical platform.

Metrical data for cores are present in Table 16. 2.

Retouched Tools: The assemblage includes 153 retouched tools. The frequencies of the various types are listed by raw material in Table 16.4. They have been classified into 25 of the Tixier (1963) types. Except varia (13.7%) the tool kit is dominated by perforators (21.7%), geometrics (17.6%), burins (15%) and by a group of notches and denticulates (12.4%). Flint is predominant among the retouched tools (96.1%). Metrical data for retouched tools are given in Table 16.5.

Perforators: This is the most numerous group of the retouched tools (33 pieces). The 22 complete and 11 fragmentary specimens are flint (Table 16.4) except three? made of ostrich eggshell fragments. The length of the perforators is 11 to 36 mm, the width from 2 to 17 mm, and thickness from 2 to 5 mm (Table 16.5).

Single perforators (Type 12). These are made on tertiary flint bladelets, except three pieces made on ostrich eggshell fragments? (Fig. 16.7: 6). The working tips is located on the distal end and formed by obverse, bilateral retouch (Fig. 16.7: 11). Most of them are broken.

Perforator on a backed bladelet (Type 13). All are made on tertiary, secondary, and primary flint bladelets. They have obverse backing on the sinister or dexter edge. Seven have their points at the distal and one at the proximal ends (Fig. 16.7: 2, 8, 9).

Double-backed perforator (Type 16). All are made on flint on tertiary (14 pieces) or secondary (2 pieces) blanks. They have two pointed ends formed by obverse entire bilateral retouch (Fig. 16.7: 3-5, 7, 10, 13).

Burins: All are complete and made of flint (Table 16. 4), mostly on flakes, only occasionally on blades. The length of these specimens is 21 to 53 mm, the width from 12 to 42 mm, and thickness from 3 to 17 mm (Fig. 16.5).

Dihedral burin (Type 17). They are made on tertiary, rarely secondary or primary flint flakes (Fig. 16.7: 1). They are almost evenly divided between distal and proximal ends; two are symmetrical and eight *déjeté* (sinister). All except two have more than one facet on each side, usually two or four.

Dihedral angle burin (Type 18). Both of these are distal burins on the sinister side, made on tertiary flake.

Angle burin on a break Type 19. This is tertiary flake with face formed at the proximal, dexter end.

Multiple dihedral burin (Type 20). It is tertiary flake with three burin-edges formed on the distal sinister and dexter and proximal, dexter ends by 1 or four facets (Fig. 16.5: 6).

Angle burin on a convex truncation (Type 24). They are made on the primary or secondary blanks with working parts located evenly at the distal or proximal end. One is symmetrical, three dexter.

Table 16.3. Nab El Diep Area, Site E-00-2, Surface and Level 0-10 cm below the Surface. Absolute and percentage frequencies of core types by raw materials.

Core type	**Flint No.**	**Quartz No.**	**Chalced. No.**	**Total No,**	**%**
Single platform	2	4	-	6	18.7
Opposed platform	4	1	-	5	15.6
Ninety degree platform	1	8	1	10	31.2
Multiple platform	4	3	-	7	21.9
Unidentifiable	-	1	1	2	6.2
Initialy struck	-	2	-	2	6.2
Total	**11 (34,4%)**	**19 (59.4%)**	**2 (6.2%)**	**32**	**100**

Table 16.4. Nab El Diep Area, Site E-00-2, Surface and Level 0-10 cm below the Surface. Absolute frequencies of tool types by raw materials.

No. Following Tixier, 1963	Types	Flint No.	Quartz No.	Basalt No.	Ostrich eggshell No.	Total No.	%
12	Simple perforator	5			3	8	5.3
13	Perforator on a backed bladelet	9				9	5.9
16	Duble-backed perforator	16				16	10.5
17	Dihedral burin	11				11	7.2
18	Dihedral angle burin	2				2	1.3
19	Angle burin on a break	1				1	0.6
20	Multiple dihedral burin	1				1	0.6
24	Angle burin on a convex truncation	4				4	2.6
27	Multiple moxed burin	4				4	2.6
66	Fragment of a backed bladelet	7				7	4.6
74	Notched flake	3				3	2
75	Denticulated flake	2				2	1.3
76	Notched blade	1				1	0.6
77	Denticulated blade	8	2			10	6.5
79	Notched or denticulated piece with continuous retouch	3				3	2
80	Truncation	3				3	2
82	Lunate/Segment	2				2	1.3
90	Scalene triangle	5				5	3.3
95	Elongated scalene triangle with small short side	18				18	11.7

97	Elongated scalene triangle with concave short truncation	1				1	0.6
98	Scalene perforator	3				3	2
104	Scaled piece	2				2	1.3
105	Pieces with continuous retouch	9				9	5.9
106	Sidescraper	7				7	4.6
112	Varia	21		1		21	13,7
	Total	**147 (96.1%)**	**2 (1.3%)**	**1 (0.6%)**	**3 (2%)**	**153**	**100%**

Table 16.5. Nab El Diep Area, Site E-00-2, Surface and Level 0-10 cm below the Surface. Metrical data for tools (measurements in mm).

	Sample	Mean	Standard Deviation	Minim.	Maxim.	Mode	Sample in Mode
Perforators							
Length	24	22.80	7.18	11	36	0-20	12
Width	26	4.80	2.91	2	17	0-5	19
Thicness	26	3.15	0.86	2	5	0-5	33
Burins							
Length	22	34.82	6.82	21	53	21-40	20
Width	22	23.09	8.17	12	42	21-40	13
Thicness	22	9.83	3.14	3	17	6-10.	13
Gemoetrics							
Length	20	14.74	3.33	10	25	0-20	20
Width	25	5.36	1.47	3	9	0-5	16
Thickness	25	2.81	1.96	1	9	0-5	24
Denticulated blades							
Length	7	49.86	13.88	35	77	40-60	6
Width	11	17.00	7.15	7	31	0-20	7
Thickness	11	5.45	4.68	2	19	0-5	8

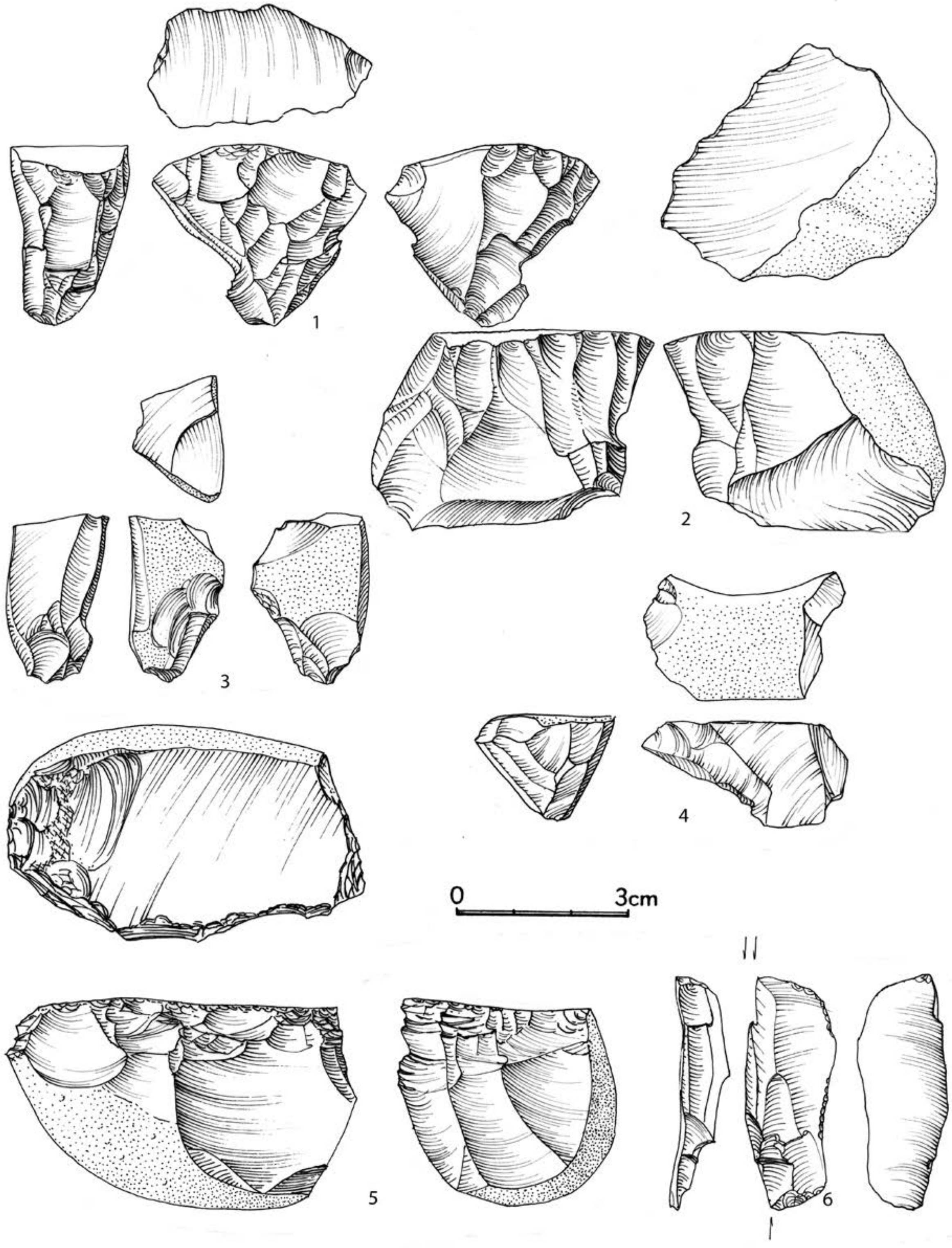


Figure 16.5. Nab El Diep Area, Site E-00-2. Surface and Level 0-10 cm below the surface. Cores and retouched tools. Key: 1-5 – cores; 6 – burin. Drawn by M. Puszkarski.

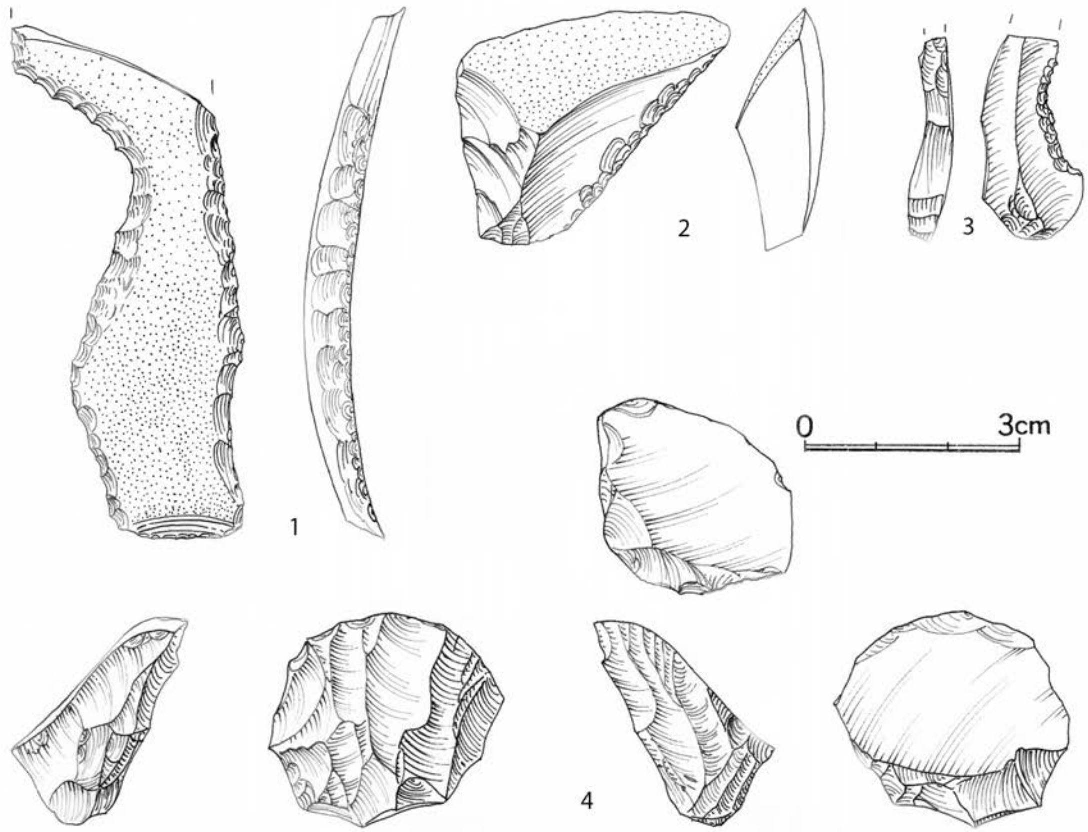


Figure 16.6. Nab El Diep Area, Site E-00-2. Surface and level 0-10 cm below the surface. Core and retouched tools. Key: 1, 3 – notch; 2 – continuously retouched flake; 4 – core. Drawn by M. Puszkarski.

Multiple mixed burin (Type 27). Two are prepared on a secondary, one on a primary flake, and one on a tertiary blade. All have two burin-edges located at the distal and proximal end or at distal sinister and dexter edges, as well as at the proximal sinister and dexter (Fig. 15.5: 6, 16.7: 12). The number of facets ranges from one to four.

Backed Bladelets: All are fragments (Type 66), made on the tertiary flint bladelets; three are distal and four are unidentifiable fragments (Fig. 16.7: 14, 16-18, 20). One piece has Ouchtata retouch, six obverse retouch on the sinister or dexter side. There are no traces of microburin scars.

Notches and Denticulates: This group consist of nineteen specimens made mostly of flint (17 pieces), rarely of quartz (2 pieces).

Notched flakes (Type 74). Two are on tertiary flint flakes and one is on a secondary one. The notches are formed by obverse retouch on the sinister or dexter edge. One piece has two notches located on sinister and dexter edges (Fig. 16.8: 6). The length of single notch varying from 5 to 20 mm. All are very shallow.

Denticulated flake (Type 75). Both are primary flint flakes. The denticulate edges are formed by obverse entire retouch at one or both sides.

Notched blade (Type 76). This is a tertiary flint blade with a notch formed by obverse retouch on a dexter edge (Fig. 16.6: 3).

Denticulated blade (Type 77). With the exception of two quartz blanks, all are flint: three secondary, seven tertiary. The denticulated edges are on one or both sides and are prepared by obverse retouch rarely by inverse or Ouchtata retouch.

Notched or denticulated pieces with continuous retouch (Type 79). These are primary, secondary, or tertiary flint notched blades with entire obverse retouch on the opposite sinister or dexter edge (Fig. 16.6: 1, 16.8: 5).

Truncations (Type 80): All are made on tertiary flint blanks. Two have truncation at the distal (Fig. 16.7: 15), one at the proximal end, formed by obverse retouch. The angle of the truncation varies from 107° to 136°.

Geometrics: The category contains twenty-six pieces made of flint. Their length is from 10 to 25 mm, the width from 3 to 9 mm and the thickness from 1 to 9 mm.

Lunate (Type 82): Both are a tertiary flint blank, backing by obverse retouch with two pointed ends (Fig. 16.7: 19, 22,).

Scalene triangle (Type 90): Four are made from tertiary flint bladelets, one from a primary one. The truncations are mostly straight, sinister, and obverse (Fig. 16.7: 23, 24,35). Only two are dexter and concave. The angle of distal truncations varies from 115° to 150°; the proximal truncations from 106° to 149°.

Elongated scalene triangle with small short side (type 95): All pieces (18) are made from flint bladelets (Fig. 16.7: 26, 27, 30-34). Most of the proximal ends have obverse retouch, one a *sur-eclume* retouch at the sinister or dexter side. The majority of them are straight, only a few are convex or convex-concave. The angles range from 123° to 168°. All distal truncations have obverse retouch, fourteen of them being straight, three convex, and one concave. Their angles vary from 106° to 180°. Eleven triangles are sinister and seven are dexter. No microburin scars have been observed.

Elongated scalene triangle with slightly concave short side (Type 97): This is a very narrow tertiary flint bladelet. The distal sinister straight truncation was prepared by *sur-eclume* retouch. The proximal concave truncations have obverse retouch. Both retouched sides meet almost in a right angle (Fig. 16.7: 21).

Scalene-perforator (type 98). They are made on tertiary flint bladelets (Fig. 16.7: 25, 28, 29). The distal truncations are straight or convex on the sinister or dexter site and formed by continuous obverse or fragmentary retouch. The angle varies from 140º to 169º. The proximal truncation is straight and prepared by obverse retouch, and the angles are 91º and 139º. The working tip is located on the distal end.

Scaled Pieces (Type 104): Both are tertiary flint blanks with unifacial distal platform and bifacial proximal ones.

Pieces with continuous retouch (Type 105): Five are made from tertiary, two secondary, and two primary flint blanks (Fig. 16.6: 2, 16.8: 1-3). Six of them have obverse retouch on both lateral edges, two have retouch on the sinister and one on the dexter edge.

Sidescrapers (type 106): Four are made on tertiary flint blanks, two on primary and one on a secondary one (Fig. 14.8: 4). They have concave or straight retouched edges located on the sinister or dexter side. Most of them are broken.

Varia: The assemblage contains twenty-one flint tertiary blanks with fragmentary obverse retouch, except one secondary with step retouch. One piece is basalt, probably a fragment of grinding stone with fragmentary retouch on both edges.

Handstones: Six are granite, three are heavily weathered and not identifiable. Two complete pieces were circular or oval in shape with one or two straight and convex polished faces.

Beads

The excavated area yielded 55 ostrich eggshell beads (Fig. 16.9: 1-9), some of them were finished and occasionally very used. The beads are circular in shape, about 6 mm in diameter, polished, with a hole drilled from both sides. They were prepared in two ways. The first was formed a circle, their edges were polished and at the end the hole was drilled. Sometimes the hole was drilled at the beginning in an irregular piece of ostrich eggshell fragment and later a circle was formed. The beads had rectangular or square cross-section.

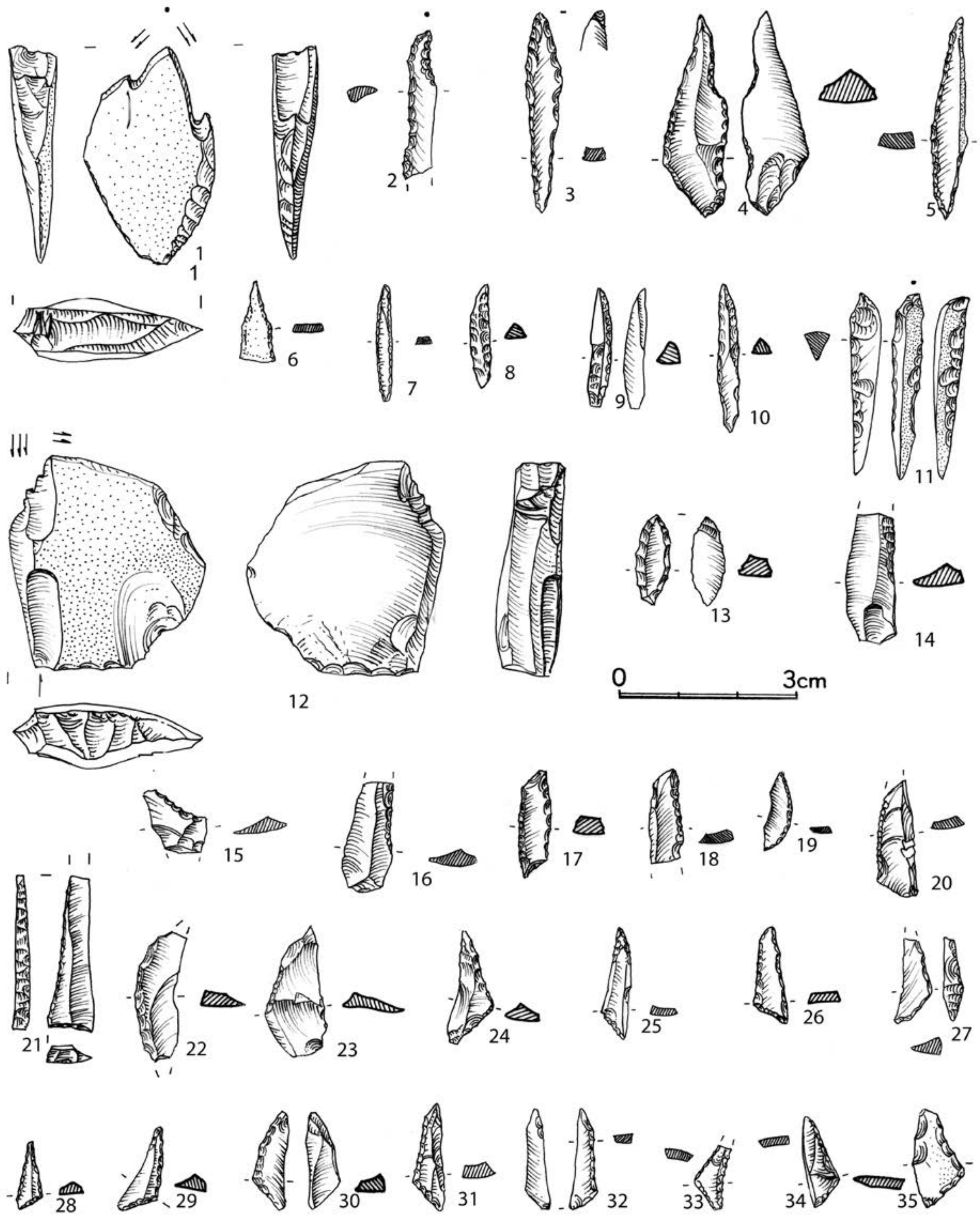


Figure 16.7. Nab El Diep Area. Site E-00-2. Surface and Level 0-10 cm below the surface. Retouched tools. Key: 1, 12 – burins, 2-11, 13 – perforators and borers, 14, 16-18, 20 – backed pieces, 15 – truncation, 19, 22 – lunates, 21, 23-35 – triangles. Drawn by M. Puszkarski.

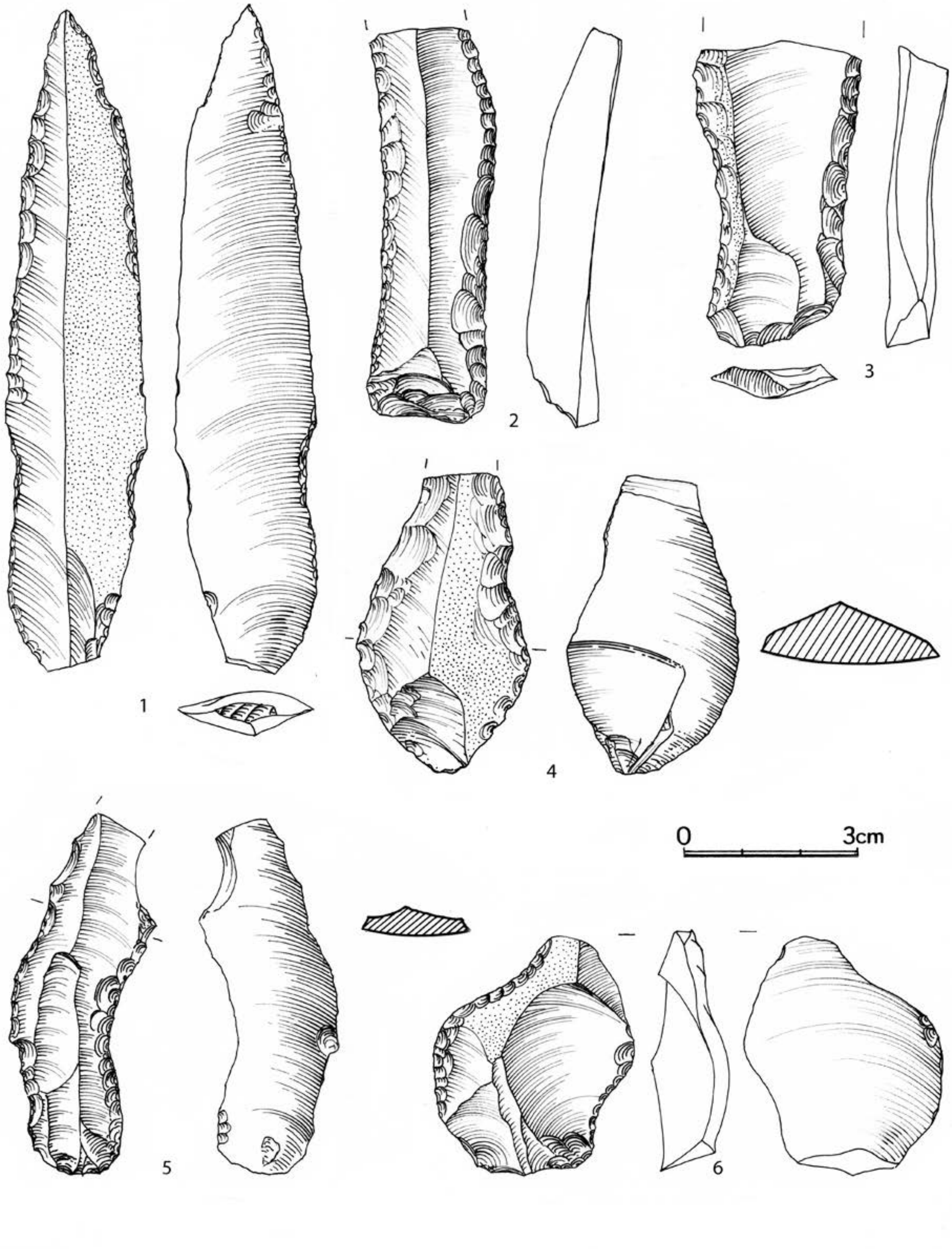


Figure 16.8. Nab El Diep Area. Site E-00-2. Surface and Level 0-10 cm below the surface. Retouched tools. Key: 1-3 – retouched blades, 4 – sidescraper, 5 – denticulate, 6 – notch. Drawn by M. Puszkarski.

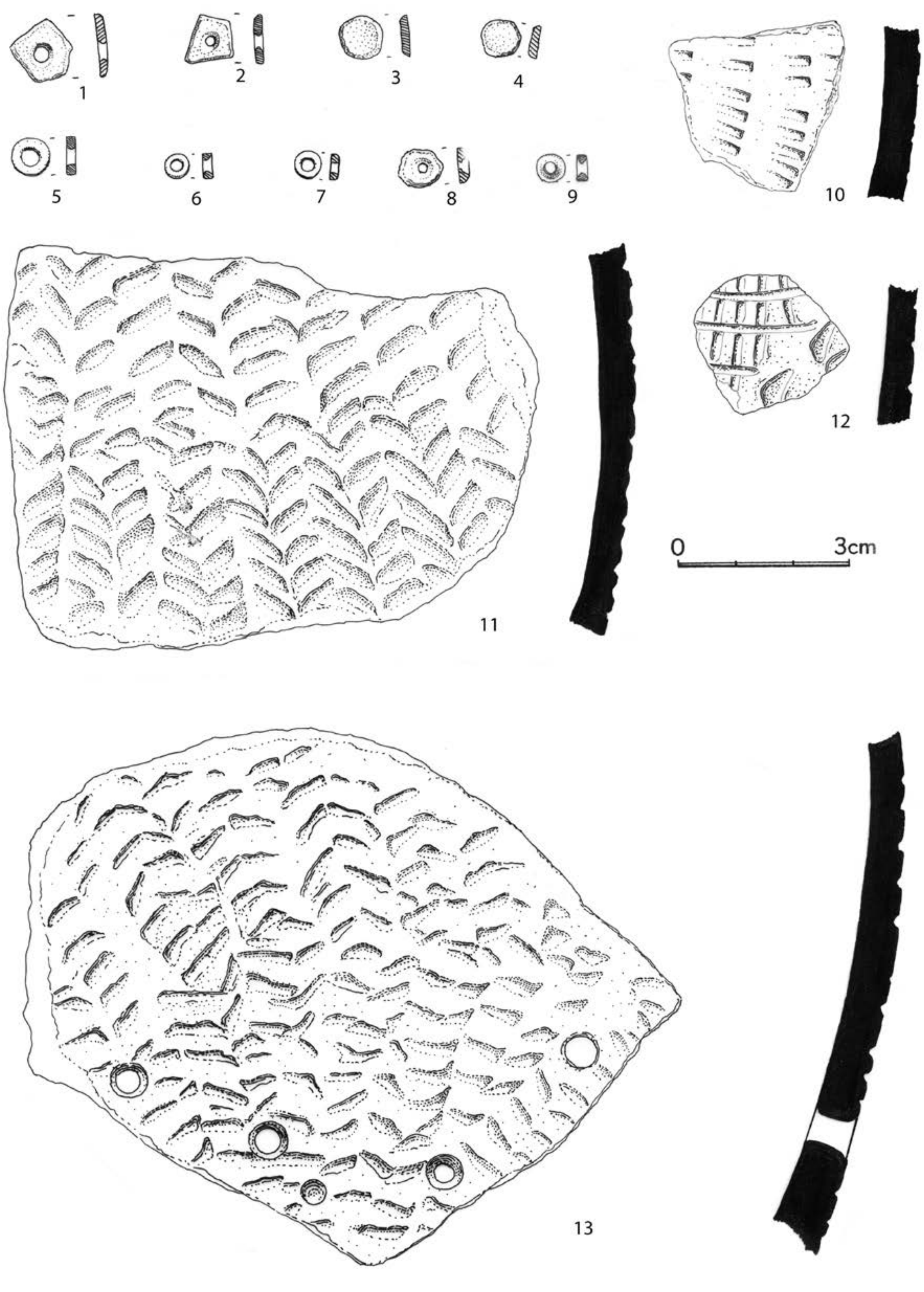


Figure 16. 9. Nab El Diep Area. E-00-2. Surface and level 0-10 cm below the surface. Key: 1-9 – ostrich egg shell beads, 10-13 – pottery sherds. Drawn by M. Puszkarski.

Pottery

The assemblage contains twenty-four body sherds and two rim fragments (Fig. 16.9: 10-13, 16.10: 1). Most of them were light reddish brown in colour. They were made by coiling with very fine sandy clay, tempered by crushed granite. The thickness of the sherds varying from 5 to 10 mm. Three different designs covered the surface of the sherds. There was wolf tooth motif and two types of Spaced Rocker-Stamp design. One body fragment had five holes drilled mostly from both sides, probably connected with a repair.

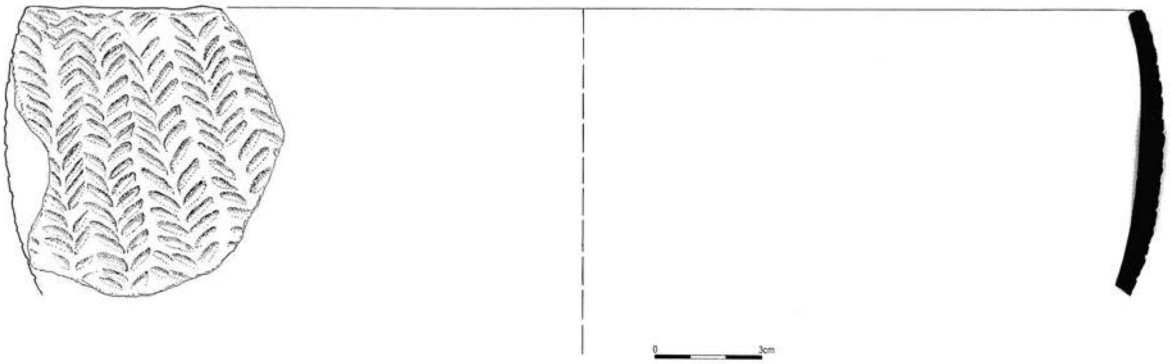


Figure 16.10. Nab El Diep Area. E-00-2. Surface and Level 0-10 cm below the surface. Pottery sherd. Drawn by M. Puszkarski.

3. Conclusion

The site was heavily deflated and mostly exposed on the surface. The lithic material was weathered, only a few items were in a fresh state. The assemblage is probably not homogenous and is associated with at least two different variants of the Early Neolithic, *El Ghorab*, and *El Nabta* (cf. Table 3.3). The situation is complicated by the fact that part of the *El Ghorab* complexes were collected from the surface and only small parts of the sites were excavated (E-79-3 and 4). Only the assemblages from sites E-76-6 (Kharga Area) and E-72-5 seem to be culturally uniform. The flint technology is based here most often on single- or double-platform blade or bladelet cores. A characteristic feature among the retouched tools is the elongated scalene triangle with small short sides (the retouched sides meet in a right angle or acute angle) and truncated blades made on blades or bladelets (similar to the truncated blades of the later *El Adam* groups). Among the retouched tools are also small and elongated scalene triangles with small short sides (obtuse angled), perforators, burins, fragments of backed bladelets and microburins. The continuously retouched pieces, as well as notches and denticulate, are big, mostly made on blades.

Site E-00-2 yielded elongated scalene triangles (the retouched edges meet in a right angle or acute angle), characteristic only for El Ghorab assemblages (Fig. 16.7: 21) as well as the 14C date from eggshell fragment (8200±70 years BP), indicating period of the El Ghorab occupation.

The geometrics at the site are of miniature size, including very small scalene triangles, they are common in all variants of Early Neolithic assemblages. On the other hand the core types and high frequencies of burin and burin spalls or perforators indicate that part of the assemblage could represent *El Nabta/ Al Jerar* occupation.

The ostrich eggshell beads found at Site E-00-2 have rectangular or square cross-section and are smaller than beads coming from features and cultural layer of the *El Ghorab* type from Site E-75-6 (Królik and Schild 2001: 117), which have a lenticular section, and are similar to the forms found in the assemblages at *El Nabta/ Al Jerar*.

The assemblage also contains pottery sherds with wolf tooth design (Fig. 16.9: 11, 13), which appears in *El Ghorab* and *El Nabta* assemblages (Nelson 2002: 13) and Spaced Rocker-Stamp design characteristic for the younger part of Early Neolithic assemblages. It is likely that the assemblage from Site E-00-2 is not homogeneous and could be connected with *El Ghorab* and *El Nabta/Al Jerar* variants.

There were no traces of pits or residential buildings typical of later Early Neolithic settlements in the studied area. Their lack can be associated with the considerable destruction of the studied area or its peripheral location in relation to the settlement.

Chapter 17.

Site E-02-3 – Final Neolithic Occupation at the Nab El Diep Playa

Halina Królik and HebatAllah A.A. Ibrahim

1. Introduction

Site E-02-3 occurs in the Nab El Diep Area, a narrow deflational trough bordering the Nabta Playa on the southwest. It is located around 1 km to the south of the Toushka/Darb El Arba'en road, close to Site E-00-2, which is situated about 40 m to the northwest of Site E-02-3 (cf. Fig.1.5). The site was found by HebatAllah A.A. Ibrahim in the course of the survey conducted by the Combined Prehistoric Expedition (CPE) during the second Field School season in 2002. It was investigated by the authors and Ahmed Gaber Salama Nour Eldin, Hassan Kamal Ahmed, and Omar Mahmoud Mohamed Zaky.

When found, it was an extensive area of sand dotted with many hundreds of flagstones resting on a gentle southwest slope of the deflated Old Dune showing the exposed B horizon of an aridisol. Some of the uncovered stones formed rather tight concentrations marking the locations of the stone-lined shallow basins of small hearths. These mostly occurred on a low rise measuring ca. 7 m x 6 m (Fig. 17.1, 17.2); three other hearths were placed about 12 m to the southwest, very close to the exposed sandstone bedrock remnants; four others were adjacent to the northeastern corner of the main concentration of hearths. Several were placed on the slope towards the east and northeast. These probably formed a line bordering prehistoric wells, today covered by a massive recent dune.

A thin concentration of archaeological material, mostly pottery sherds, covered by a recent thin layer, was also observed on the surface as well as the remains of a semi-complete ceramic pot, partially buried in a shallow hole in the sand, in the middle of the group of hearths.

A grid measuring 6 x 7 m was laid out and a thin bed of recent sandsheet that was removed, thereby exposing the truncated B zone of the aridisol developed in the topmost portion of the fossil dune as well as very thin patches of greyish colluvial fine sand overlapping the dune.

Figure 17.1. Nab El Diep, Site E-02-3. View of the site from the north. Photo by H. Królik.

Figure 17.2. Nab El Diep, Site E-02-3. View of the site from the south-east. Photo by H. Królik.

2. Excavation of the Basin Hearths

On the surface, the hearths were seen as concentrations of small slabs and pebbles of fire-cracked rocks, some of them in a vertical position, partially covered by the recent layer (Fig. 17.3, 17.4). Most of the hearths were located on the highest part of the rise; some, however, were found in the lower section of the gridded area.

At least 20 hearths in different stages of preservation have been recorded in the exposed area of the site. The edges of the individual hearths were observed just below the recent sandsheet. Only eight hearths have been cross-sectioned and partially excavated (Fig. 17.5).

Figure 17.3. Nab El Diep, Site E-02-3. View of the site from the east. Photo by H. Królik.

Hearth 1 *(Square O/9)* occurred at the southern border of the grid and was heavily deflated. On the surface, a few fire-cracked rocks marked its presence. It had an oval outline and measured ca. 40 cm in diameter. The hearth was cut into the sand dune to the depth of ca. 8 cm and was filled with yellowish washed-in sand containing a few charcoal pieces (Fig. 17.6).

Hearths 2 and 3 *(Squares S-T/15)*. On the surface, the two hearths appeared as if they were parts of a single one. After removing a recent sandsheet, two hearths were seen, although they were reused at least three times. They formed a flat oval area ca. 85 cm in length, marked by small sandstone slabs and pebbles. The hearth was located in a concavity with vertical rocks at the edges (Fig. 17.7, 17.8), except for the southwestern margin where a pothole was observed. Each phase of reuse of the hearth was manifested by a small concavity filled with a yellowish grey colluvial sand, rich in charcoal pieces, and by a reddish, oxidized sand at the base. In the upper section, the hearth was filled with two phases of the washed-in, /inconspicuously laminated sand, ca. 3-9 cm thick, suggestive of two phases of deposition and mixed with small slabs and pebbles. Near the southern edge of the hearth, a probable pothole, 18 cm in diameter, occurs. The infill of the hearths yielded a few scraps of mammal bones, as well as some very small fragments of pottery sherds.

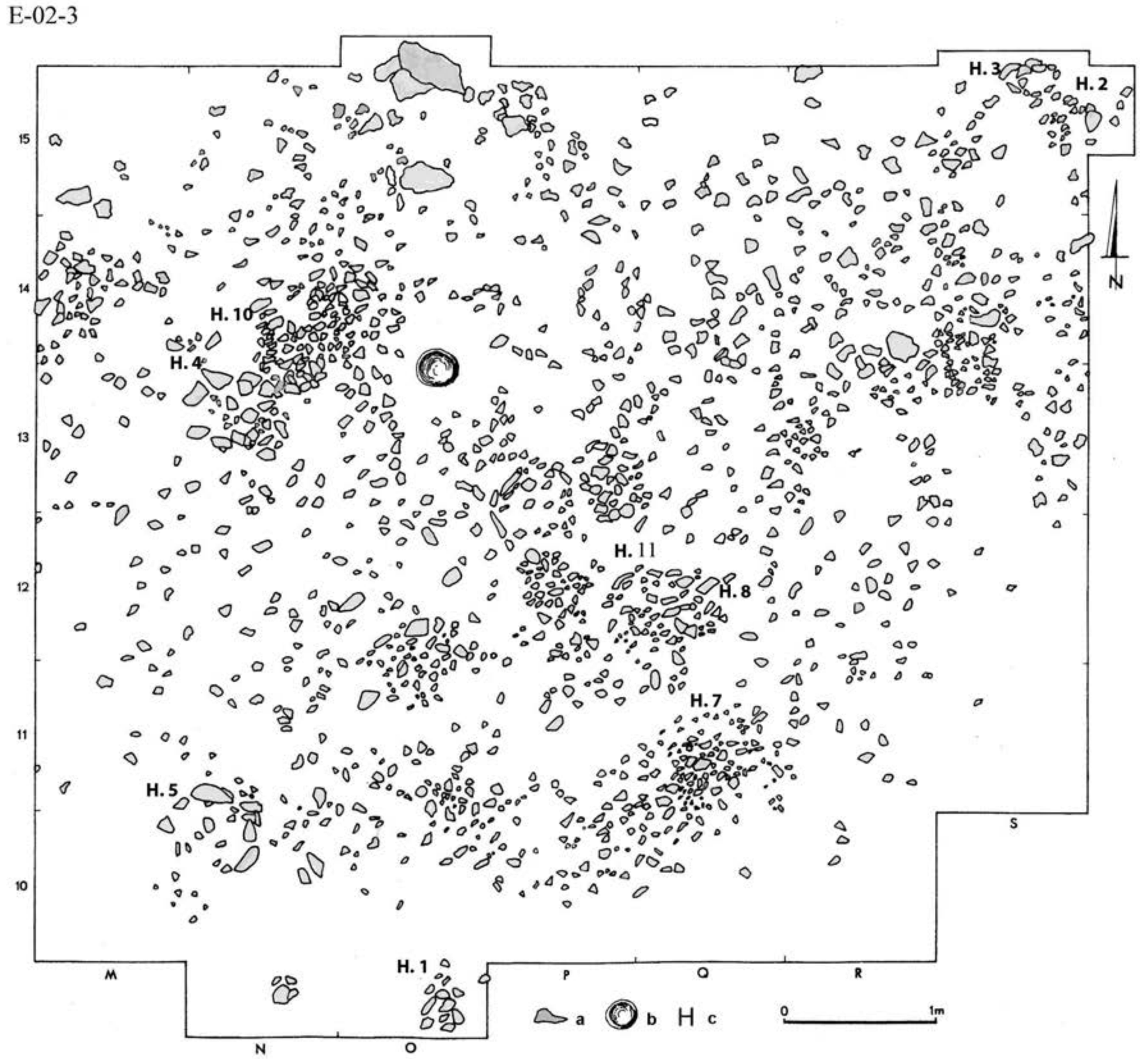


Figure 17.4. Nab El Diep, Site E-02-3.Concentration of hearths. Key: a – slab of rock, b – pot, c – excvated hearth. Map by H.A.A. Ibrahim, A.G.S.N. Eldin, O.M.M. Zaky, H.K. Ahmed, H. Królik. Drawn by M. Puszkarski and E. Gumińska.

Hearths 4 and 10 (*Squares N/13-14).*The hearths occurred in the highest section of the small rise. They were covered by sandstone slabs and were cut into the soil B horizon of the topsoil. Hearth 4 was oval in shape, ca. 60 cm long, and filled with a yellowish sand very rich in charcoal pieces, small chunks of rocks, and some fragments of pottery sherds as well as small scraps of mammal bones. Probably it was intersected by Hearth 10. The latter was not excavated, but seemed to be of the same shape and size as Hearth 4, however, it had an adjacent pothole, about 20 cm in diameter, located near the northern edge of the hearth.

Hearth 5 (*Squares M-N/10-11*) was located in the southwestern corner of the cluster. It was discernible on the surface due to the presence of small sandstone slabs placed mostly along the edges of the hearth. The hearth was circular in shape, about 75 cm in diameter, and had a shallow basin, about 8 cm deep, having nearly vertical walls in the northern, northwestern, and northeastern sections and gently sloping ones in the southern and southwestern sectors of the basin (Fig. 17.9). A pothole, some 20 cm in diameter, occurred near the southwestern edge of the hearth.

The sand underneath the hearth and the pothole was oxidized by fire. Both features were filled with a yellowish sand very rich in charcoal and a colluvial washed-in sand mixed with small sandstone chunks in the topmost section.

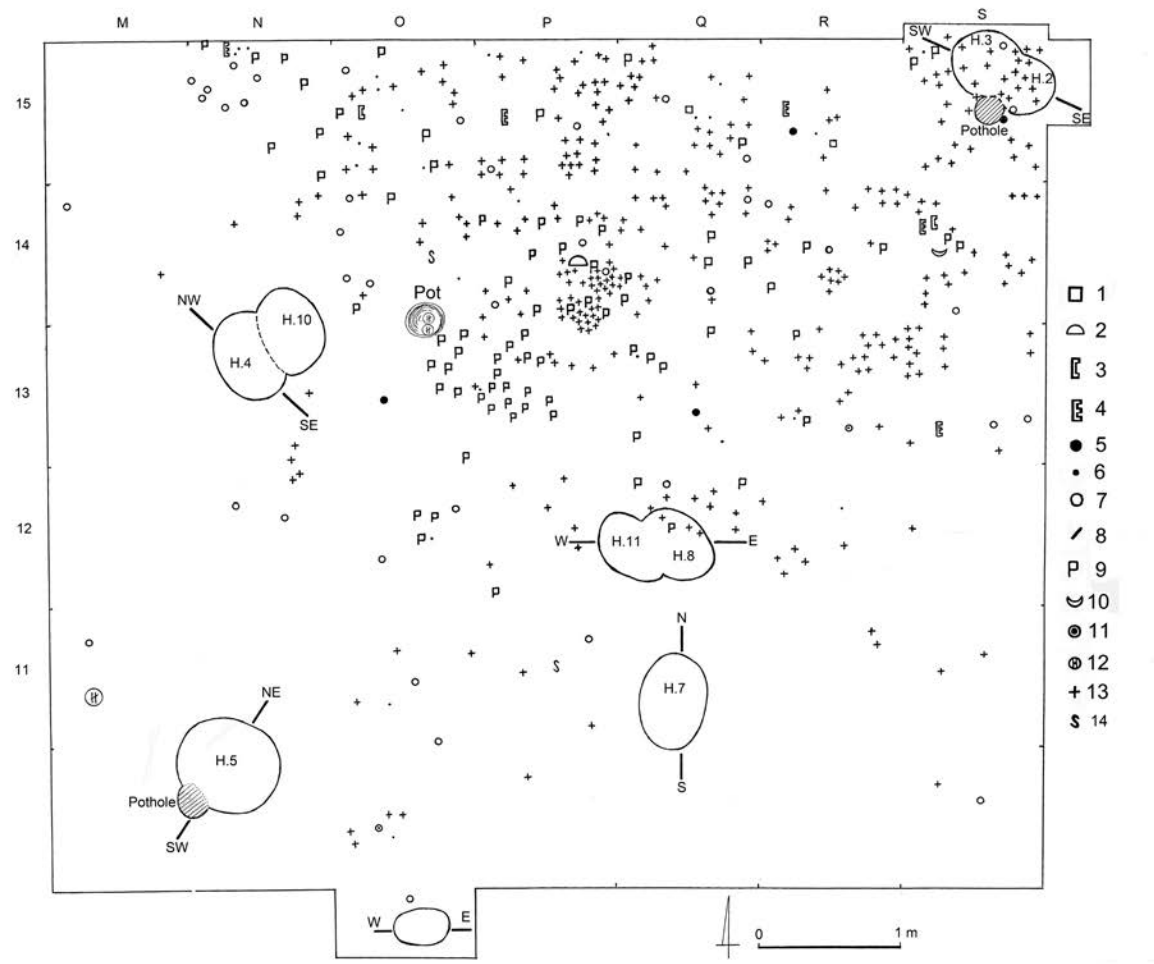


Figure 17.5. Nab El Diep, Site E-02-3. Map showing distribution of artefacts and shape of examined hearths. Key: 1 – core, 2 – endscraper, 3 – notch, 4 – denticulate, 5 – varia, 6 – chip and chunk, 7 – flake, 8 – blade, 9 – ceramic sherd, 10 – ostrich eggshell, 11 – bead, 12 – handstone, 13 – bone fragment, 14 – snail shell. Map by H. Królik, drawn by M. Puszkarski and E. Gumińska.

Hearth 7 (*Square Q/11*) formed a small rise at the south part of the concentration (Fig. 17.5, 17.10). The hearth was oval in shape, ca. 65 cm long and 4 cm deep. A yellowish grey sand, rich in charcoal and small chunks of rock at the top, filled the basin. A few scraps of mammal bones were recovered in the very vicinity of the hearth.

Hearths 8 and 11 (*Squares P-Q/12*). Both features appeared on the surface as a single oval hearth, about 85 cm long. Both were covered with small sandstone slabs, of which some were placed along the edges of the structure. At the northwestern border of the feature they are standing in a vertical position. The hearths reached a depth of about 18 cm. Their relation is not clear (Fig. 17.10-17.12), probably Hearth 11 was younger. Both basins were filled with a thin (2 cm) bed of grey sand, rich in charcoal pieces and two discrete thin beds of the yellowish washed-in sand mixed with numerous small sandstone pebbles and charcoal pieces. The sand underneath the hearths was oxidized by fire.

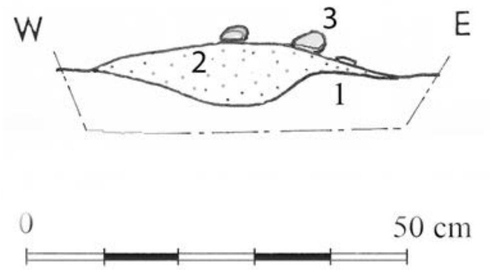


Figure 17.6. Nab El Diep, E-02-3. Hearth 1. Key 1 – sand dune, 2 – yellowish washed sand with a few charcoal pieces, 3 – slabs of rocks. Drawn by H. Królik and M. Puszkarski.

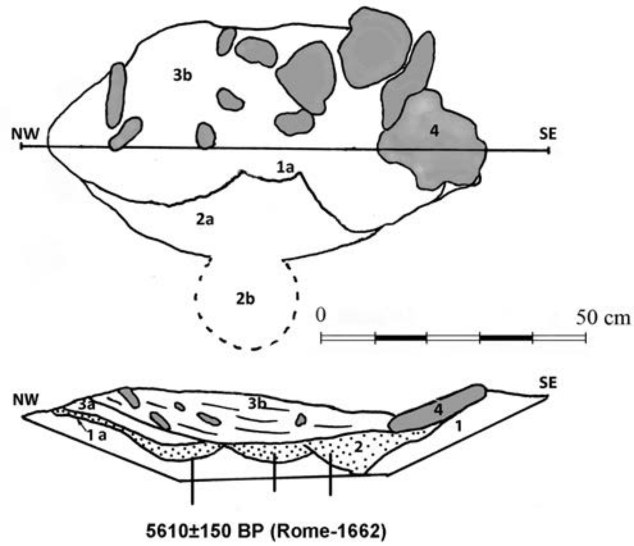


Figure 17. 7. Nab El Diep, Site E-02-3. Hearths 2 and 3 below recent sandsheet. Key: 1 – sand dune, 1a – red burned sand below hearth, 2a – bottom of the hearths, 2b – bottom of the pothole, 2 – yellowish-grey sand rich in charcoal pieces, fill of the hearths, 3a-b – yellowish washed sand covering the hearths, 4 – rock. Drawn by H. Królik, M. Puszkarski and E. Gumińska.

Figure 17.8. Nab El Diep, Site E-02-3. Bottom of Hearths 2 and 3. View from north-east. Photo by H. Królik.

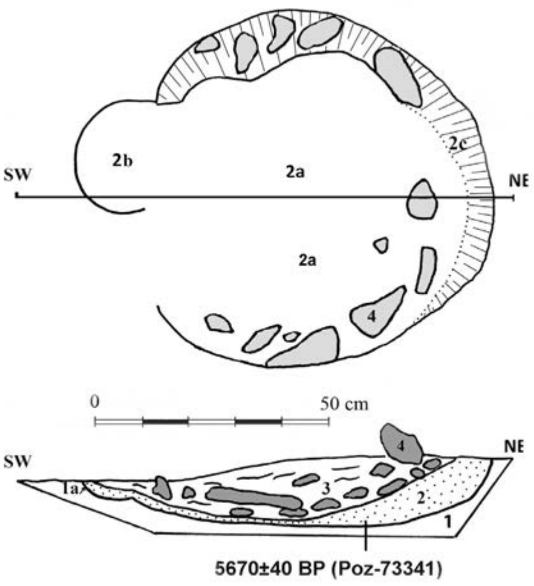


Figure 17.9. Nab El Diep, Site E-02-3. Hearth 5. Key: 1 – sand dune, 1a – red burned sand below hearth, 2a – bottom of the hearth, 2b – bottom of the pothole, 2c – almost straight wall of the hearth, 2 – yellowish-grey sand rich in charcoal pieces, fill of the hearth, 3 – laminated washed sand, last phase of the filling, 4 – rocks. Drawn by H. Królik, H.A.A. Ibrahim, H.K. Ahmed, O.M.M. Zaky and E. Gumińska.

