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Front cover. General view of Site WNP-J-22\1, Al-Jabalain, White Nile State. Photo by Hamad Mohammed Hamdeen.

Jebel Barkal 2018–2023: new research on the Napatan and Meroitic city

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Introduction

Jebel Barkal (ancient Napata) was a major urban centre of ancient Kush for over 1000 years (Figure 1). It became the royal capital of Kush in the Napatan period during the 8th century BC and expanded after Piankhy conquered Egypt around 720 BC (where he inaugurated the rule of Egypt's 25th dynasty). It remained an important urban centre well into the Meroitic period, when constructions included pyramid burials of several ruling Kushite queens known as *kandakas*, probably including Queen Amanirenas who defeated the Romans in southern Egypt around 25 BC.

A new field project co–directed by Geoff Emberling of the Kelsey Museum of Archaeology at the University of Michigan and El–Hassan Ahmed Mohamed of the National Corporation for Antiquities and Museums Sudan (NCAM) began work at Jebel Barkal in December 2018 at the invitation of Dr Abdelrahman Ali, then Director General of NCAM, supported by Timothy Kendall, who had directed excavation at the site since the 1980s. The new *Jebel Barkal Archaeological Project* (JBAP – https://sites.lsa.umich.edu/jbap/) aimed to investigate Jebel Barkal as an urban centre beyond the temple and palace areas that have been the focus of research at the site (recently: Kendall and El–Hassan 2017; 2022; Ciampini and Iannarilli 2022).

One of the conditions that Dr Abdelrahman set for granting the new joint permit was that the project initiate conservation work in the temple area of the site, which has not been the focus of substantial conservation since it was exposed by George Reisner's excavations of 1916–1920. We received a significant four–year grant from the Ambassadors Fund for Cultural Preservation of the US State Department that was built around the idea of full–fledged collaboration between Sudanese and foreign researchers, as well as engagement with the community, and that organisation has since extended throughout the project – each supervisory position on the project is now jointly held by Sudanese and international colleagues.

Preliminary publication of our results from 2018 to the present (seasons in January–February of 2019, 2020, 2022, and 2023) has been presented at a number of conferences and public lectures. The purpose of the present article is to summarise the work we have done, and the ongoing analysis that continues even as conditions in Sudan make it impossible for us to conduct fieldwork for the moment. More detailed publication of all aspects of the project are in progress.

In brief, since 2018 we have identified a large area of dense urban settlement at the site through magnetic gradiometry ('magnetometry'); excavated in three areas that show occupation in the

[1] We thank successive directors of Sudan's National Corporation for Antiquities and Museums (NCAM) for their support of our work (Abdelrahman Ali, Hatim el–Nour, Ghalia Gar el–Nabi, and Eglal El Malik) as well as successive directors of the Kelsey Museum of Archaeology at the University of Michigan (Chris Ratté, Terry Wilfong, and Nicola Terrenato). We thank our funders, including the Qatar–Sudan Archaeological Project (QSAP), the Ambassadors Fund for Cultural Preservation of the State Department of the United States (and the US embassy in Khartoum), the National Geographic Society, the University of Michigan, and private donors including Kitty Picken, Roger and Ann Cogswell, and Larry and Julie Bernstein. We also thank key team members Henrik Brahe, Murtada Bushara, Caitlin Clerkin, Elmontaser Dafalla, Bailey Franzoi, Rudi Kneiß, Nadejda Reshetnikova, Kate Rose, Mustafa Sharif, and Marlene Tielmann, and we thank local community members, including those who worked with us on the excavation and conservation fieldwork.

Figure 1. Map of Kush *c.*600 BC with location of Jebel Barkal (map by Lorene Sterner).

Meroitic period (*c.*250 BC–AD100) on the surface and of the Napatan period (*c.*700–600 BC) in lower levels; and conducted analyses of ceramics as well as archaeobotanical and faunal remains. A cache of some 3000 lumps of sealing clay was found in a Meroitic context and is similar to caches found in the Natakamani Palace. We conducted an extensive Ground–Penetrating Radar (GPR) survey in the temples and Napatan palace area and established that it was also part of a dense urban settlement. Two transects of geomorphological cores give a preliminary idea of the changing ancient environment around the site. Our conservation work began in Temple B700 (the temple of Osiris–Dedwen built by Atlanersa and Senkamanisken in the late 7th century BC). As part of the conservation project, we have also begun a programme of engagement with communities around the site.