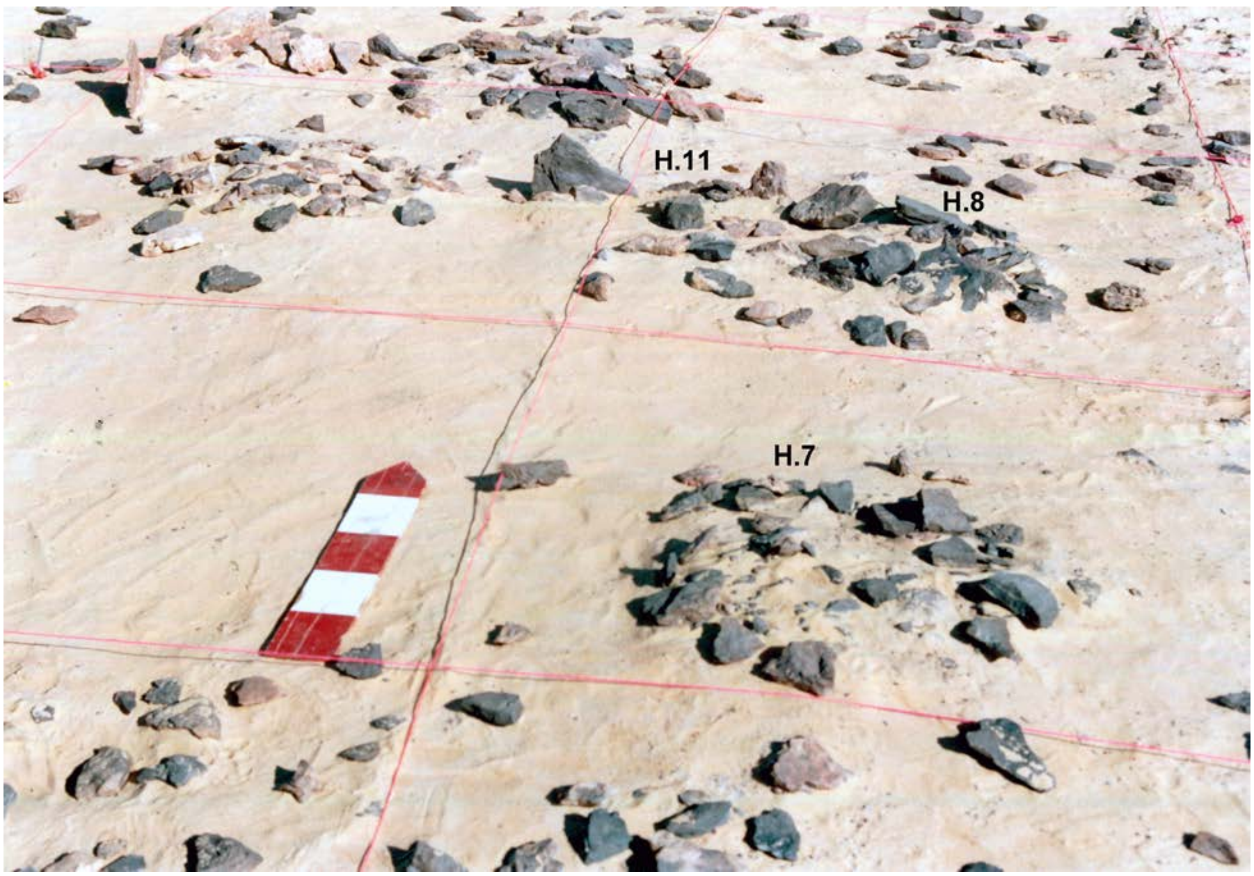


Figure 17.10. Nab El Diep, Site E-02-3. Hearths 7, 8, 11. View from the south. Photo by H. Królik.

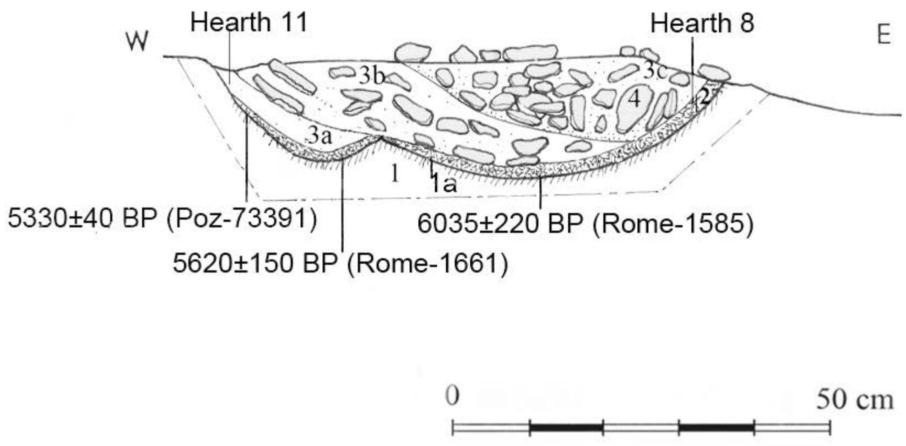


Figure 17.11. Nab El Diep, Site E-02-3. Hearths 8 and 11. Key: 1 – sand dune, 1a – red burned sand below hearths, 2 – grey sand rich in charcoal pieces, fill, 3a-c – yellowish washed sand with a few charcoal pieces mixed with slabs of rocks, three phases of filling, 4 – slabs of rocks. Drawn by H. Królik, M. Puszkarski and E. Gumińska.

Figure 17.12. Nab El Diep, Site E-02-3. Pot and Hearth 11. View from the south. Photo by H. Królik.

3. Description of the Material

The archaeological material was collected from the surface, sub-surface, and from the fill of excavated hearths. In total, 74 pieces of debitage, two cores, eight retouched tools, two ostrich eggshell beads, 150 fragments of pottery sherd, three handstones, and about 250 very small fragments of mammal bones have been recovered from the gridded area. The artefacts were concentrated in the northern and northeastern parts of the site. On the other hand, the southern section of the studied area was heavily deflated and thus there were fewer finds in this area than in the northern part.

Table 17.1. Nab el Diep Area, Site E-02-3. Frequencies of debitage types by raw material.

Raw Material	**Flint**	**Quartz**	**Quartzitic Sandstone**	**Limestone**	**Total**
Primary flake	1	-	-	5	6
Flake from single platform core	7	6	-	3	16
Flake from multiple platform core	4	1		-	5
Unidentifiable flakes	1	9	2	4	16
Blade from single platform core	1	-	-	-	1
Chips and chunks	16	6	8	-	30
Total	**30**	**22**	**10**	**12**	**74**

Debitage

The categories of the debitage and raw materials are given in Table 17.1. Flakes are the most frequent group of the debitage and represents about 98% of the collection (excluding chips and chunks). Among the flakes, those from single-platform cores are dominant. They are small in size: lengths varying from 10 to 30 mm. The majority of them are tertiary flakes with lisse platforms. Primary flakes, flakes from multiple platform cores, and blades from single platform cores are also present. The most common raw material is Eocene flint (30 pieces), followed by quartz (22 pieces). Some pieces were made of limestone (12 pieces) or quartzitic sandstone (10 pieces).

Cores

Only two cores were collected from the cluster of hearths. These are single and multi-platform cores for flakes with cortex or lisse platform. They were made of quartz and chalcedony.

Retouched tools

The typology and frequencies of retouched tools are given in Table 17.2. The tool list is based upon Tixier's typology (1963). There are only eight retouched tools; all are made of flint:

1. A single endscraper made on a tertiary flake. Its front is formed at the distal end.
2. Two notches, both were prepared on the tertiary flakes. The notches are formed either by an obverse direct retouch or by a combination of retouch and single blow on the dexter side.

3. Three denticulated pieces, of which only one is complete. All are made on primary or secondary flakes. The denticulated edges are formed by both a single blow and obverse retouch and are located on the sinister or both edges (Fig. 17.13: 1, 2).

4. Two unidentifiable fragments of flakes with fragmentary retouch.

Table 17.2. Nab El Diep Area, Site E-02-3. Frequencies of tool types by raw material.

Tool Types	**Flint No.**	**Granit No.**	**Ostrich Eggshall beads No.**
Single endscraper on a flake	1		
Notched flakes	2		
Denticulated flakes	3		
Varia	2		
Sub- total	**8**		
Ostrich eggshall beads			2
Handstones		3	

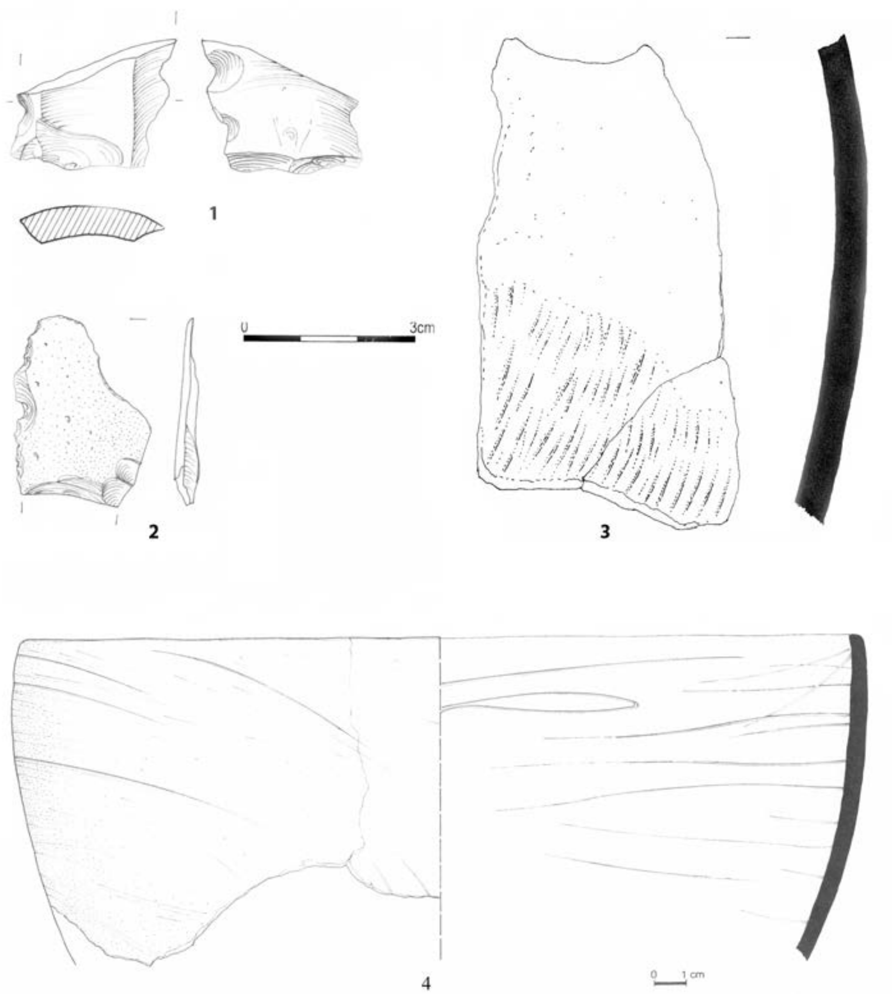


Figure 17.13. Nab El Diep, Site E-02-3. Retouched tools and pottery sherds. Key: 1, 2 – denticulate pieces, 3 – body sherd, 4 – bowl (?). Drawn by M. Puszkarski.

Beads

Two ostrich eggshell beads have been collected, both are finished, circular in shape, ca. 6.5 mm in diameter, with rectangular cross-section and polished edges.

Handstones

Two handstones were found under the truncated pot and one occurred in the southwestern part of the concentration (Fig. 17.14). Two are oval in shape, with two working faces. One is circular with one polished straight face. One piece shows traces of red ochre.

Pottery

The collection includes about 150 small fragments of pottery sherds and one partially restorable bowl (Figs. 17.4, 17.12, 17.13: 3, 4). All of the pottery pieces are of the Red Ware Smoothed variant as defined by Nelson (2001c; 2002a; 2002b), except for one sherd of Ripple Ware category. All are characteristic of the Late Neolithic in the Nabta Area. There is one sherd originating from a small tulip-shaped jar (Fig. 17.16); all the others appear to be from bowls.

Of particular interest is the partially restorable globular bowl (the base is missing). It is a Smoothed Red Ware, Black Topped specimen, about 26.5 cm in diameter and about 6 mm thick with rounded lip (Fig. 17.15). It is made by coiling of a fine alluvial clay tempered with fine sand and small, organic fibres. The vessel was given an initial smoothing by using grass or similar fibre that left prominent, diagonal striations over the interior and exterior surfaces. On the interior, these striations were only partially obliterated during the final smoothing. The final smoothing (not burnishing) may have been done with a stone, but more likely by a moisturized hand, produced in some spots a thin pseudo slip. It had a black rim on the exterior wall located from 7 to 10 cm below the rim. The pot was fired in an oxidizing atmosphere. The vessel was found lying upside down, near a hearth; its base was truncated by the deflation.

Among the remaining miscellaneous sherds, the following specimens were identified: a small fragment with traces of minor ripples on the exterior; several small body sherds of Smoothed Red Ware, originating from a number of vessels. No base sherds were found, and only one identifiable rim sherd occurred in the assemblage. One larger body sherd derived from the neck and another body sherd originated from a small tulip-shaped jar. It was made of the fine alluvial clay with some organic inclusions. The single rim sherd had a drilled hole near the rim, either for repair or for hanging.

Animal Bones

The excavated area yielded about 250 very small scraps of mammal bones. According to Achilles Gautier, the bone fragments represented hare, gazelle, cattle (square O/10), and an ovicaprid.

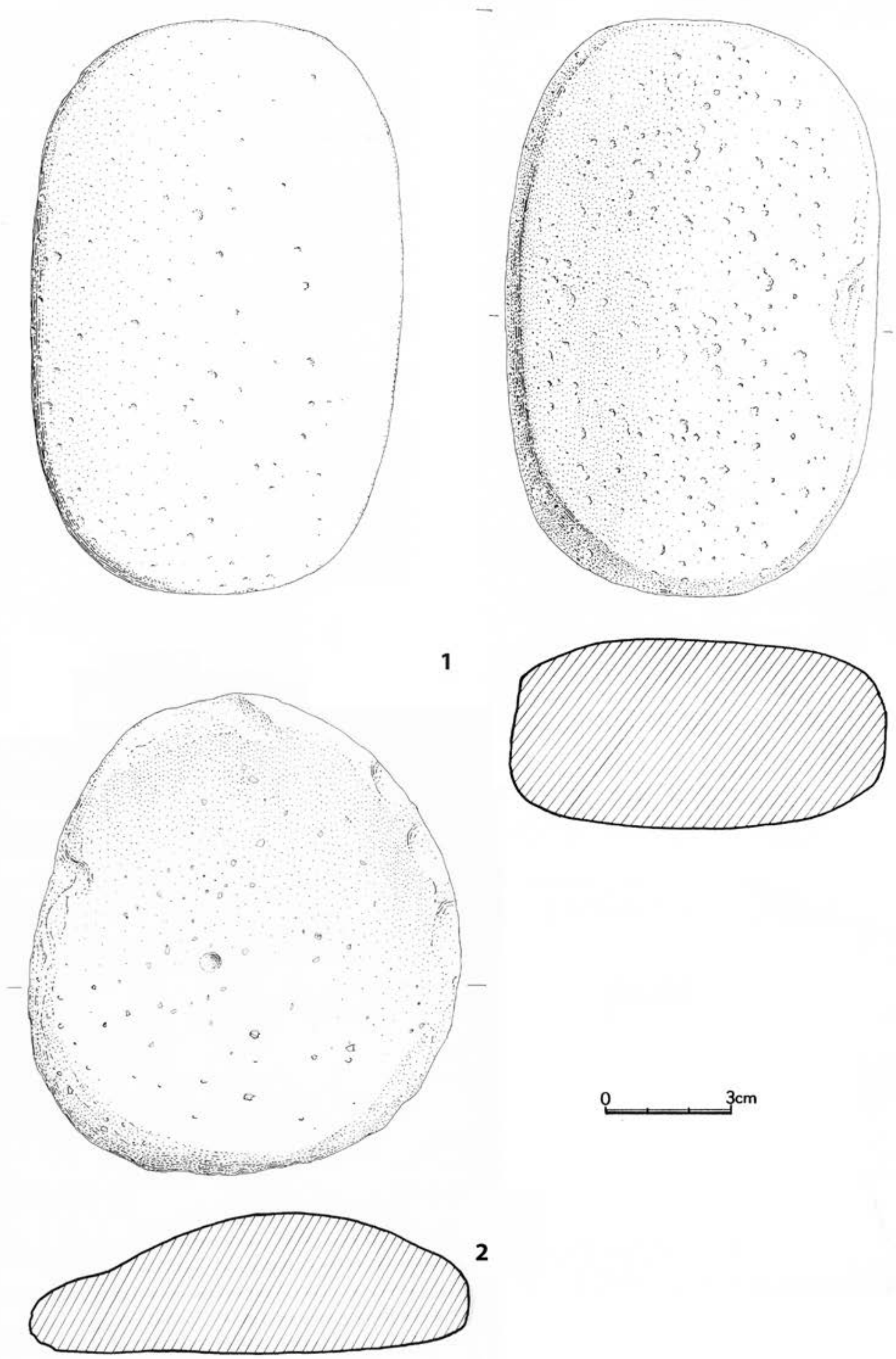


Figure 17.14. Nab El Diep, Site E-02-3. Handstone. Drawn by M. Puszkarski.

Figure 17.15. Nab El Diep, Site E-02-3. Globular bowl. Photo by H. Królik.

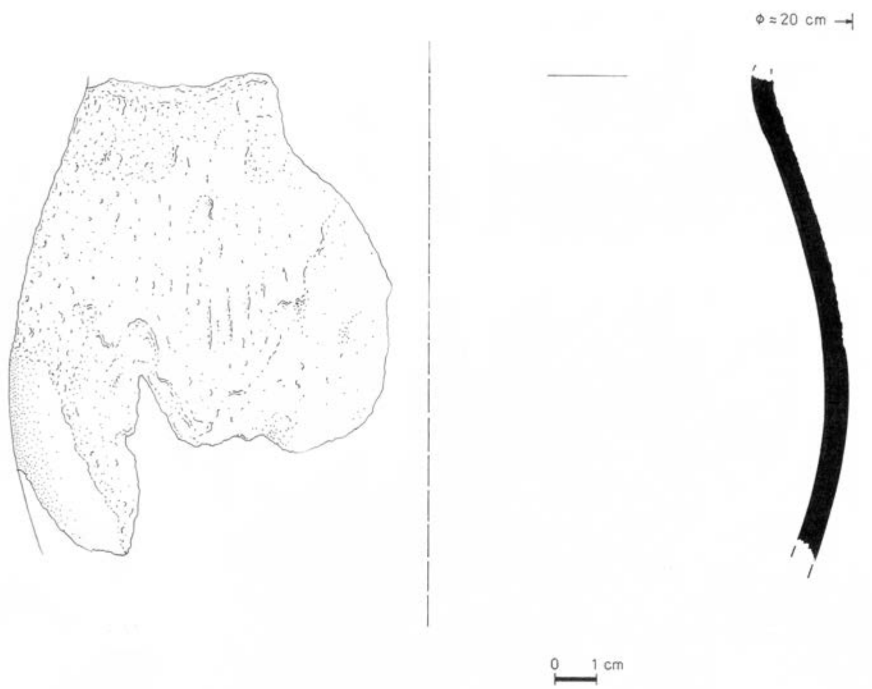


Figure 17.16. Nab El Diep, Site E-02-3. Tulip-shaped jar. Drawn by M. Puszkarski.

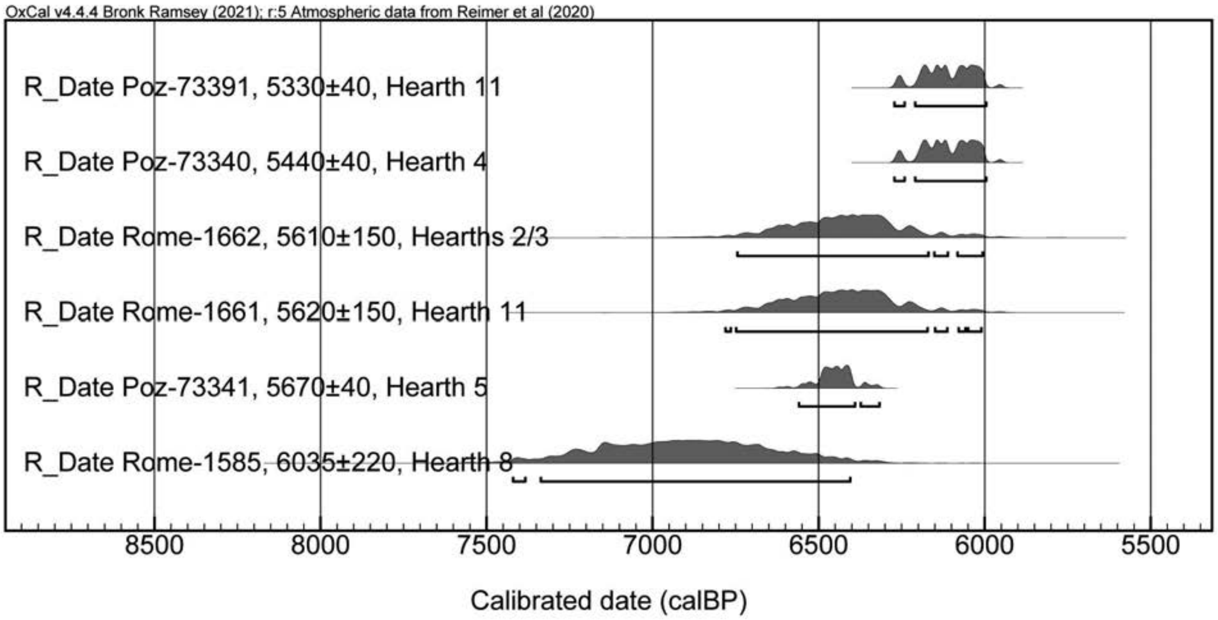


Figure 17.17. Nab El Diep, Site E-02-3. Calibrated radiocarbon age estimates. OxCal v.4.4.4. and IntCal 20 calibration curve (at 2σ).

4. Radiocarbon Dates

A number of ^{14}C dates measured on charcoal have been obtained from the infills of five hearths (Fig. 17.17). They gave the following uncalibrated and calibrated ages (OxCal v4.4.4, IntCal 20 at 2σ):

1. Hearth 11: 5330 ± 40 BP (Poz-73391); and 6270-5990 calBP; (4320-4040 calBC)
2. Hearth 4: 5440± 40 BP (Poz-73340); and 6310-6120 calBP; (4360-4170 calBC)
3. Hearths 2/3: 5610+/-150 BP (Rome-1662); and 6750-6000 calBP; (4800-4050 calBC)
4. Hearth 11: 5620 ±150 (Rome- 1661); and 6780-6010 calBP; (4830-4060 calBC)
5. Hearth 5: 5670 ± 40 BP (Poz-73341); and 6560-6310 calBP; (4610-4360 calBC)
6. Hearth 8: 6035±220 BP (Rome-1585); and 7420-6400 calBP; (5470-4450calBC)

Five of the results fall in the time-frame of the Final Neolithic (Fig. 17.17). However, several of them seem to be associated with the discrete settlement episode. The older age (Rome-1585) from Hearth 8 could be a result of "the old wood effect"? or contamination by older, washed-in charcoal, but it is also likely that the site may contain Late Neolithic incidences of occupations.

5. Conclusions

The cluster of the hearths of Site E-02-3 represents an example of a common Final Neolithic settlement patterning of the *Bunat El Asnam* occupations in the South-Western Desert (cf. Table 3.3). This is characterized by the presence of numerous small basin hearths and hearth groups often installed in the same spots. The cross-sections of Hearths 2 and 3 (Fig. 17.8) are a good example of this pattern, consisting of a small series of three intersecting small hearths, sometime stone-lined. Each hearth was, in turn, covered by thin beds of washed-in and slightly laminated colluvial sand. A few potholes, adjacent to the edges of hearths, were also recorded. The sizes of all the hearths as well as their pattern are very similar to the Final Neolithic hearths excavated at Site E-92-7 at Nabta Playa (Królik and Fiedorczuk 2001: 342-345). Most of the Hearths were oval in shape and about 60 x 50 cm in size. Only Hearth 5 was circular in outlines, measuring about 75 cm in diameter.

Some hearths were used at least a few times, suggesting repetitive settling of the same place. It seems that this would be in agreement with the finding of the inverted bowl with two handstones insite, left in a small pit for further use in anticipation of an imminent return to the area (Fig.17.15). The pot is identified as of Black Top Red Ware, clearly suggesting a Late to Final Neolithic date for this episode.

The paucity of stone artefacts at the site is considered to be an additional indication of the transitory character of the occupations. The assemblage includes only eight retouched tools, all of background character and not diagnostic. About 250 very small fragments of mammal bones were recovered, and they exhibit a quite typical faunal composition of the *Ru'at El Baqar* settlers of the semi-desert areas, concentrated around the areas where ground water was available.

Chapter 18.

Site E-04-3 – Neolithic occupation adjacent to the South-Eastern Group of Megalithic Structures at Nabta Playa

Agnieszka Czekaj-Zastawny and Hebat Allah A.A. Ibrahim

1. Introduction

Site E-04-3 occurs at the southern part of Nabta Playa (Fig. 18.1). The excavation work was conducted in two parts of the site (A and B); both are situated on the western slope of the low knoll on which was the South-Eastern Group of megalithic structures that made up the Playa site. The research in this area was a part of the activities documenting the Nabta Playa megaliths, because the site was located adjacent to one of the megalithic groups composed of a few clusters of collapsed megalithic stelae that showed marks of wind deflation.

The excavated site was recognized as a small concentration of archaeological material and fire-cracked rocks exposed on the surface. The work was begun on the first part of the site (E-04-3A) found about 10 m south of one of the megalithic clusters. The site yielded only a very few pieces of debitage, and thus investigation was not continued at this spot, but a new grid was laid out to the south. The second part of the site (E-04-3B) was about 50 m south of E-04-3A, measured 8 m by 4 m, with a north/south axis (Fig. 18.2, 18.3). The archaeological material recorded on the surface included flaked stone artefacts, very small pottery sherds that were sometimes difficult to recognize, small scraps of bones, a fragment of ostrich eggshell, and some scattered big blocks of stones (grinding implements?).

On the surface, two hearths occurred in the gridded area. They were marked by small slabs of fired-cracked rocks, and partially covered by the recent sandsheet layer, under which they were in a poor stage of preservation. The edges of the individual hearths were observed just below the recent sandsheet.

All surface material was collected and the scatter plotted. A layer of 0-20 cm was excavated, the soil was screened and all artefacts were collected and studied. We would like to mention that we are grateful to Christy Bednar and Fred Wendorf for taking part in the work during the analysis and registration of lithic artefacts and pottery sherds in the camp at the end of the season.

Figure 18.1. Location of Site E-04-3 in the Nabta Playa basin.

Figure 18.2. Nabta Playa, location of Site E-04-3 on the western slope of the low hill of the south-eastern group of megalithic structures, looking north. Photo by H.A.A. Ibrahim.

Figure 18.3. Nabta Playa, Site E-04-3 during the work in layer 0-10 cm of the truncated and heavily weathered soil horizon of 8.2 ka event reddish playa silt, looking west. Photo by R. Schild.

2. Description of Material

The archaeological material was collected from the surface, sub-surface, and from the infill of excavated hearths. In total, 1518 pieces of debitage, 31 cores, 77 retouched tools (Table 18.1), 32 very small fragments of pottery sherds, and 4 handstones were recovered from the gridded area. They were concentrated in the north and northwestern part of the site.

Table 18.1. Nabta Playa, Site E-04-3. The lithic assemblage type frequencies.

Type	Number	%
Debitage (excluding chips and chunks)	352	75.86
Cores	31	6.68
Retouched Tools	77	16.59
Handstones	4	0.86
Total	464	99.99

Debitage

The types of debitage and raw materials are given in (Tables 18.2-18.4). Flakes are the most frequent group of debitage and represent about 76.02% of the assemblage (excluding chips and chunks). Among the flakes, the single-platform core flakes were represented by 22.16%, the majority of them were tertiary flakes with lisse platforms. Primary flakes (9.66 %), flakes from opposed platform cores (2.28%), flakes from 90° platform cores, and flakes from multiple platform cores (1.71%), and unidentifiable flakes (35.52%) were present. A percentage of blades was included in the assemblage (19.27 %); from single-platform cores (16.47%), opposed platform cores (0.85%), multiple platform cores (0.56%), and unidentifiable forms of cores (2.27 %). Other types of debitage were recorded in the site such as burin spalls (0.56%), core tablet (1.13 %), lame á créte (0.85 %), and other core-trimming elements (4.26 %).

The most common raw material was flint (130 pieces), followed by quartz (121 pieces). Some pieces were made of chert (32 pieces), sandstone (21 pieces), quartzitic sandstone (21 pieces), petrified wood (9 pieces), basalt (8 pieces), granite (9 pieces), and agate (1 piece).

Table 18.2. Nabta Playa, Site E-04-3. Frequencies of debitage types.

Debitage type	No	%
Primary flake	34	9.66
Flake from single platform core	78	22.16
Flake from opposed platform core	8	2.28
Flake from 90° platform core	6	1.71
Flake from multiple platform core	6	1.71
Unidentifiable flakes	125	35.52
Blade from single platform core	58	16.47
Blade from opposed platform core	3	0.85
Blade from multiple platform core	2	0.56

Debitage type	No	%
Unidentifiable blade	8	2.27
Burin spall	2	0.56
Core tablet	4	1.13
Lame á créte	3	0.85
Other core-trimming element	15	4.26
Chips and chunks	1166	--
Sub-total	**352**	9.99
Total	**1518**	

Table 18.3. Nabta Playa, Site E-04-3. Frequencies of debitage raw material (chips and chunks excluded).

Debitage raw material type	No	%
Quartz	121	34.37
Flint	130	36.93
Chert	32	9.10
Quartzitic sandstone	21	5.96
Sandstone	21	5.96
Basalt	8	2.27
Granite	9	2.56
Agate	1	0.28
Petrified wood	9	2.56
Total	**352**	99.99

Table 18.4. Nabta Playa, Site E-04-3. Frequencies of debitage raw material (chips and chunks included).

Debitage raw material type	No	%
Quartz	1001	65.94
Flint	283	18.64
Chert	77	5.07
Quartzitic sandstone	57	3.75
Sandstone	22	1.45
Basalt	13	0.86
Granite	15	0.99
Agate	7	0.46
Petrified wood	43	2.83
Total	**1518**	100.0

Cores

The assemblage included 31 cores that were recovered from the gridded area (Table 18.5; Fig. 18.4-18.8, 18.9: 1, 2, 5). Quartz is the most common raw material (67.74%), followed by fint (9.68%), chalcedony, basalt, quartzitic sandstone (6.45%), and chert (3.22%).

Table 18.5. Nabta Playa, Site E-04-3. Frequencies of raw material types of cores.

Core raw material type	**No**	**%**
Quartz	21	67.74
Flint	3	9.68
Chert	1	3.22
Quartzitic sandstone	2	6.45
Basalt	2	6.45
Chalcedony	2	6.45
Total	31	99.99

The cores' types are recorded in Table 18.6. The sample is dominated by single-platform (8 pieces) and opposed platform cores (6 pieces). Ninety degree platform (4 pieces), patterned multiple platform (2), unpatterned multiple platform variety (3), a discoidal core (1), initially struck (4 pieces), and unidentifiable cores (3 pieces) were also present. Almost all the cores had had no preparation; only few had traces of some preparation. The majority of cores were for flakes and only two were for blade production, both from flint. Seven types of cores were recorded:

- *Single platform cores*: They were all cores for flakes without any preparation (six of quartz and one of basalt), except one of flint for blades with some preparation. The platform types were dominant by lisse platform (4) and cortex platform (3), while one facetted platform existed. The platform angles vary between 73º and 90º.

- *Opposed platform cores*. Except one of chalcedony for flakes, all were without preparation (4 quartz for flakes and 1 flint for blades). The platforms types include cortex and cortex (1), lisse and lisse (2), and cortex and lisse (2), and one was broken contains one lisse platform and the other was missing, all were from the same side. The range of platform angles was 92º-79º.

- *Ninety degree platform cores:* Most of them were quartz (3) without any preparation, only one piece was flint with some preparation, and all were for flakes. Their platforms were cortex and cortex (2), lisse and lisse (1), cortex and lisse (1) or faceted (2), all on one side. The angles of the platforms ranged between 71º and 90º.

- *Multiple platform cores:* They were two patterned multiple platform cores, of quartz and quartzitic sandstone, no preparation traces were found and both were for flakes. The platform types were cortex (5) and lisse (1), their angles varied between 72º and 90º. Three unpatterned multiple platform cores were found.

- *Initially struck core*: All were for flake production, of quartz (2), basalt (1) and chalcedony (1). The platform types were cortex (2) and lisse (2), and the range of angles varied between 80º and 90º.

- *Discoidal Core*: the only discoidal core was found in the site was of quartz?, without any preparation, and for flake production. It showed four types of platforms: faceted (1), lisse (2), and cortex (1), with angles between 81º and 91º.

- *Unidentifiable Core*: there were three unidentifiable cores of quartz.

Table 18.6. Nabta Playa, Site E-04-3. Frequencies of core types.

Core type	**No**	**%**
Single platform core	8	25.81
Opposed platform core	6	19.35
90º platform core	4	12.90
Patterned multiple platform core	2	6.45
Unpatterned multiple platform core	3	9.68
Initially struck core	4	12.90
Discoidal Core	1	3.22
Unidentifiable Core	3	9.68
Total	31	100

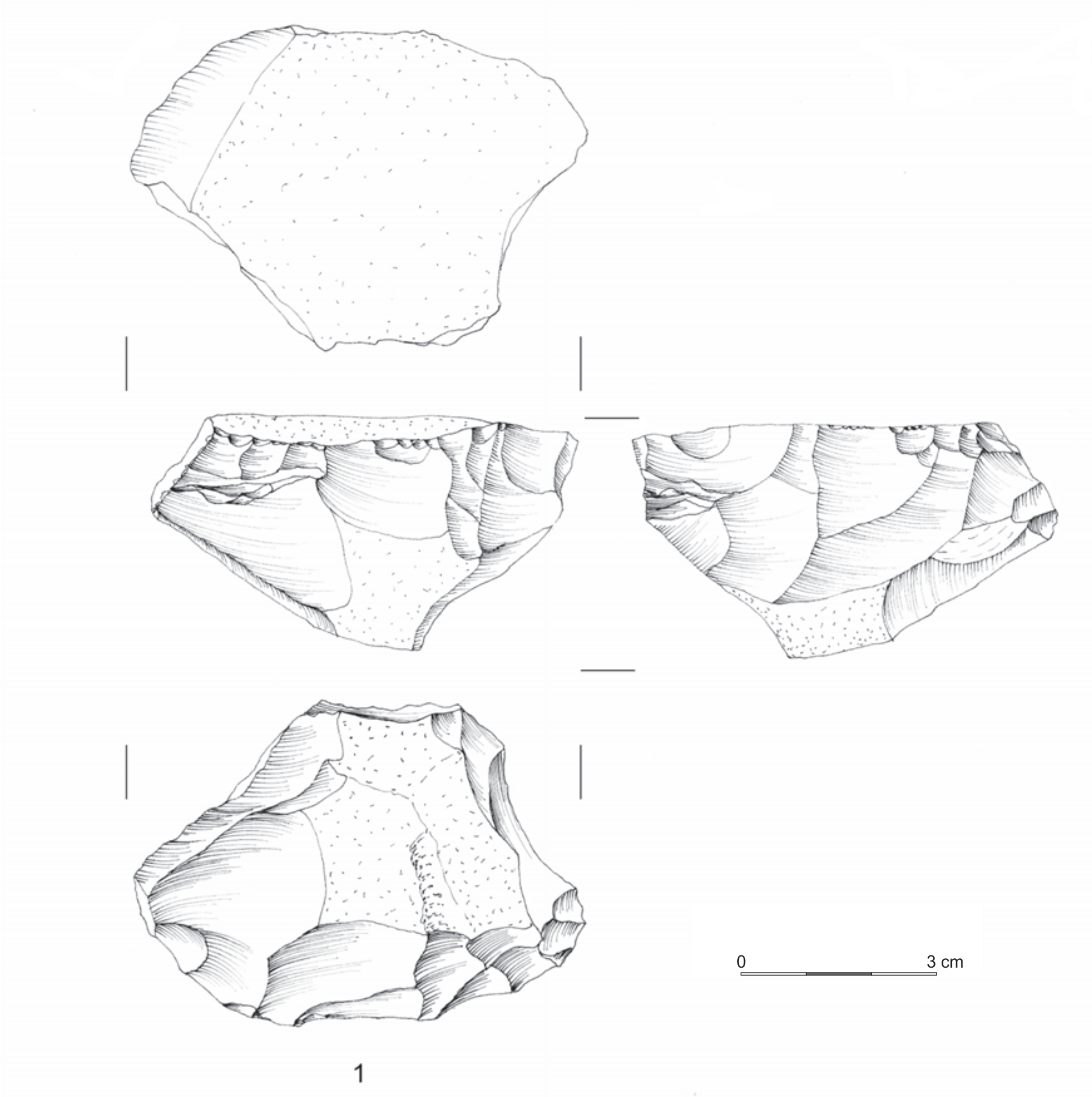


Figure 18.4. Nabta Playa, Site E-04-3. Selection of artefacts: 1 – core. Drawn by M. Puszkarski, J. Mugaj.

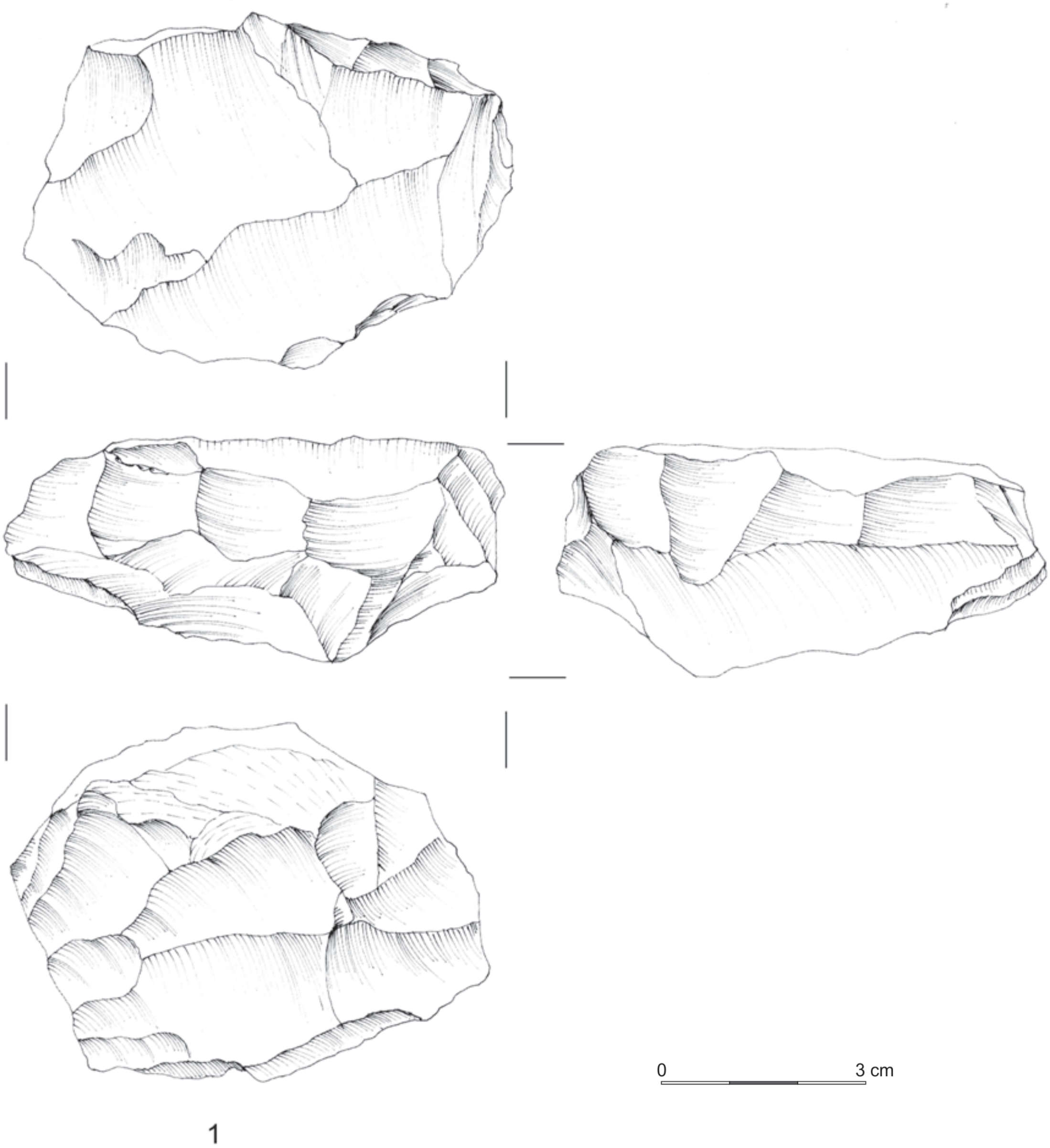


Figure 18.5. Nabta Playa, Site E-04-3. Selection of artefacts: 1 – core. Drawn by M. Puszkarski, J. Mugaj.

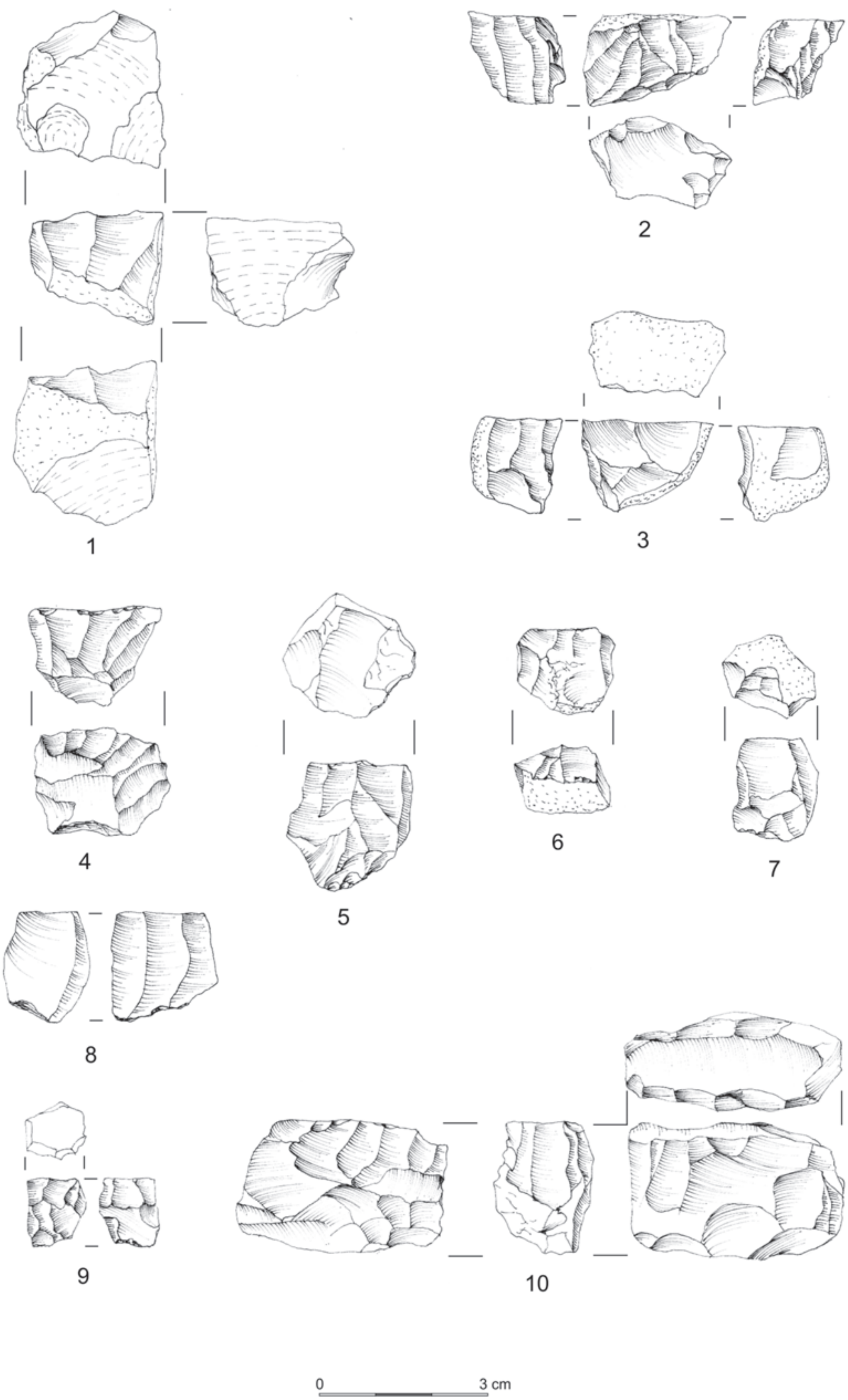


Figure 18.6. Nabta Playa, Site E-04-3. Selection of artefacts: 1-10 – cores. Drawn by M. Puszkarski, J. Mugaj.

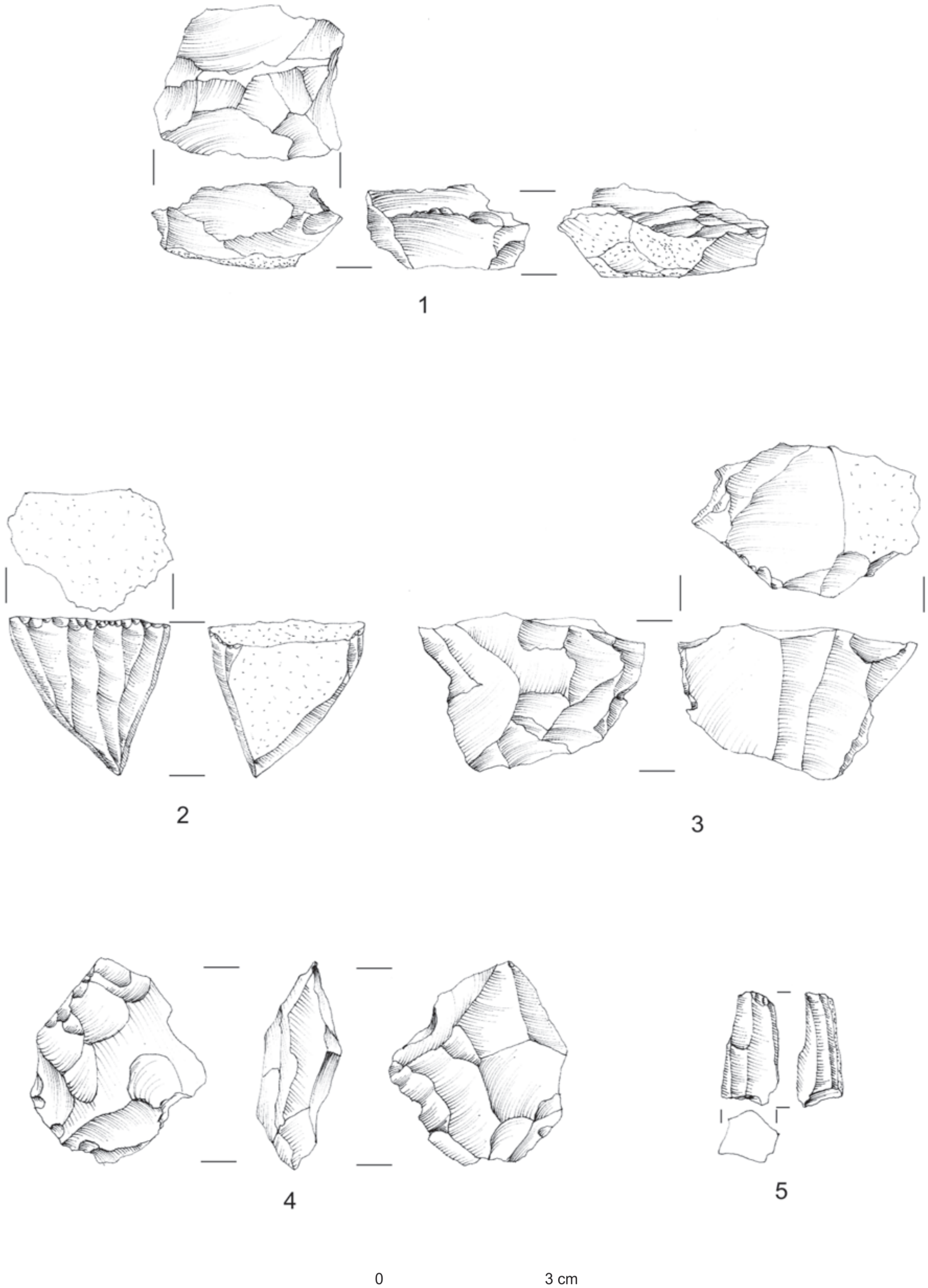


Figure 18.7. Nabta Playa, Site E-04-3. Selection of artifacts: 1-5 – cores. Drawn by M. Puszkarski, J. Mugaj.

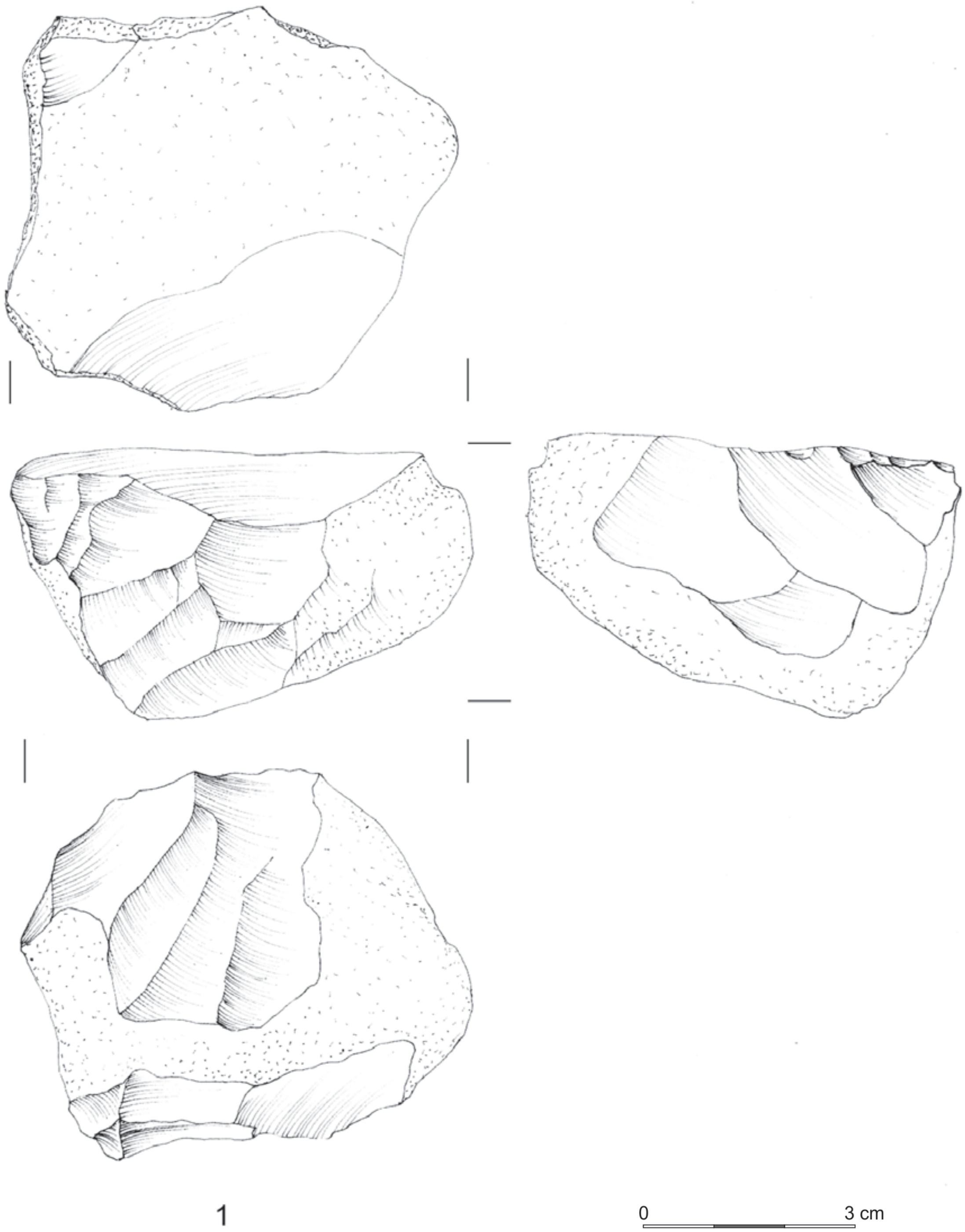


Figure 18.8. Nabta Playa, Site E-04-3. Selection of artefacts: 1 – core. Drawn by M. Puszkarski, J. Mugaj.

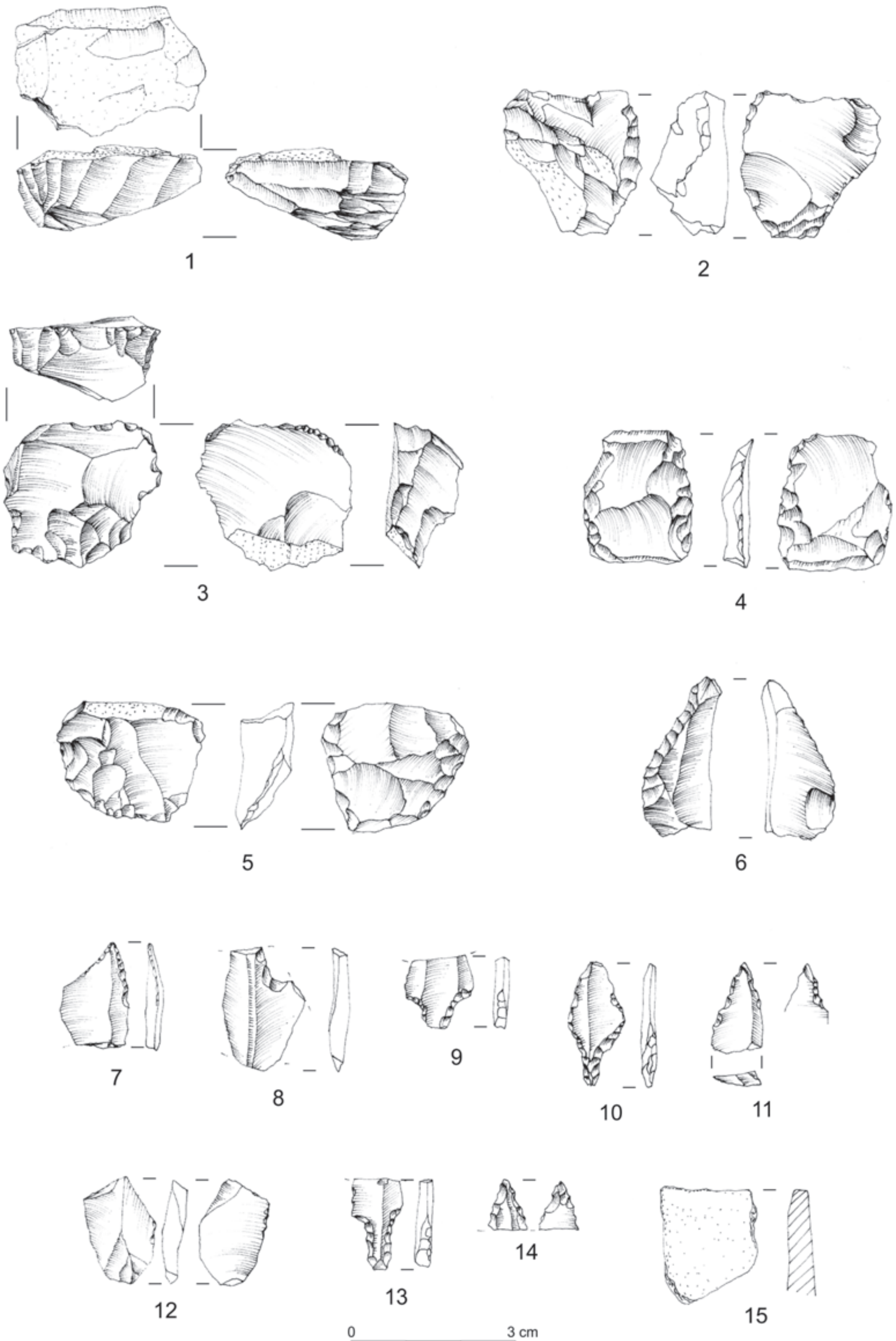


Figure 18.9. Nabta Playa, Site E-04-3.Selection of artefacts: 1, 2, 5 – cores, 3 – endscraper, 4 – retouched flake/ scraper, 6 – retouched blade, 7 – perforator, 8 – fragment of retouched tool, 9-11, 13-14 – fragments of Ounan points, 12 – microburin, 15 – pottery sherd. Drawn by M. Puszkarski, J. Mugaj.

Retouched tools

The typology and frequencies of retouched tools are given in (Table 18.7). The assemblage includes 76 retouched tools that can be classified into 12 types, based upon Tixier's typology (Tixier 1963). The frequencies of the various types are listed by Raw Material in (Table 18.8). Flint is predominant among the retouched tools (80.52%). The main types present in the tool kit are perforators (2.60 %), points (12.99%), burins (1.3%), and a group of notches and denticulates (37.67%). The twelve types of retouched tool are:

- Twenty-nine *pieces with continuous retouch* (Fig. 18.10: 17-20; 18.11: 10-18), three on flakes, 2 tertiary of flint, both had inverse retouch on the sinister and distal edges; the third retouched flake was secondary of petrified wood and had obverse retouch on the lateral edges and central part. Nineteen blades with continuous retouch, 13 of flint (2 secondary and 11 tertiary), and 6 of chert, all tertiary. Except three blades, all pieces had obverse retouch, seven of them on both lateral edges; three on the sinister edge; two on the dexter edge; one on the sinister and distal edges; one on the lateral edges and distal end; one on the proximal end and the last one on the entire edge. The last three retouched blades: one had bifacial retouch on lateral entire edges; the second had alternating retouch on entire lateral edges and the third had inverse retouch on the dexter edge and central part. Seven fragments of retouched flanks were found, 6 of flint and 1 was quartz.

- Three simple *perforators* (Fig. 18.9: 7; 18.10: 12; 18.11: 9) made on tertiary flakes of flint. The working tips were located on the distal ends and formed by obverse, bilateral retouch. Two of them were broken.

- Two *microburins* (Fig. 18.9: 18.12; 18.10:10), made on tertiary flake of flint, on the proximal dexter part by obverse retouch.

- Ten projectile points: three were triangular points with a retouched base and edges, all of flint on tertiary flakes (Fig. 18.10: 3, 6). One with cortex proximal truncation, a pointed end and retouched convergent sides; the other was with convex proximal truncation, a pointed end and retouched convergent sides, and the third had denticulate retouch on both edges and a pointed end, covered by obverse retouch on the entire sinister edge and distal end, and on the dexter edge only the central and distal part, and obverse retouch on the entire proximal edge. The other seven projectile points were made on tertiary flakes of flint, all were fragments, covered by obverse retouch on the concave sinister and dexter edges. The latter are typical so-called Ounan points (Fig. 18.9: 9-11, 18.13, 18.14; 18.10: 4, 8; Wendorf and Schild 1980; Riemer *et al.* 2004).

- Sixteen *notches* (Fig. 18.11: 5, 10), nine were prepared on flakes, and seven most probably on blades. The notch on flakes were formed by obverse retouch, inverse retouch, or by a combination of retouch and single blow. Seven items were of flint, one of quartz, and one of quartzitic sandstone. The flint notches included three fragments, one was a secondary flake, the notch formed by inverse retouch on the dexter side; and one of the other two was on tertiary flakes and the notches formed by obverse retouch, one on the dexter and the other on the sinister sides. The four complete pieces were on tertiary flakes, two of them formed by obverse retouch on the sinister side. Regarding the other two: one was formed by inverse retouch on the dexter side, and the other by combination of inverse retouch on the sinister side and single blow and inverse retouch on the distal end. One notch was on an unidentifiable flake of quartz, formed by a single blow on the sinister side, and the last one was made on a secondary flake of quartzitic sandstone formed by obverse retouch on the sinister edge. Seven of the notched pieces (probably blades) were of flint; the notches formed by obverse retouch. Five were on tertiary pieces, three were on the sinister side and two on the dexter side. Of the other two, one was secondary, formed by obverse retouch on the sinister side, and the second was primary formed by obverse retouch on the sinister side and on the dexter edge. The medium length of the notches was 10.89 mm and medium thickness was 1.9 mm.

- Thirteen *denticulated pieces* (Fig. 18.11: 18.13) were identified; two were made on a flakes and the remainder (11 pieces) on blades. One of the denticulate flakes was made of a tertiary flint flake, formed by *sur enclume* retouch on the central dexter edge, the other one was of quartz, the denticulate edge formed by obverse retouch and single blow on the central sinister edge. All the denticulated blades had obverse retouch; seven were made of flint, two of chert, one of quartz, and one of quartzitic sandstone. The five flint denticulates were tertiary blades, and included a complete one and four fragments, retouched on the entire lateral edges; one is retouched on the central sinister edge; and the last one on the distal dexter and entire distal edges. The two chert denticulates were made on tertiary blades; one was complete and had retouch on the central sinister edge, and the other was a fragment and had retouch on entire lateral edges. Of the last two, one was of quartz, a fragment that was retouched on dexter proximal and entire proximal edges; the other was made of quartzitic sandstone and retouched on the entire lateral edges.

- One *endscraper* (Fig. 18.9: 3) made on a tertiary flake of flint. Its scraping edge was formed at both ends. It was a nosed or shouldered endscraper.

- One *sidescraper* (Fig. 18.10: 2) was a fragment of tertiary flint flake/blade, the scraping edge was made on the sinister edge, with concave and convex retouch.

Table 18.7. Nabta Playa, Site E-04-3. Frequencies of retouched tool types.

Tool type	**No**	**%**
Simple perforator	2	2.60
Notched flake	9	11.69
Notched pieces/ Probably blades	7	9.09
Denticulated flake	2	2.60
Denticulated blade	11	14.29
Burin	1	1.30
Microburin	1	1.29
Scaled piece	3	3.89
Piece with continuous retouch	29	37.67
Sidescraper	1	1.29
Endscraper	1	1.29
Point	10	12.99
Total	**77**	99.99

Table 18.8. Nabta Playa, Site E-04-3. Frequencies of retouched tool raw material.

Debitage raw material type	**No**	**%**
Quartz	4	5.19
Flint	62	80.52
Chert	8	10.39
Quartzitic sandstone	2	2.60
Petrified wood	1	1.29
Total	**77**	100.0

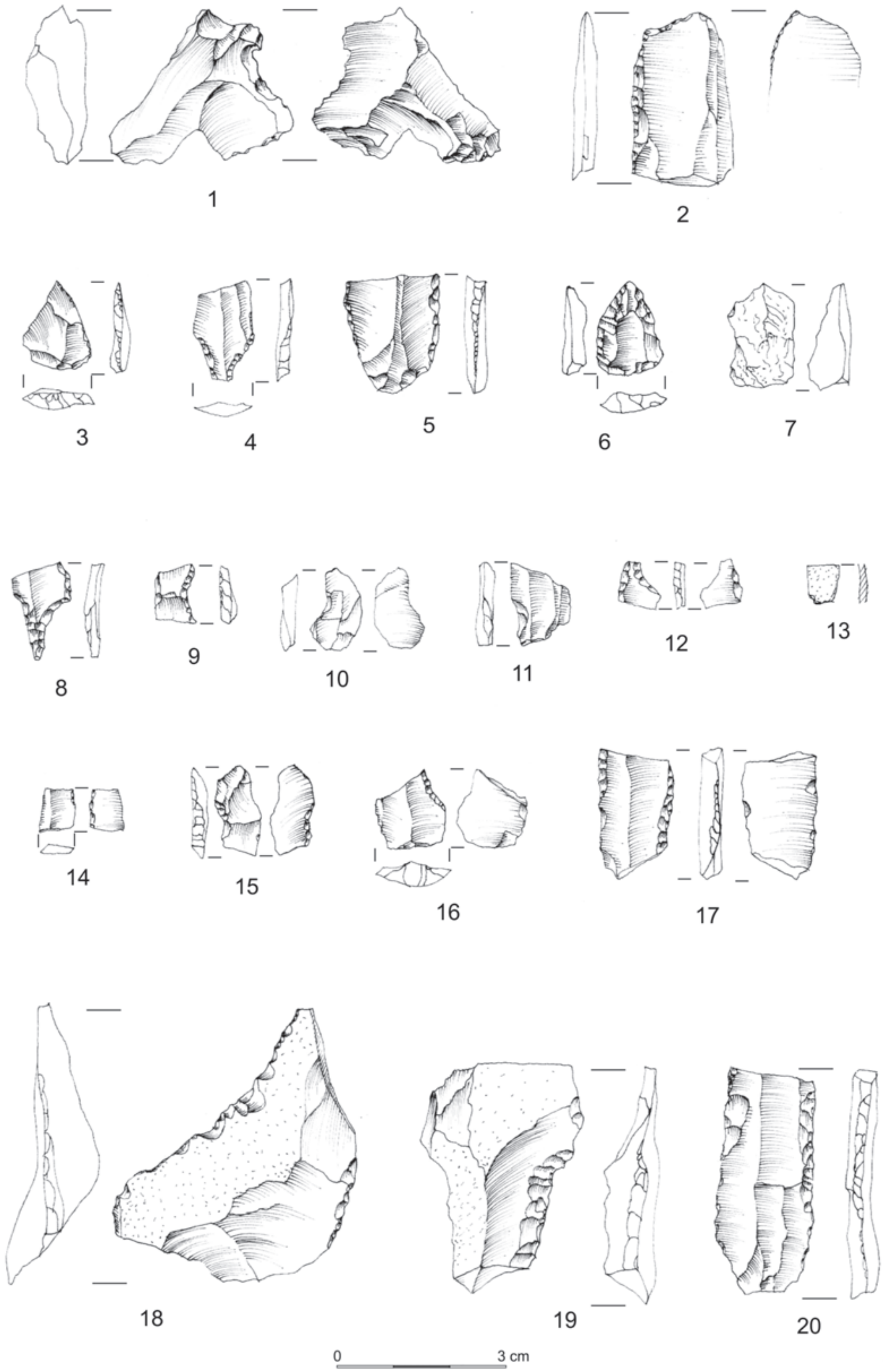


Figure 18.10. Nabta Playa, Site E-04-3. Selection of artefacts:1, 18, 19 – retouched flakes, 2 – borer, 3, 6 – triangular points, 4, 8 – fragments of Ounan points, 5, 14-17, 20 – fragments of retouched blades, 7 – flake, 9, 11 – fragments of retouched tools, 10 – microburin, 12 – fragment of perforator, 13 – pottery sherd. Drawn by M. Puszkarski, J. Mugaj.

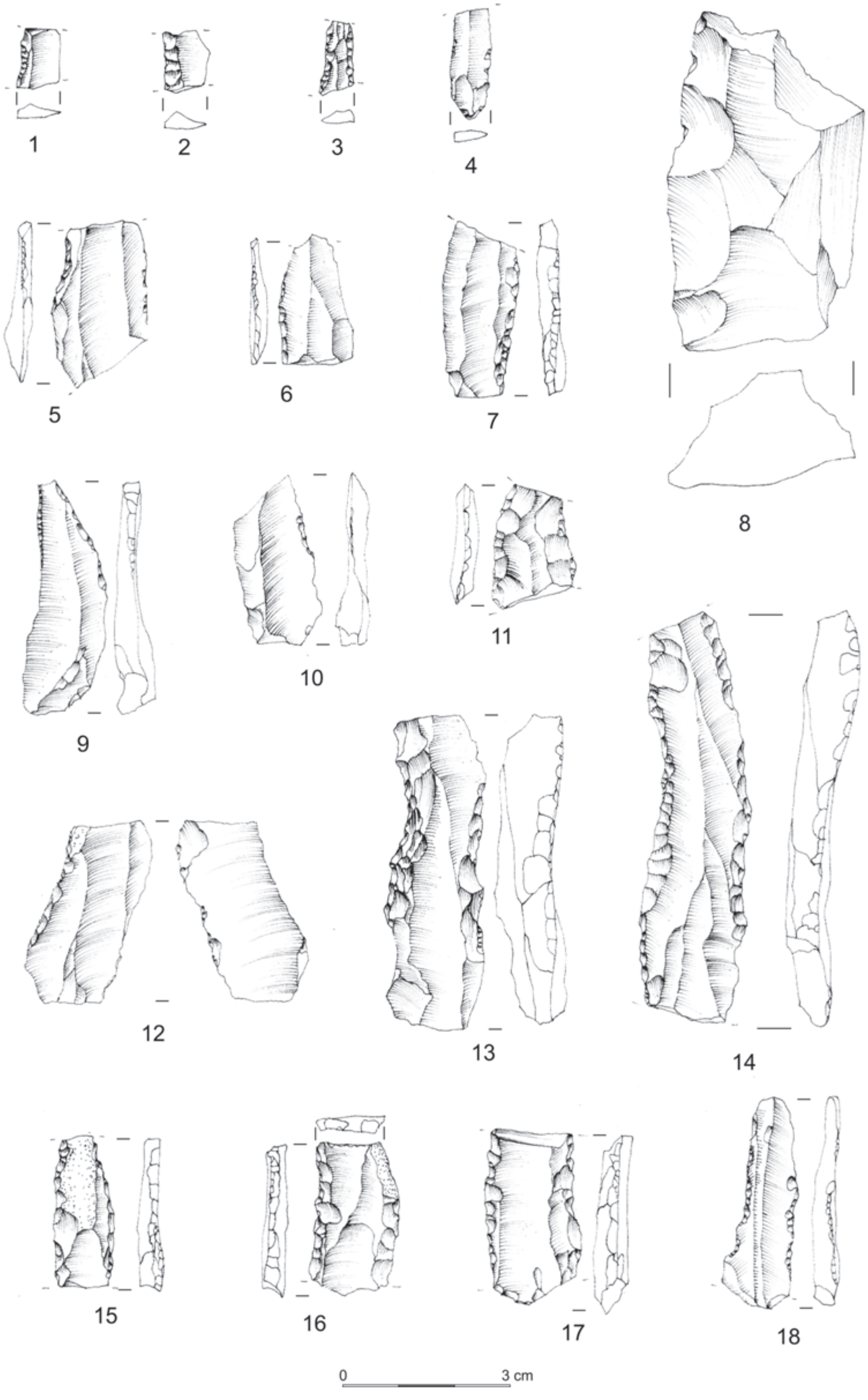


Figure 18.11. Nabta Playa, Site E-04-3. Selection of artefacts:1, 2 – fragments of backed pieces, 3-7 – fragments of retouched blades, 8 – retouched flake, 9 – perforator, 10-18 – fragments of blades with continuous retouch. Drawn by M. Puszkarski, J. Mugaj.

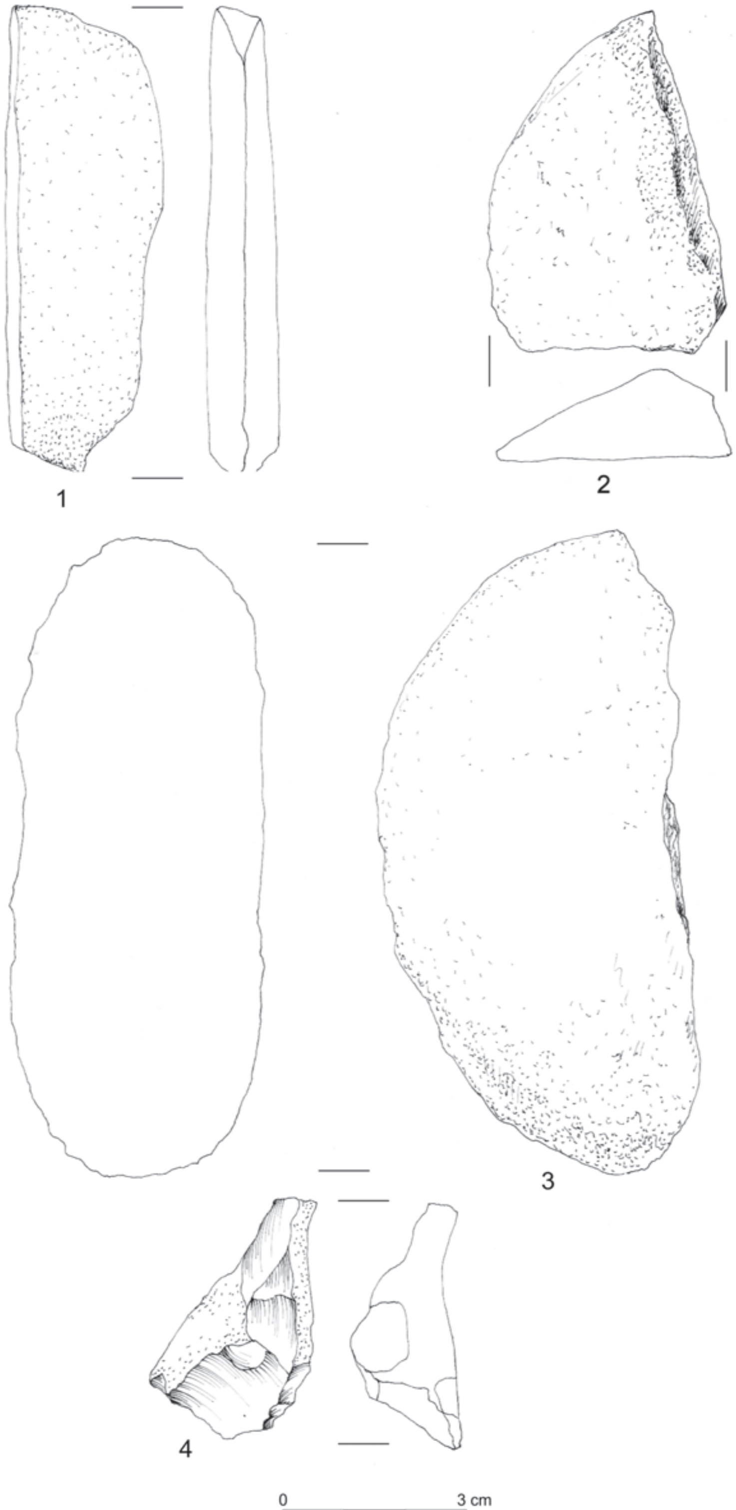


Figure 18.12. Nabta Playa, Site E-04-3. Selection of artefacts: 1-2 – stone flakes, 3 – fragment of handstone, 4 – flint flake. Drawn by M. Puszkarski, J. Mugaj.

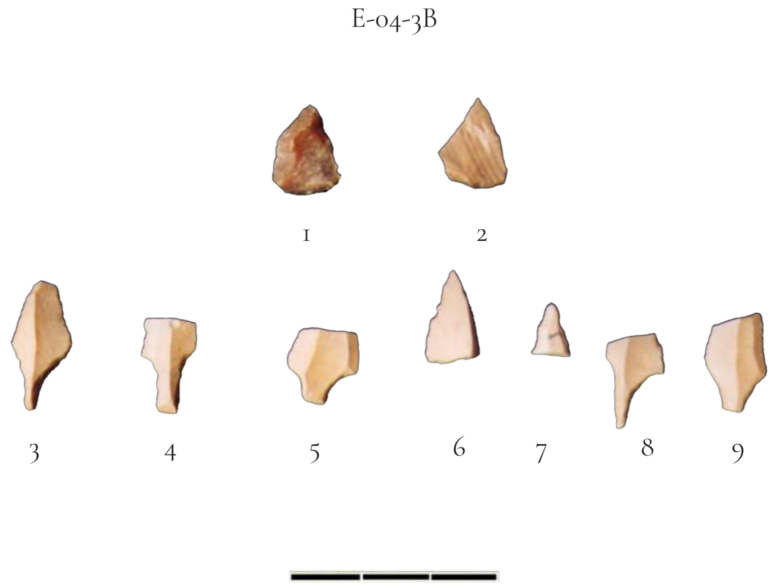


Figure 18.13. Nabta Playa, Site E-04-3. Selection of points: 1, 2 – triangular points, 3-9 – fragments of Ounan points. Photo by A. Czekaj-Zastawny.

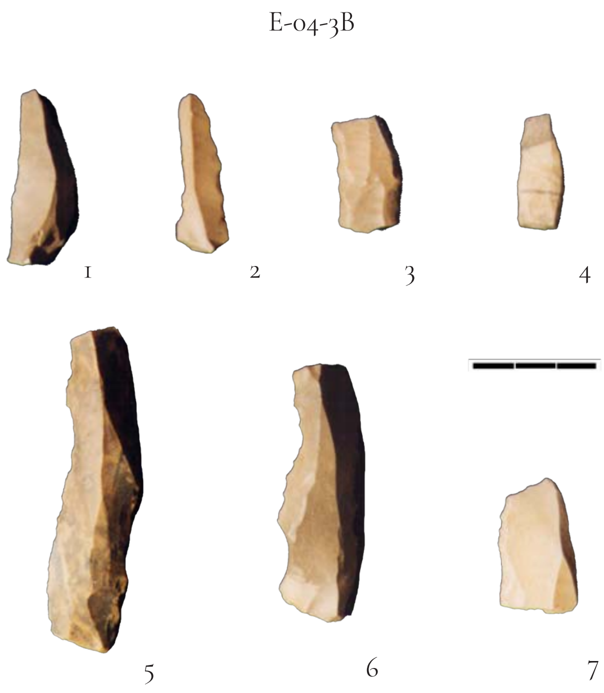


Figure 18.14. Nabta Playa, Site E-04-3. Selection of retouched blades: denticulates. Photo. by A. Czekaj-Zastawny.

- One *burin* made on tertiary flake of flint. It was a multiple or mixed burin, the first burin edge was distal sinister and the second was on the proximal dexter edge.

- Three scaled pieces were made on tertiary flakes of flint. The first one was made by inverse retouch on the distal and proximal ends, the other two were fragments, one made by bifacial retouch on the sinister and dexter edges and the other was an unidentified scaled piece.

The majority of retouched tools were made of flint (64 pieces); tools of other raw material also occur: quartz (4 pieces), quartzitic sandstone (2 pieces), chert (8 pieces), and petrified wood (1 piece).

Handstones

Four handstone fragments were found in the gridded area; all were of quartzitic sandstone (Fig. 18.12: 3). Three were circular in shape and one was too small fragment to determine its shape. Two of them were had one smooth working face, and one with two working smooth faces.

Pottery

The site produced a few sherds of undecorated, sand-tempered pottery. Several of the sherds were so badly wind-worn that little description was possible. The collection includes about 32 small fragments (Fig. 18.9: 15; 18.10: 13). Among the assemblage, 26 fragments were identified, as Smoothed Red and Brown Wares, including one rim sherd and the rest were body sherds (Gatto 1998; 1999; 2010; Nelson 2001c; 2002a; 2002b). However the rest of the examples (6) were unidentified because they were very small and too eroded to determine their nature (and may even have been small eroded sandstone fragments).

The thickness of the classifiable sherds varied between 3-8 mm. No shapes could be identified, except for one sherd that appeared to be from a small open bowl. None of those with interior or exterior surfaces intact showed any incised or impressed designs of the types known in the Early Neolithic sites in the area. According to M. Gatto (1998; 1999; 2010) the assemblage related to Late/Final Neolithic occupation.

Animal Bones

The eAxcavated area yielded some very small scraps of mammal bones. Most of the animal bone fragments were identified by A. Goutier as hare, sheep/goat, gazelle, and cattle.

3. Conclusions

Site E-04-3B appeared to have been small with no indications of long-term camping activities or of structures. The work that took place at the site was focused on providing preliminary information on the megalithic clusters near the settlement sites. Although the area was very deflated and the field research did not last for a long time (only a few days at the end of the 2004 field season), all the archaeological material present was studied, some drawn, and the surface artefacts were collected and the pattern of their scatter was plotted, including the fire-cracked rocks.

Based on the above analysis, it is clear that the lithic assemblage from Site E-04-3 is not entirely homogeneous, which is understandable considering that it was a surface collection. The main characteristic categories of the retouched tools were pieces with continuous retouch, notches, denticulates, and projectile points. The domination of the retouched pieces, as well as the high percentage of notches and denticulates, is very characteristic for the Late and Final Neolithic in the Western Desert localities (Wendorf and Schild 2001a). Moreover, the location of the site in the vicinity of one large cluster of the megalithic structures (the southeastern group of megaliths) suggests the presence of Late/Final occupations. Nevertheless, the considerable number of the Ounan and triangular points suggests an Early and Middle Neolithic dating.

It is known that the Ounan point is a significant tool type that had been used during the middle of the Early Neolithic, typical for the *Al Jerar* variant, and that it disappeared during the Middle Neolithic (Wendorf and Schild 2001a, 659; Mugaj 2016). The triangular points with a retouched base and edges occur in the Middle Neolithic and replace the Ounan points (Mugaj 2016), but recent archaeological studies proved that both of these points types existed in the same features with numerous fragments of *Al Jerar* ceramics. This modifies the old hypothesis and this feature was evidenced during 2016 field season on Site E-09-02 in the Gebel Ramlah area – 25 km northwest of Nabta Playa (Czekaj-Zastawny, Irish *et al.* 2018).

The studied assemblage indicates human activities on the E-04-3 site in different stages of the Neolithic. The characteristic Smoothed Red and Brown ceramic wares (Gatto 1998; 1999; 2010) combined with the domination of pieces with continuous retouch, notched pieces, and denticulates relates the occupation of the site to the Late/Final Neolithic. Although such lithic tool categories appeared at the end of the Early Neolithic, nevertheless they evidently dominate in the Late Neolithic (Mugaj 2016). The presence the Ounan and triangle points with a retouched base and edges in the tool assemblage indicates the use of the site during the second half of the Early Neolithic, *Al Jerar* phase (Mugaj 2016; Riemer *et al.* 2004; Wendorf and Schild 1980).

According to the basic chrono-stratigraphic units of the Neolithic occupation of the Western Desert correlated with climatic fluctuations (cf. Table 3.3; Schild and Wendorf 2013), the *El Nabta/Al Jerar* Humid Interphase is dated to ca. 8050-7300 BP, that is to ca. 7050-6150 BC, the Late Neolithic Humid Interphase to ca. 6500-5800 BP – ca. 5500-4650 BC, and the Final Neolithic Humid Interphase to ca. 5750-4800 BP – ca. 4600-3600 BC. Such a dating indicates very long occupation of the site in a few settlement episodes, between ca. 7050 and 3600 BC.

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Tabular summary of the Combined Prehistoric Expedition's Holocene Radiocarbon Dates from the Nabta, Kiseiba, Kharga, and Bir Tarfawi Areas

Romuald Schild and Halina Królik

Key:

* Entity questionable; ** probably below Layer 10, in deflated sector; ***remeasured SMU-436 (14940±160); ****Repeat; *****same sample as below; ******uncorrected; ******* very poor sample; ********corrected

[1]Legum = Leguminosae indet.seed; Schouwia = Schouwia purpurea seed; Ostrich = Ostrich eggs; Sorghum = Sorghum seed; Ziziphus = Ziziphus fruit;

a = Banks 1984, **b** = Bobrowski and others 2012, **c** = Close 1984a, **d** = Close 1984b, **e** = Connor 1984a, **f** = Connor 1984b, **g** = Connor 1984c, **h** = Haas & Haynes 1980, **i** = Hayes n.d, **j** = Hester & Hoebler 1969, **k** = Jórdeczka and others 2013, **l** = Kobusiewicz 1984, **m** = Kobusiewicz 2003, **n** = Kobusiewicz & Kabaciński 2010b, **o** = Królik & Fiedorczuk 2001, **p** = Mohamed 2001, **q** = Nelson 2001a, **r** = Nelson 2001b, **s** = Schild & Wendorf 1984, **t** = Schild & Wendorf 2001b, **u** = Schild & Wendorf 2010b, **v** = Wasylikowa & Mitka 1998, **w** = Wendorf & Close 1984, **x** = Wendorf, Close & Schild 2001, **y** = Wendorf & Schild 1980, **z** = Wendorf & Schild 1984b, **aa** = Wendorf & Schild 2001d, **bb** = Wendorf *et al.* 1987b.

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
?	Poz-4442	14300	90	E-03-1*	Gebel Ramlah		Burial 5/7	Charcoal	
Early Neolithic									
El Adam	SMU-858	9820	380	E-79-8	El Adam Playa	Trench 1/80	Horizon C-1, E-2, Hearth, 40 cm	Charcoal	s:28, e:220
El Adam	SMU-928	9610	150	E-79-8	El. Adam Playa	Sq. A-3	A-3, Hearth, 30-40 cm	Charcoal	e:220
El Adam	SMU-758	9440	230	E-79-8	El. Adam Playa	Trench 1/80	Horizon C & D, G-2, Hearth, 40-50 cm	Charcoal	e:220
El Adam	SMU-927	9350	120	E-79-8	El Adam Playa	Trench 1/80	Top of trench, E-8, Hearth, 5 cm	Charcoal	e:220
El Adam	SMU-925	9220	120	E-80-4	El Adam Playa	Collected Area	Subsurface	Charcoal	c: 347
El Adam	Poz-19184	9210	50	E-06-1	Nabta Playa	Cut I/06, 15/C	Lower hut,Hearth, 50 cm	Charcoal	k:279
El Adam	SMU-914	9180	140	E-79-8	El Adam Playa	Trench 1/80	Horizon D-1, F-2, Hearth, 20-30 cm	Charcoal	s:28, e:220
El Adam	Poz-19181	9180	50	E-06-1	Nabta Playa	Cut I/06, 15/C	Lower hut, Hearth?, 55-60 cm	Charcoal	k:279
El Adam	Poz-19186	9170	50	E-06-1	Nabta Playa	Cut I/06, 14/C	Upper Hut, Hearth 17a, 10-20 cm	Charcoal	k:279
El Adam	SMU-861	9060	80	E-79-8	El Adam Playa	Trench 1/80	G-3, Hearth, 30 cm	Charoal	s:28, e:220
El Adam	Poz-19183	9020	140	E-06-1	Nabta Playa	Trench	Lower layer, 85 cm	Charcoal*******	k:279
El Adam	Poz-19182	8980	70	E-06-1	Nabta Playa	Cut I/06, 13/C	Hearth 13, 0-10 cm	Charcoal*******	k:279
El Adam	SMU-440	8960	110	E-77-7	Gebel El Beid Playa	Collected Area	Surface/subsurface	Charcoal	c:347, h:374
El Adam	SMU-757	8920	130	E-79-8	El Adam Playa	Trench 6/80	Above Horizon F(?), A-3, 10-20 cm	Charcoal	e:220
El Adam	ETH-8583	8875	75	E-77-7	Gebel El Beid Playa	Cut 90	Subsurface	Charcoal	t:52
El Adam	SMU-416	8840	90	E-77-3	El Kortein Playa	Pit 1	Hearths A & B	Charcoal	h:374
El Adam	A-11081	8750	70	E-75-9	Nabta Playa		Surface/subsurface	Charcoal	t:52
El Adam	SMU-200	9360	70	E-75-6*	Nabta Playa	Trench 2/74	NW of Feature 100, pit	Charcoal	h:374
El Adam ?	Rome-1579	8550	210	E-01-2	Gebel Ramlah	Camp	Hearth 5, 0-10 cm	Charcoal	u:172
El Adam ?	Poz-19187	8500	130	E-06-1	Nabta Playa	Cut I/06, 16/C	Lower hut,Hearth 35, 45-55 cm.	Charcoal*******	
El Ghorab	SMU-862	8560	140	E-79-4	El Ghorab Playa	Units 3a and 3b	Lowermost Hearths	Charcoal	s:18; l:159
El Ghorab	SMU-1014	8390	90	Scarp survey	Kiseiba Plateaux	Locality I		Ostrich********	*z:412*
El Ghorab	SMU-744	8300	130	E-79-3	Kiseiba Trench	Stratigraphic Trench		Ostrich********	*z:412*

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
El Ghorab	SMU-257	8290	80	E-75-6	Nabta Playa	Excavations 1977	Horizon A, Basin House	Ostrch	h:374
El Ghorab	SMU-750	8250	140	E-79-4	El Ghorab Playa	Lower Cultural Layer	5 - 15 cm bs	Charcoal	s:18
El Ghorab	SMU-734	8240	70	E-76-6	Kharga	Collected Area	Surface/subsurface	Ostrich********	z:412
El Ghorab	SMU-326	8200	70	E-76-6	Kharga	Collected Area	Surface/subsurface	Ostrich********	z:412
El Ghorab	A-11080	8200	70	E-00-2	Nab el Diep	Surface		Ostrich	Chapter 16 in this volume
El Ghorab	SMU-750	8190	120	E-79-4	El Ghorab Playa	Lower Cultural Layer	5-15 cm bs	Charcoal****	s.18, l:159
El Ghorab	SMU-739	8250	70	E-79-1*	Kiseiba Trench	Trench 1	Near base	Ostrich	s:14
El Nabta	Gd-6260	8260	100	E-75-6	Nabta Playa	Horizon A	Pit 1/90	Charcoal	t.52
El Nabta	SMU-255	8130	60	E-75-6	Nabta Playa	Excavations 1975, 1977	Pit 3	Charcoal	h:374
El Nabta	SMU-760	8130	110	E-79-2	El Adam Playa	Excavated Area	Feature 2a	Charcoal	a:97
El Nabta	SMU-199	8120	100	E-75-6	Nabta Playa	Excavations 1975, 1977	Feature 117	Charcoal	h:374
El Nabta	SMU-219	8120	80	E-75-6	Nabta Playa	Excavations 1975, 1977	Feature 132	Humates	h:374
El Nabta	OxA-3215	8095	120	E-75-6	Nabta Playa	Cut I/90	Feature 1/90, Hearth	Leguminos	v:10
El Nabta	OxA-3214	8080	110	E-75-6	Nabta Playa	Cut I/90	Feature 1/90, Hearth	Schouwia	v:10
El Nabta	SMU-252	8080	90	E-75-6	Nabta Playa	Excavations 1975, 1977	Pit 1	Charcoal	h:374
El Nabta	SMU-253	8070	90	E-75-6	Nabta Playa	Excavations 1975, 1977	Pit 2, 30-40 cm	Charcoal	h:374
El Nabta	OxA-3222	8060	120	E-75-6	Nabta Playa	Cut I/90	Feature 2/90, Hearth	Sorghum	v:10
El Nabta	OxA-3218	8050	130	E-75-6	Nabta Playa	Cut I/90	Feature 1/90, Hearth	*Ziziphus*	v:10
El Nabta	SMU-249	8040	90	E-75-6	Nabta Playa	Excavations 1975, 1977	Pit 2, 30-40 cm	Charcoal	h:374
El Nabta	OxA-3220	8025	120	E-75-6	Nabta Playa	Cut 1/90	Pit 1/90	Ziziphus	v:10
El Nabta	OxA-3217	8020	160	E-75-6	Nabta Playa	Cut 1/90	Feature 1/90, Hearth	Sorghum	v:10
El Nabta	SMU-761	8020	190	E-79-5	El Balaad Playa	Sample Area	Fire-blackened Areas	Charcoal	g:167
El Nabta	SMU-915	8020	70	E-80-1	El Adam Playa	Sample Area	Pit 3	Charcoal	d:296
El Nabta	SMU-926	8020	90	E-80-1	El Adam Playa	Area C	Pit 4	Charcoal	d:296
El Nabta	SMU-203	8010	80	E-75-6	Nabta Playa	Excavations 1975, 1977	Feature 132	Charcoal	h:374
El Nabta?/Al. Jerar	Poz-20315	7990	40	E-06-4,4	Nabta Playa	Sacred Mountain	Structure 2/3	Charcoal	b:419-420
El Nabta	SMU-864	7990	90	E-79-4	El Ghorab Playa	Upper Cultural Level	Pit 25, 20-40 cm	Charcoal	l:159
El Nabta	OxA-3221	7980	110	E-75-6	Nabta Playa	Cut I/91	Feature 1/91, Hearth	Sorghum	v:10

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
El Nabta	OxA-3485	7980	95	E-75-6	Nabta Playa	Reexcavations 1992	Pit 75/5	Ziziphus	v10
El Nabta	SMU-240	7970	70	E-75-6	Nabta Playa	Excavations 1975, 1977	Pit 1, 40-45 cm	Charcoal	h:374
El Nabta	Gd-5971	7960	70	E-75-6	Nabta Playa	Cut I/91	Feature 1/91, Hearth	Charcoal	t:52
El Nabta?/Al. Jerar	Poz-20288	7960	50	E-06-4,2	Nabta Playa	Sacred Mountain	Tumulus 2	Charcoal	b:419-420
El Nabta	OxA-3216	7960	100	E-75-6	Nabta Playa	Cut I/91	Feature 1/91, Hearth	Sorghum	v:10
El Nabta	OxA-3484	7950	90	E-75-6	Nabta Playa	Cut I/90	Feature 2/90, Hearth	Pnicum	v:10
El Nabta	OxA-3219	7950	160	E-75-6	Nabta Playa	Cut I/90	Feature 3/90, Hearth	Sorghum	v:10
El Nabta	SMU-208	7930	40	E-75-6	Nabta Playa	Excavations 1975, 1977	Feature 132	Charcoal	h:374
El Nabta	Gd-6258	7920	100	E-75-6	Nabta Playa	Cut I/90	Feature 2/90, Hearth	Stic	t:52
El Nabta	SMU-924	7920	180	E-80-1	El Adam Playa	Area C	Square T3	Humates	d:296
El Nabta	Gd-6500	7910	110	E-75-6	Nabta Playa	Cut I/90	Feature 20/9, Hearth	Charcoal	t:52
El Nabta	SMU-756	7890	90	E-79-4	El Ghorab Playa	Upper Cultural Level	Pit 2	Charcoal	l:159
El Nabta	Gd-6506	7850	90	E-75-6	Nabta Playa	Cut I/91	Feature 1/91, Below Level C14	Charcoal	t:52
El Nabta	Gd-6498	7830	110	E-75-6	Nabta Playa	Cut I/90	Feature1/90, Hearth	Charcoal	t:52
El Nabta	Gd-6257	7770	110	E-75-6	Nabta Playa	Cut 1/90	Feature 1/90, Hearth	Charcoal	t:52
El Nabta	Gd-12186	8180	100	E-91-1*	Nabta Playa	Area 12	Pit 18, 20-60 cm bs	Charcoal	t:52
El Nabta	DRI-3525	7935	80	E-91-1*	Nabta Playa	Area 4	Feature 2, Pit 1	Charcoal	t:52
Al. Jerar?/El Nabta	DRI-3374	7850	70	E-91-1	Nabta Playa	Area D	Pit G	Shell	x:183
Al. Jerar	Rome-1578	7775	120	E-01-2	Gebel Ramlah	CAMP	Hearth 14, 20-30 cm	Charcoal	u:172
Al. Jerar	Gd-9307	7760	240	E-92-7 (South)	Nabta Playa	Area D, Trench 5	Pit 1, Lower Cultural Level	Charcoal	t:52, 0:334
Al. Jerar	DRI-3526	7735	115	E-91-1	Nabta Playa	Area 2	Feature 20, level 2	Charcoal********	q:211
Al. Jerar	DRI-3599	7700	170	E-91-1	Nabta Playa	Area 6	Feature 15, N House, Level A	Charcoal	t:52
Al. Jerar	SMU-2741	7695	110	E-91-1	Nabta Playa	Area B	Feature 4	Charcoal	t:53
Al. Jerar	CAMS-41691	7680	80	E-75-6	Nabta Playa	Excavations 1975, 1977	Feature 77/5	Sorghum	v:10
Al. Jerar	DRI-3550	7650	135	E-91-1	Nabta Playa	Area 3	Feature 2, Stone-lined Hearth	Charcoal	t:53
Al. Jerar	Gd-6507	7610	120	E-75-6	Nabta Playa	Cut I/91	Feature 1/91, Level C14	Charcoal	t:53
Al. Jerar	DRI-3548	7610	110	E-91-1	Nabta Playa	Area 2	Feature 2, Top Lens	Charcoal	t:53
Al. Jerar	SMU-2740	7600	110	E-91-1	Nabta Playa	Area B	Feature 1	Charcoal	x:183
Al. Jerar	SMU-274	7595	105	E-91-1	Nabta Playa	Area B	Feature 1, Pit	Charcoal	t:53

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
Al. Jerar	DRI-3355	7590	185	E-91-1	Nabta Playa	Trench 1/97	Al. Jerar Soil	Charcoal	t:53
Al. Jerar	Gd-6503	7590	110	E-75-6	Nabta Playa	Cut I/91	Late Hearth into Feature 3/90	Charcoal	t:53
Al. Jerar	DRI-2843	7570	95	E-77-1	Gebel Nabta Playa	Top dune	Surface/subsurface	Ostrich	aa:433
Al. Jerar	DRI-3533	7545	165	E-91-1	Nabta Playa	Area 9	Pit 1	Charcoal	t:53
Al. Jerar	Gd-6508	7540	110	E-75-6	Nabta Playa	Reexcavations 1992	Pit 4/90	Charcoal	t:53
Al. Jerar	DRI-3524	7540	100	E-91-1	Nabta Playa	Area 2	Feature 22, Pit, Hearth	Charcoal	t:53
Al. Jerar	SMU-2738	7536	110	E-91-1	Nabta Playa	Area C	Pit 2	Charcoal	t:53
Al. Jerar	SMU-462	7530	180	E-77-5	El Kortein Playa	Collected Area	Central Hearth, 0-15 cm	Charcoal	h:375
Al. Jerar	DRI-3527	7503	149	E-91-1	Nabta Playa	Area 4	Feature 2, Pit 2	Charcoal	t:53
Al. Jerar	Gd-6509	7480	110	E-75-6	Nabta Playa	Cut I/90	Pit 2/90	Charcoal	t:53
Al. Jerar	CAMS-17285	7480	60	E-77-1	Gebel Nabta Playa	Dune, C-4/E-4	Level 2, 30-40 cm	Charcoal	aa:433
Al. Jerar	Gd-4586	7450	120	E-75-6	Nabta Playa	Reexcavations 1992	Pit BB/10	Charcoal	t:53
Al. Jerar	DRI-3600	7430	120	E-91-1	Nabta Playa	Area 4	Feature 2, Pit 3	Charcoal	t:53
Al. Jerar	DRI-3532	7425	120	E-91-1	Nabta Playa	Area 9	Feature 1, Floor Hearth	Charcoal	t:53
Al. Jerar	CAMS-17291	7420	70	E-77-1	Gebel Nabta Playa	Dune, G-5/G-6, 30-40 cm	Level 2, 30-40 cm	Charcoal	aa:433
Al. Jerar	DRI-3356	7380	150	E-91-1	Nabta Playa	Area D	Trench 4/97, Al. Jerar Soil	Charcoal	t:53
Al. Jerar	Gd-15027	7360	120	E-91-1	Nabta Playa	Area 15	Feature 12, 15-20 cm bs	Charcoal	t:53
Al. Jerar	Gd-12188	7360	90	E-91-1	Nabta Playa	Area 10	Feature 6, 0-10 cm bs	Charcoal	t:53
Al. Jerar	Gd-6510	7330	100	E-75-6	Nabta Playa	Cut I/91	Pit 1/91	Charcoal	t:53
Al. Jerar	CAMS-17286	7320	70	E-77-1	Gebel Nabta Playa	Dune, G-5/G-6	Level 2; 30-40 cm	Charcoal	t:53, aa:433
Al. Jerar	Gd-10112	7250	110	E-92-7 (South)	Nabta Playa	Area D, Trench 4	Hearth 17, Upper Cultural Level	Charcoal*****	t:53, o:340
Al. Jerar	Gd-10112	7040	80	E-92-7 (South)	Nabta Playa	Area D, Trench 4	Hearth 17, Upper Cultural Level	Charcoal	t:53, o:340
Al. Jerar	Gd-16007	6800	330	E-91-1	Nabta Playa	Area 1, Feature 1, Base	Feature 6, 0 - 10 cm bs	Charcoal*******	t:53
Al. Jerar	SMU-2743	7850	75	E-91-1*	Nabta Playa	Area B	Feature 3	Charcoal	t:53
Al. Jerar	DRI-3530	7850	70	E-91-1*	Nabta Playa	Area 6	Feature 2, Pit 9, Hearth	Charcoal	t:53
Al. Jerar	DRI-3528	7785	115	E-91-1*	Nabta Playa	Area 3	Feature 1	Charcoal	t:53
Al. Jerar	SMU-807	7780	130	E-79-2*	Kiseiba Trench	Excavated Area	Feature 3	Charcoal	a:120
Al. Jerar	SMU-764	7610	70	E-79-2*	Kiseiba Trench	Excavated Area	Hearth cutting Feat.1/91	Charcoal	s:14

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
Al. Jerar	SMU-1224	7360	200	E-79-7*	Gebel El Feel Playa	Dune	Trench 2, 80 -85 cm	Charcoal	w:215
Al. Jerar	SMU-470	7230	100	E-77-5A*	El Kortein Playa	Stone Structure	Hearth	Charcoal	h:375
Al. Jerar	DRI-3551	6520	290	E-91-1*	Nabta Playa	Area 6	Feature 15, N House, Level B	Charcoal	t:53
Middle Neolithic									
Ru'at El Ghanam?	SMU-436	14940	160	E-75-8	Nabta Playa	Connecting Trench, Bed 2a	Resampled as SMU-2505	Charcoal	h:374
Ru'at El Ghanam	SMU-472	8900	80	E-75-8	Nabta Playa	Eastern Stratigraphic Trench	Bed 7	*Zootecus insularis*	h:375
Ru'at El Ghanam	SMU-491	8310	?	E-75-8	Nabta Playa	Connecting Trench, Bed 2a		Charcoal	y:95
Ru'at El Ghanam	SMU-2745	7220	75	E-75-8	Nabta Playa	Cut I/90	Charcoal Lens Bed1, top	Charcoal	t:53
Ru'at El Ghanam	Poz-20665	7190	40	E-06-4,6	Nabta Playa	Sacred Mountain	Structure 2/1	Bone, carbonate fraction	Chapter 3 in this volume
Ru'at El Ghanam	SMU-749	7170	80	E-79-6	Gebel El Feel Playa	Excavated Area	Ca. 20 cm bs	Charcoal	w:215
Ru'at El Ghanam	SMU-242	7120	150	E-75-8	Nabta Playa	Vertical Matate Trench	Dune 30 -40 cm	Charcoal	h:375, t:53
Ru'at El Ghanam	DRI-3545	7110	55	E-75-8	Nabta Playa	Vertical Matate Tr./1998	Layer 1, base	Charcoal	t:53
Ru'at El Ghanam	SMU-421	6960	150	E-75-8	Nabta Playa	Younger Dune	Pit 3, 90 cm	Charcoal	h:375, t:53
Ru'at El Ghanam	Poz-20316	6890	40	E-06-4,5	Nabta Playa	Sacred Mountain	Hearth 1/07	Charcoal	b:419-420
Ru'at El Ghanam	SMU-373	6880	70	E-75-8	Nabta Playa	On Dune	Hearth 3	Charcoal	h:375, t:53
Ru'at El Ghanam	SMU-2505	6870	190	E-75-8	Nabta Playa	Connecting Trench	Bed 2a, resampled SMU-436	Charcoal***	t:53
Ru'at El Ghanam	DRI-3546	6860	120	E-75-8	Nabta Playa	Cut I/98, Area A	Feature 4, Bed 4a	Charcoal	t:53
Ru'at El Ghanam	ETH-20305	6855	65	E-75-8	Nabta Playa	Cut I/98, Area A, L. 3d	Bed 3, higher hearth	Charcoal	t:53
Ru'at El Ghanam	SMU-261	6700	50	E-75-8	Nabta Playa	Surface	Hearth 2 (B?)	Charcoal	h:374, t:53
Ru'at El Ghanam	SMU-424	6690	80	E-75-8	Nabta Playa	Connecting Trench	Bed 2, higher hearth	Charcoal	h:374, t:53
Ru'at El Ghanam	Gd-15019	6650	120	E-75-8	Nabta Playa	South Trench	Layer 1, cluster in dune	Charcoal	t:53
Ru'at El Ghanam	SMU-352	6630	90	E-75-8	Nabta Playa	Vertical Matate Trench	Dune 30 -40 cm	Charcoal	h:374, t:53
Ru'at El Ghanam	SMU-452	6570	70	E-75-8	Nabta Playa	Connecting Trench	Bed 2, higher hearth	Charcoal	h:374, t:53
Ru'at El Ghanam	Rome-1577	6570	75	E-01-2	Gebel Ramlah		Hearth 10, 40-50 cm	Charcoal	b:419-420
Ru'at El Ghanam	Poz-7920	6550	50	W Field of Megaliths	Nabta Playa	Sector C 0/12	S part of W Field of Megalithic, Cow tooth	Collagen	Chapter 6 in this volume

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
Ru'at El Ghanam	SMU-435	6500	80	E-75-8	Nabta Playa	Connecting Trench	Bed 3a, Lowest Hearth cut into Bed 3	Charcoal	h:375, t:53
Ru'at El Ghanam	SMU-2504	6430	90	E-75-8	Nabta Playa	Cut I/90	Hearth, 10-20 cm bs, Spit 2	Charcoal	t:53
Ru'at El Ghanam	Poz-7979	6440	40	W Field of Megaliths	Nabta Playa	Sector C, 0/12	S part of W Field of Megalithic, Cow tooth	Structural carbonates****	Chapter 6 in this volume
Ru'at El Ghanam	Gd-15032	6690	100	E-75-8*	Nabta Playa	Cut I/99, Area F	Level 10?, Feature 1, Hearth	Charcoal**	t:53
Late Neolithic									
Ru'at El Baqar	DRI-2877	6550	95	E-77-1	Gebel Nabta Playa	On dune, Surface	Hearth 2	Charcoal********	t:53; aa:433
Ru'at El Baqar	SMU-487	6550	80	E-75-8	Nabta Playa	Connecting Trench	Bed 4d, A-B/18	Charcoal	h:374, t:53
Ru'at El Baqar	SMU-368	6500	90	E-75-8	Nabta Playa	Surface	Hearth 2 (B?)	Charcoal	h:375, t:53
Ru'at El Baqar	CAMS-17289	6470	270	E-94-1	Nabta Playa	Northern Tumulus	Burial Pit	Wood	t:54
Ru'at El Baqar	Rome- 1580	6400	100	E-01-2	Gebel Ramlah	CAMP	Hearth 12, 20-30 cm	Charcoal	u:172
Ru'at El Baqar	Rome-1584	6395	85	E-01-2	Gebel Ramlah	CAMP	Hearth 11, 30-40 cm	Charcoal	u:172
Ru'at El Baqar	Rome- 1583	6370	85	E-01-2	Gebel Ramlah		SQ 13/III, below sceleton	Charcoal	u:171
Ru'at El Baqar	CAMS-16590	6350	60	E-77-1	Gebel Nabta Playa	Near Area C	Hearth 4, 15 cm bs	Charcoal	t:53; aa:433
Ru'at El Baqar	Rome-1663	6335	140	E-01-2	Gebel Ramlah	CAMP	Hearth 0, V/3-4, 0-10 cm	Charcoal	u:172
Ru'at El Baqar	Gd-926	6330	100	E-79-4	El Ghorab playa	Late Neolithic Area	Hearth near Burial	Charcoal	t:53, l:159
Ru'at El Baqar	SMU-441	6310	90	E-75-8	Nabta Playa	Connecting Trench	Hearth?,Bed 4, top, A-B/15,20 cm	Charcoal	h:375, t.53
Ru'at El Baqar	SMU-1120	6310	70	Site I	Bir Murr	Hearth B	Tumulus?	Charcoal	f:391, t:54
Ru'at El Baqar	CAMS-17292	6290	60	E-94-3	Gebel Nabta Playa	Surface/Subsurface	Hearth 6	Charcoal****	aa:457
Ru'at El Baqar	CAMS-17294	6280	60	E-94-3	Gebel Nabta Playa	Surface/Subsurface	Hearth 6	Charcoal	aa:457
Ru'at El Baqar	CAMS-17395	6260	60	E-77-1	GebelNabta Playa	On dune	Hearth 3	Charcoal	t:54, aa:433
Ru'at El Baqar	DRI-2873	6250	70	E-94-3	Gebel Nabta Playa	Surface/Subsurface	Hearth 3	Charcoal	t:54;aa:457
Ru'at El Baqar	Poz-20418	6240	40	E-06-4,1	Nabta Playa	Sacred Mountain	Sandstone hill, (,altar'). Feature 21	Bone, carbonate fraction	b:419-420
Ru'at El Baqar	DRI-2879	6220	90	E-94-2	Nabta Playa	Area A	Hearth 51	Charcoal	p:425, t:54
Ru'at El Baqar	Rome-1582	6185	100	E-01-2	Gebel Ramlah	CAMP	Hearth 14, 20-30 cm	Charcoal	u:172
Ru'at El Baqar	SMU-965	6180	70	E-79-5B	El Balaad Playa	Surface Collection Area	Hearth B	Charcoal	t:54, g:185
Ru'at El Baqar	DRI-3547	6160	110	E-75-8	Nabta Playa	Cut I/98 (A)	Bed 7a, Feature 1	Charcoal	t:54, r:387

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
Ru'at El Baqar	Rome- 1576	6150	80	E-01-2	Gebel Ramlah		Hearth 6, 10-20 cm	Charcoal	u:172
Ru'at El Baqar	DRI-2872	6120	70	E-77-1	Gebel Nabta Playa	On dune	Hearth 1	Charcoal	t:54, aa:433
Ru'at El Baqar	DRI-2880	6120	90	E-94-3	Gebel Nabta Playa	Surface/Subsurface	Hearth 1	Charcoal	t:54, aa:457
Ru'at El Baqar	CAMS-16591	6070	60	E-94-3	Gebel Nabta Playa		Hearth 8, 10 cm bs	Charcoal	t:54, aa:457
Ru'at El Baqar	Rome-1414	6045	60	E-01-1	Gebel Ramlah	Cut 3, Pit 1,	Hearth, 100 cm	Charcoal	u:181
Ru'at El Baqar	DRI-3552	6030	200	E-75-8	Nabta Playa	South Trench	Bed 8, top	Charcoal	t:54
Ru'at El Baqar	Rome-1412	6025	80	E-01-1	Gebel Ramlah	Cut 3, Pit 4	Hearth, 30-40 cm	Charcoal	u:181
Ru'at El Baqar	Poz-14025	6020	40	E-05-3	Nabta Playa	Quarry, Trench, 12/B	Exploated pit, bottom of Hearth 3, ca 35 cm bs.	Charcoal	Chapter 5 in this volume
Ru'at El Baqar	CAMS-16592	6020	60	E-94-3	Gebel Nabta Playa		Hearth 2, 10 cm bs	Charcoal	t:54, aa:457
Ru'at El Baqar	CAMS-17287	6000	60	E-92-9	Nabta Playa	Calendar Crcle	Hearth 9	Charcoal	t:54
Ru'at El Baqar	DRI-2878	6000	50	E-94-3	Gebel Nabta Playa	Surface/Subsurface	Hearth 7	Charcoal	aa:457
Ru'at El Baqar	Rome-1415	5990	75	E-01-1	Gebel Ramlah	Cut 3, Pit 2	Hearth, 80-90 cm	Charcoal	u:181
Ru'at El Baqar	Poz-19188	5980	110	E-06-2	Nabta Playa	Quarry, Trench	Hearth 2, 30 cm; secondary deposit ?	Charcoal*******	Chapter 5 in this volume
Ru'at El Baqar	DRI-2884	5980	60	E-94-2	Nabta Playa	Subsurface	Hearth 10	Charcoal	p:425, t:54
Ru'at El Baqar	Rome-1581	5980	75	E-01-2	Gebel Ramlah		Hearth 8, 20-30 cm bs	Charcoal	u:172
Ru'at El Baqar	DRI-2883	5970	50	E-94-2	Nabta Playa	Area A	Hearth 6	Charcoal	p:425, t:54
Ru'at El Baqar	DRI-2876	5970	90	E-94-3	Gebel Nabta Playa	Subsurface	Hearth 5	Charcoal	t:54, aa:457
Ru'at El Baqar	Rome-1413	5945	70	E-01-1	Gebel Ramlah	Cut 3, Pit 3	Hearth, 50-60 cm	Charcoal	u:181
Ru'at El Baqar	Gd-10114	5940	110	E-92-7 (North)	Nabta Playa	Area A	Hearth 8	Charcoal	t:54, o:351
Ru'at El Baqar	DRI-2881	5910	50	E-94-2	Nabta Playa	Area A	Hearth 4	Charcoal	p:425, t:54
Ru'at El Baqar	DRI-2871	5860	70	E-94-2	Nabta Playa	Area C	Hearth 8	Charcoal	p:425, t:54
Ru'at El Baqar	DRI-2869	5840	60	E-94-2	Nabta Playa	Area A	Hearth 1	Charcoal	p:425, t:54
Ru'at El Baqar	DRI-2882	5830	60	E-94-2	Nabta Playa	Area B	Hearth 7	Charcoal	p:425, t:54
Ru'at El Baqar	ETH-22674	5825	60	E-00-1	Nab el Diep	Area J	double burial	Charcoal	
Ru'at El Baqar	SMU-473	5810	80	E-75-8	Nabta Playa	South Trench	Bed 9e, Hearth	Charcoal	h:375, t:54

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
Final Neolithic									
Bunat El Asnam	Rome-1585	6035	220	E-02-3	Nab el Diep	Cut 1	Hearth 8, Q/12, E part	Charcoal	Chapter 17 in this volume
Bunat El Asnam	Gd-12185	5750	80	E-75-8	Nabta Playa	Cut 1/99, Area D	Layer 10, Feature 2, 20 cm bs	Charcoal	t:54
Bunat El Asnam	Poz-459	5740	50	E-01-2	Gebel Ramlah	Cemetery	Burial 5	Charcoal	n:119
Bunat El Asnam	Poz-73341	5670	40	E-02-3	Nab el Diep	Cut 1	Hearth 5, N/10	Charcoal	Chapter 17 in this volume
Bunat El Asnam	Gd-10111	5660	110	E-92-7 (North)	Nabta Playa	Area B	Hearth 14	Charcoal	t:54, o:351
Bunat El Asnam	Poz-73335	5630	40	E-04-4	Nabta Playa	Quarry, Trench 1, 9/A	Cult.layer ca 50 cm bs	Charcoal*******	Chapter 5 in this volume
Bunat El Asnam	Rome-1661	5620	150	E-02-3	Nab el Diep	Cut 1	Hearth 11,P-Q/12	Charcoal	Chapter 17 in this volume
Bunat El Asnam	Rome-1662	5610	150	E-02-3	Nab el Diep	Cut 1	Hearths 2 and 3, S/15	Charcoal	Chapter 17 in this volume
Bunat El Asnam	Poz-460	5610	45	E-01-2	Gebel Ramlah	Cemetery	Burial 10	Charcoal	n:119
Bunat El Asnam	Poz-7917	5600	40	E-04-4	Nabta Playa	Quarry, Trench 1	Hearth 1	Charcoal	Chapter 5 in this volume
Bunat El Asnam	SMU-1551	5600	60	E-85-7	Bir Safsaf	Survey Area	Hearth	Charcoal	bb:49
Bunat El Asnam	Poz-73203	5580	40	E-04-4	Nabta Playa	Quarry, Trench 1, 12/A	Hearth 1 , 5-10 cm bs	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Gd-10109	5580	110	E-92-7 (North)	Nabta Playa	Area A	Hearth 4	Charcoal	t:54, o:351
Bunat El Asnam	Poz-466	5555	60	E-01-2/1 S.C.	Gebel Ramlah	Cemetery	Burial 3	Structural carbonates	n:119
Bunat El Asnam	Poz-4402	5535	35	E-03-1	Gebel Ramlah	Cemetery	Burial 4	Structural carbonates	n:119
Bunat El Asnam	Gd-16008	5530	180	E-75-8	Nabta Playa	Cut 1/99, Area C	Level 10, Feature 1, Hearth, 0-10 cm	Charcoal	t:54

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
Bunat El Asnam	Poz-7818	5530	40	E-04-4	Nabta Playa	Quarry, Trench 1	Hearth 1	Charcoal	Chapter 5 in this volume
Bunat El Asnam	DRI-3529	5515	90	E-75-8	Nabta Playa	South Trench	Level 10	Charcoal	t:54
Bunat El Asnam	Poz-73339	5505	35	E-05-3	Nabta Playa	Quarry, 13/B	Exploated pit, Hearth 4, ca 35 cm bs	Charcoal	Chapter 5 in this volume
Bunat El Asnam	DRI-3354	5500	160	E-97-6	Nabta Playa	Tumulus	Inside offering	Charcoal	t:54
Bunat El Asnam	Poz-14024	5490	40	E-05-3	Nabta Playa	Quarry,Trench, 12/B	Exploated pit, Hearth 2, 10-15 cm bs	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Poz-14306	5480	40	E-05-2	Nabta Playa	Quarry, Trench, 26/A	Cultural layer, 10-15 cm bs	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Poz-7919	5470	40	E-04-4	Nabta Playa	Quarry, Trench 2	Hearth 4	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Poz-73204	5470	40	E-05-2	Nabta Playa	Quarry, Trench, 26/B	Wash sand, hearth?, ca 5 cm bs	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Poz-73338	5470	50	E-05-3	Nabta Playa	Quarry, Trench, 12/A	Exploated pit, Cult. layer, 20-25 cm bs	Charcoal*******	Chapter 5 in this volume
Bunat El Asnam	Poz-7819	5460	40	E-04-4	Nabta Playa	Ouarry, Trench 1	Hearth 2	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Poz-7918	5450	40	E-04-4	Nabta Playa	Quarry, Trench 2	Hearth 3	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Gd-15020	5450	100	E-75-8	Nabta Playa	Cut 1/99, Area C	Layer 10, Feature 10, Hearth, 5-20 cm	Charcoal	t:54
Bunat El Asnam	Poz-73340	5440	40	E-02-3	Nab el Diep	Cut 1	Hearth 4, N/13	Charcoal	Chapter 17 in this volume
Bunat El Asnam	Gd-10110	5430	100	E-92-7 (North)	Nabta Playa	Area A	Hearth 10	Charcoal	t:54, 0:351
Bunat El Asnam	A-11083	5415	160	E-00-1	Nab el Diep	Area B	Hearth?, N/10	Charcoal	

Entity	Lab nr.	Age	Sigma	Site	Area	Locus	Feature/Horizo	Material	Reference
Bunat El Asnam	Poz-73337	5410	40	E-05-3	Nabta Playa	Quarry, Trench, 12/B	Exploated pit, Hearth 2, 15-20 cm bs	Charcoal	Chapter 5 in this volume
Bunat El Asnam	Poz-73336	5390	40	E-05-3	Nabta Playa	Quarry, Trench, 11/B	Exploated pit, Hearth 2, 10-15 cm bs	Charcoal*******	Chapter 5 in this volume
Bunat El Asnam	Poz-73391	5330	40	E-02-3	Nab el Diep	Cut 1	Hearth 11,P- Q/12	Charcoal	Chapter 17 in this volume
Bunat El Asnam	DRI-2874	5260	60	E-94-2	Nabta Playa	Area D	Hearth 9	Charcoal	p:425, t:54
Bunat El Asnam	A-11082	5170	80	E-00-1	Nab el Diep	Area G	Well, 80 cm bs	Charcoal	m:103
Bunat El Asnam	Poz-8267	4820	40	E-04-2	Nabta Playa	Tumulus	Grave shaft, Human skull	Structural carbo-nates	Chapter 9 in this volume
Bunat El Asnam	Poz-8036	4450	60	E-04-2	Nabta Playa	Tumulus	Grave shaft, Human skull	Collagen*******	Chapter 9 in this volume
Bunat El Asnam	DRI 3358	4800	85	E-96-1*	Nabta Playa	Megalith E	Megalithic Structure, Pit 1, under struct.	Charcoal	t:54, Chap-ter 5 in this volume
Unknown Neolithic									
Bunat El Asnam?	SMU-741	5450	80	E-76-7	Kharga	Excavated Area	Subsurface	Ostrich	h:374
C-Group?	SMU-967	4580	50	Transect A	Kiseiba Plateau	Locality VI	Occurrance A5/21	Charcoal	f:375
C-Group?	SMU-1104	4530	375	Transect B	Kiseiba Plateau	Locality VIII	B1/20	Charcoal	f:384
C-Grupa?	SMU-74	4510	70	BT 20	Bir Tarfawi	Collected Area	Hearth	Ostrich******	i
Old Kingdom?	SMU-966	5070	120	E-79-9*	Kiseiba Plateau	Collected Area S corner	Hearth	Charcoal	f:352
C-Group?	Gd-16009	4160	360	E-91-1*	Nabta Playa	Area 1	Feature 1, Hearth B, cut into older fill	Charcoal*******	t:54
C - Group									
	DRI-3357	3860	40	E-92-8	Nabta Playa	Slab House, West Room	Floor of room	Charcoal	t:54
	?	3625	180	Site 8773	Dungul Area		Feature 3	Charcoal	j:51, t:54
	Gd-6746	3130	110	E-92-8	Nabta Playa	Slab House, Central Room	Hearth on floor	Charcoal	t:54

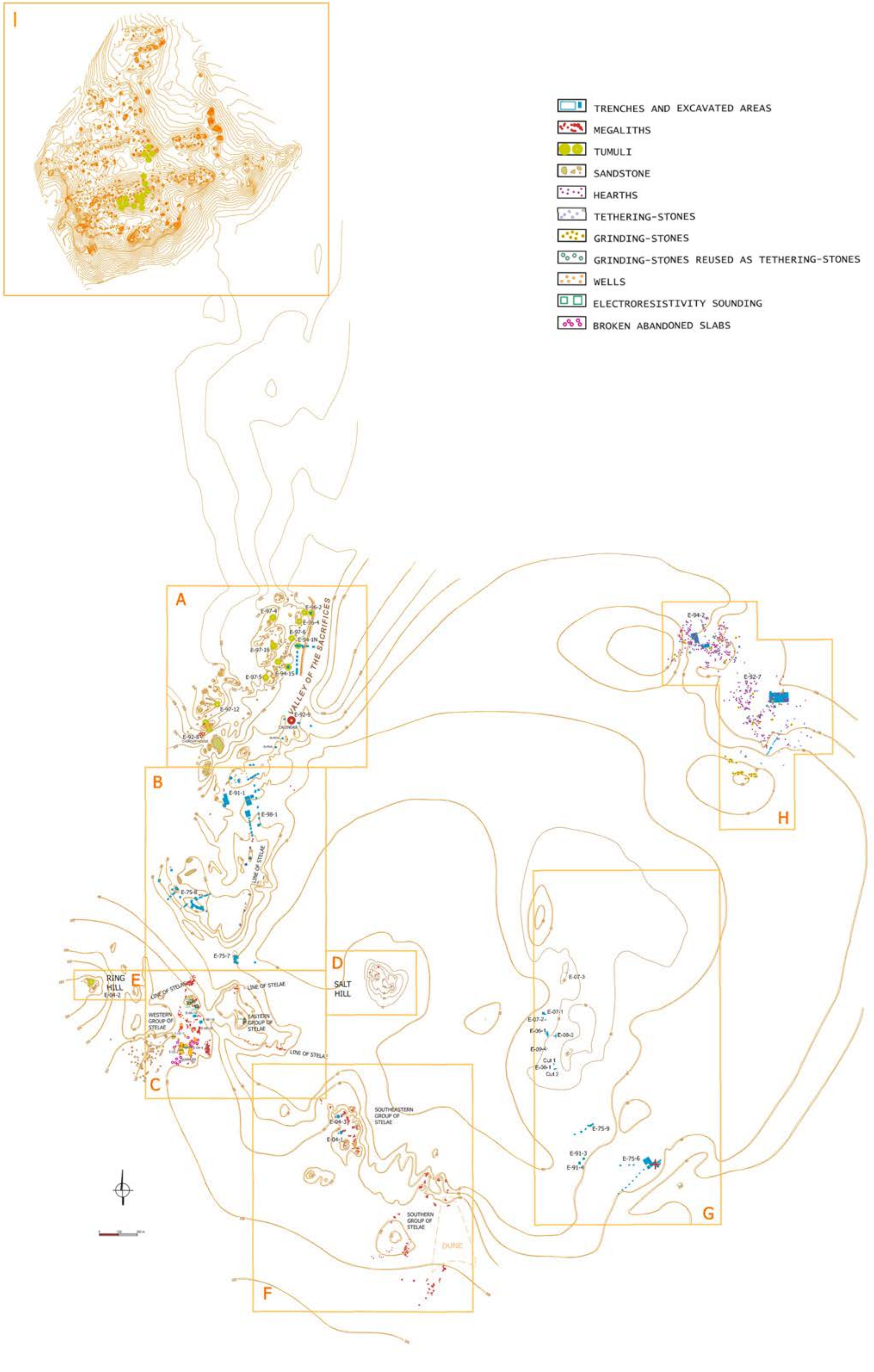
Catalog of recorded complete and fragmentary megaliths of Nabta Playa

Drawn by Marek Puszkarski

Key:

Kapital letters B-F: sector (the division into sectors is referred to in the general map below)

Figure and lower case letter: square (for location see Figs. 2.1, 2.3-2.7)


TRENCHES AND EXCAVATED AREAS
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SANDSTONE
HEARTHS
TETHERING-STONES
GRINDING-STONES
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WELLS
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BROKEN ABANDONED SLABS
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VALLEY OF THE SACRIFICES
LINE OF STELAE
RING HILL
SALT HILL
WESTERN GROUP OF STELAE
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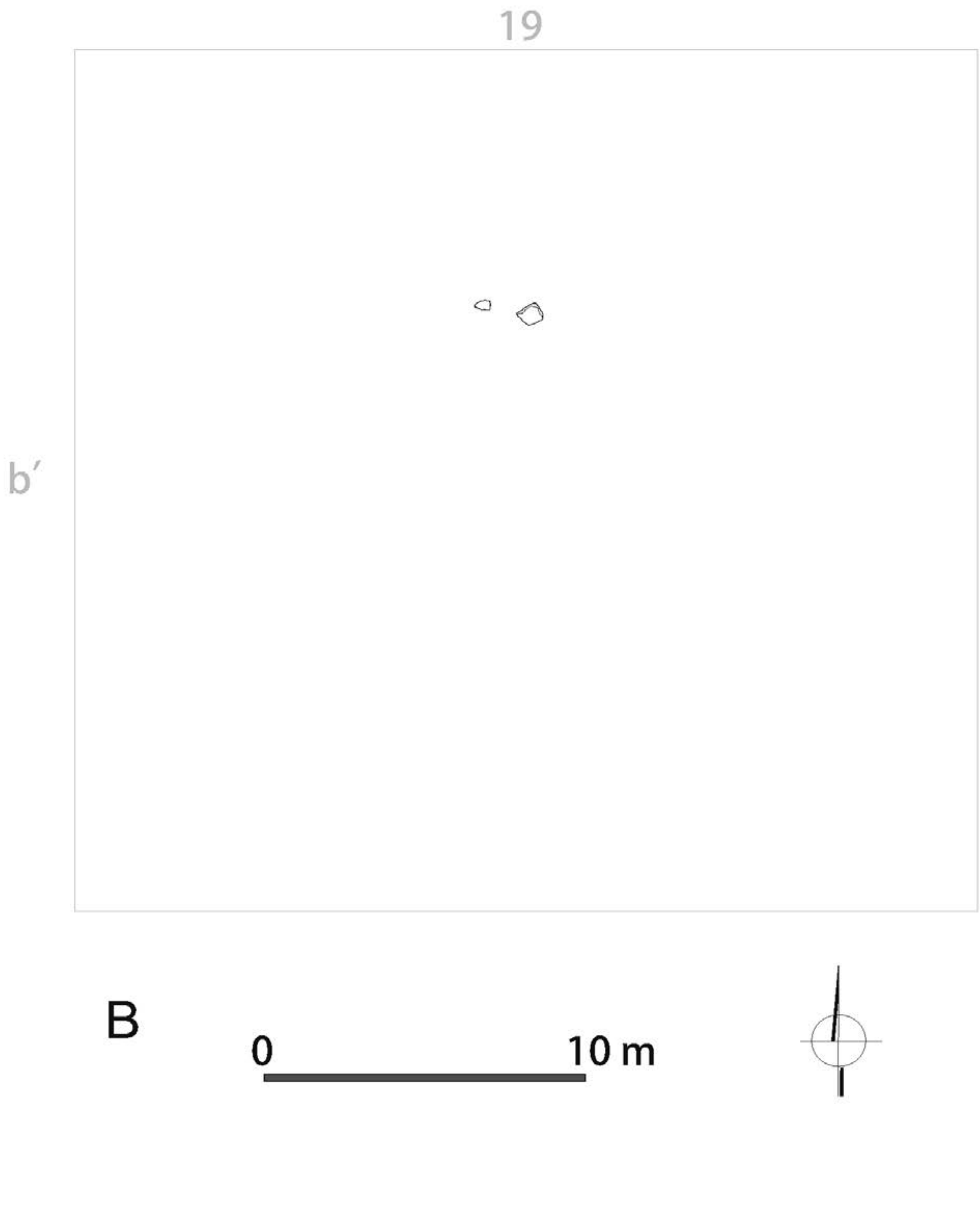
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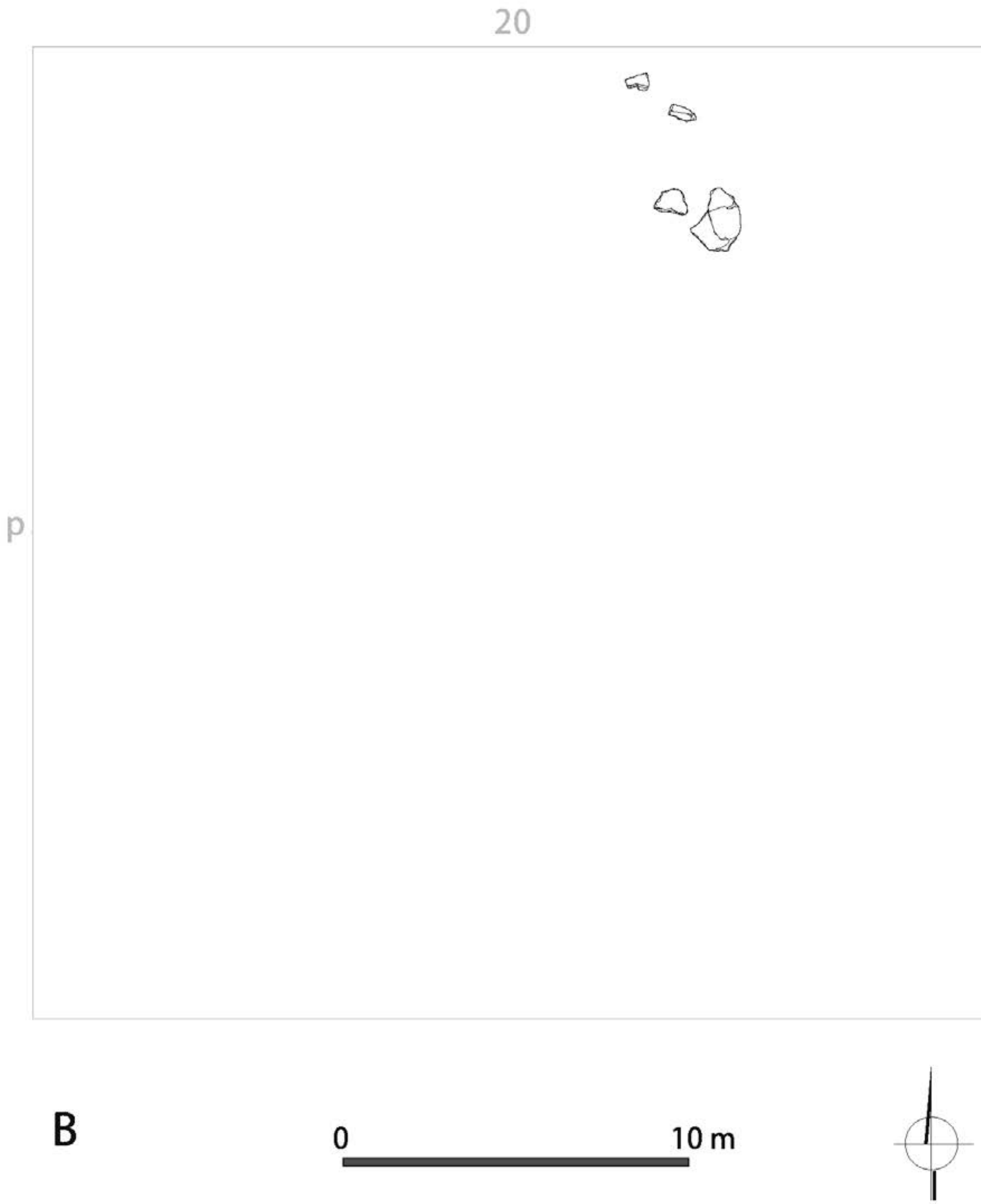
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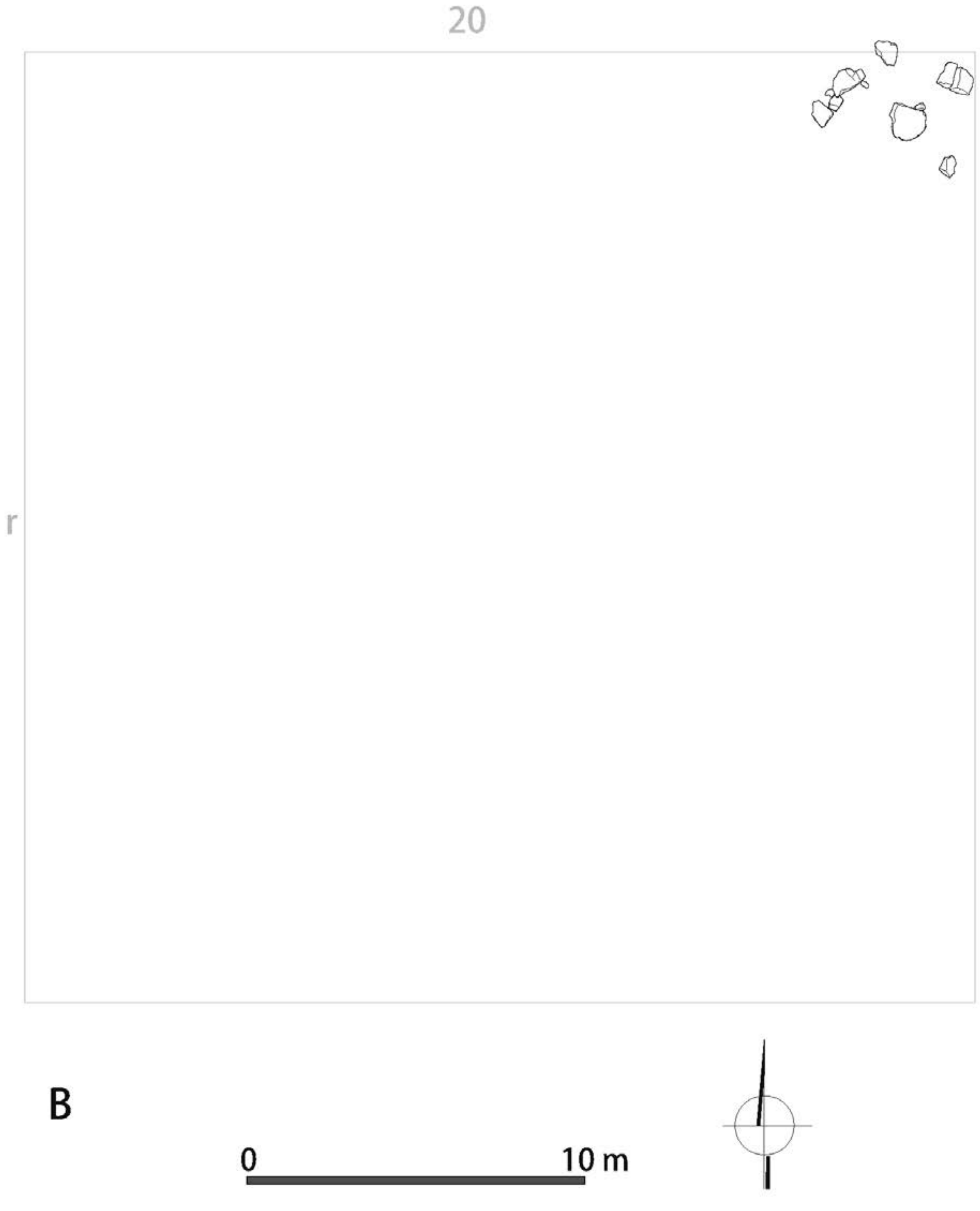

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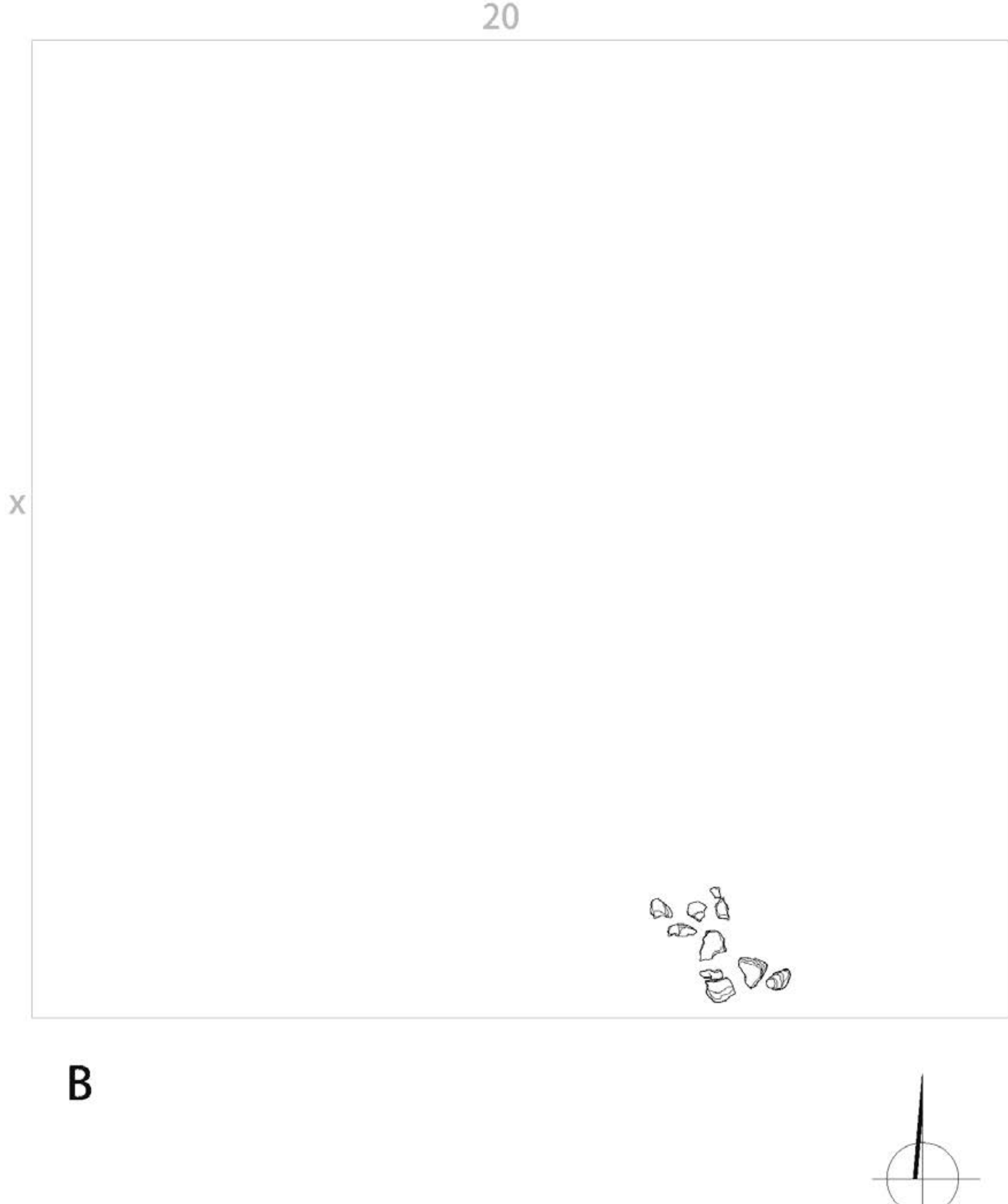
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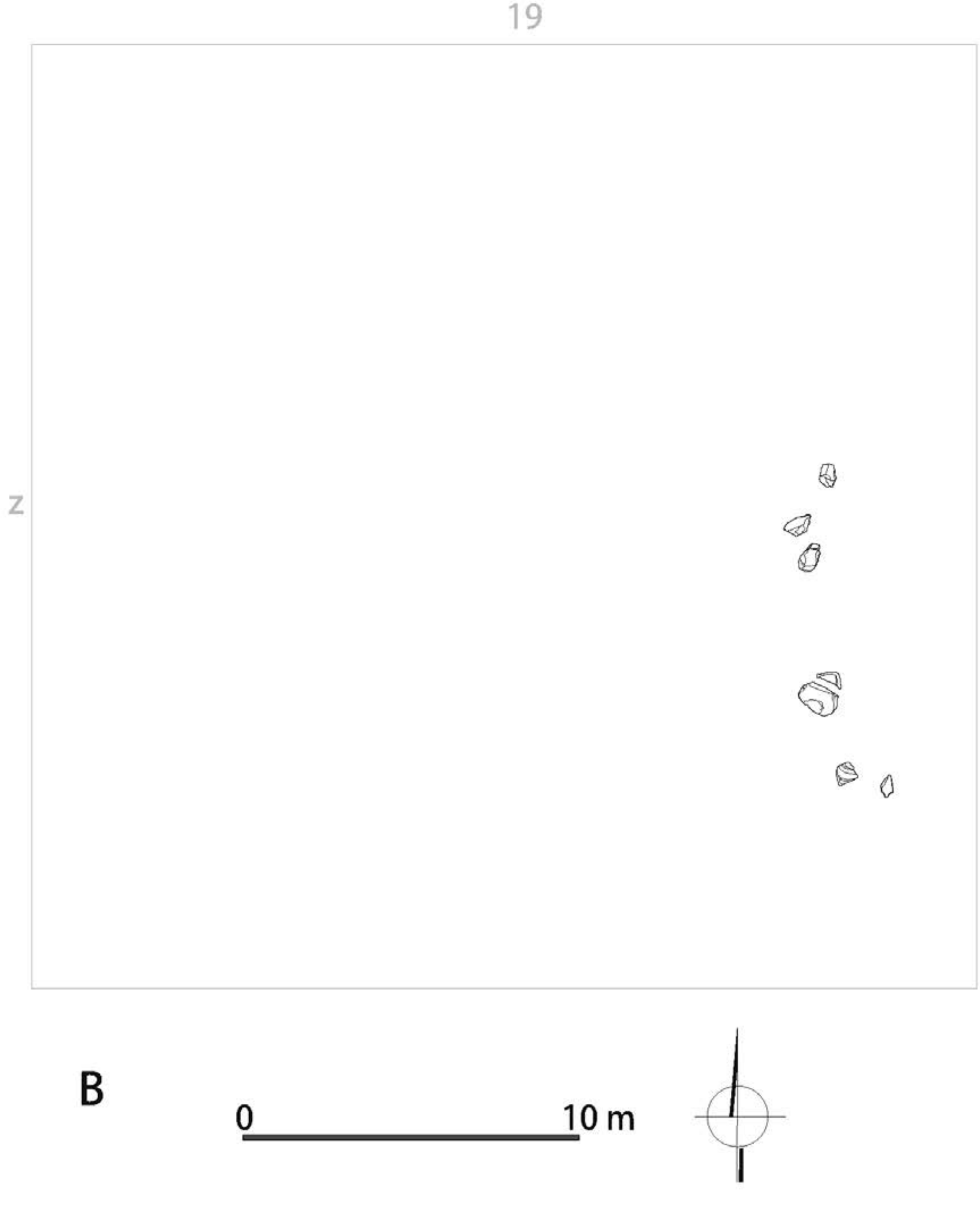

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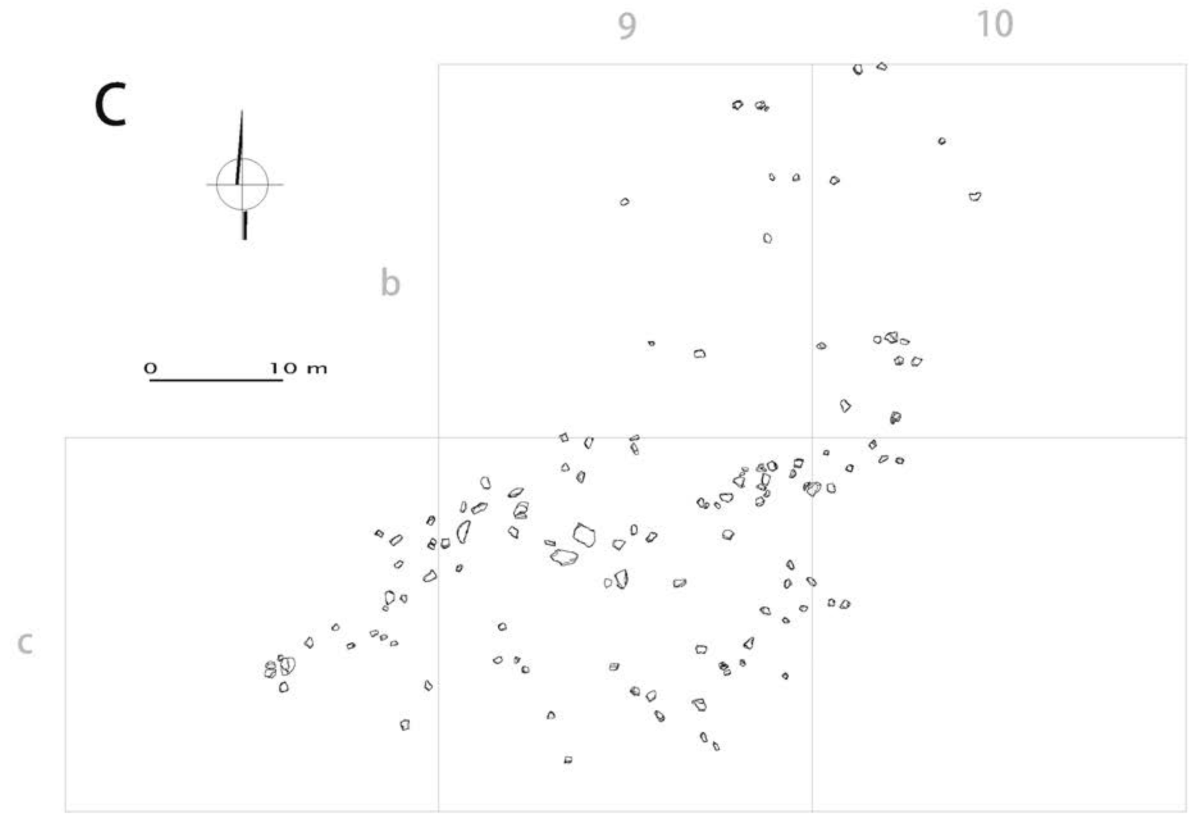
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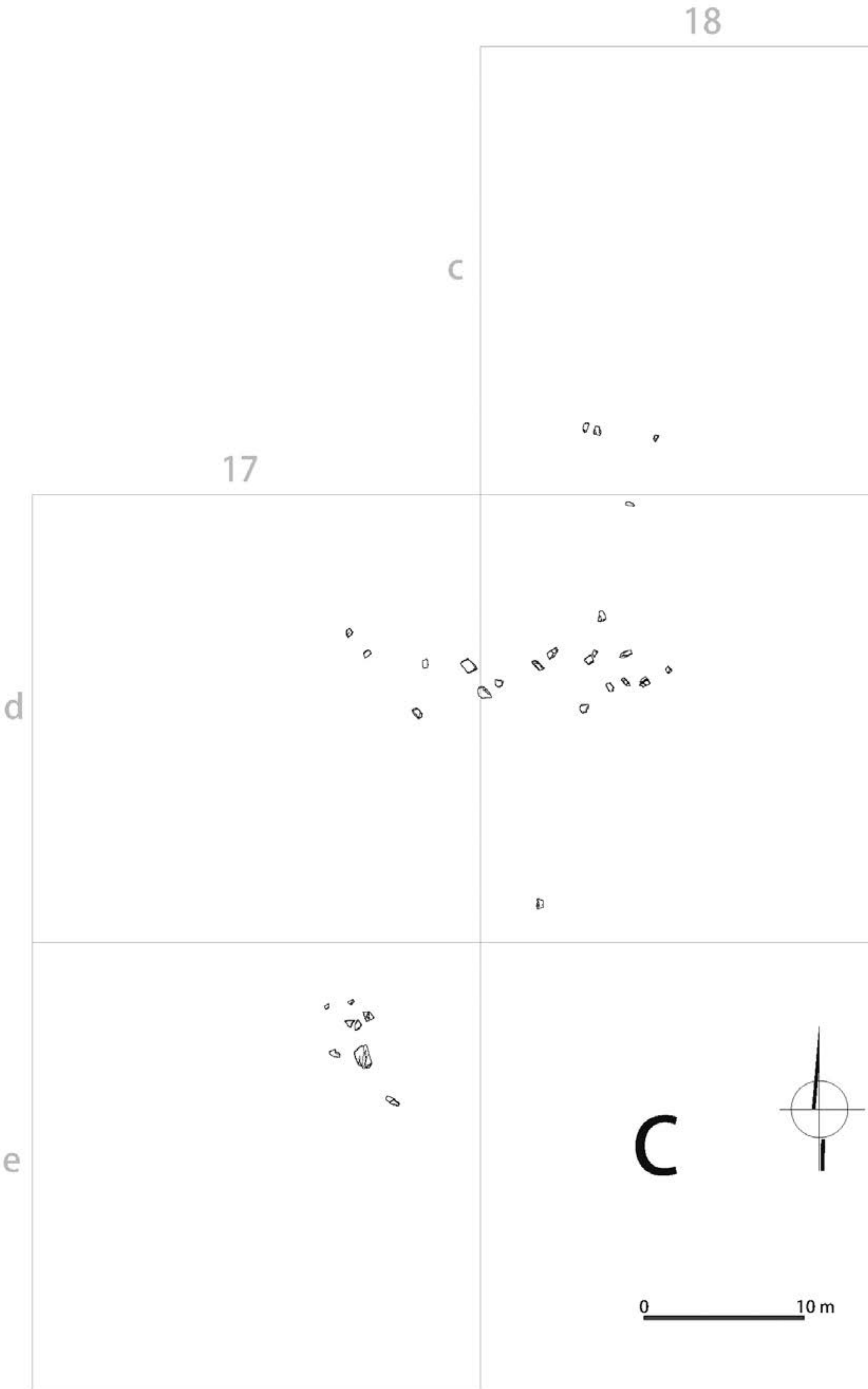
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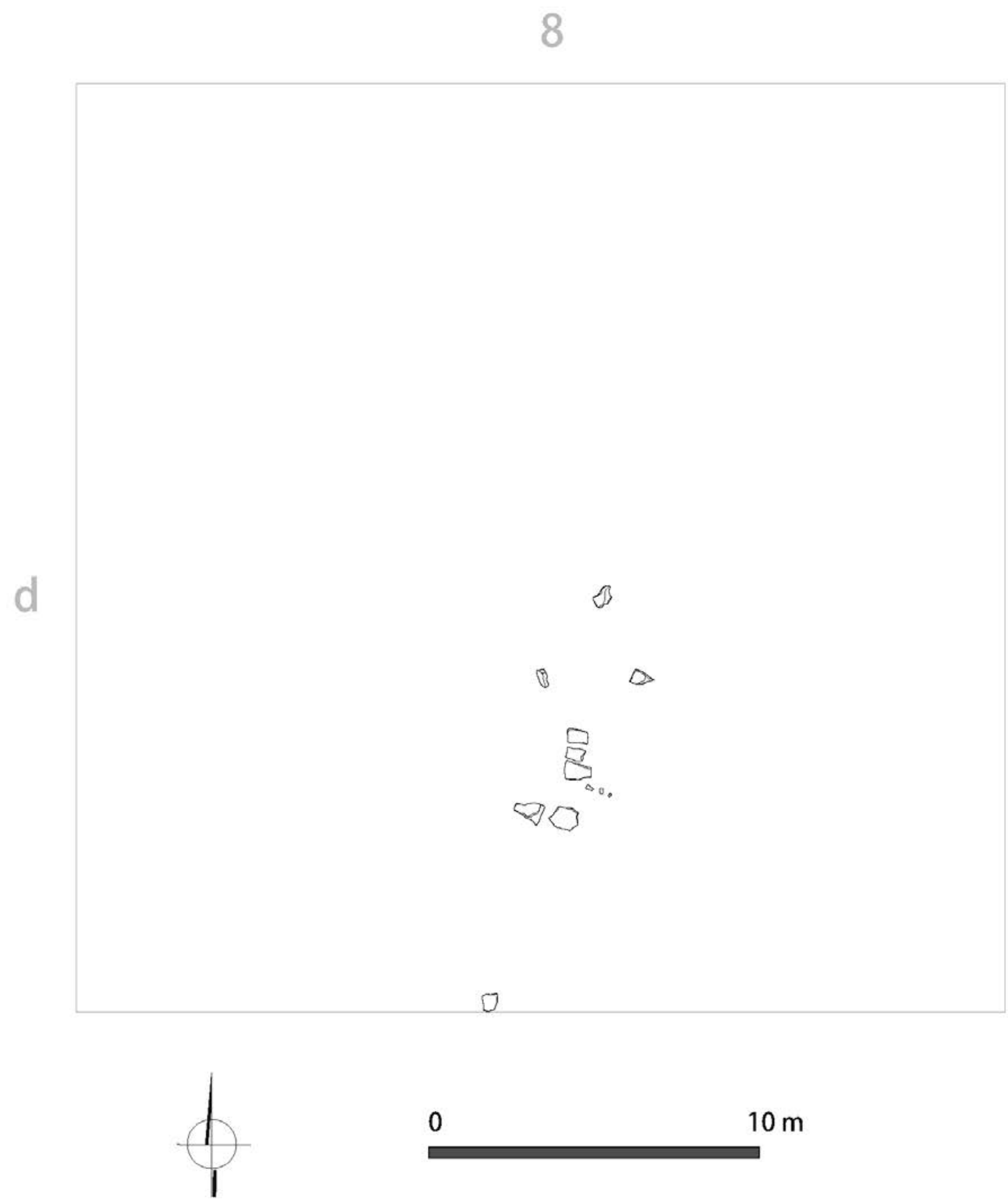

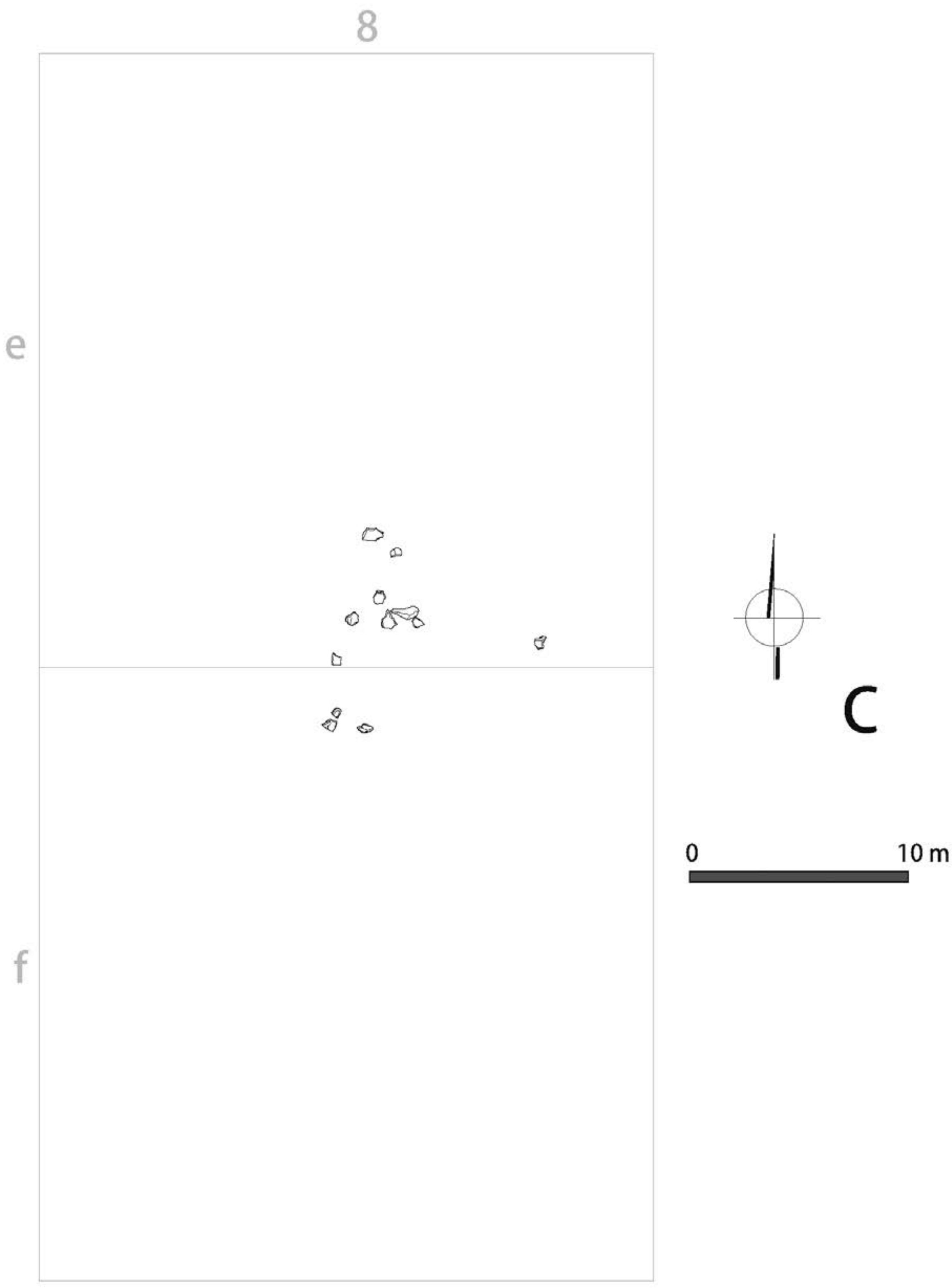
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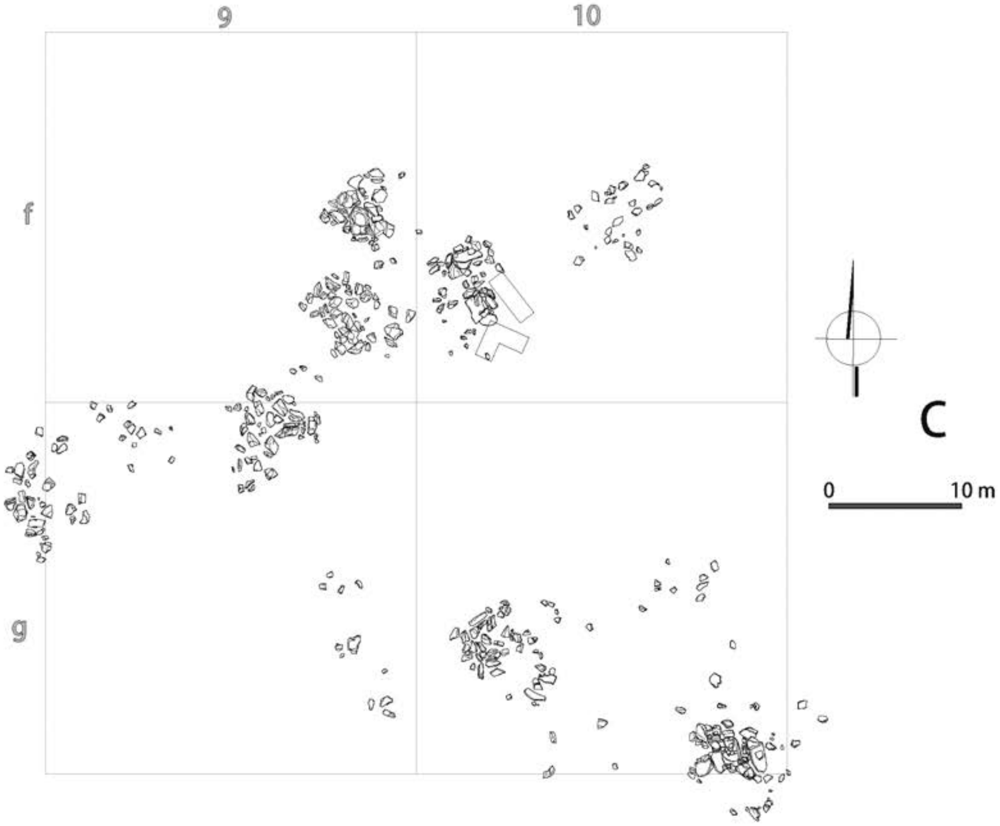

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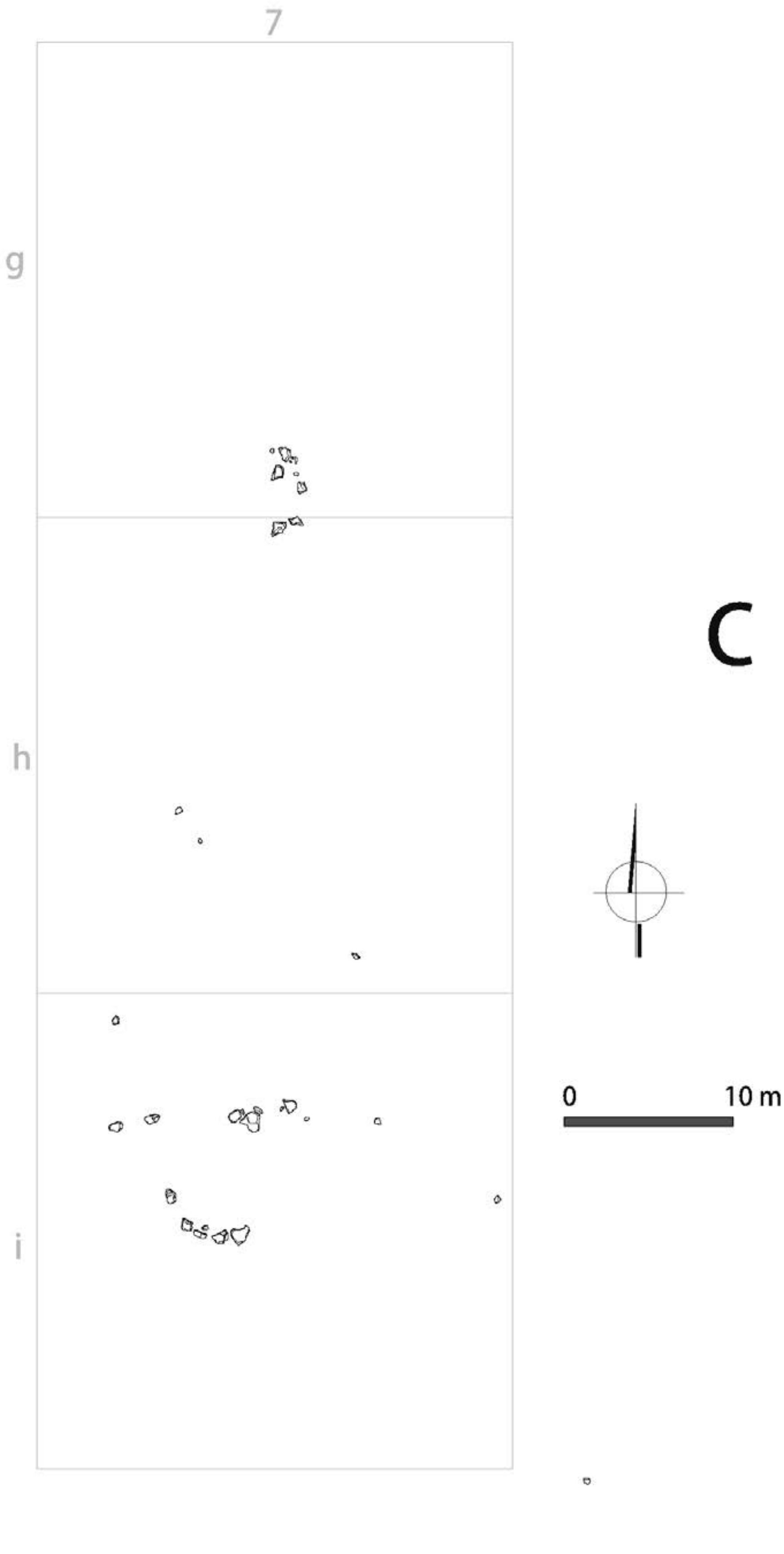
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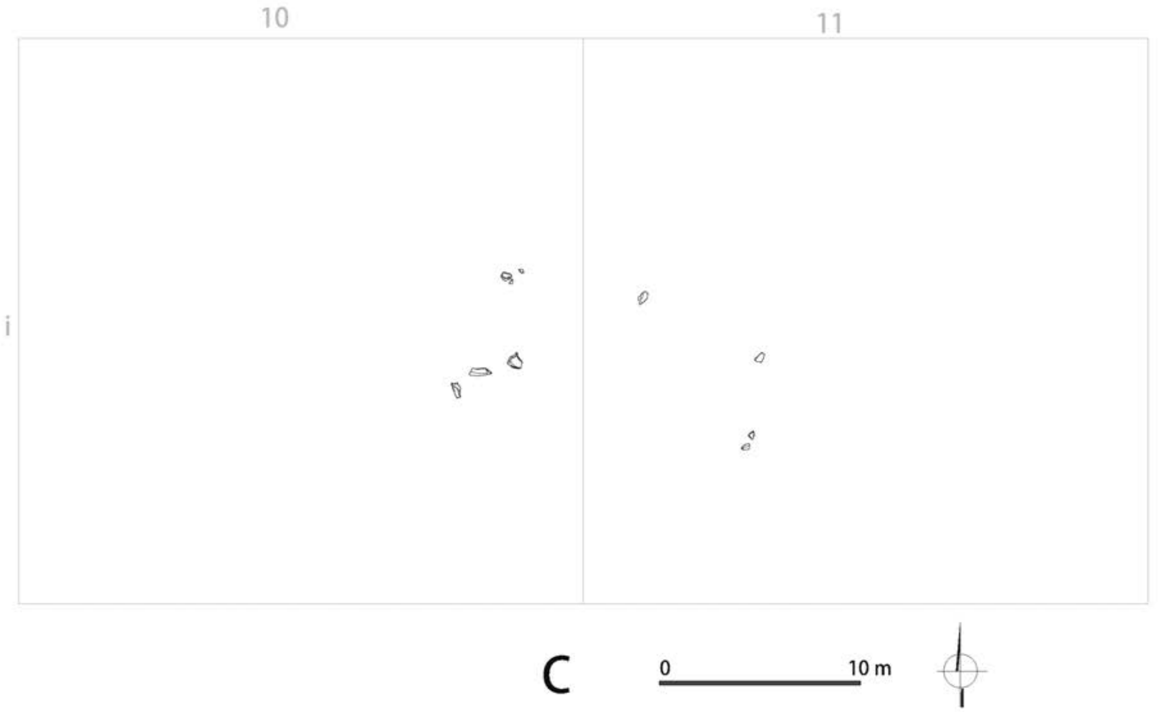
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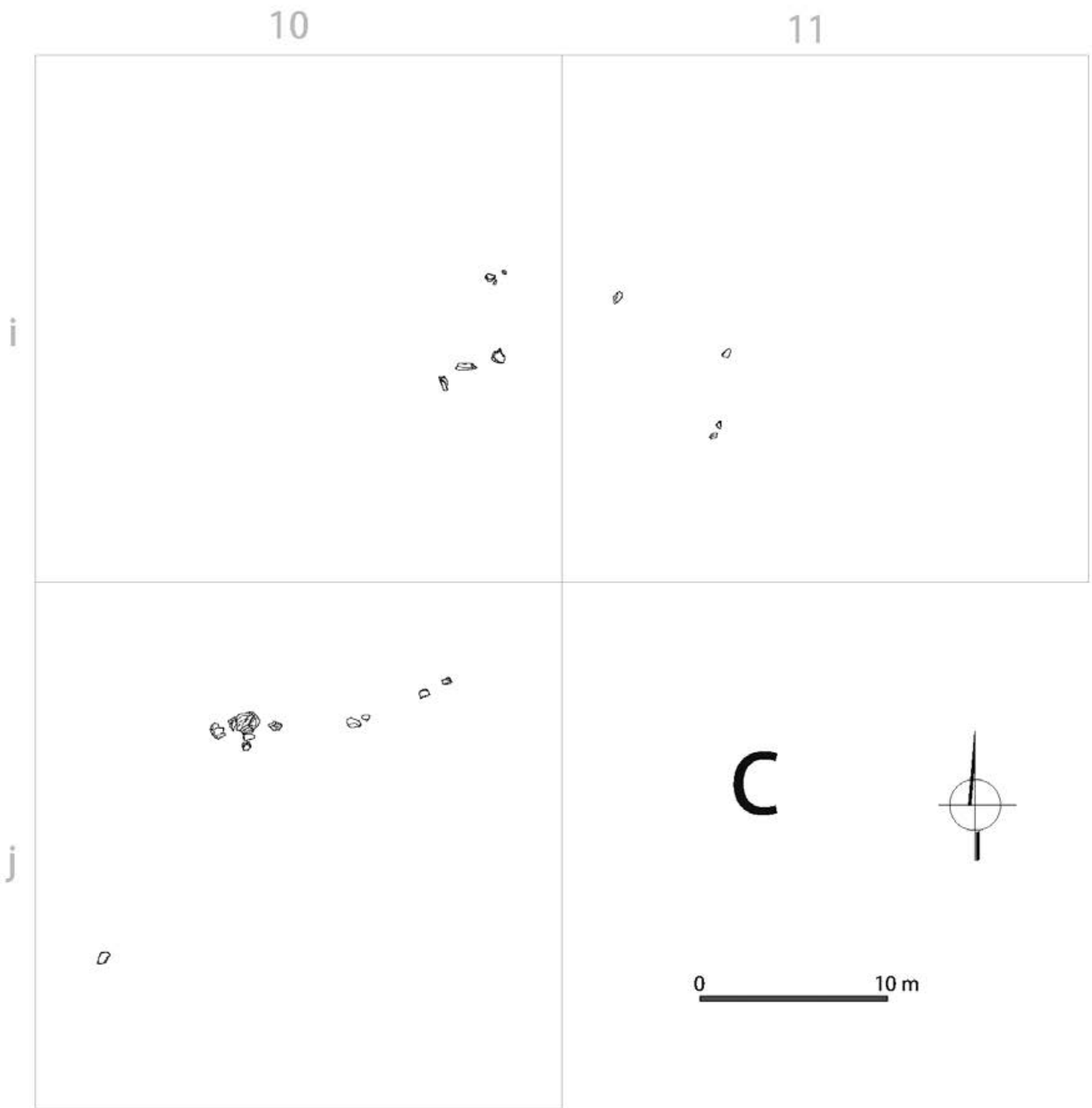
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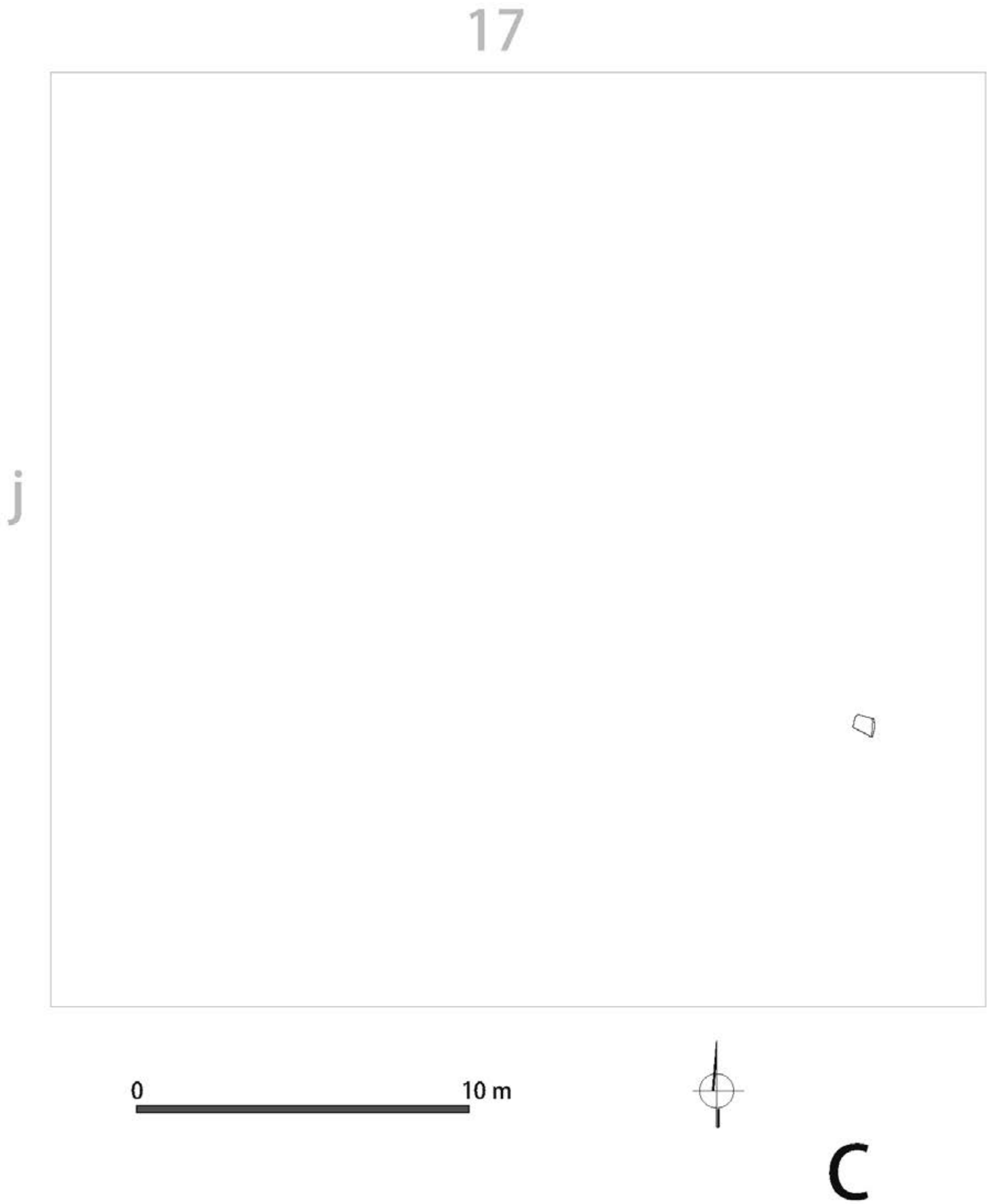
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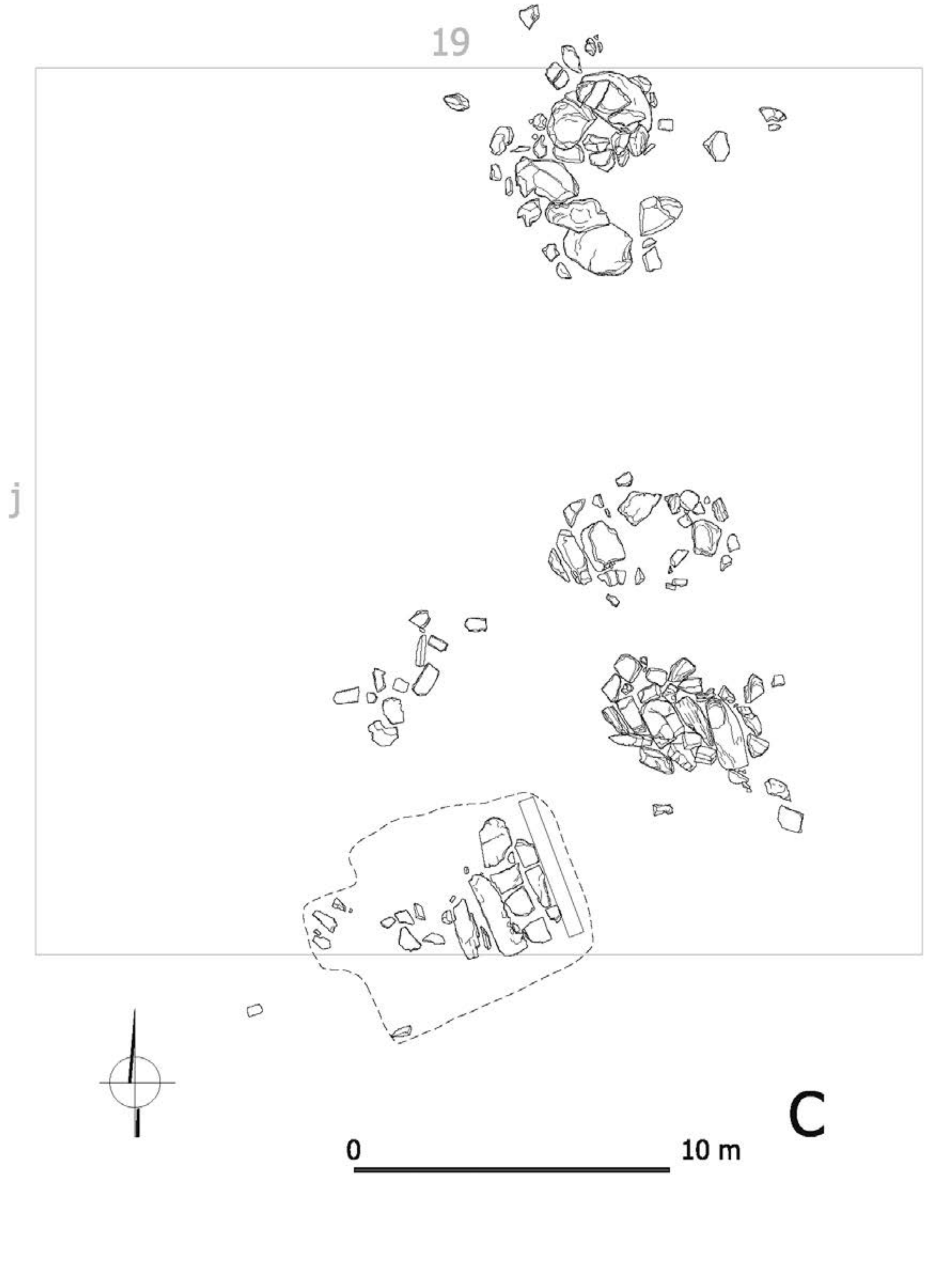

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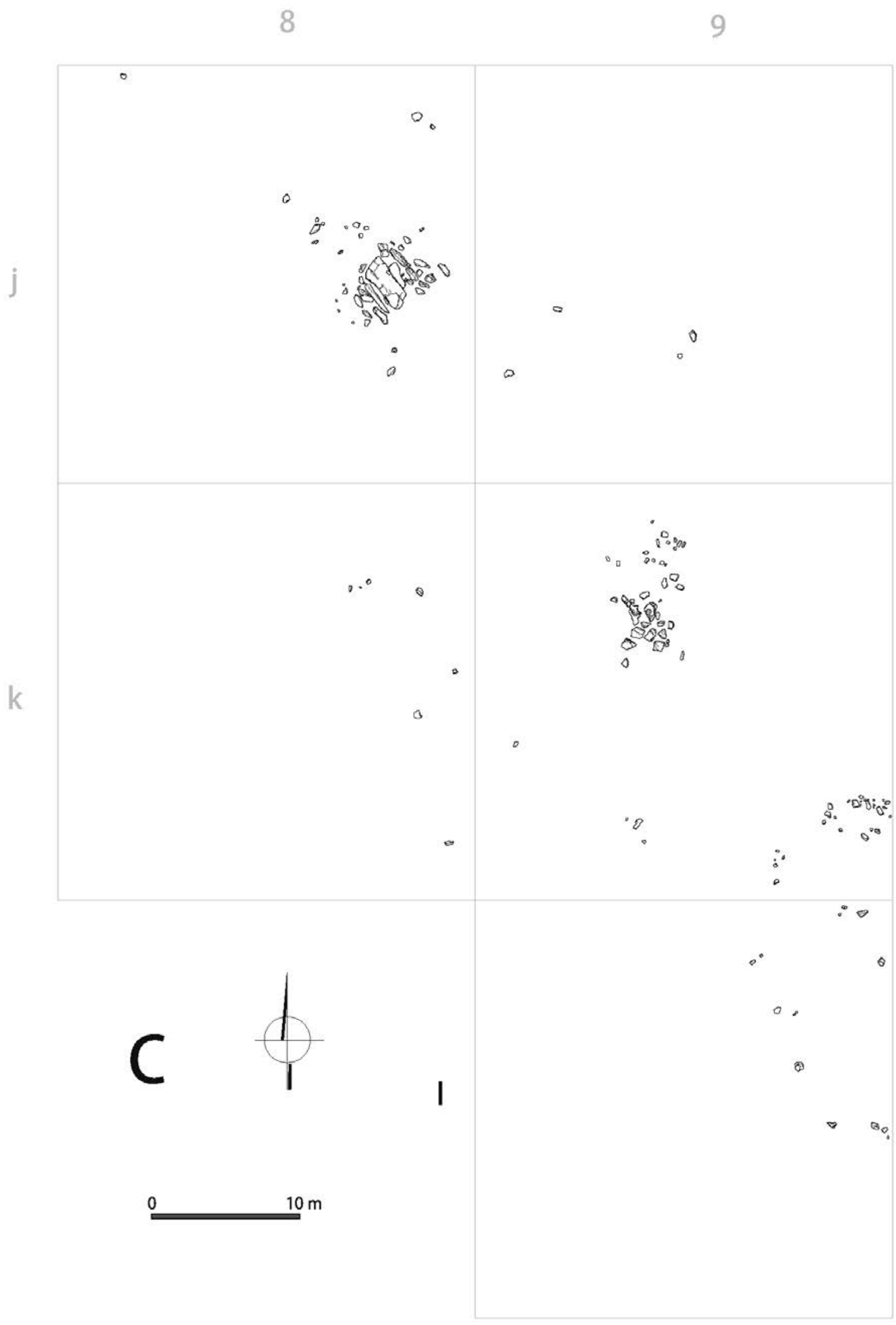
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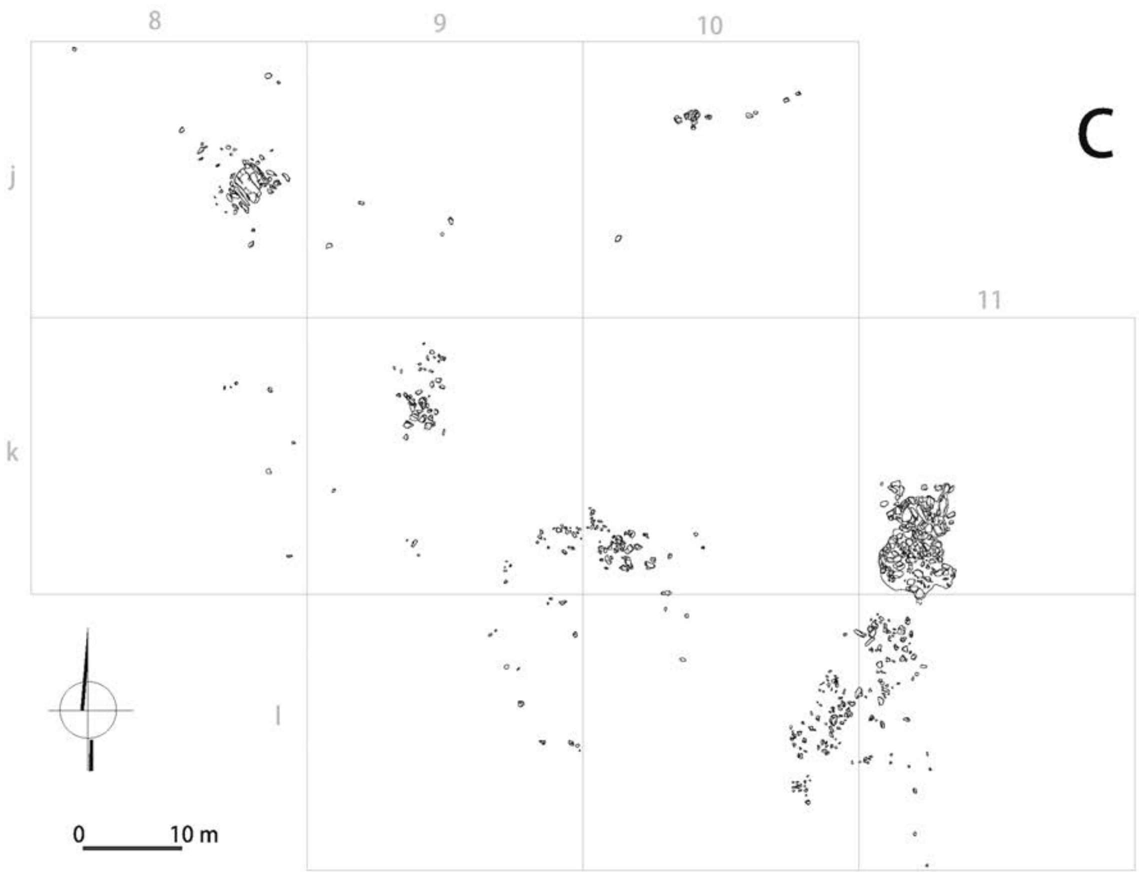
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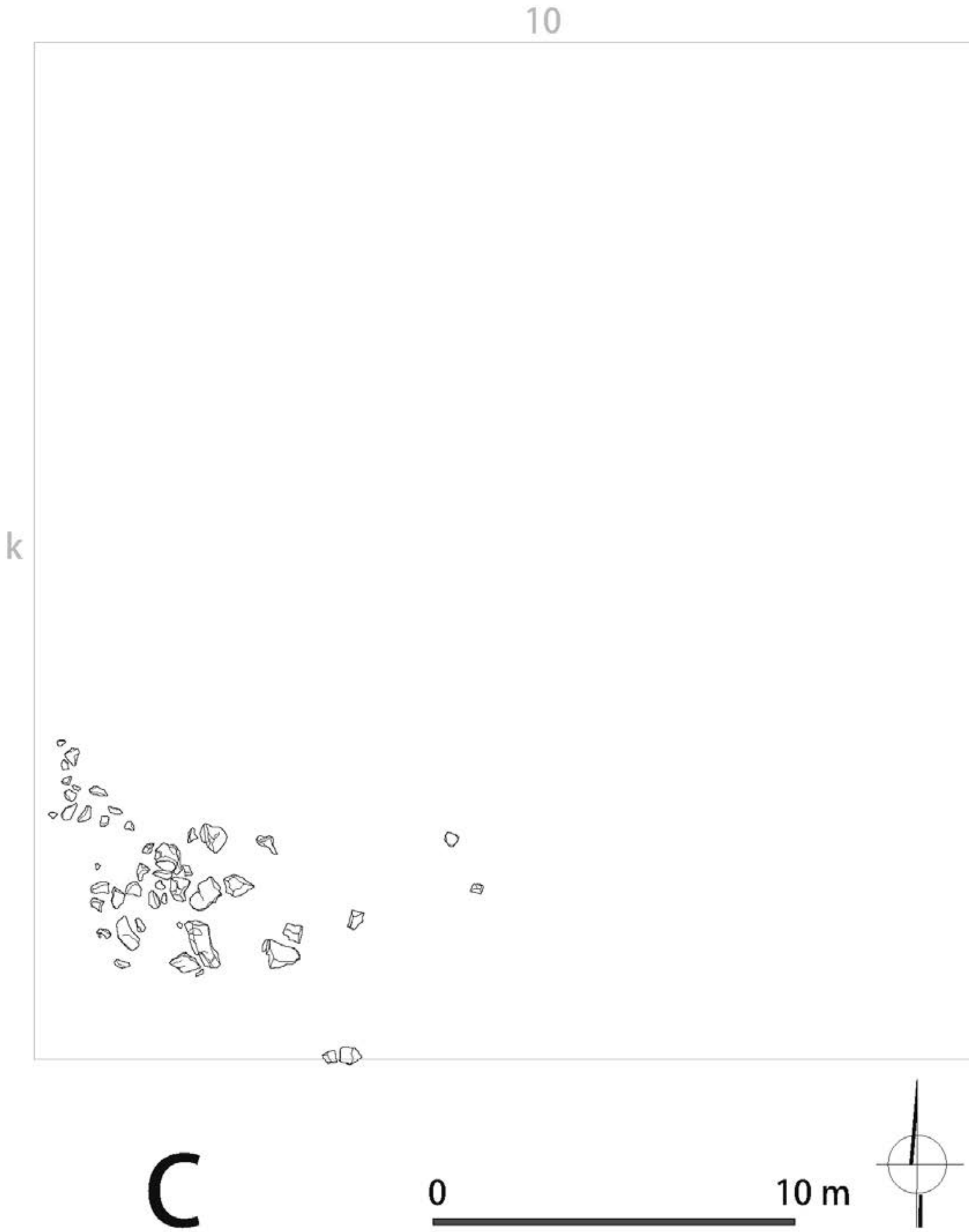
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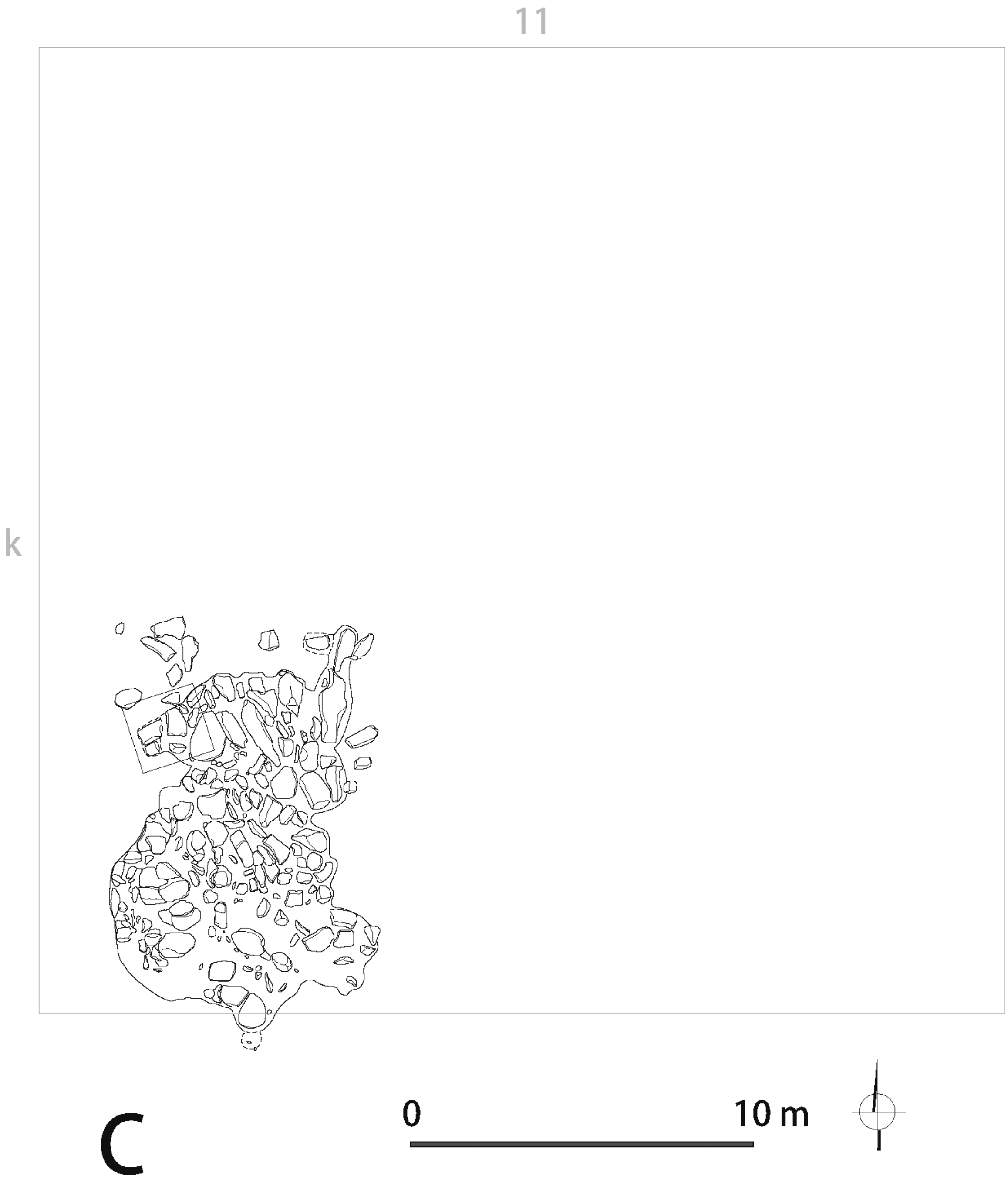
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7
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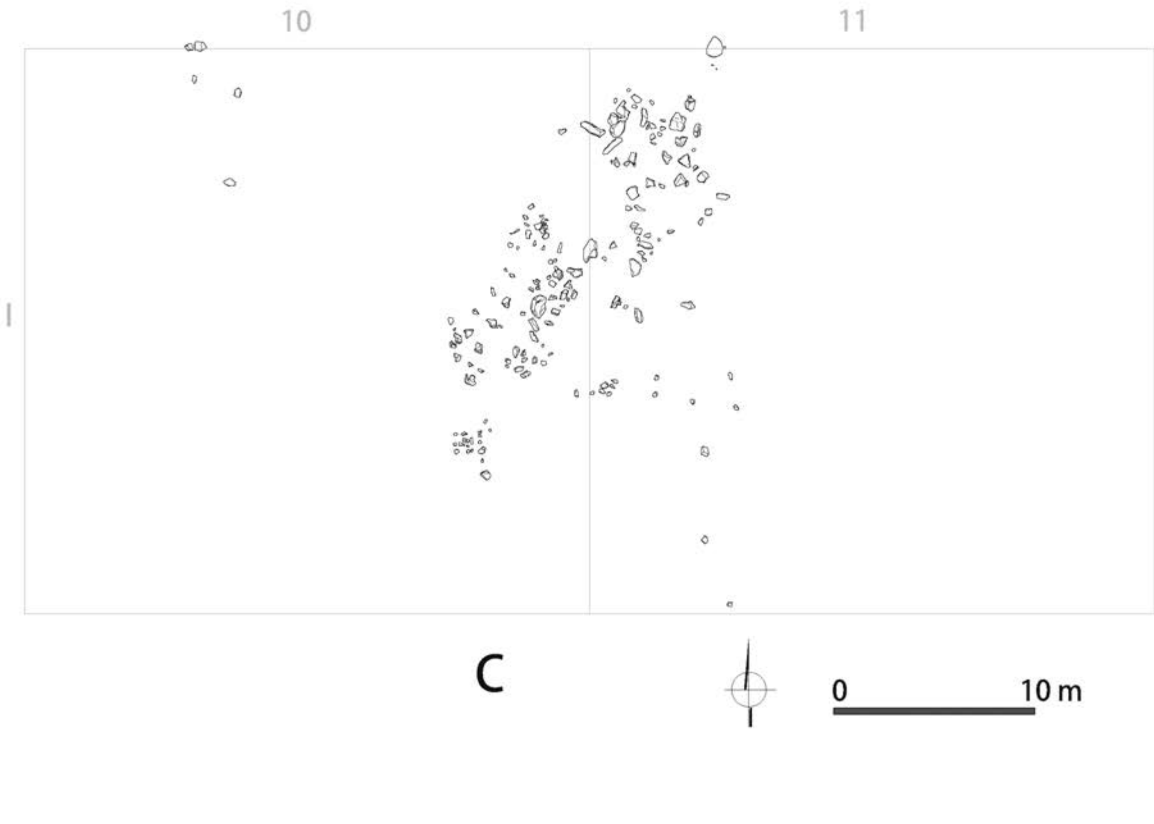
0
10 m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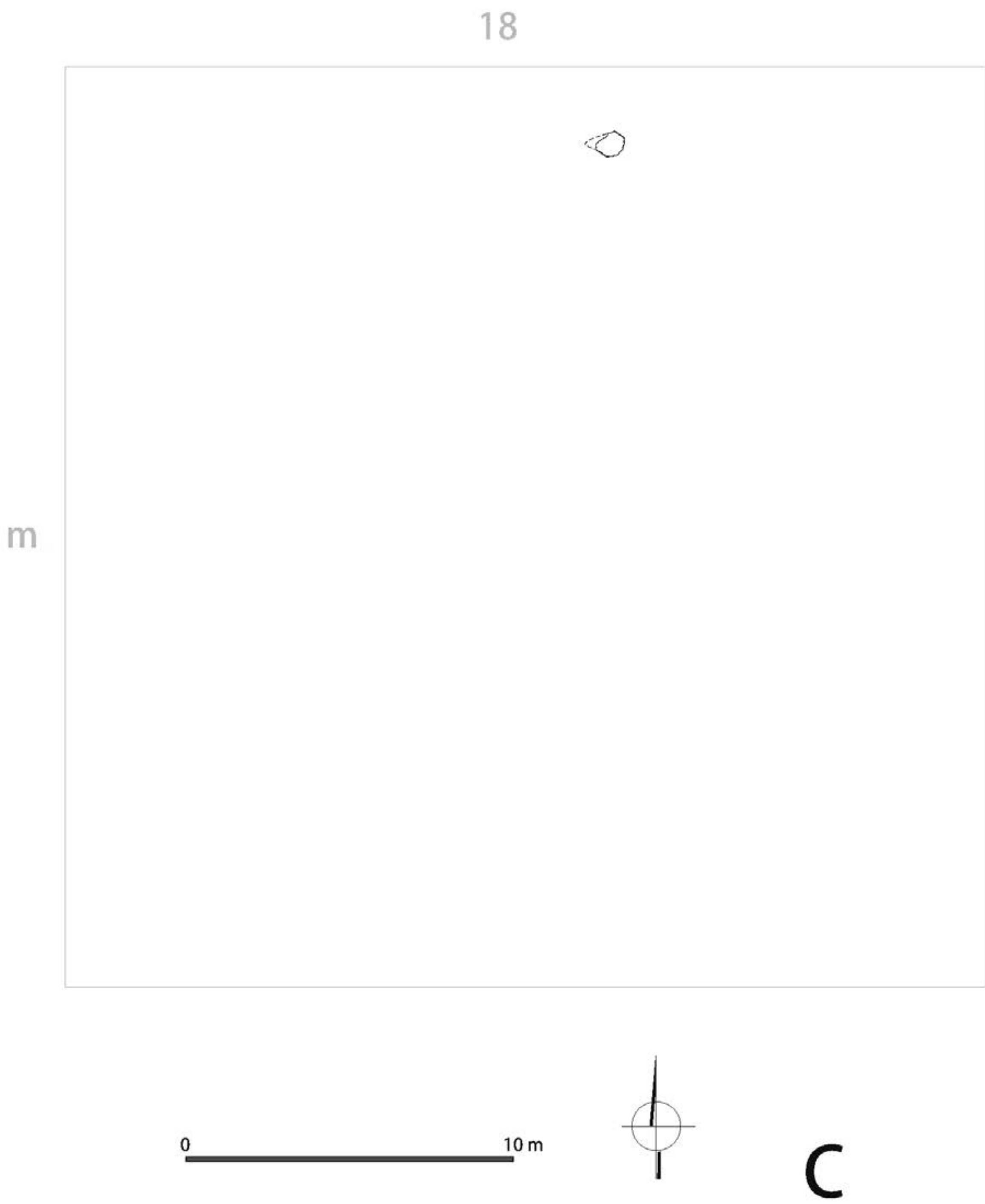
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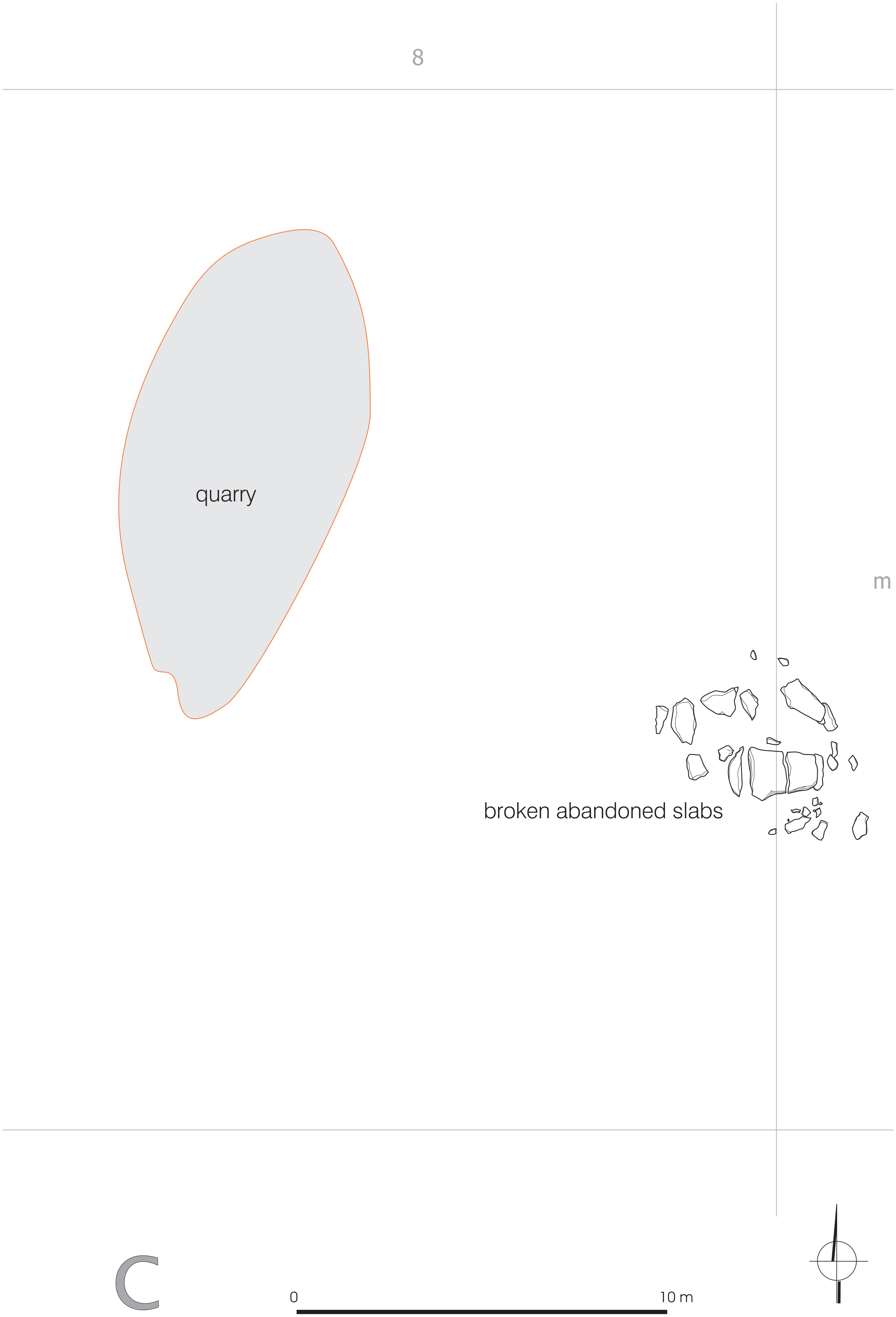
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0
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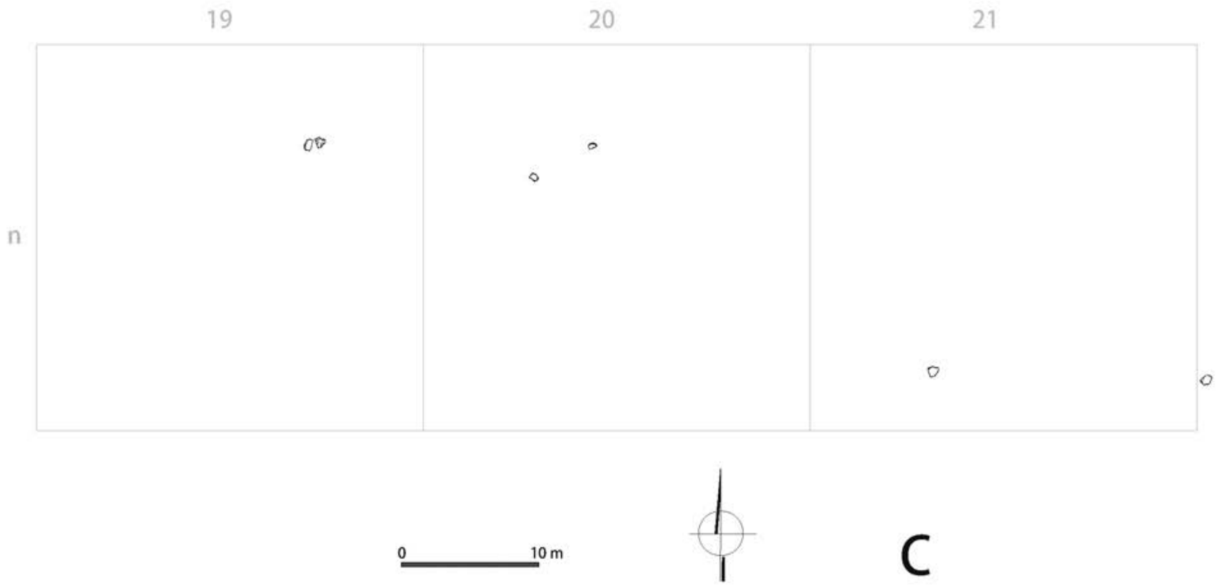
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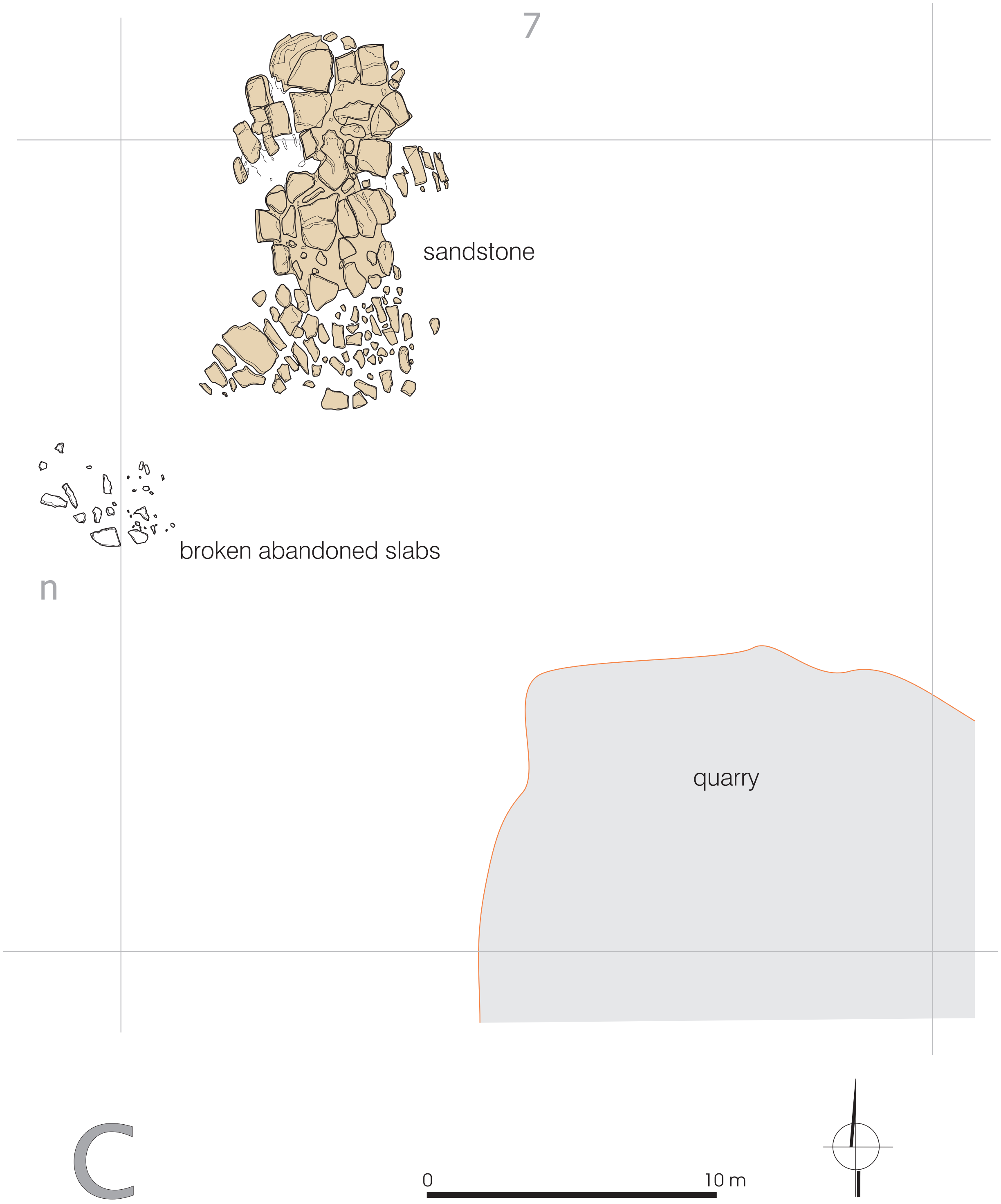
broken abandoned slabs
sandstone
quarry
E-04-4
C
0
10 m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broken abandoned slabs
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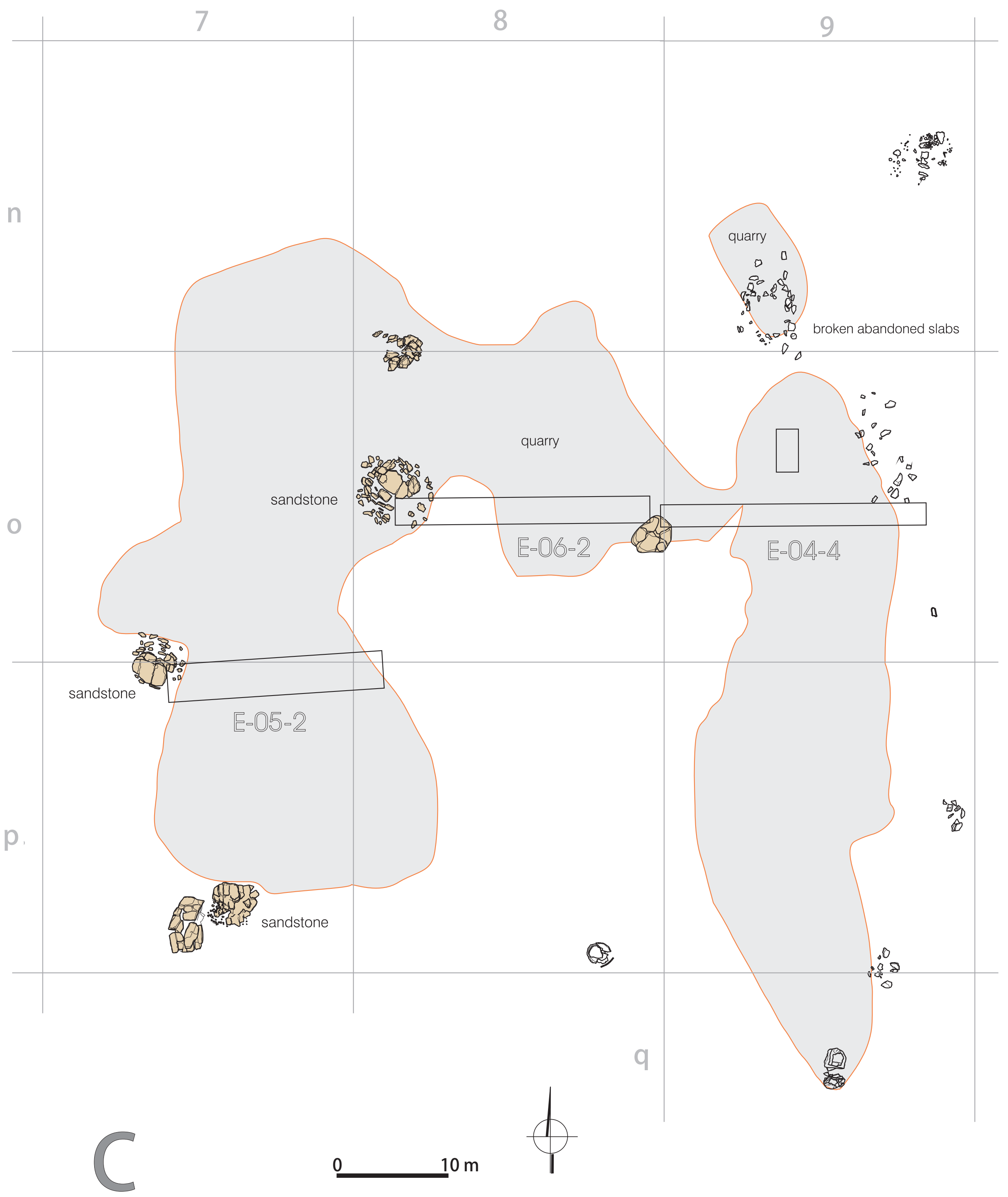
quarry
C
0
10 m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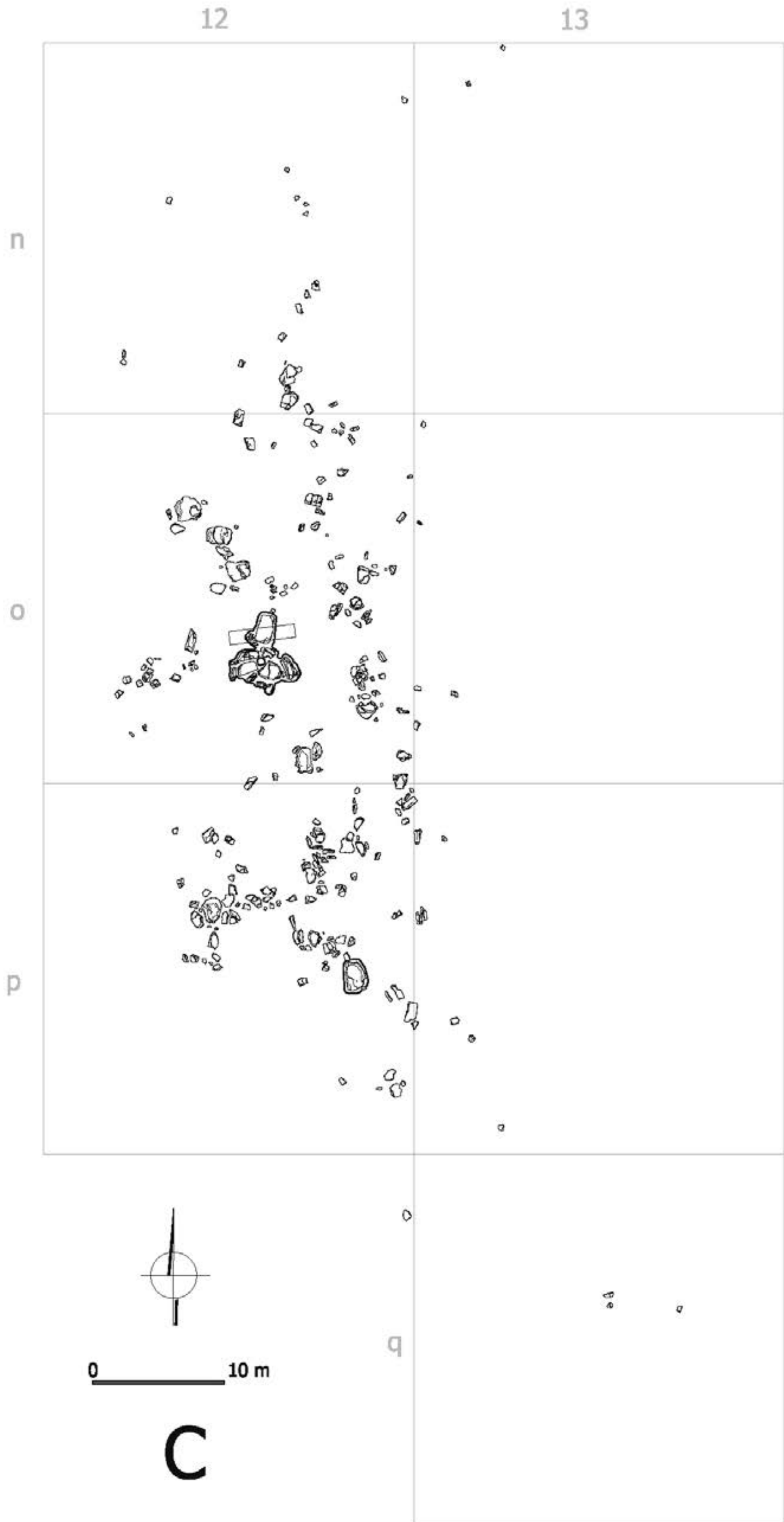
E-05-2
sandstone
C
0
10 m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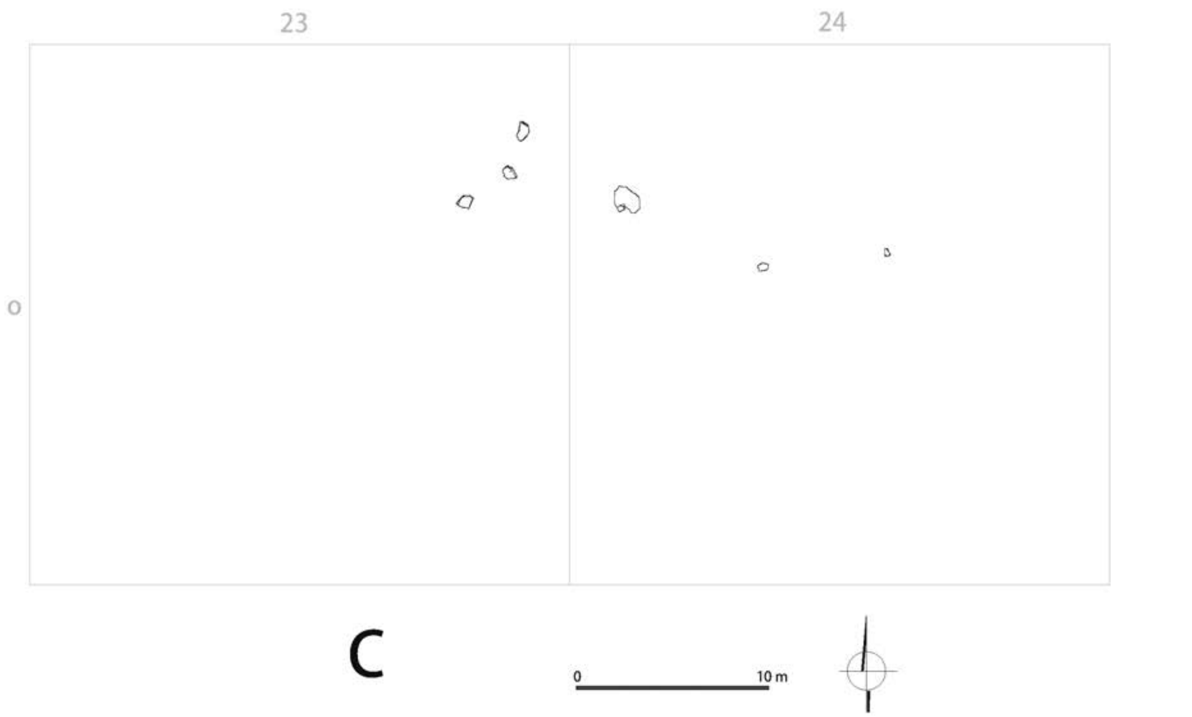
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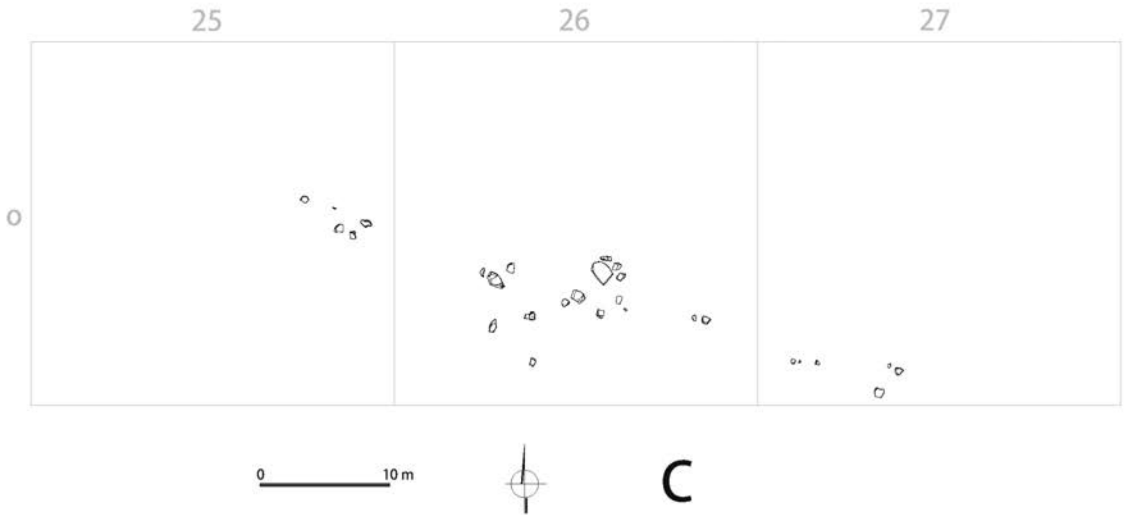
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10 m
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6
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sandstone
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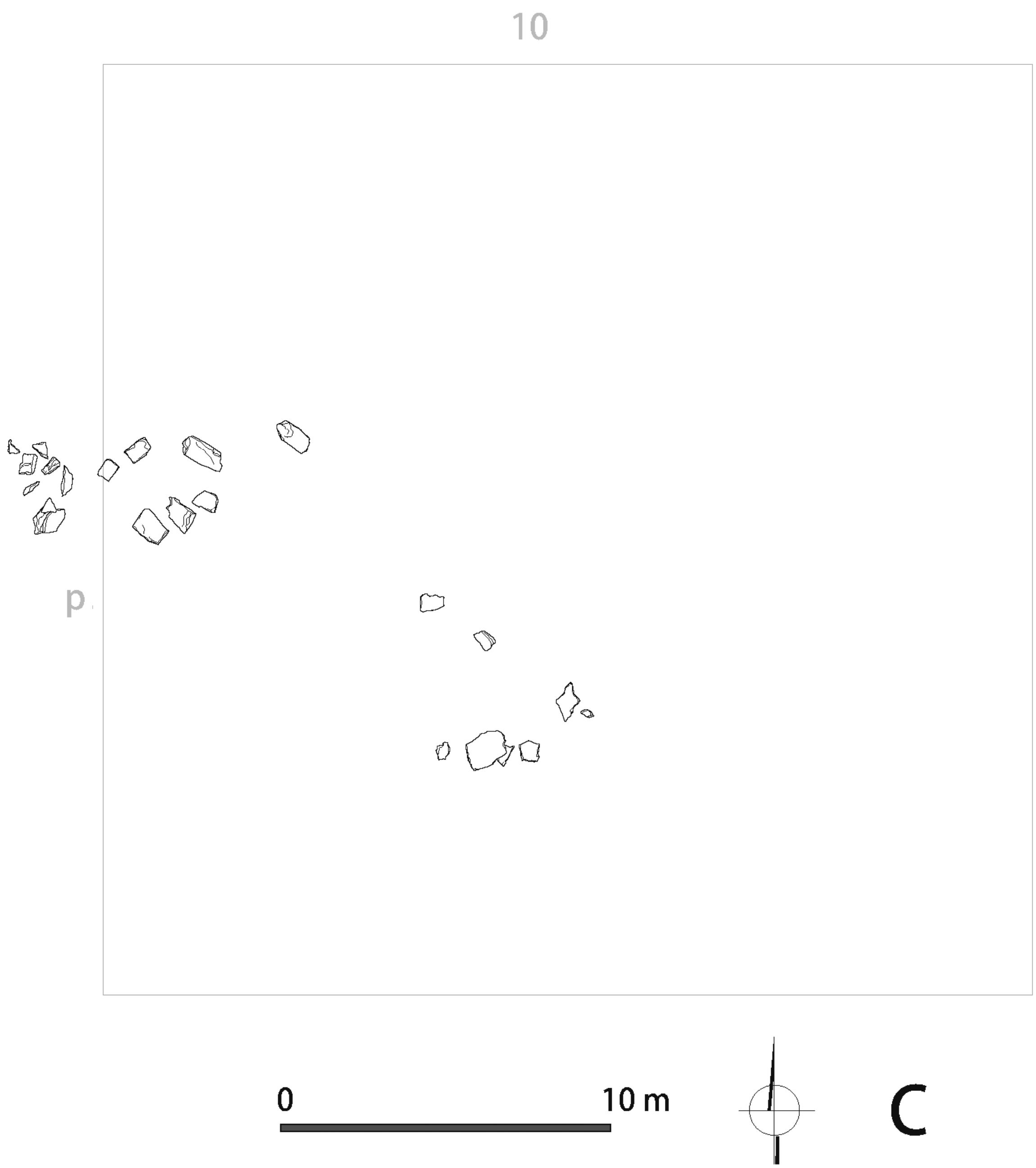
sandstone
C
0
10 m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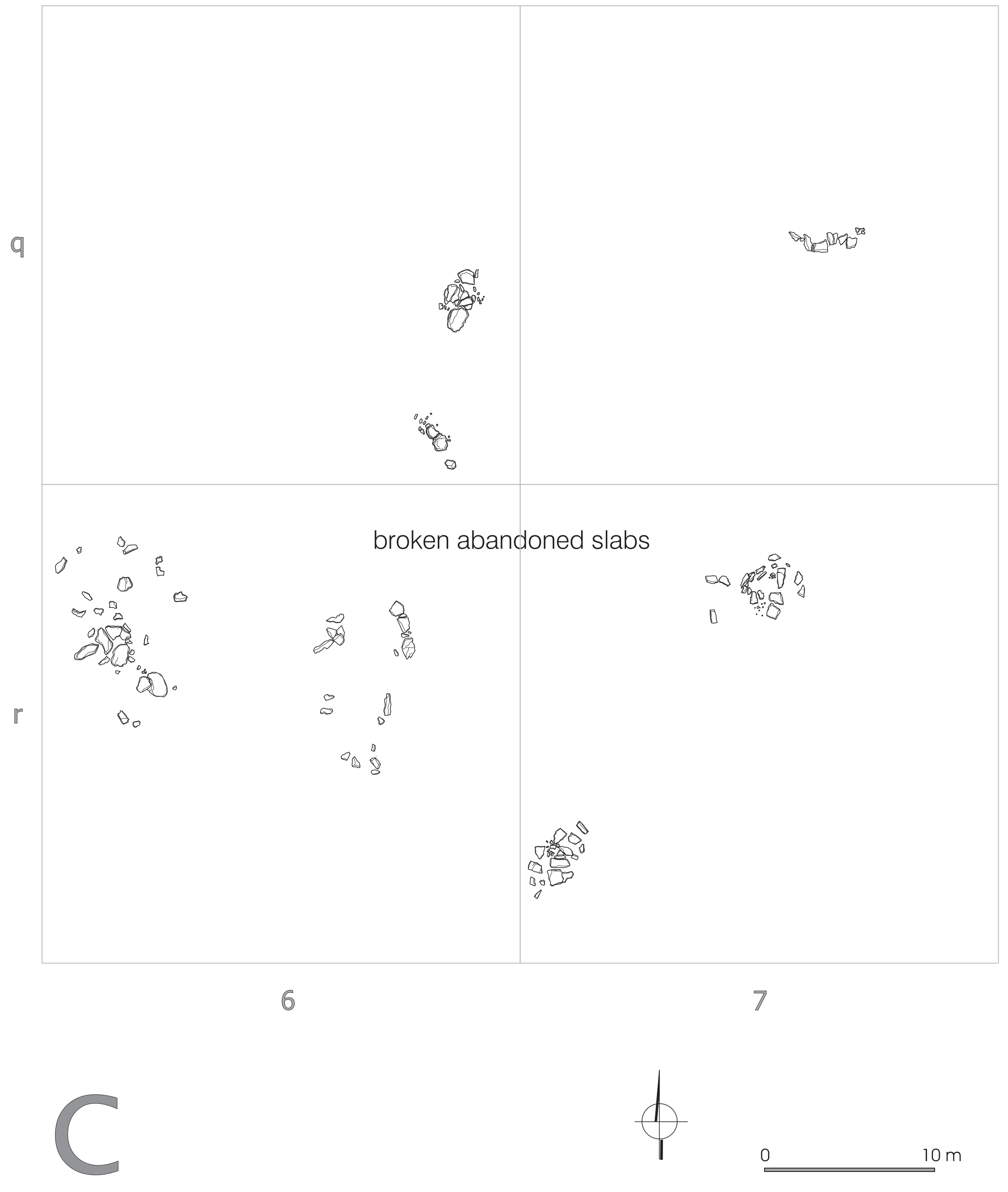
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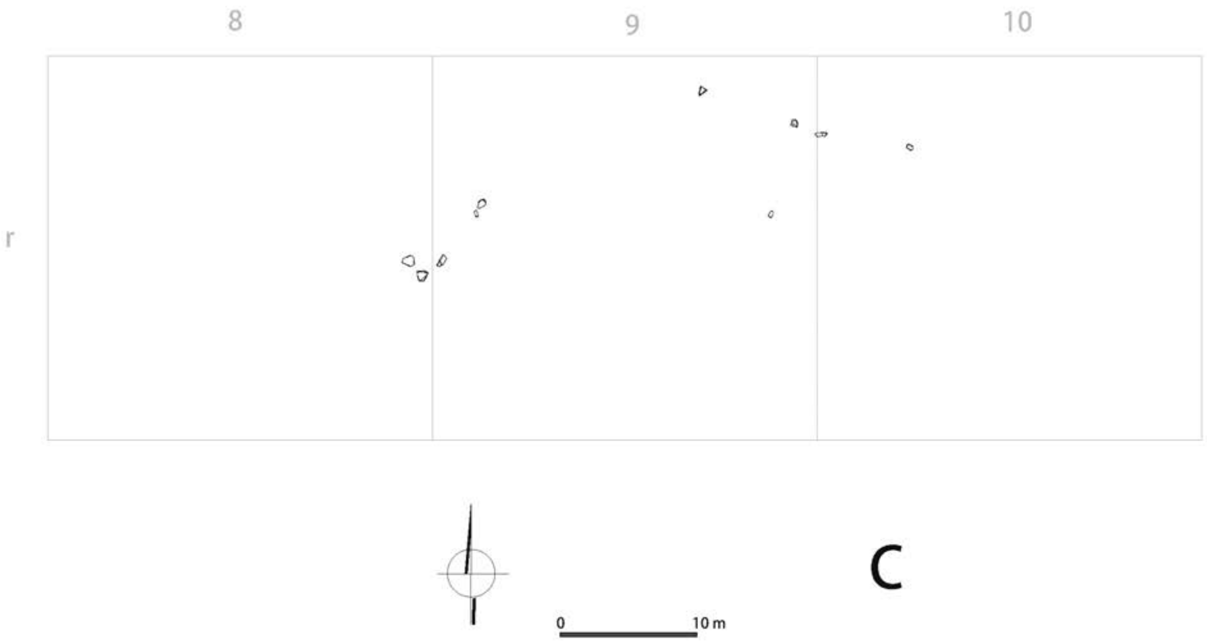
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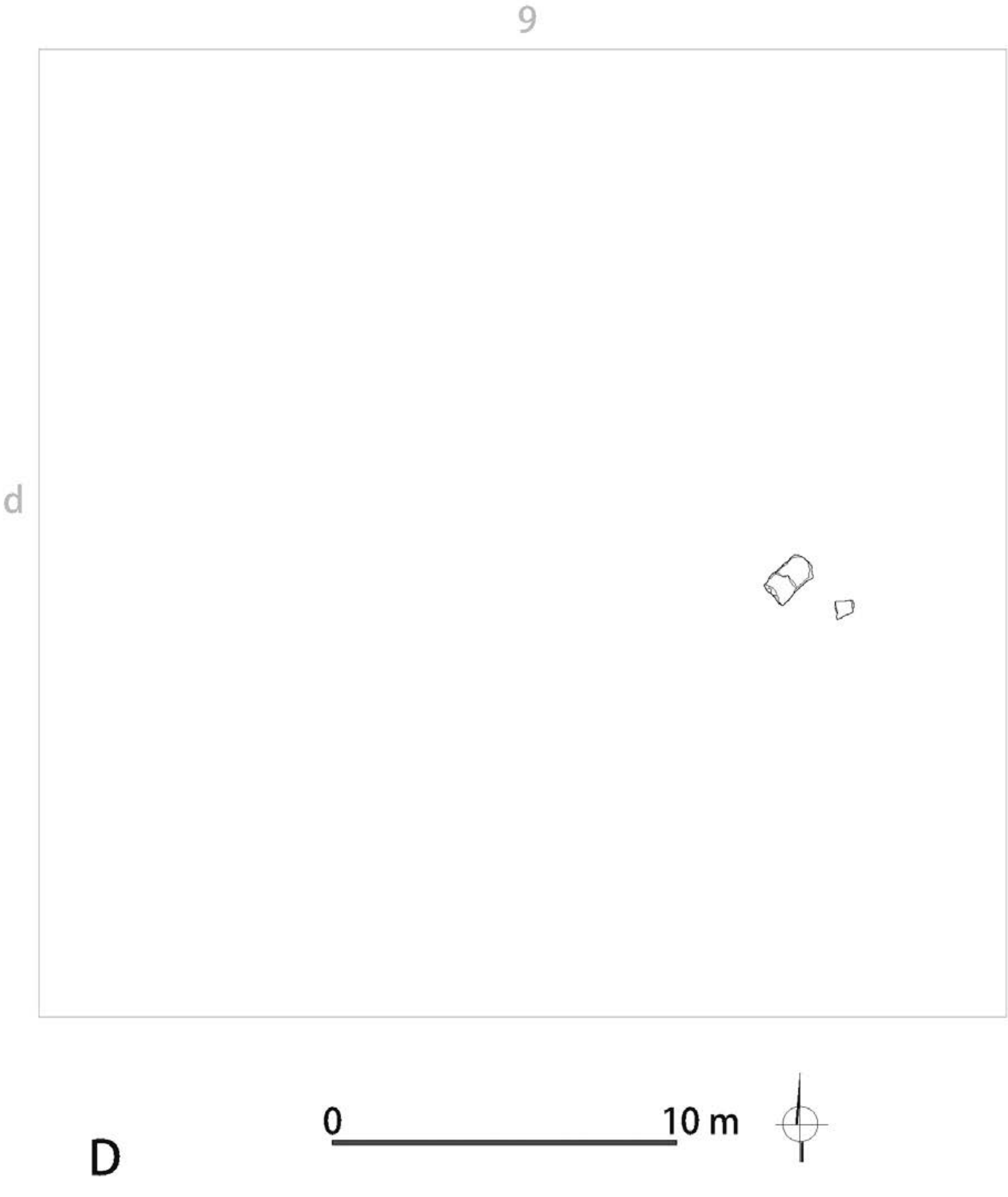
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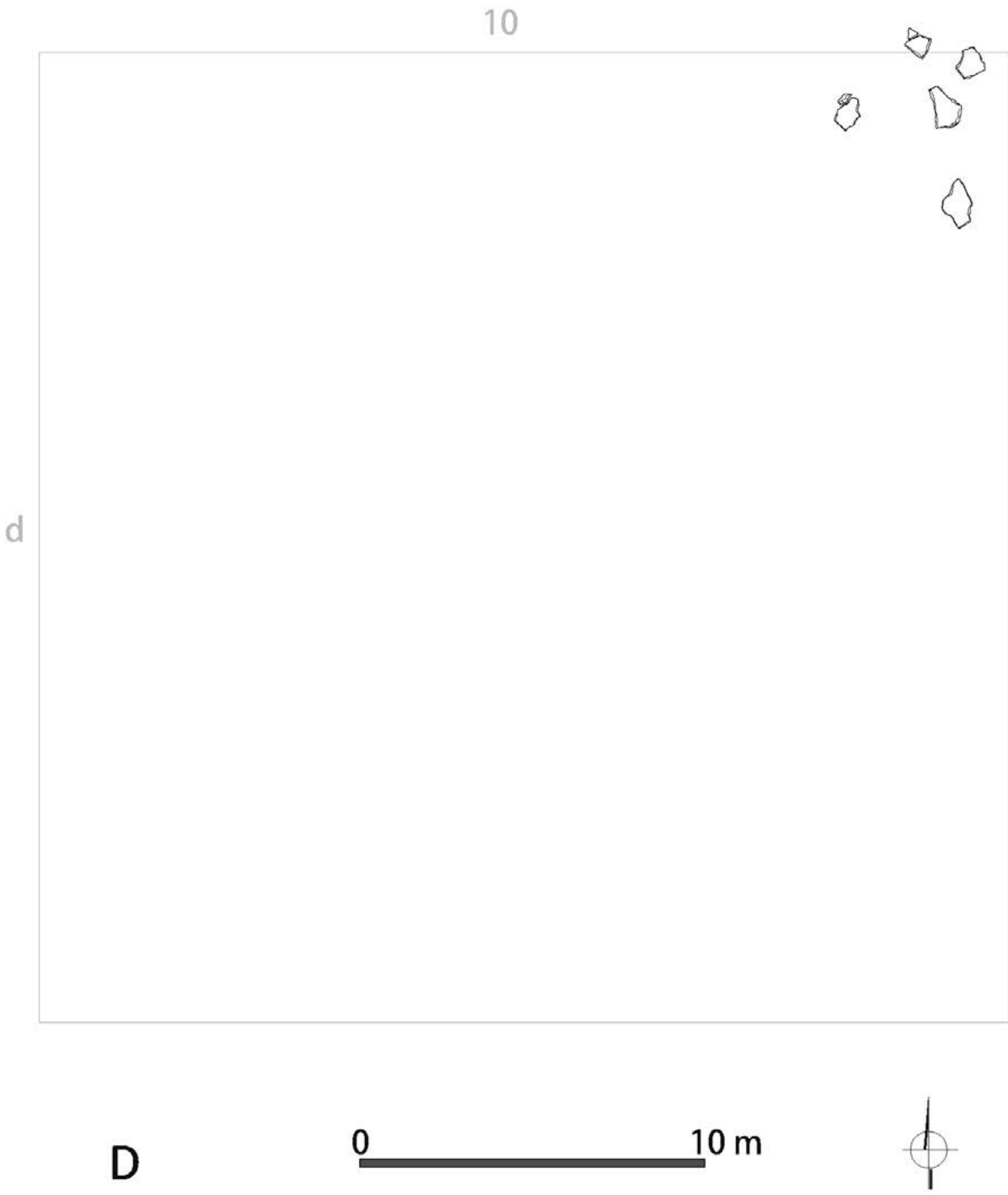
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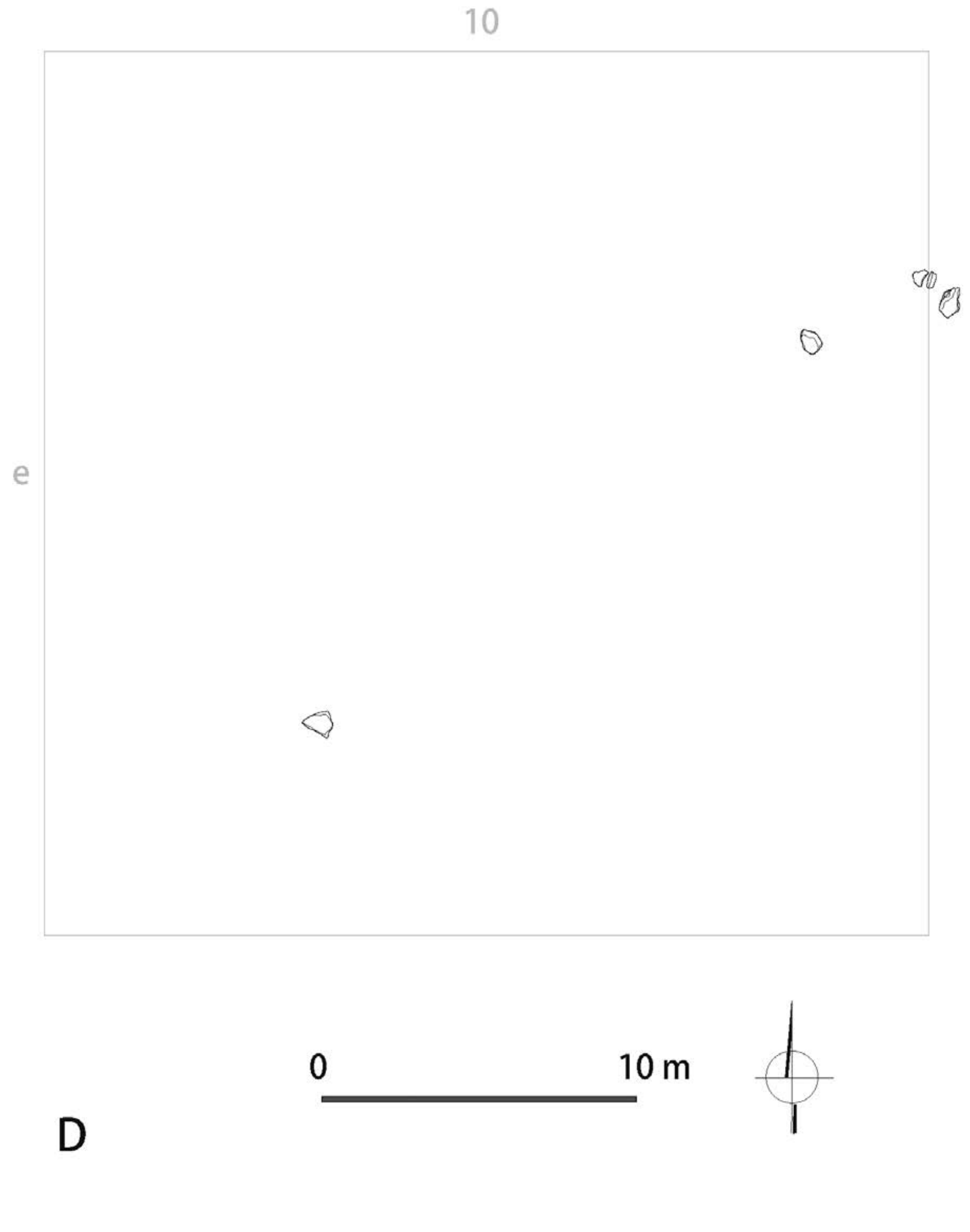
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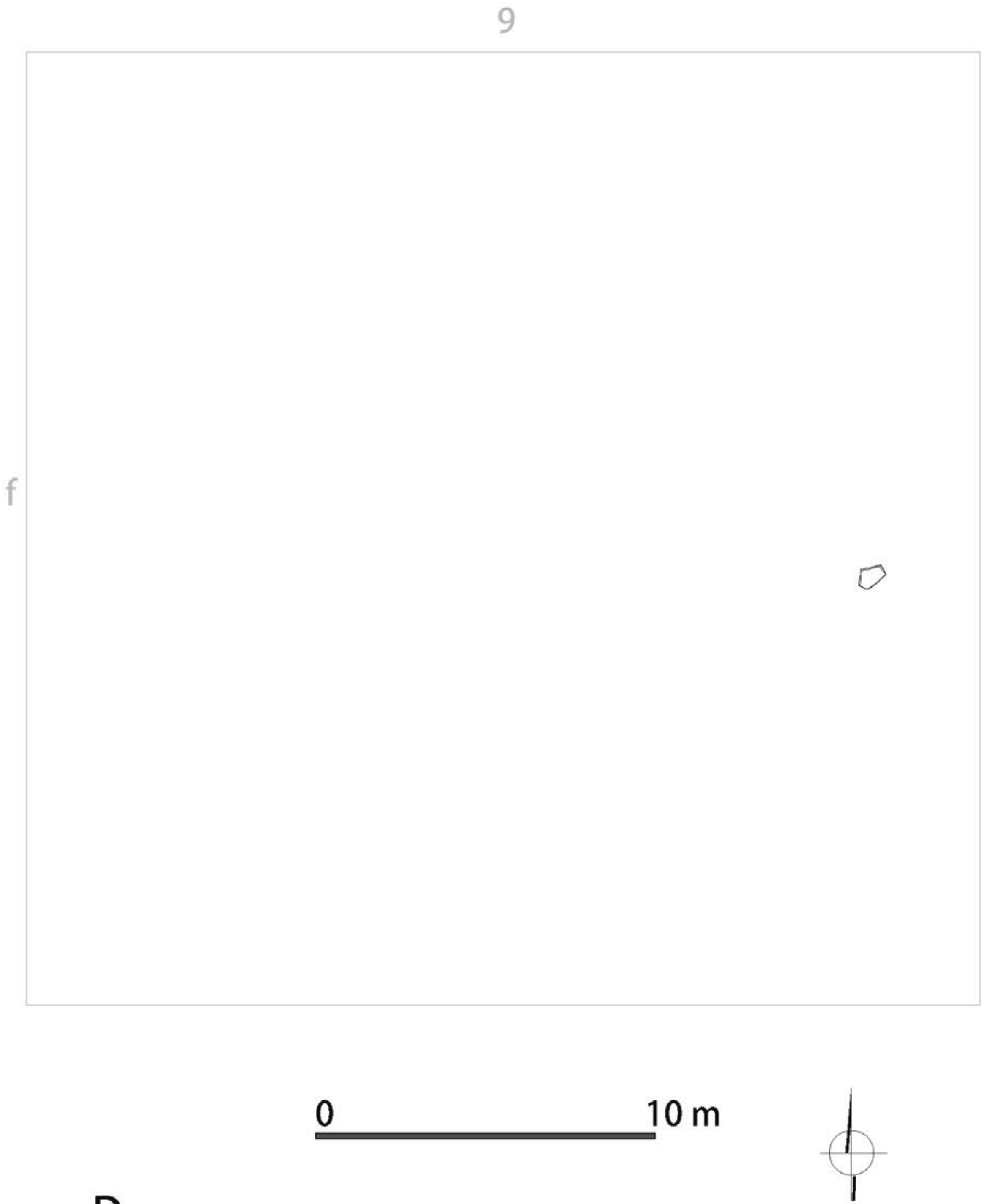

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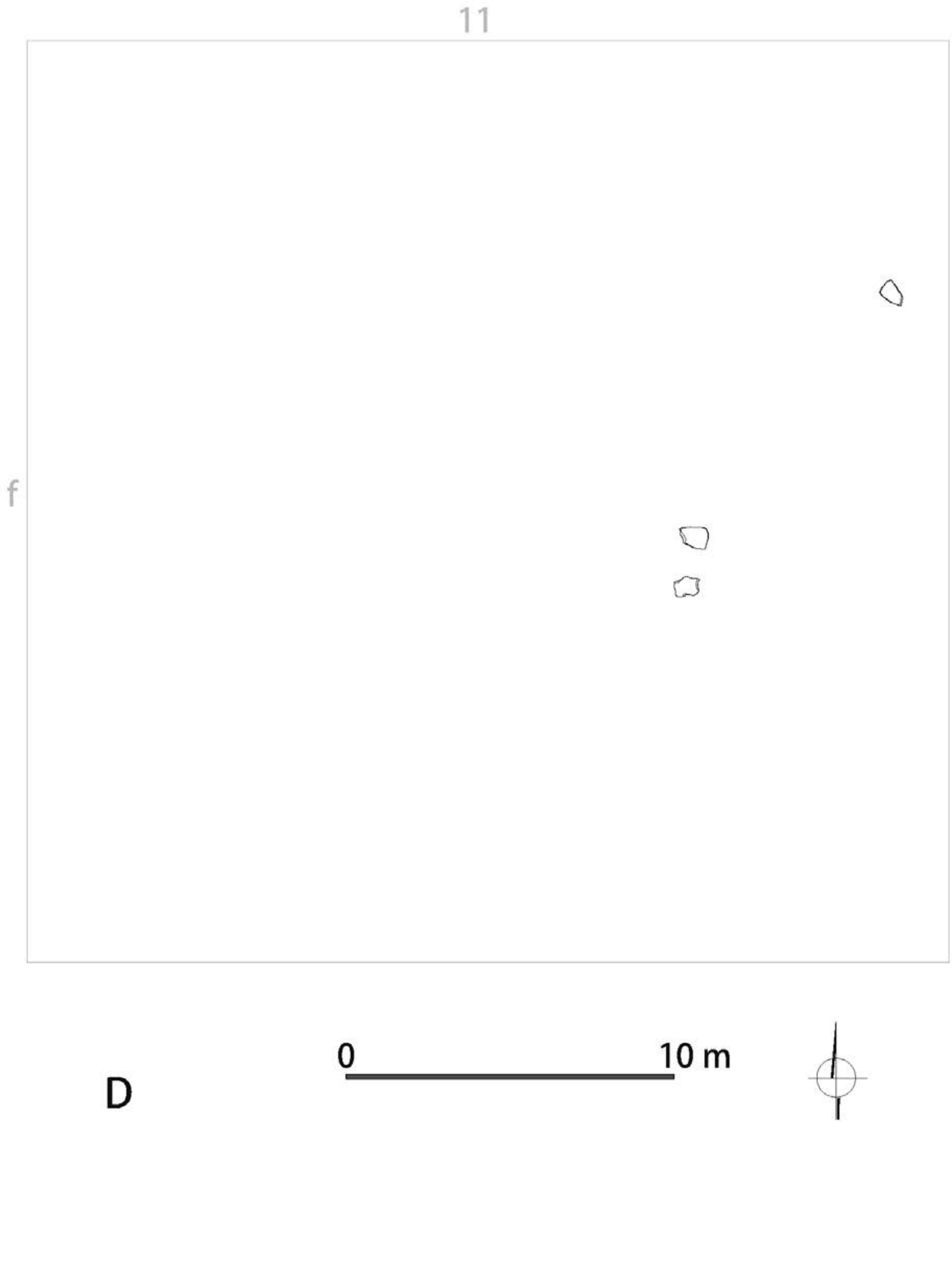
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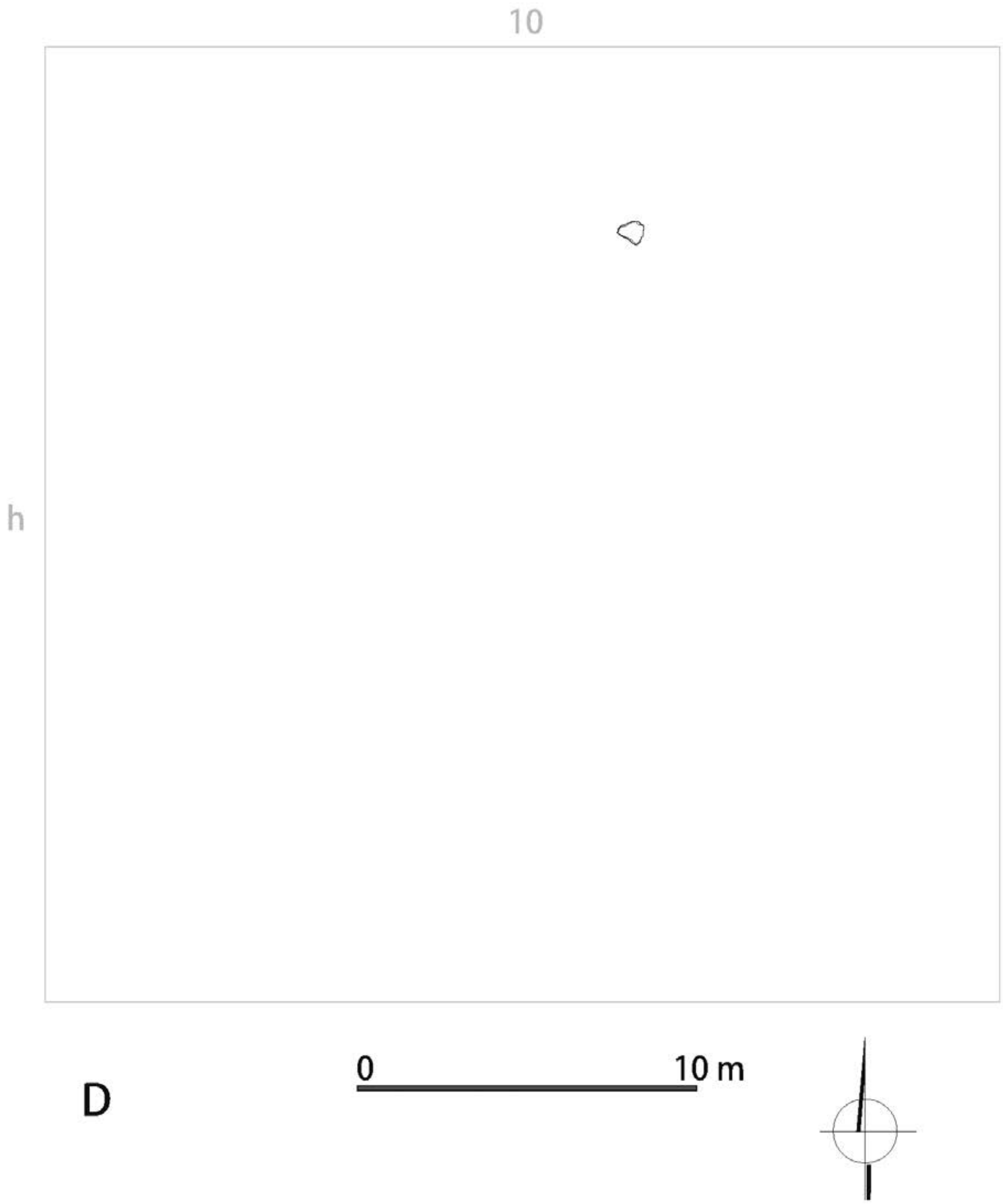
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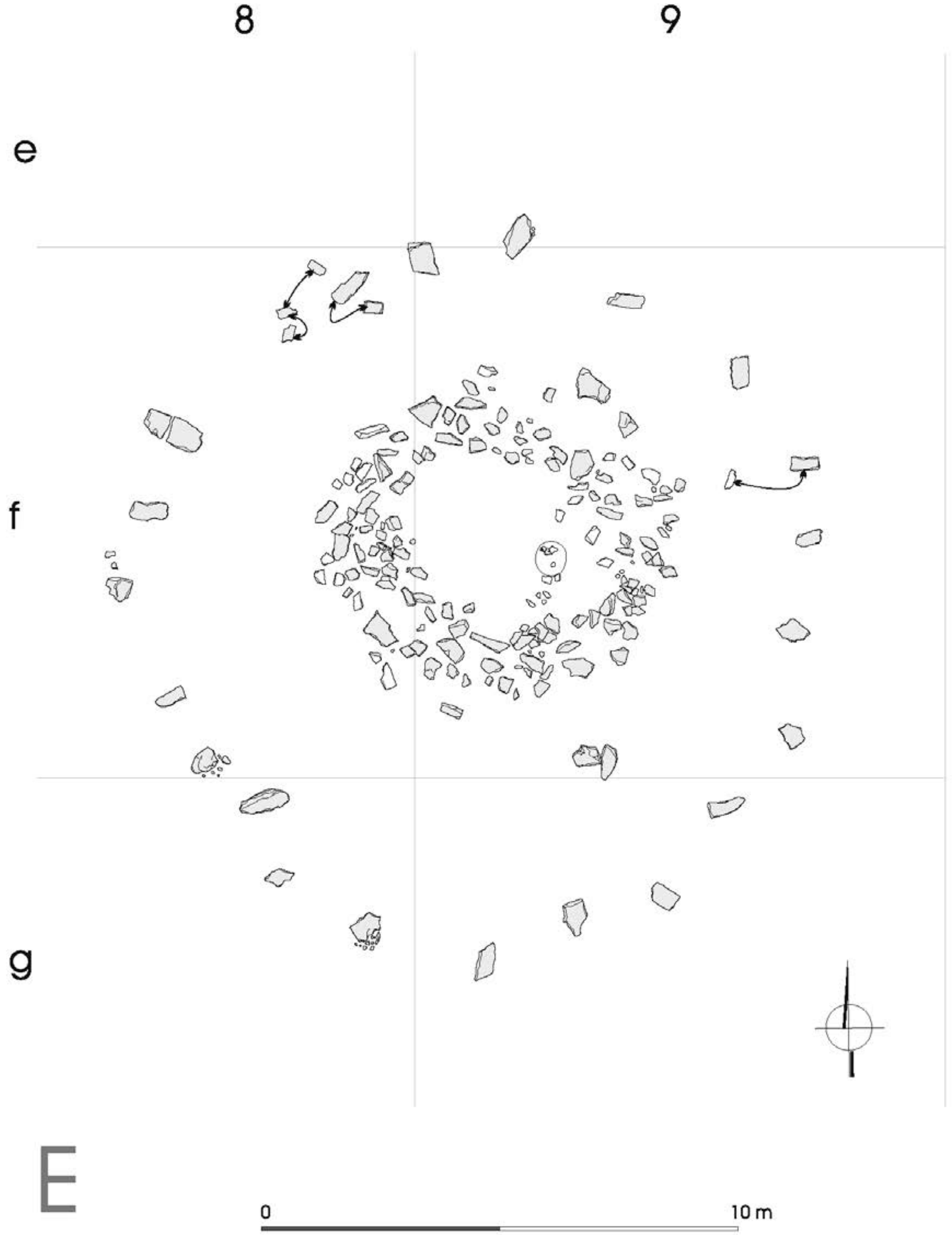
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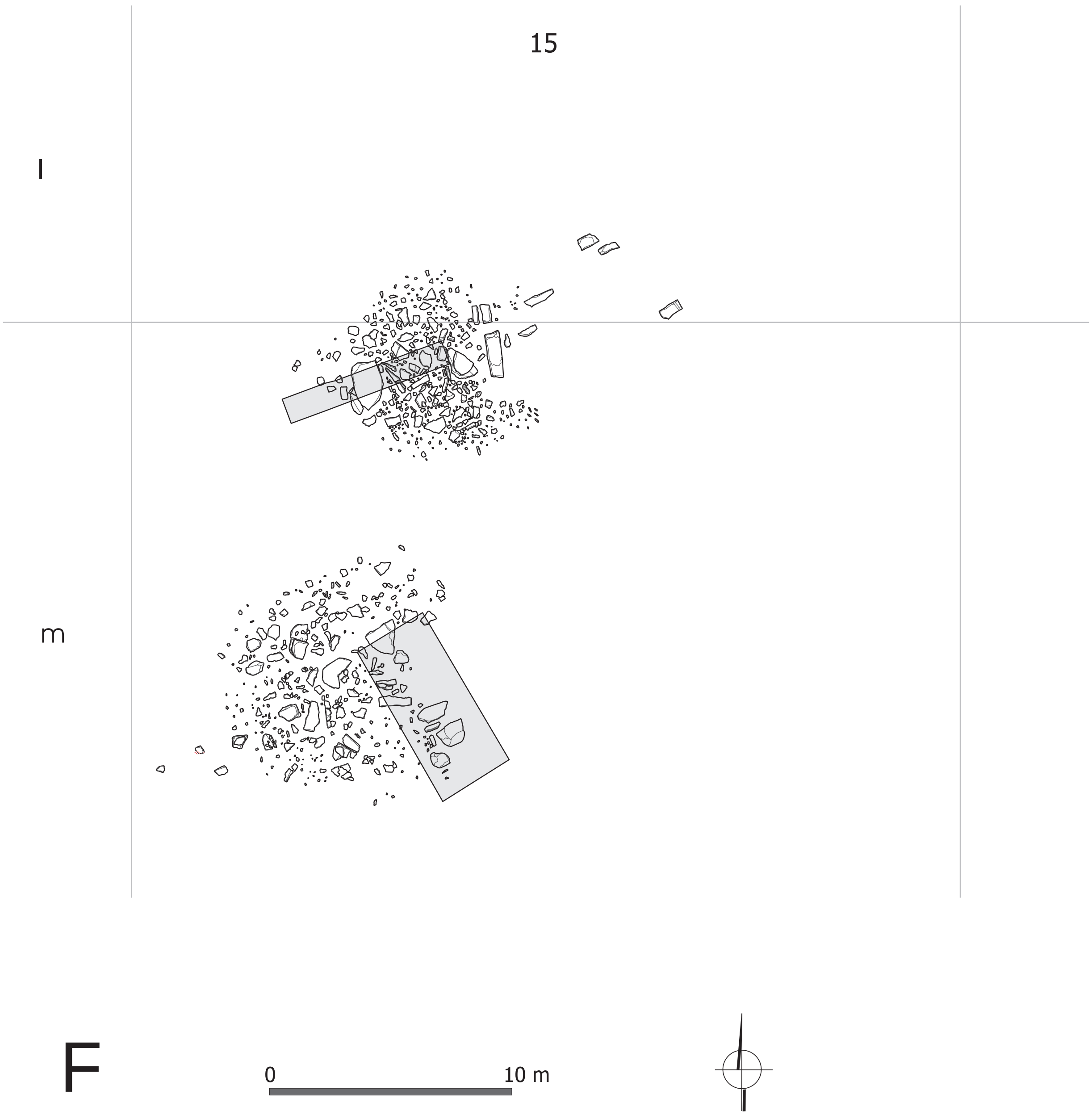
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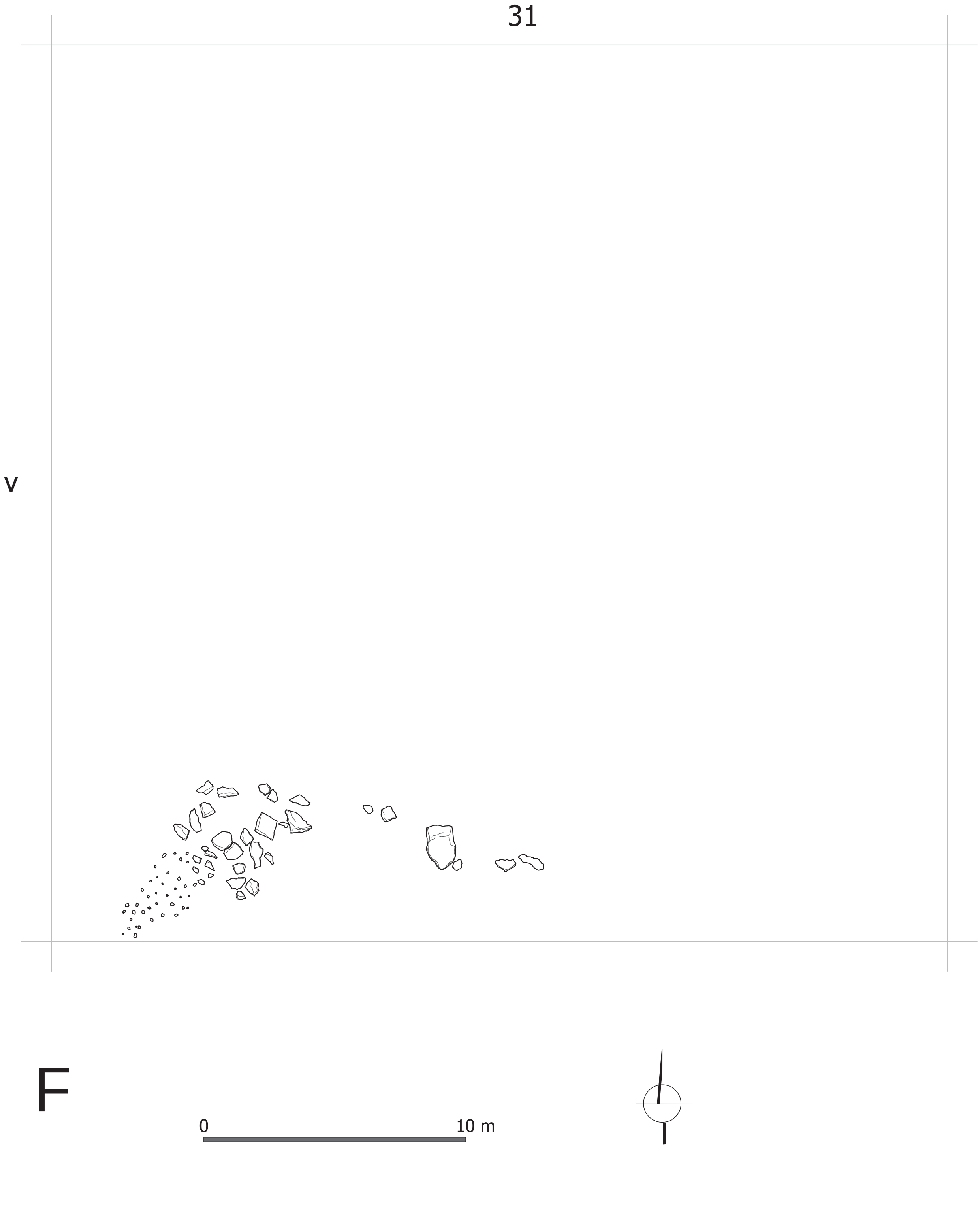
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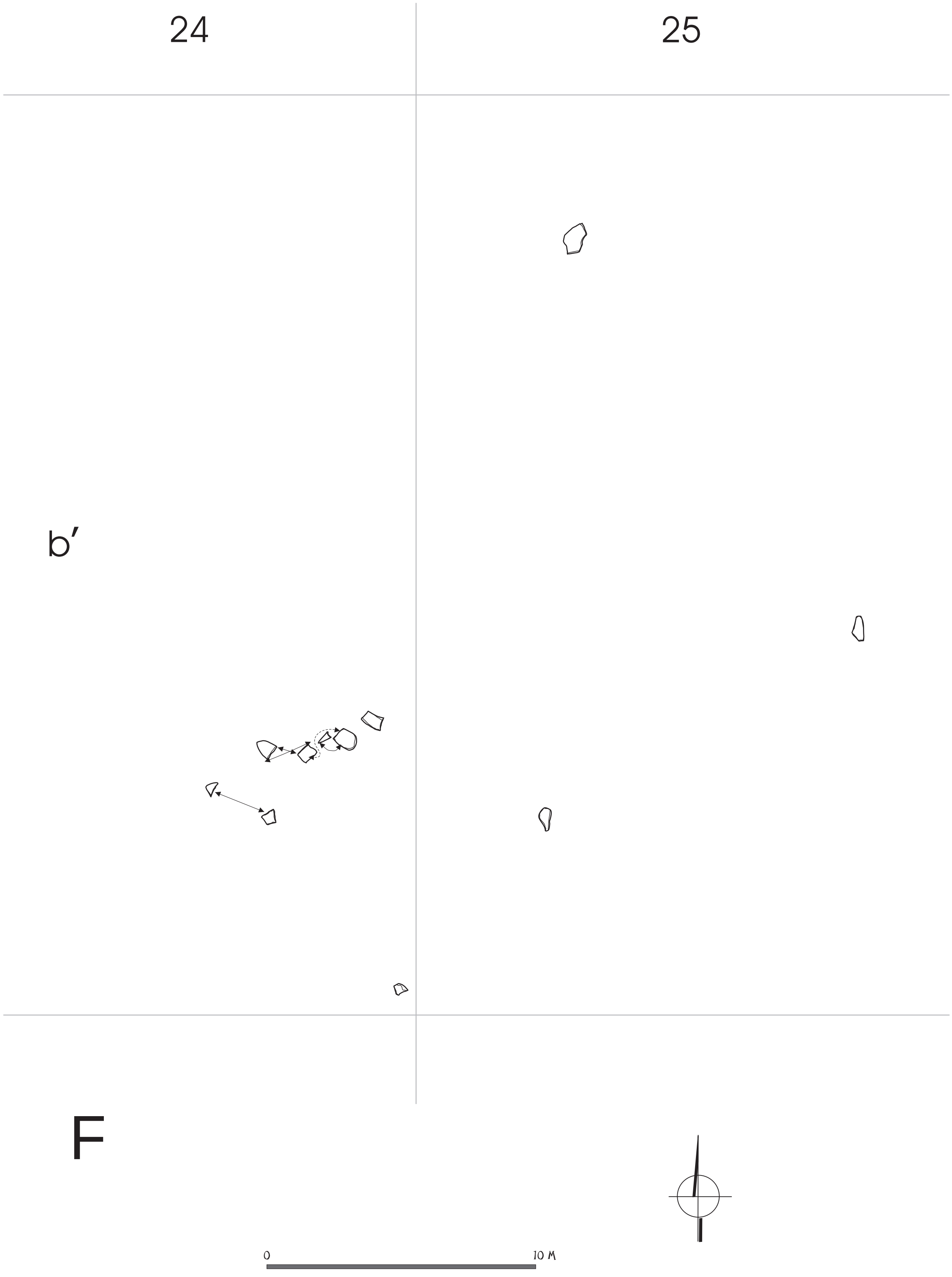
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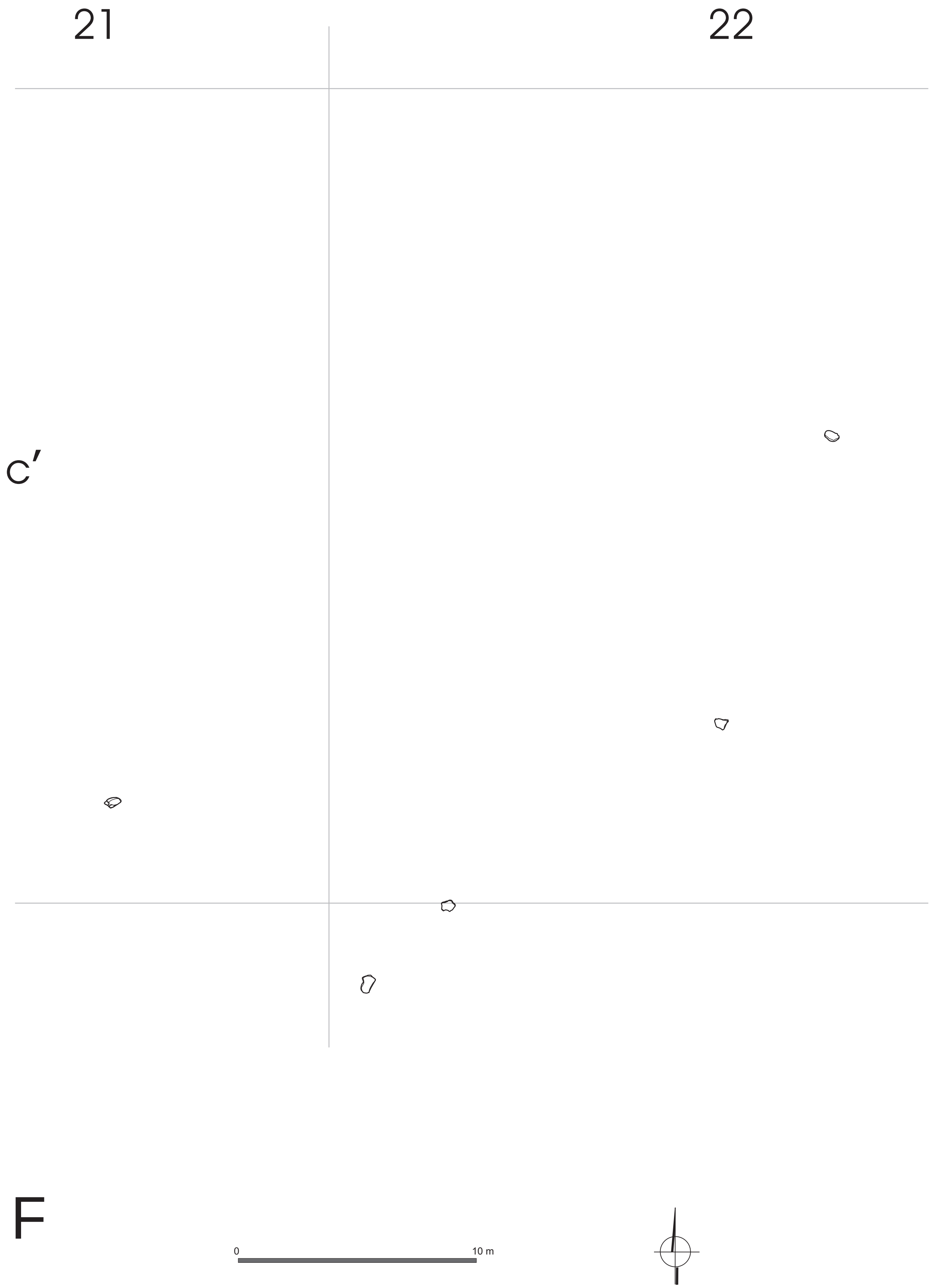
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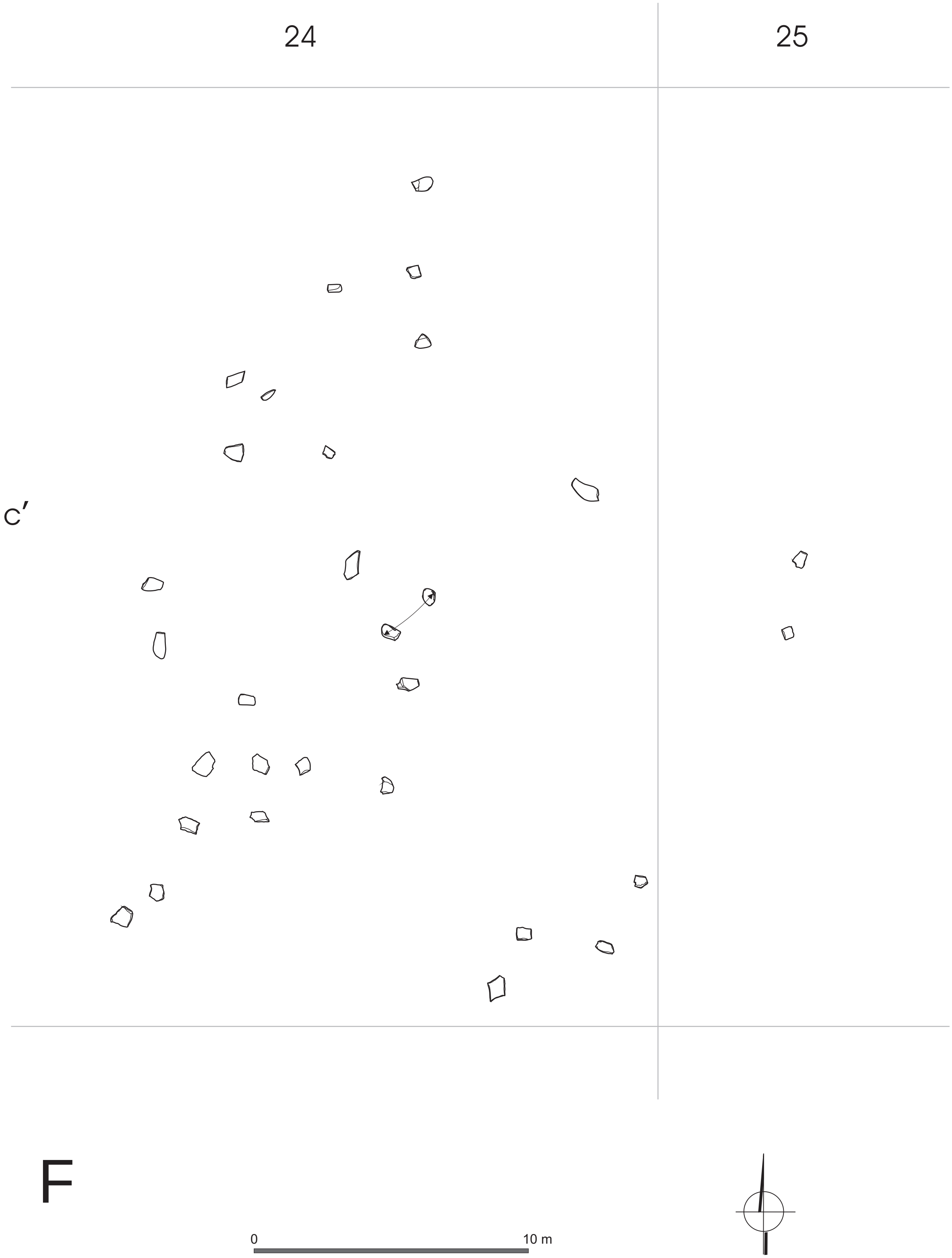
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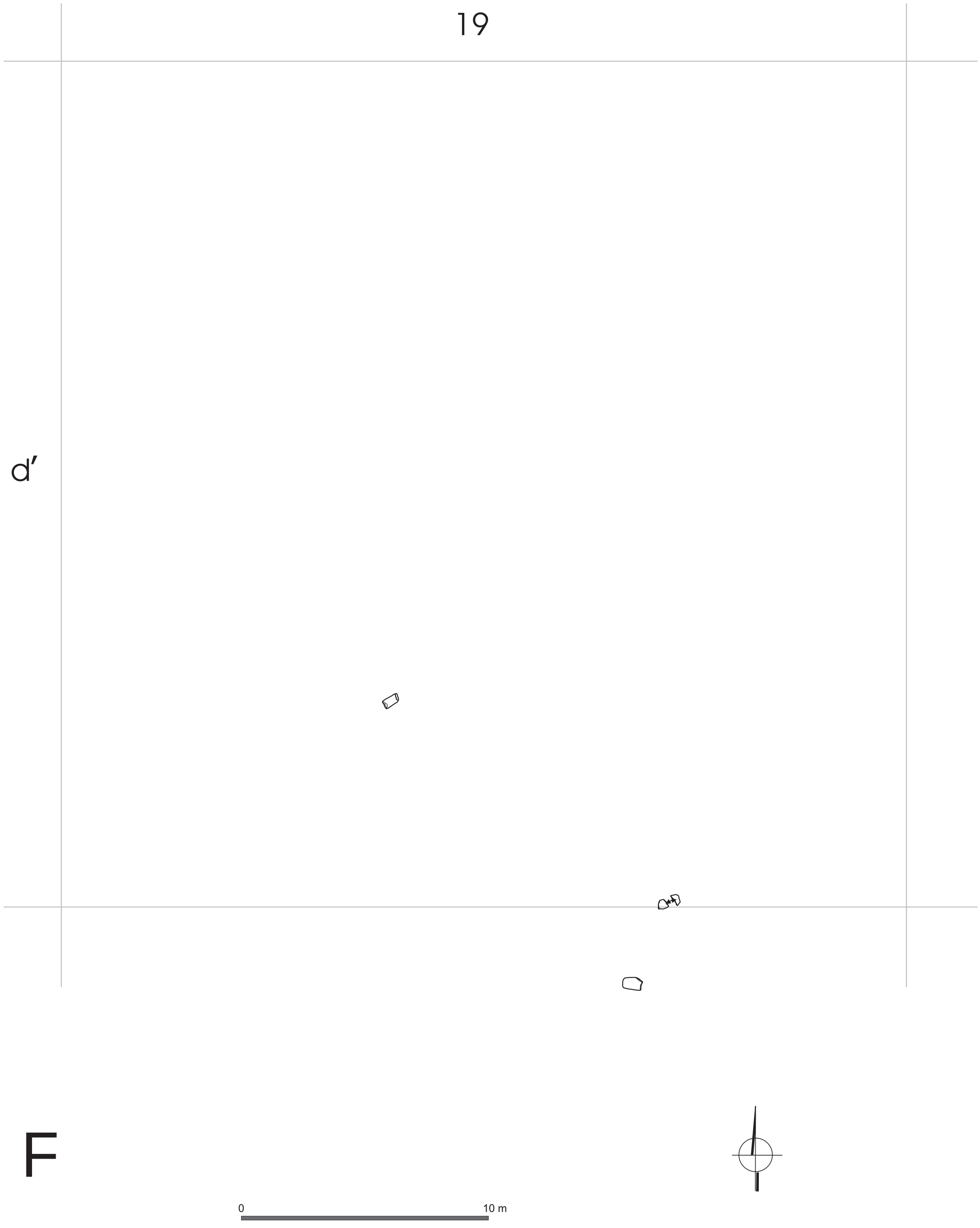
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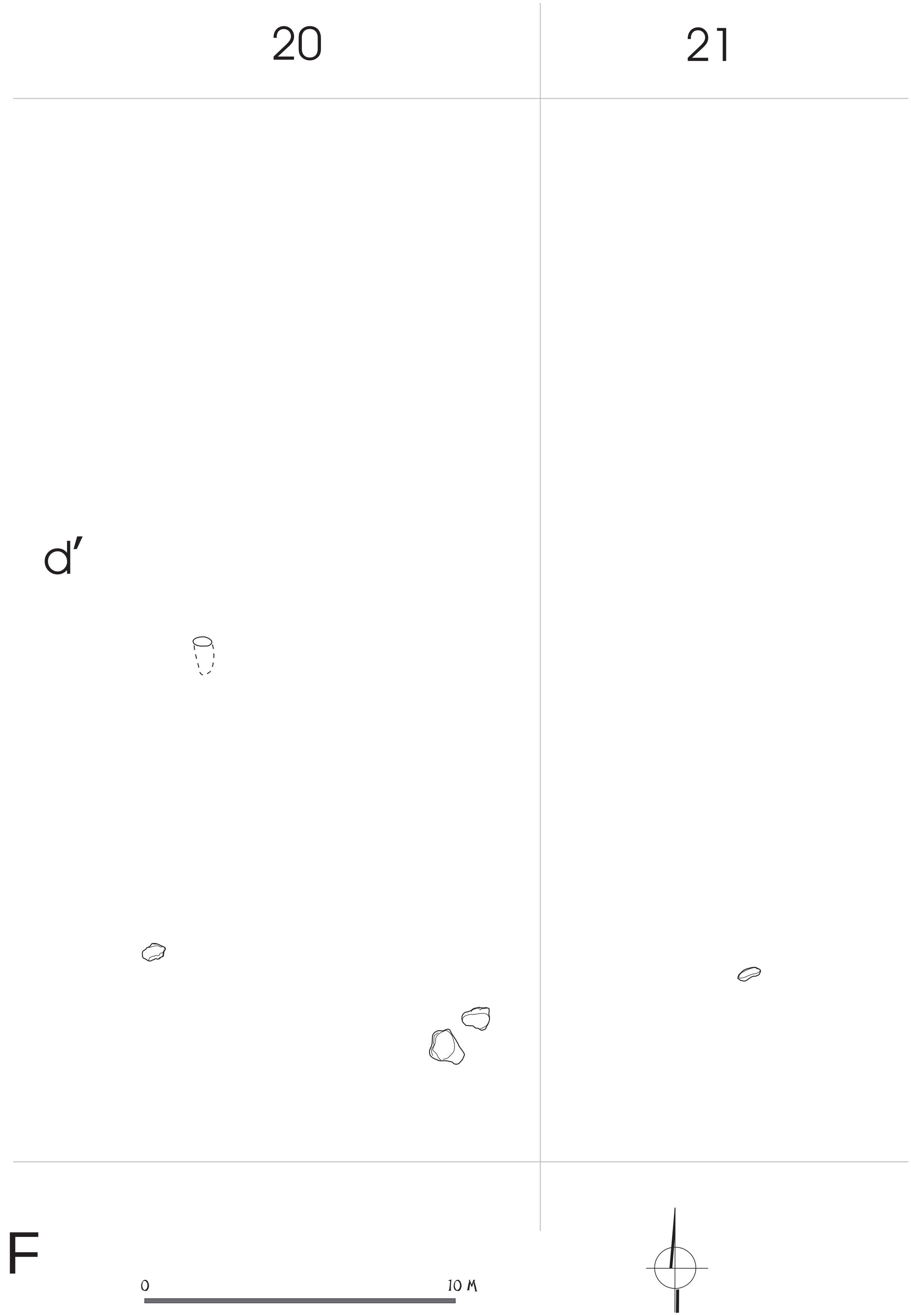
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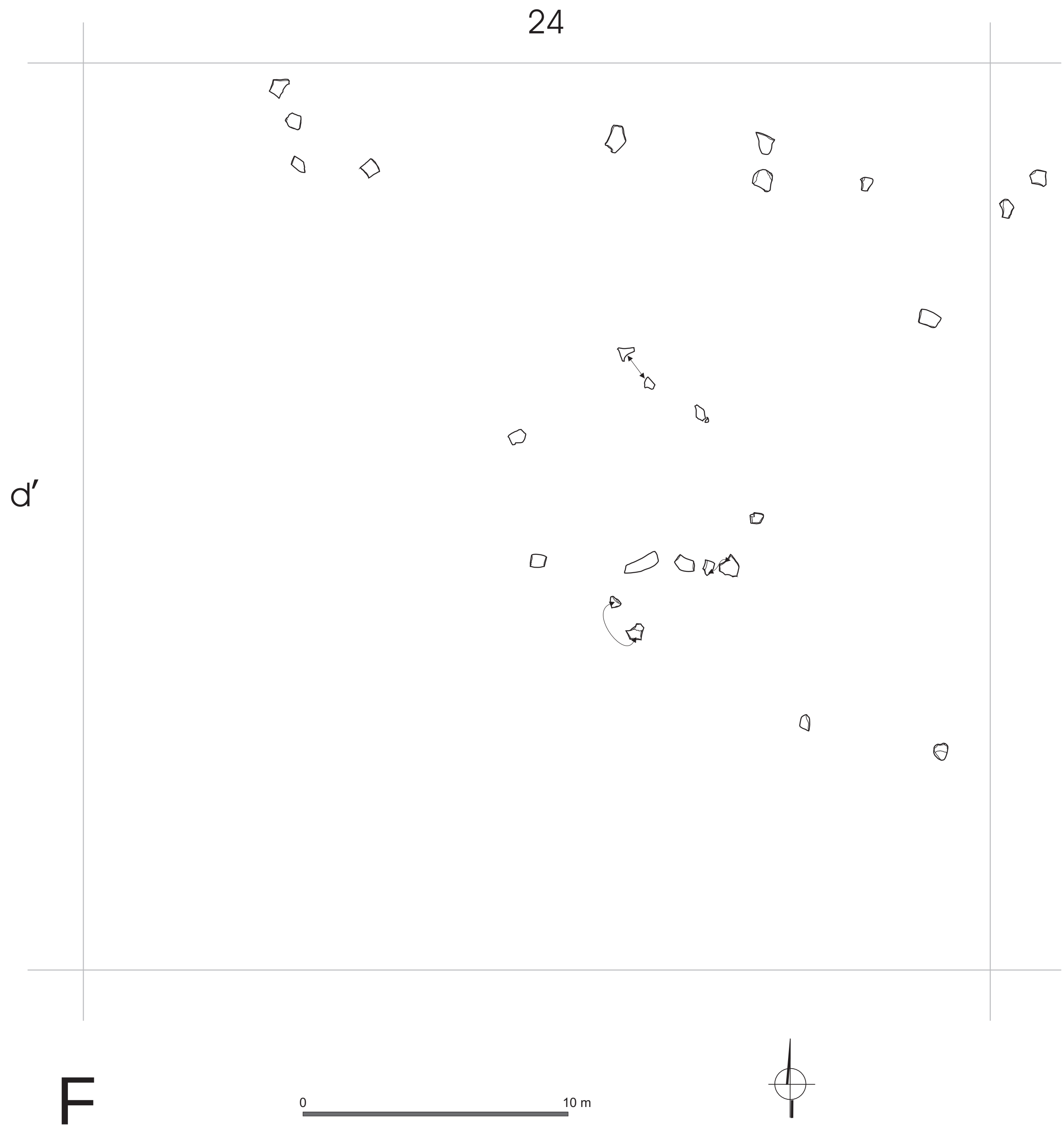
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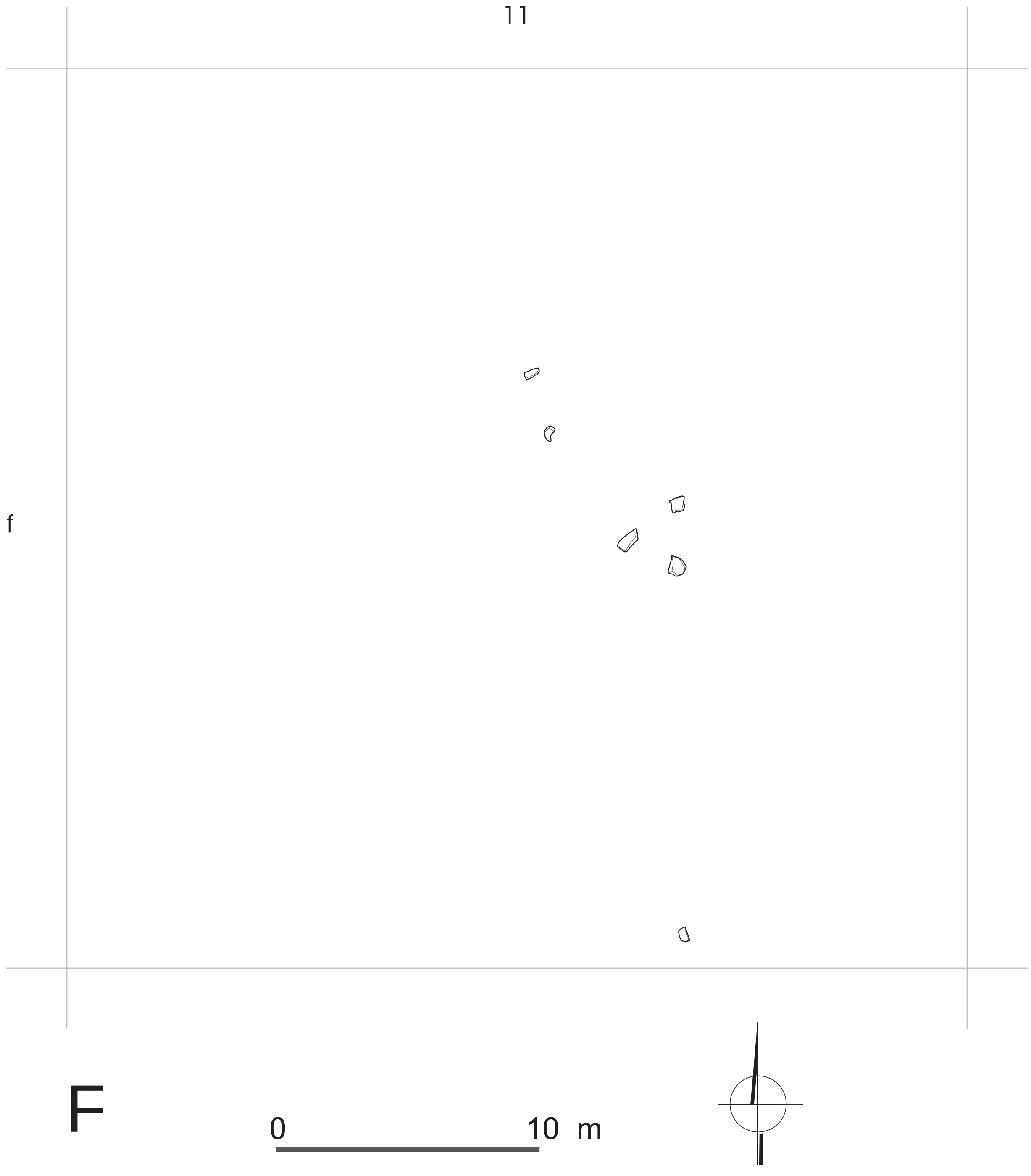
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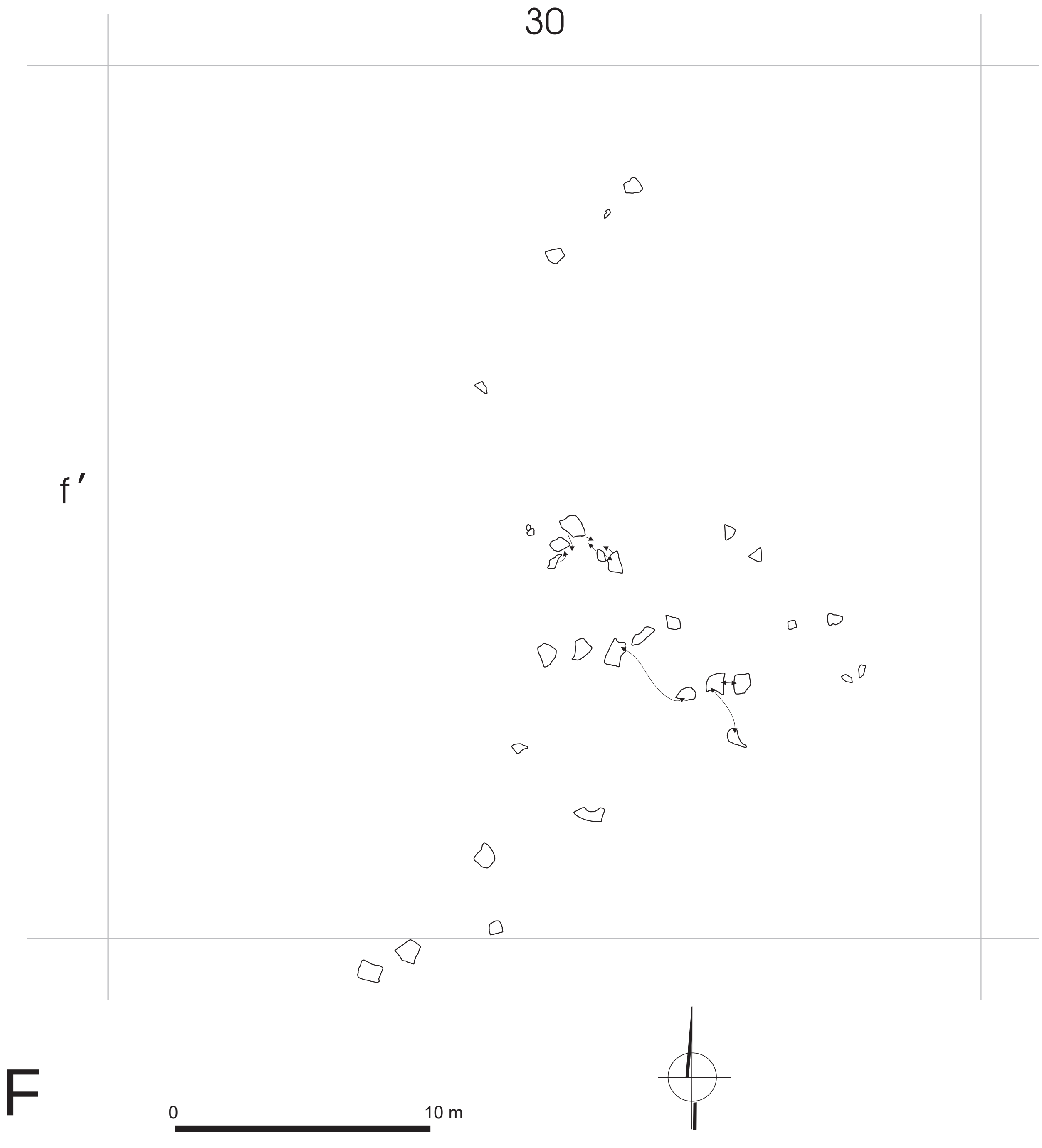
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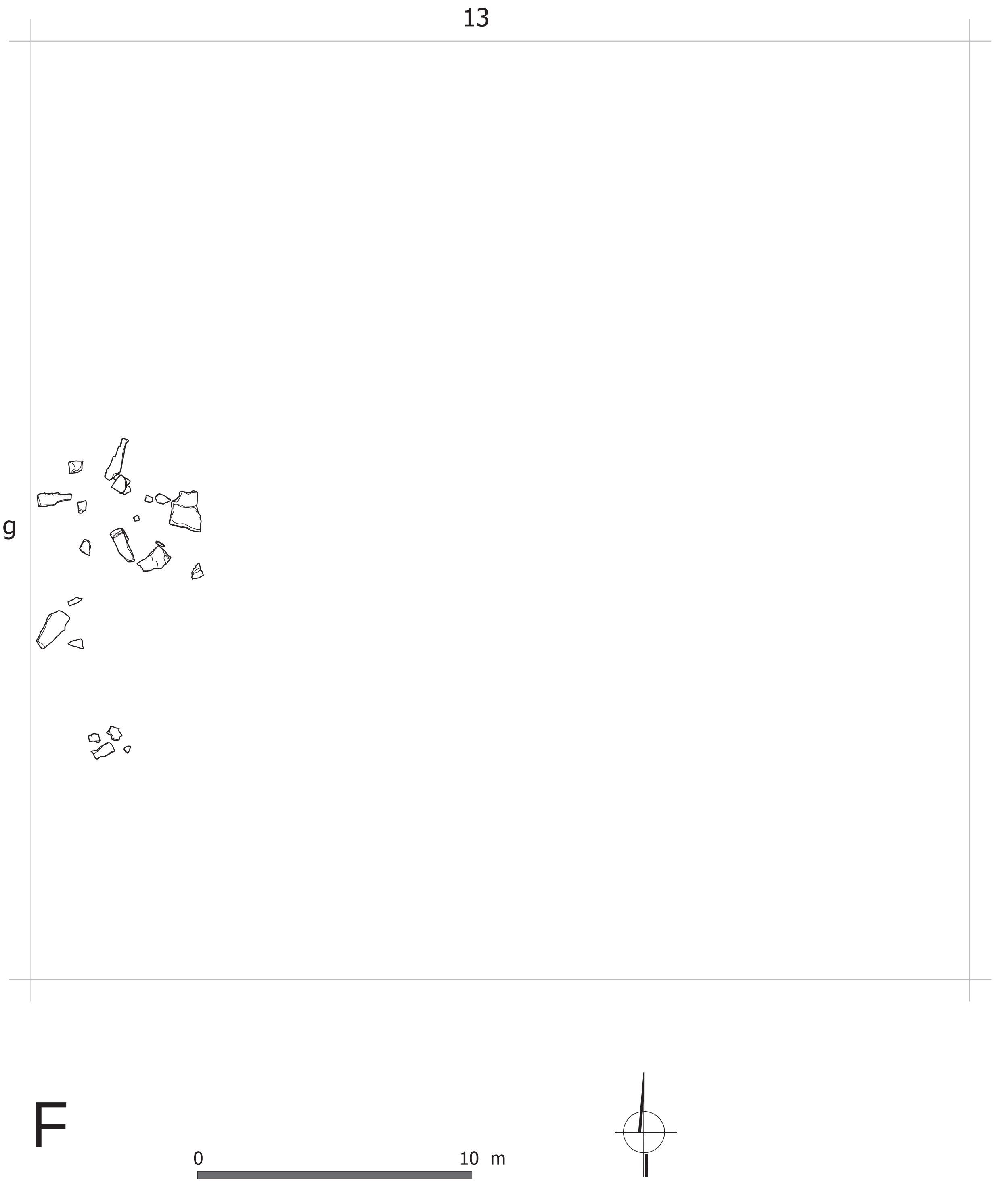
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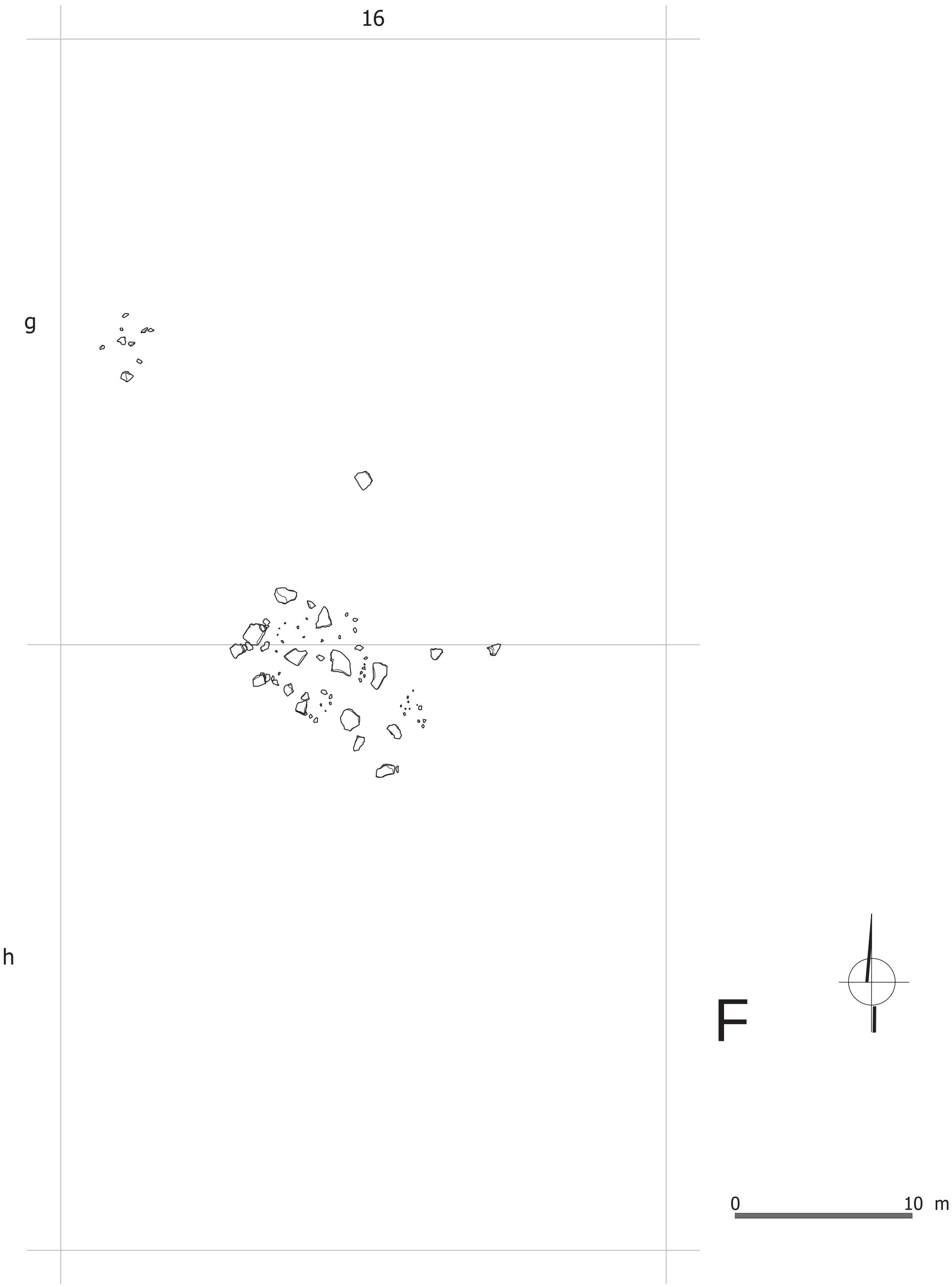
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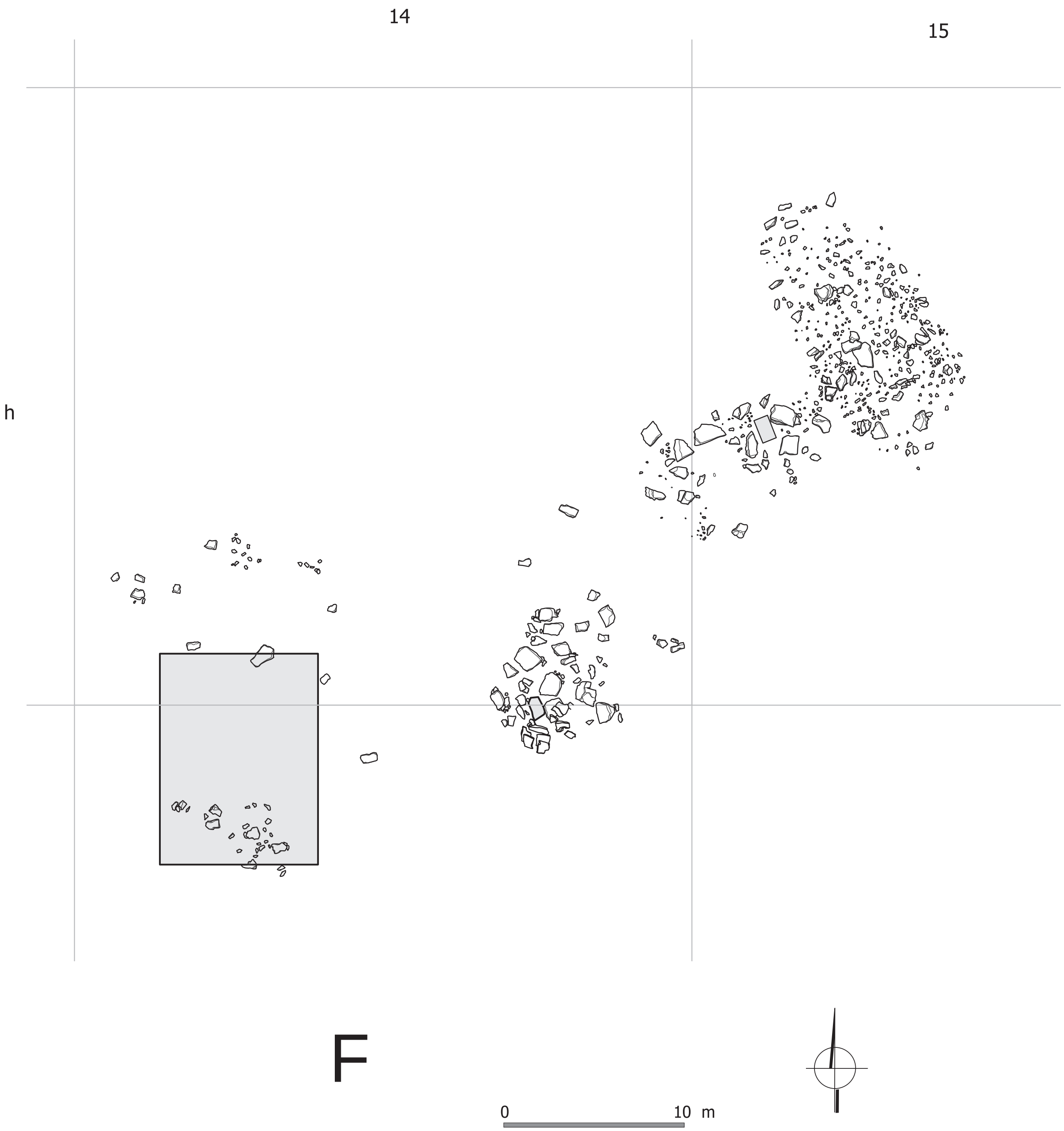
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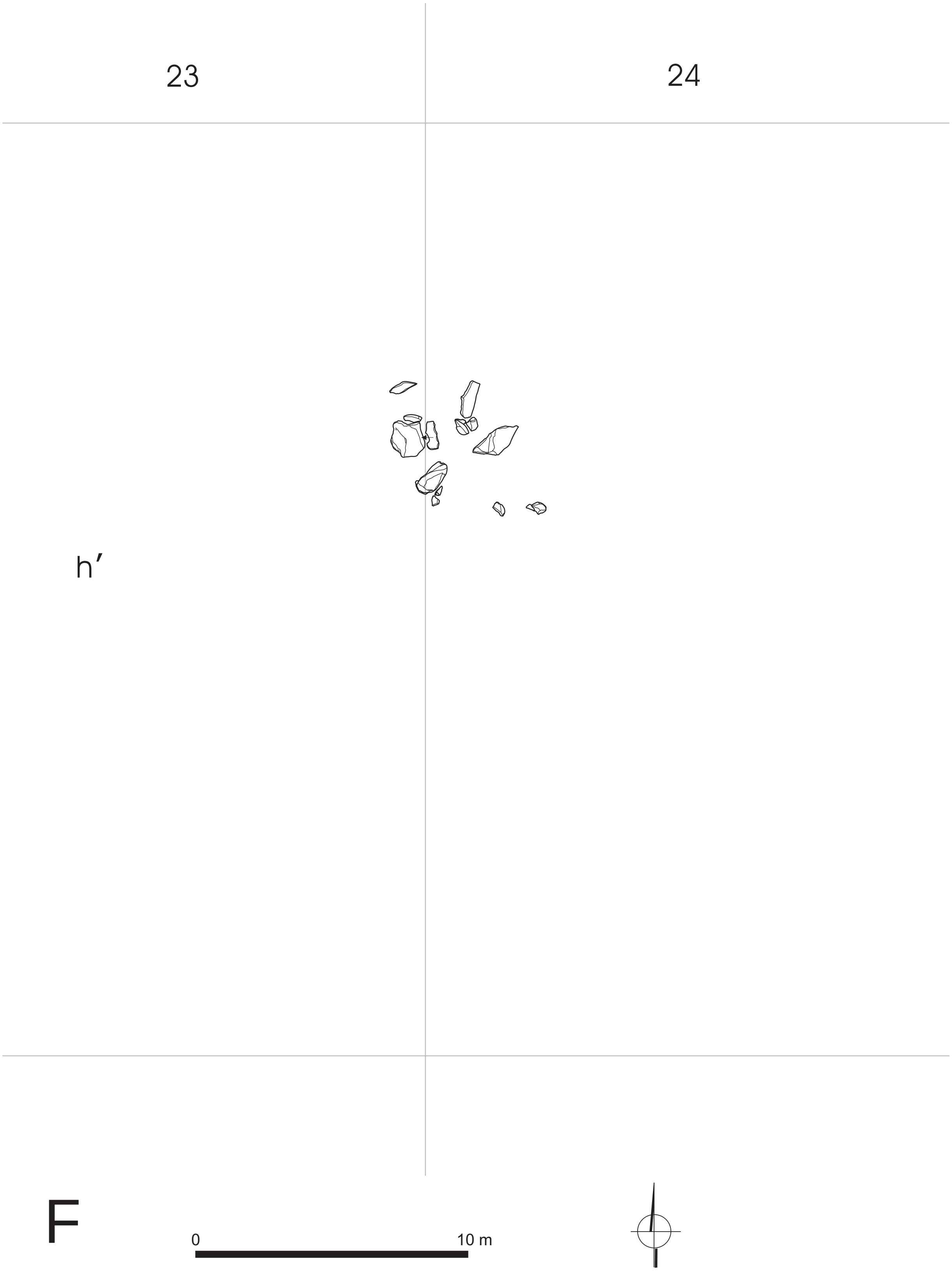
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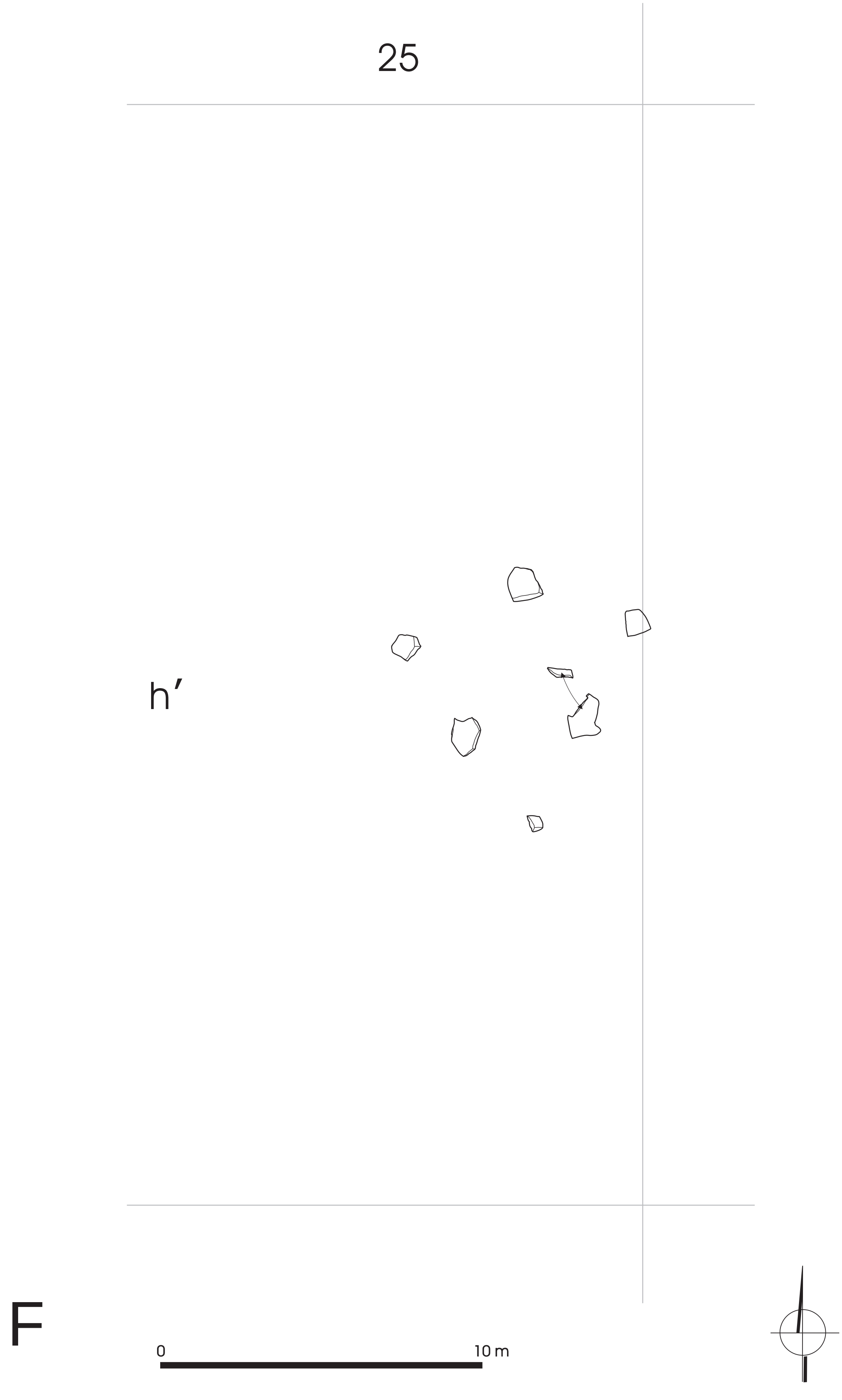
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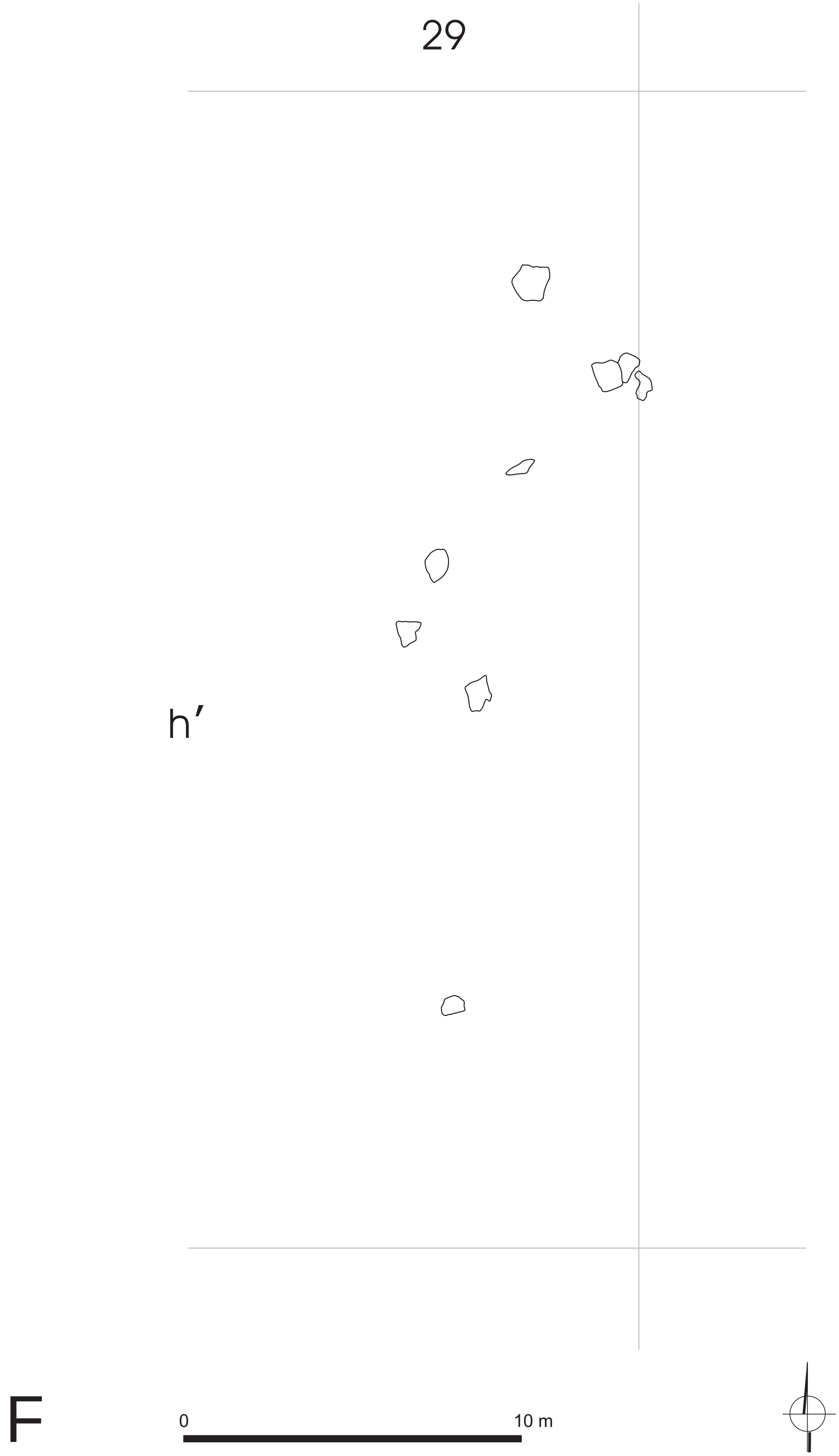
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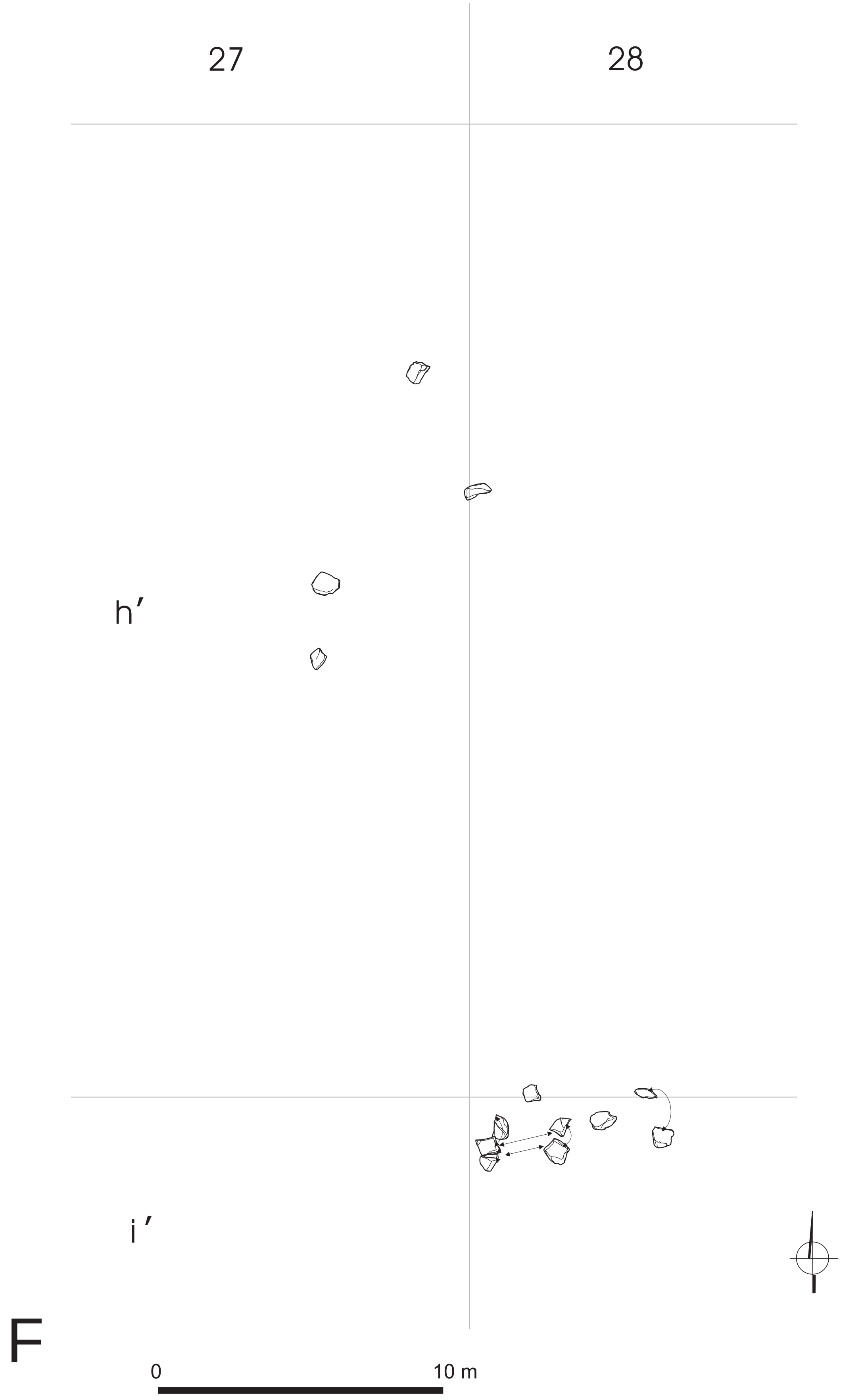
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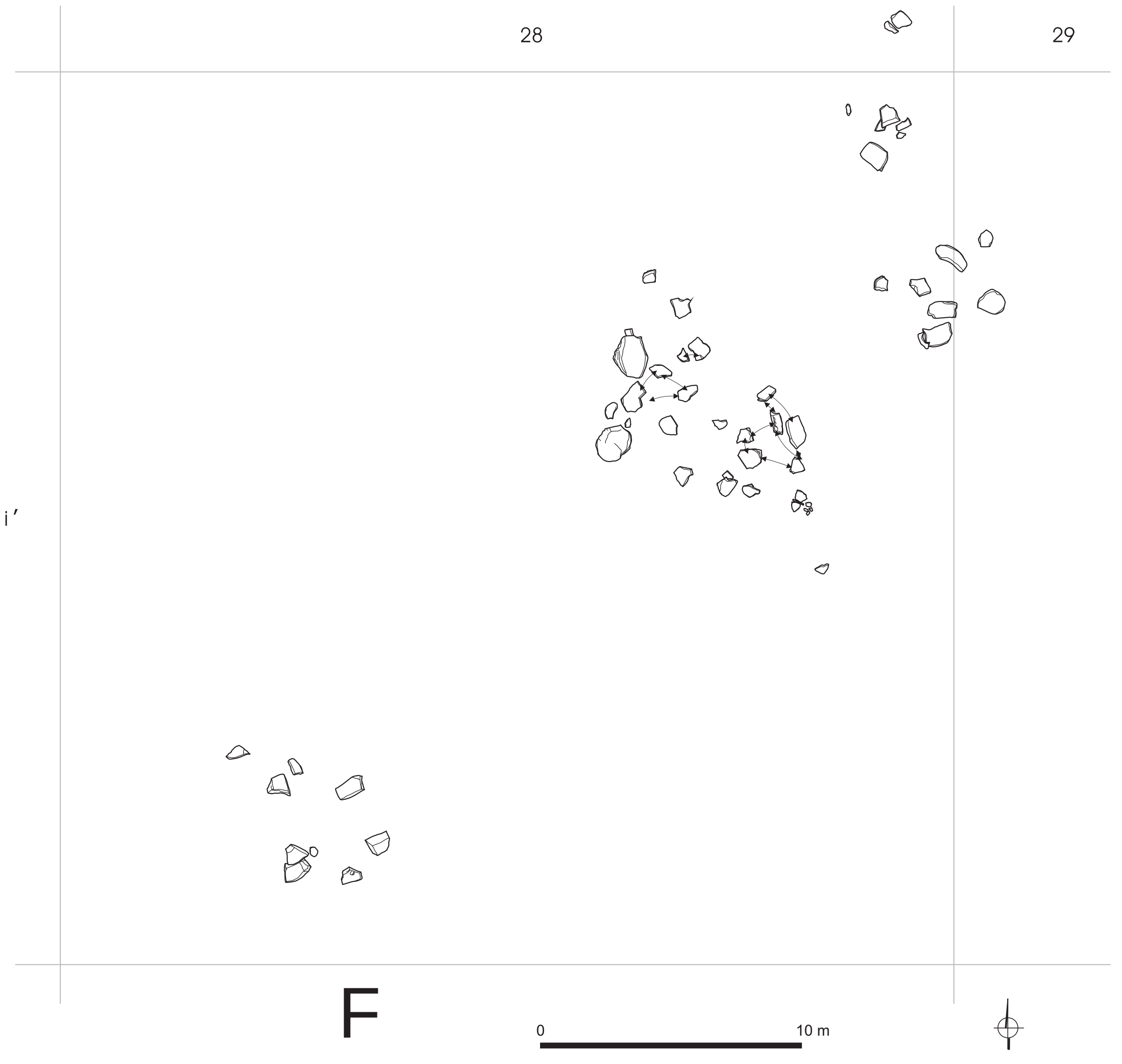

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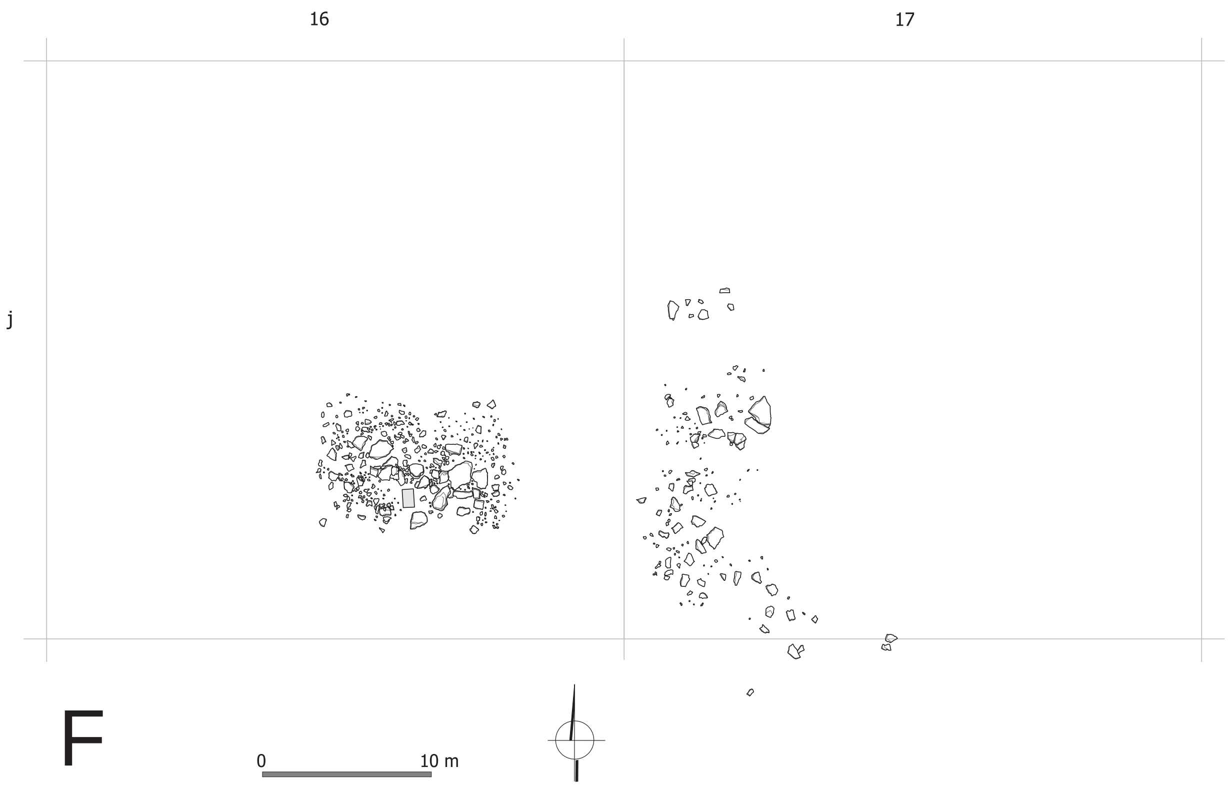
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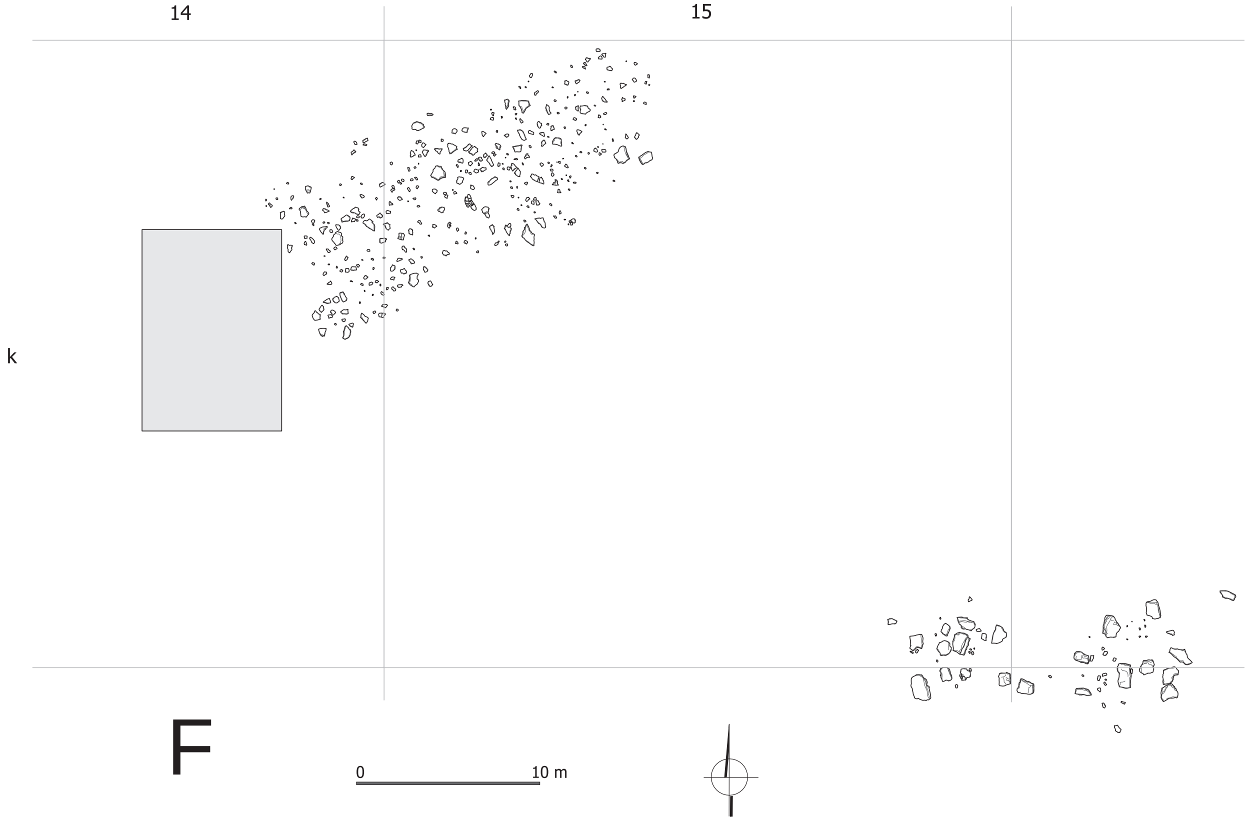
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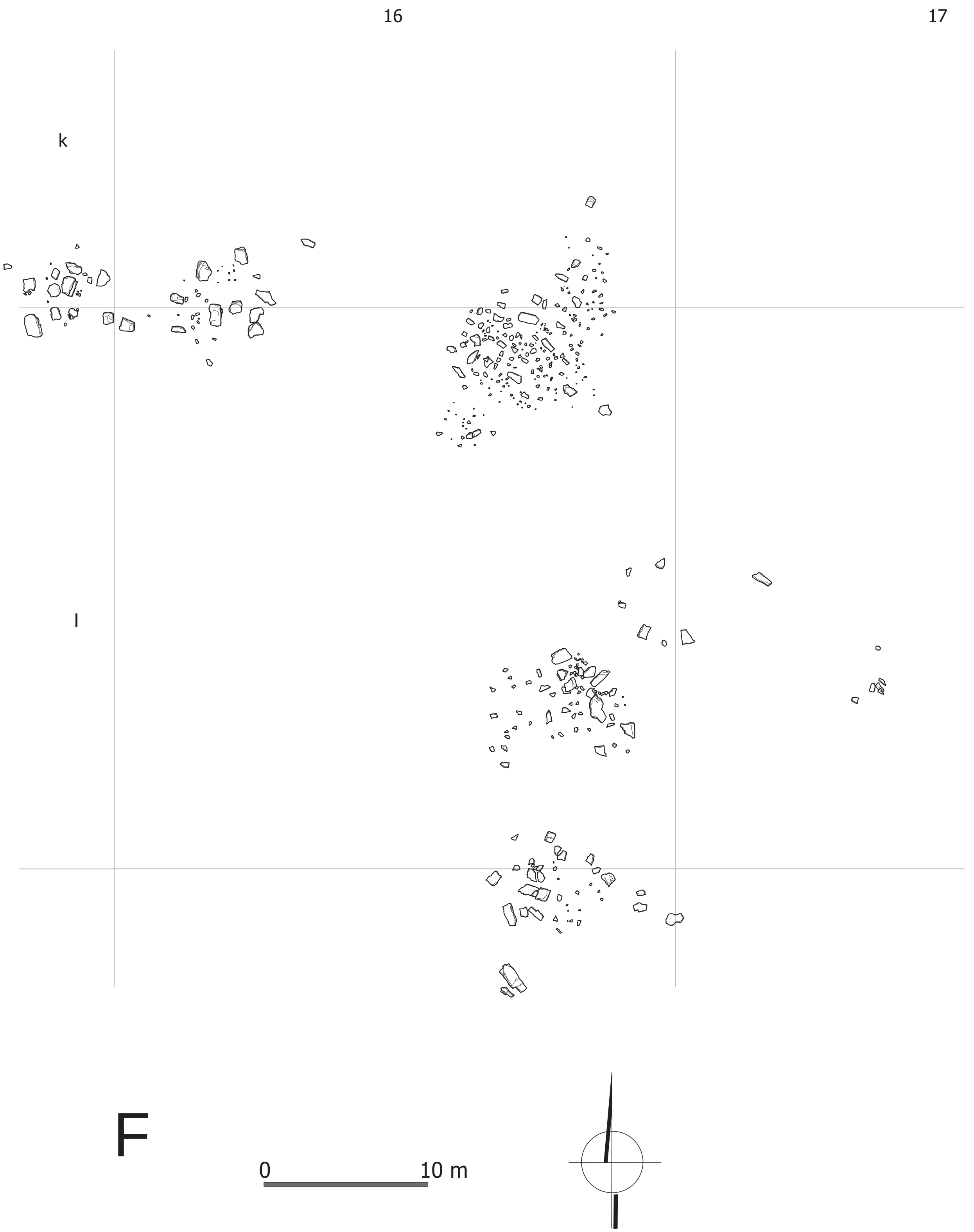
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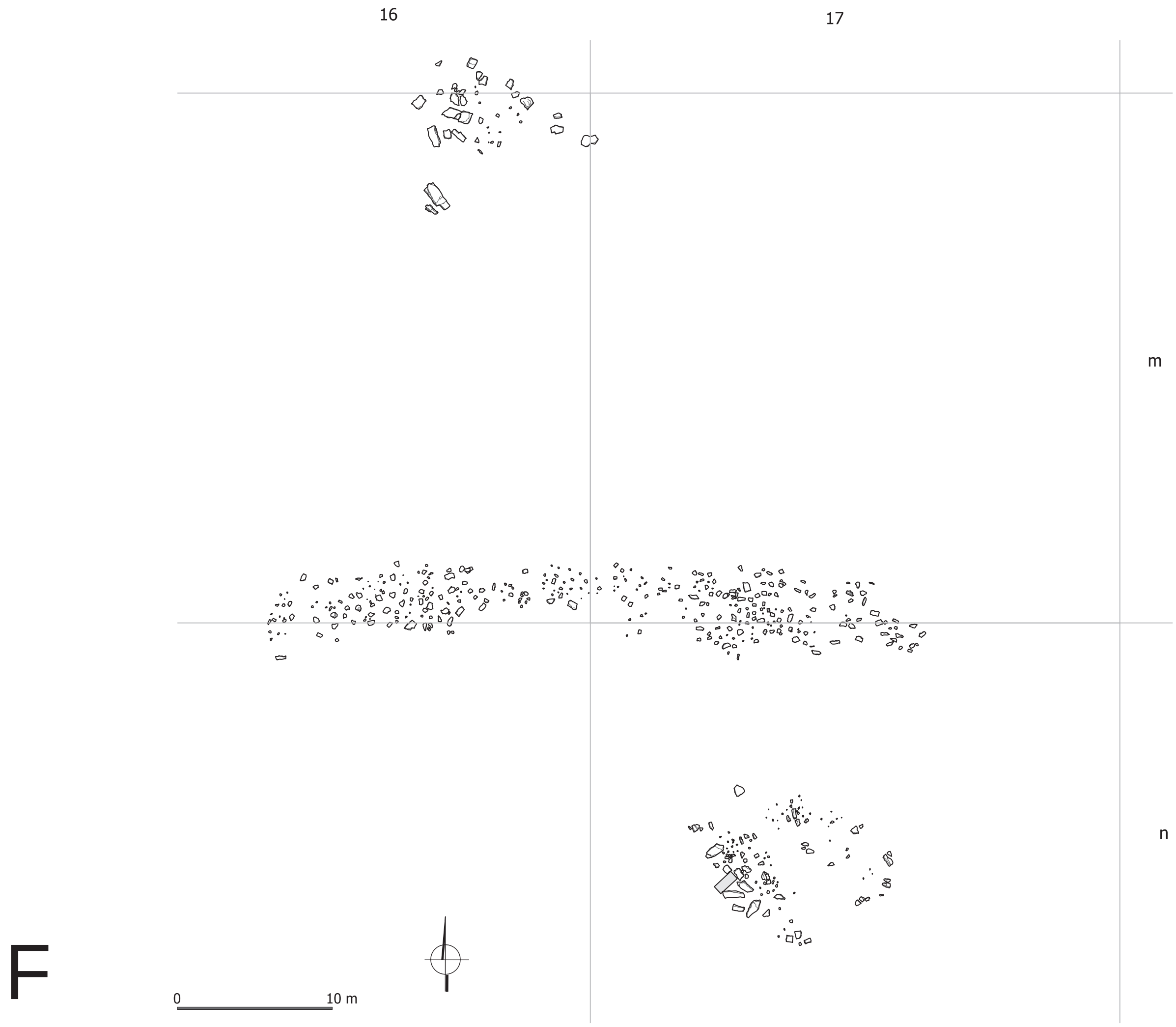
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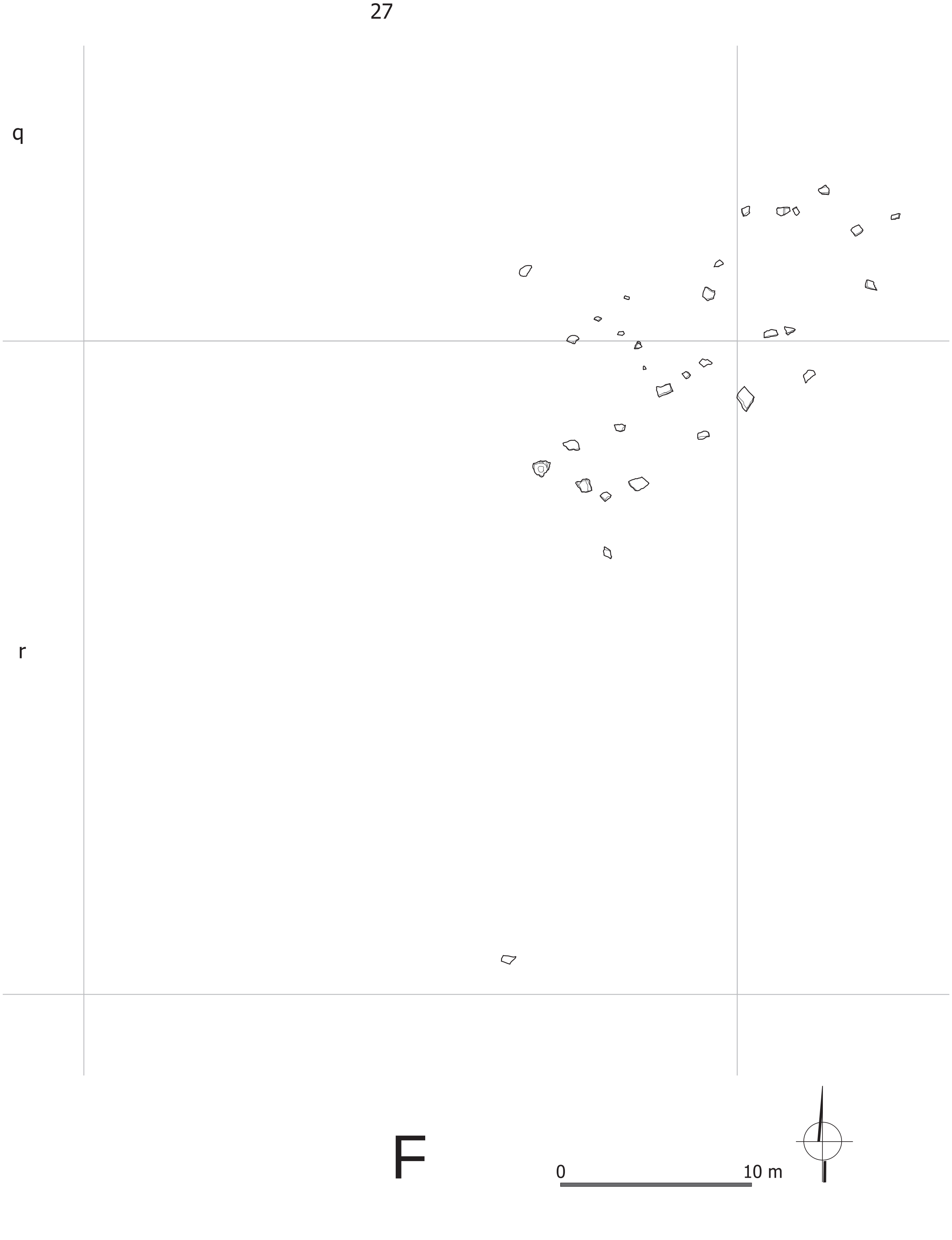
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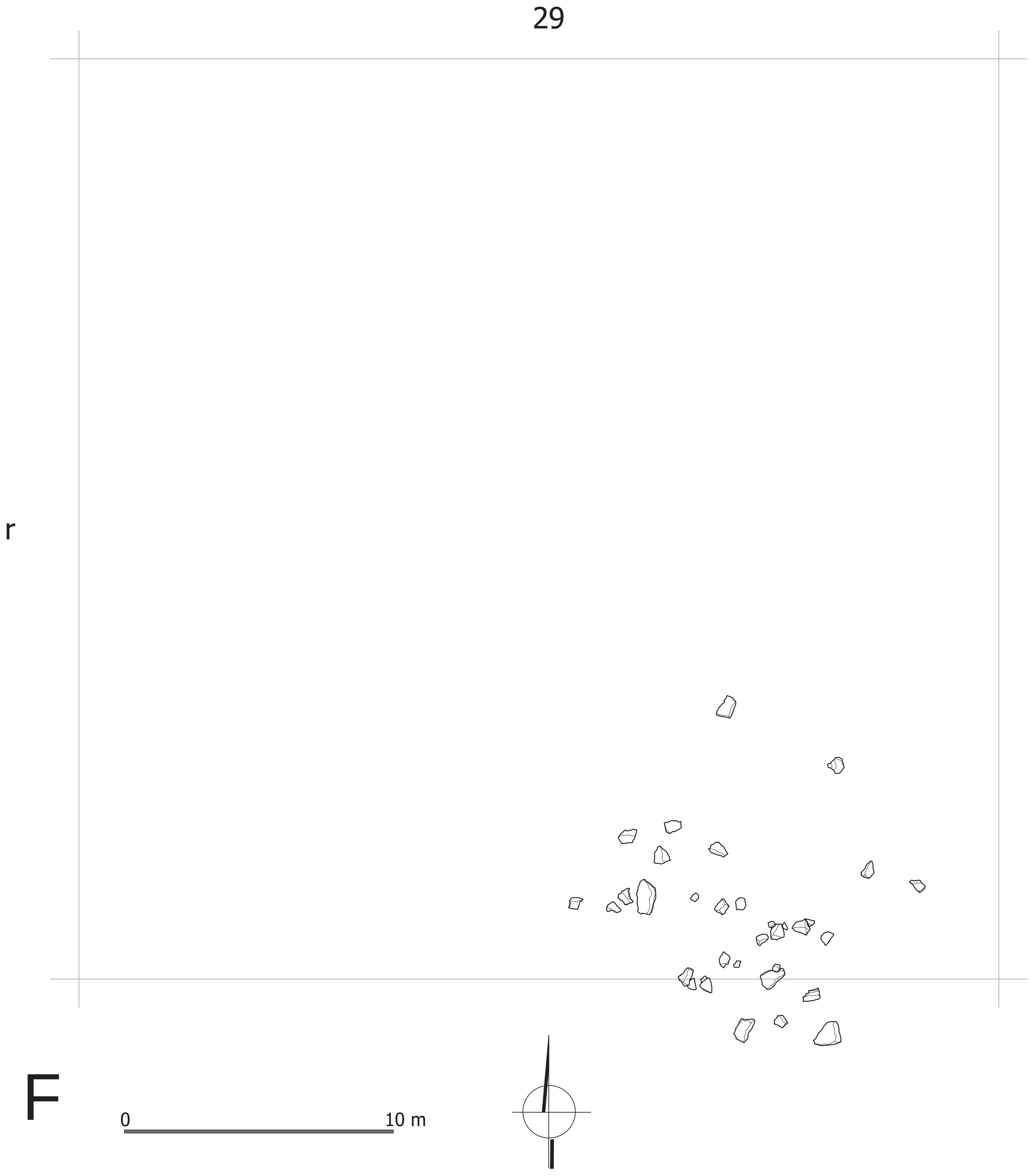
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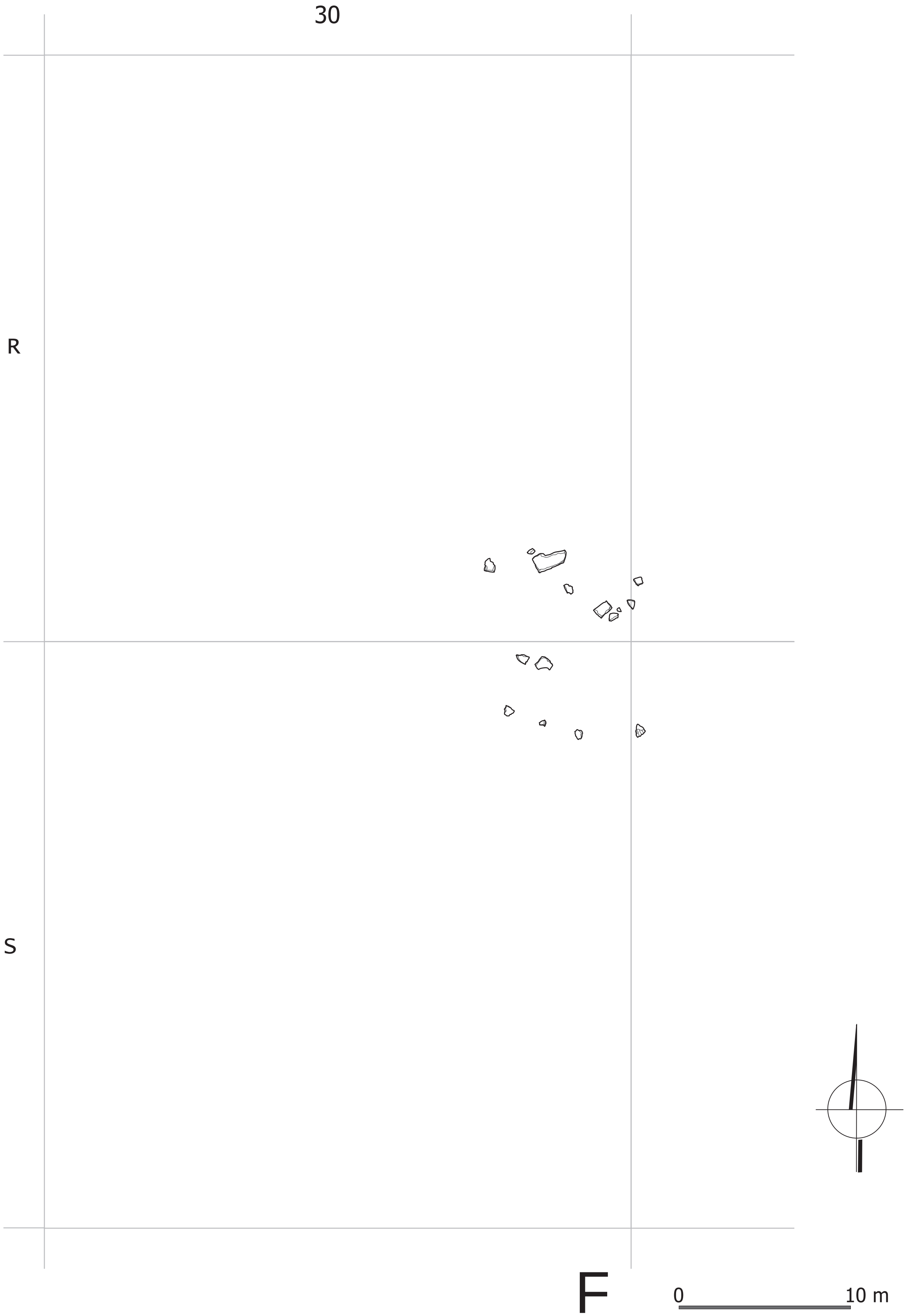
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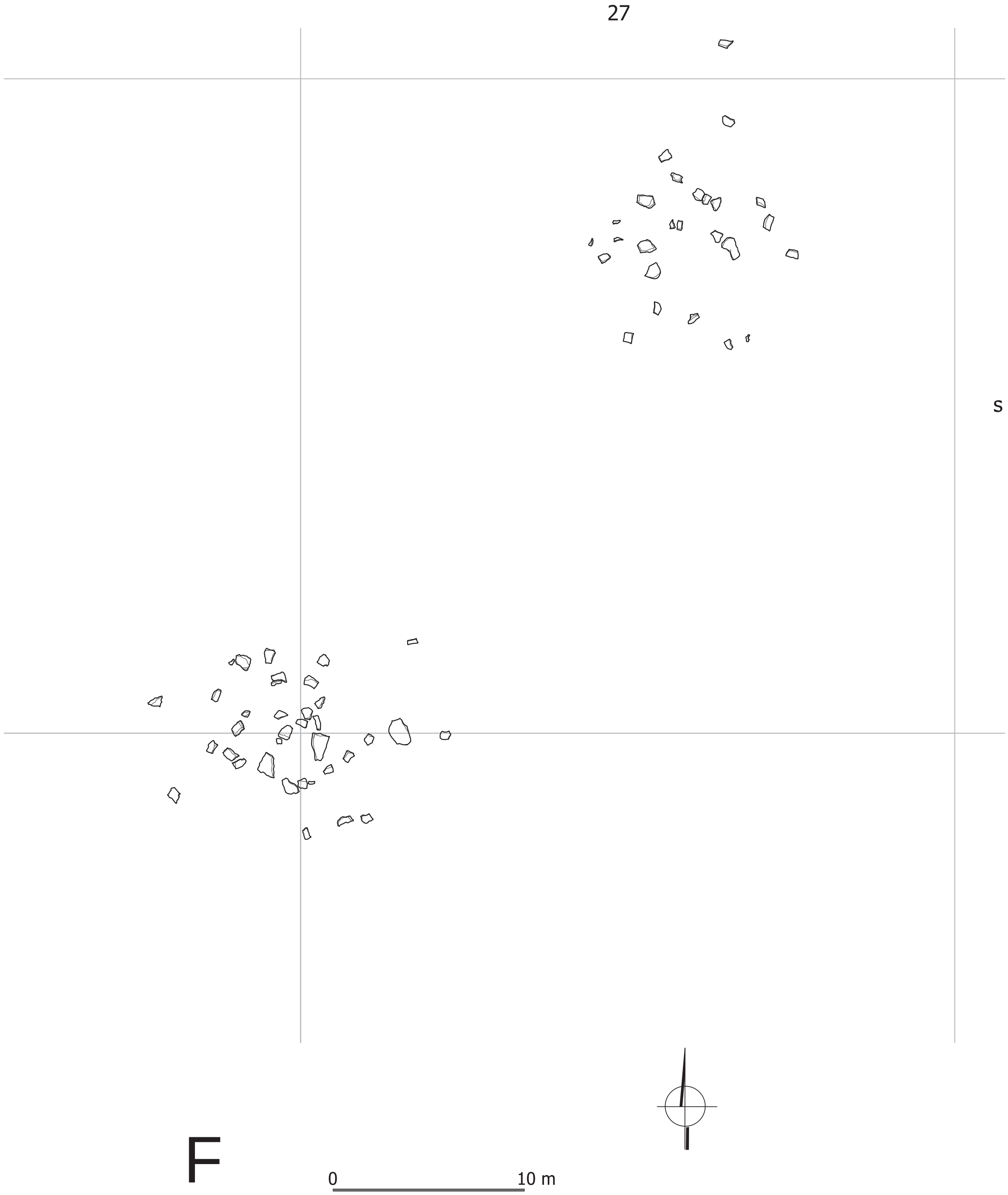
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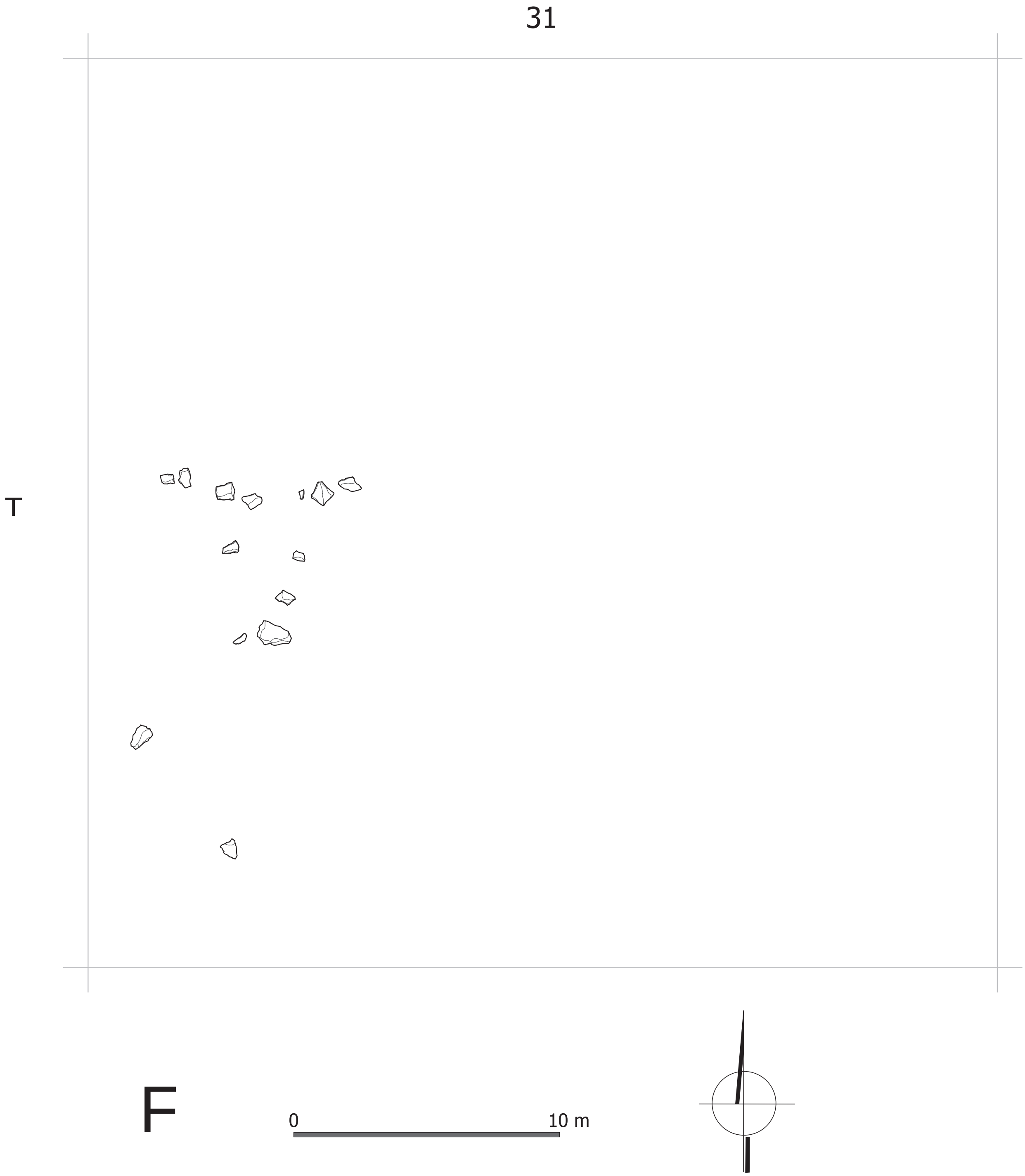

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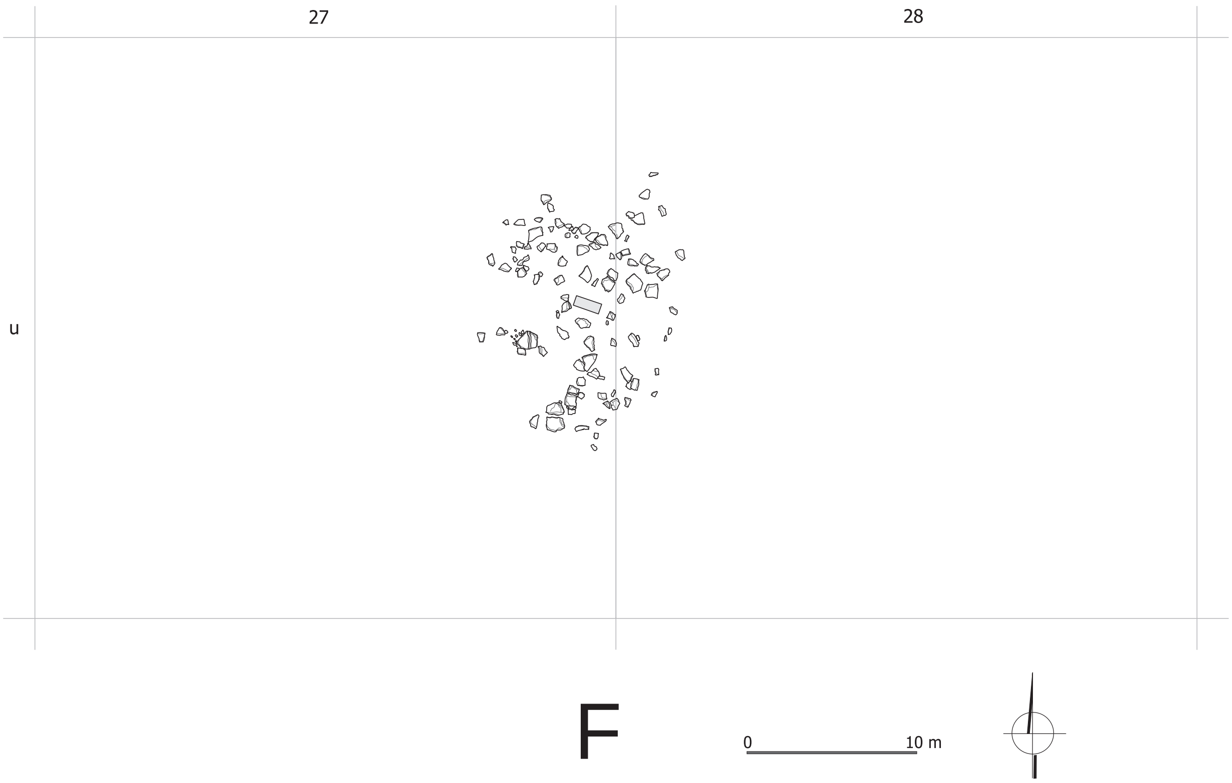
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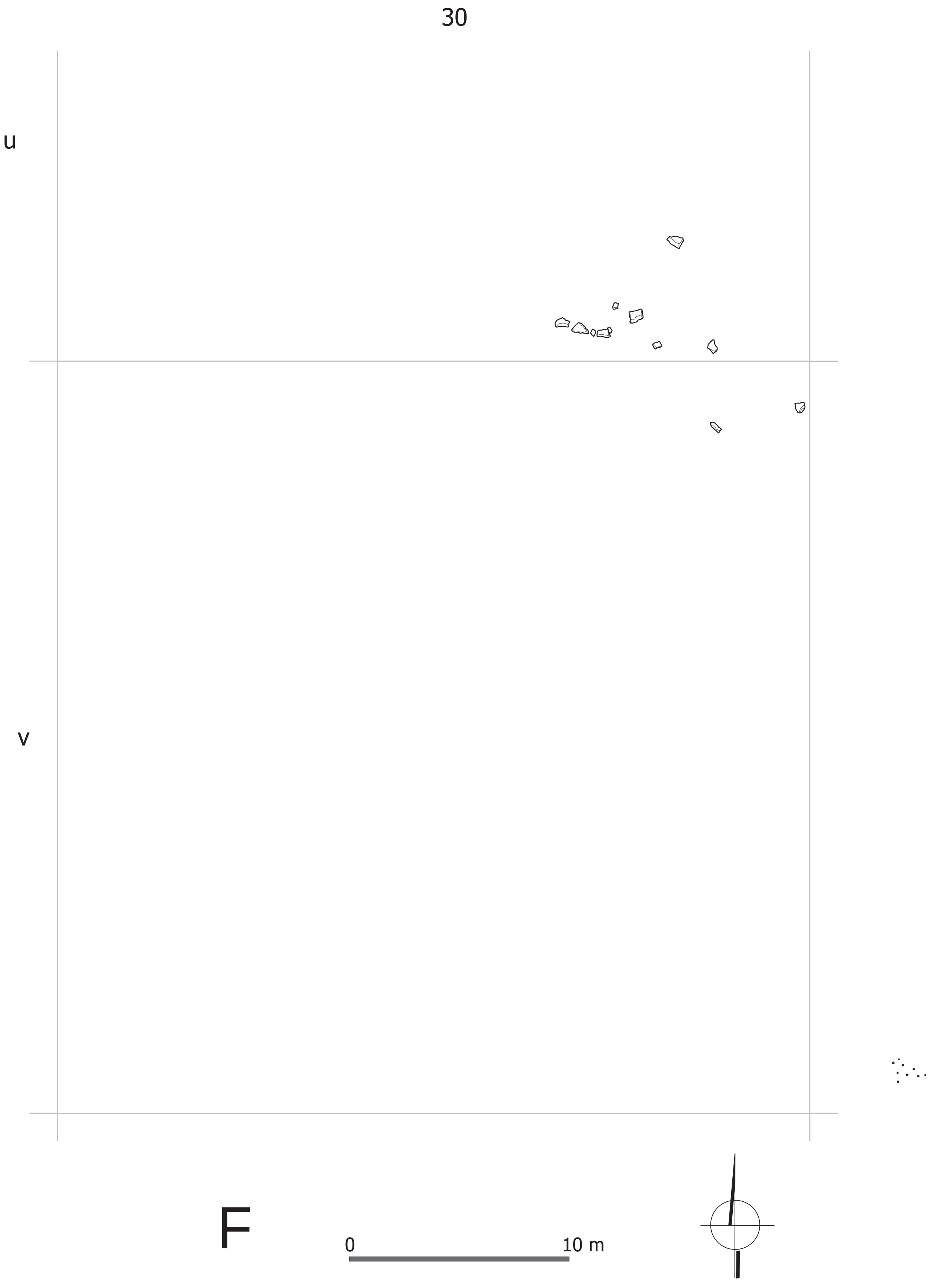
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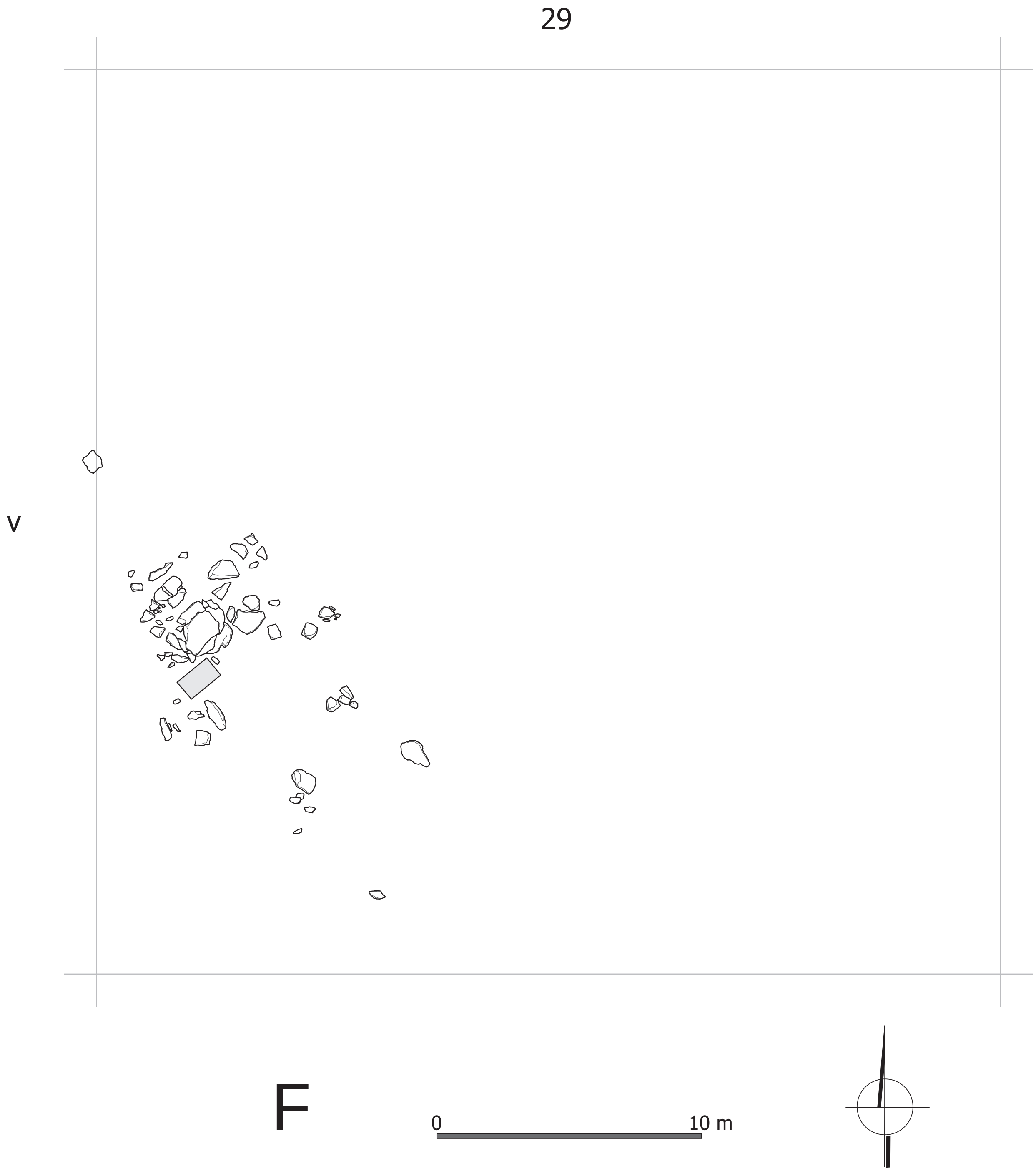
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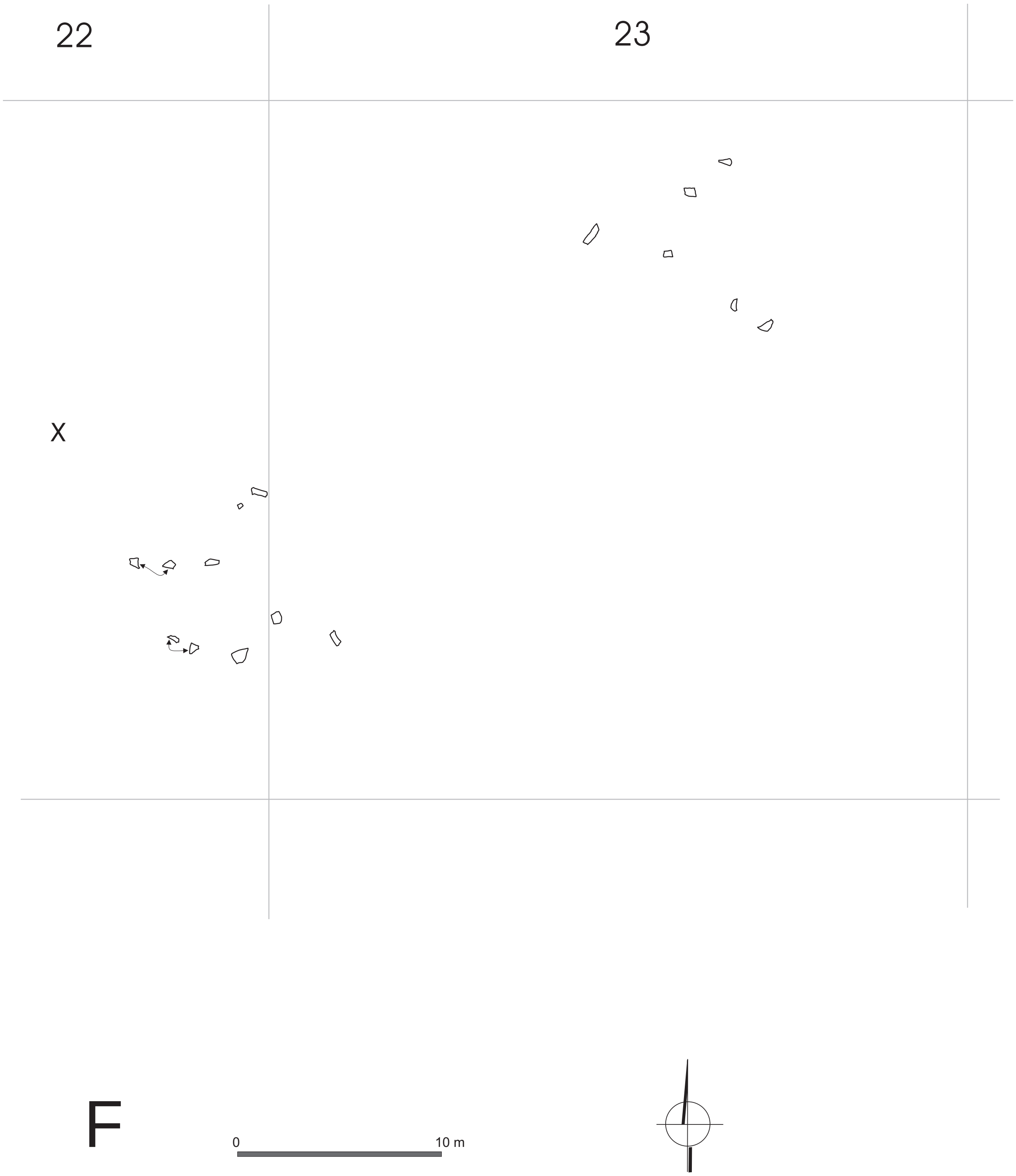
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