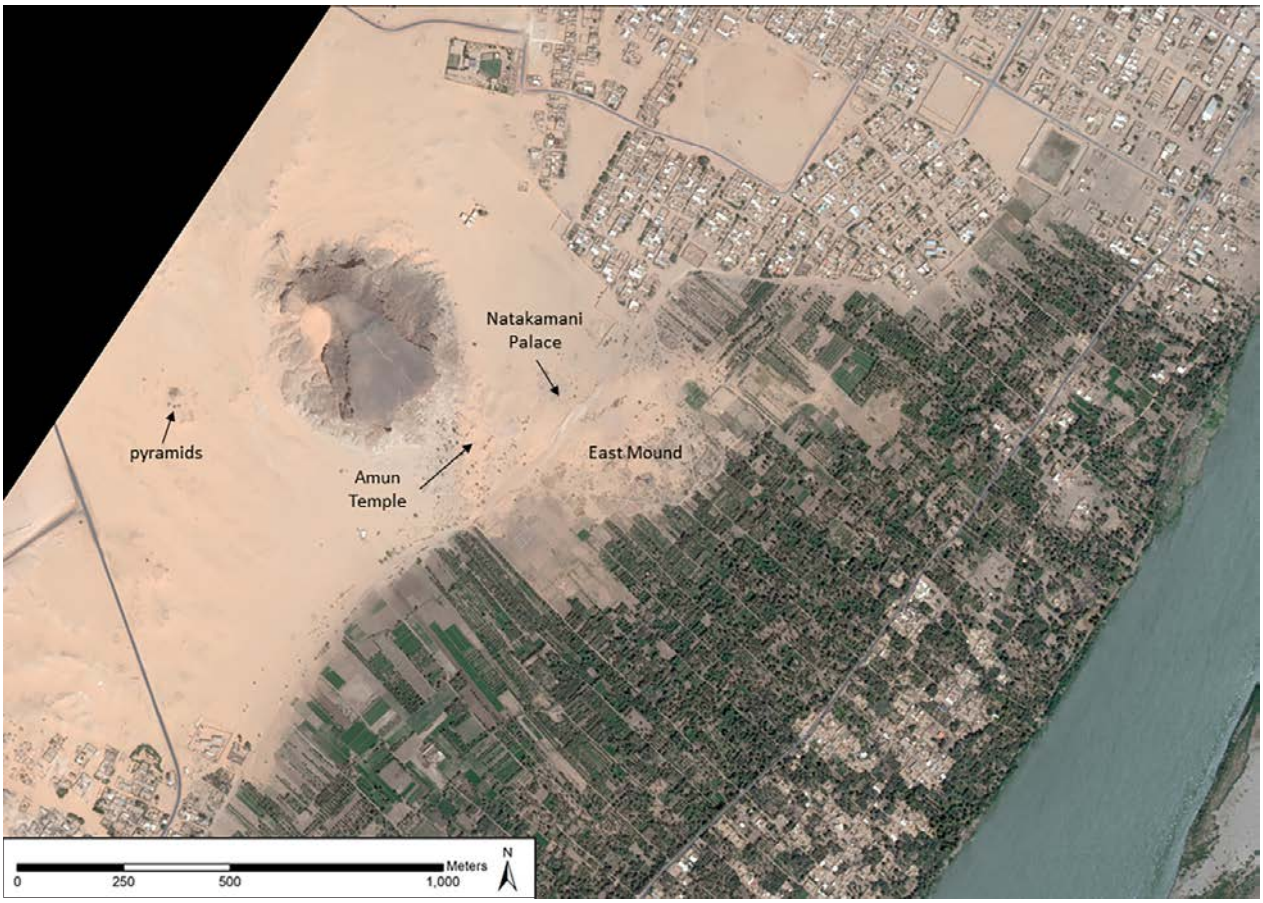


Figure 2. Natural colour satellite image of Barkal showing existing monumental structures (WorldView 2 imagery; 11th February 2011)

The East Mound

In 2016 Tim Kendall suggested we consider taking over work in the area of the site where he and Dr El–Hassan had been working, which was the old Reisner concession centred on the Amun Temple. As our team was particularly interested in investigating urban settlement, we began by looking for an area of dense occupation on the site. A brief magnetometry survey in 2016 located an area of dense settlement (Tucker and Emberling 2016) in an area close to the palm groves in a part of the site that had been investigated by the Italian team from 1973–1981, before they moved the focus of their work to the Natakamani Palace area (e.g., Donadoni and Bosticco 1982; Barocas 1982; Cataldi Tassoni and Vincentelli 1986). The earlier Italian excavations on the East Mound had documented three Meroitic buildings, two of which were temples built of stone blocks, and the other a mudbrick structure. This area of the site is bounded on the jebel side by the old unpaved road across the site, which itself has been the focus of salvage excavations and field schools of the University of Dongola at Karima in recent decades (Mohamed Fath al-Rahman 2024).

We termed this area of about 10ha the 'East Mound' (Figures 2–5), although in truth it is not so much a mound as an interruption of the slope of the ground surface down towards the Nile. Its ancient urban character had been obscured by deposits of silt from occasional Nile floods, small sand dunes moving across its surface, and trash dumping by the local community, all of which contributed to there being a limited number of potsherds visible on its surface.

Magnetic Gradiometry

In December 2018, University of Michigan PhD student Gregory Tucker returned to the East Mound and, with the help of a group of young men we had previously worked with in El–Kurru, completed the

Figure 3. Photo from top of Jebel Barkal showing the Amun temple in the foreground with the East Mound against the palm trees and the Nile River in the distance (photo by Raymond Silverman, 2016).

Figure 4. Drone photo of Jebel Barkal with excavation area in the foreground (photo by Kate Rose, 2019).

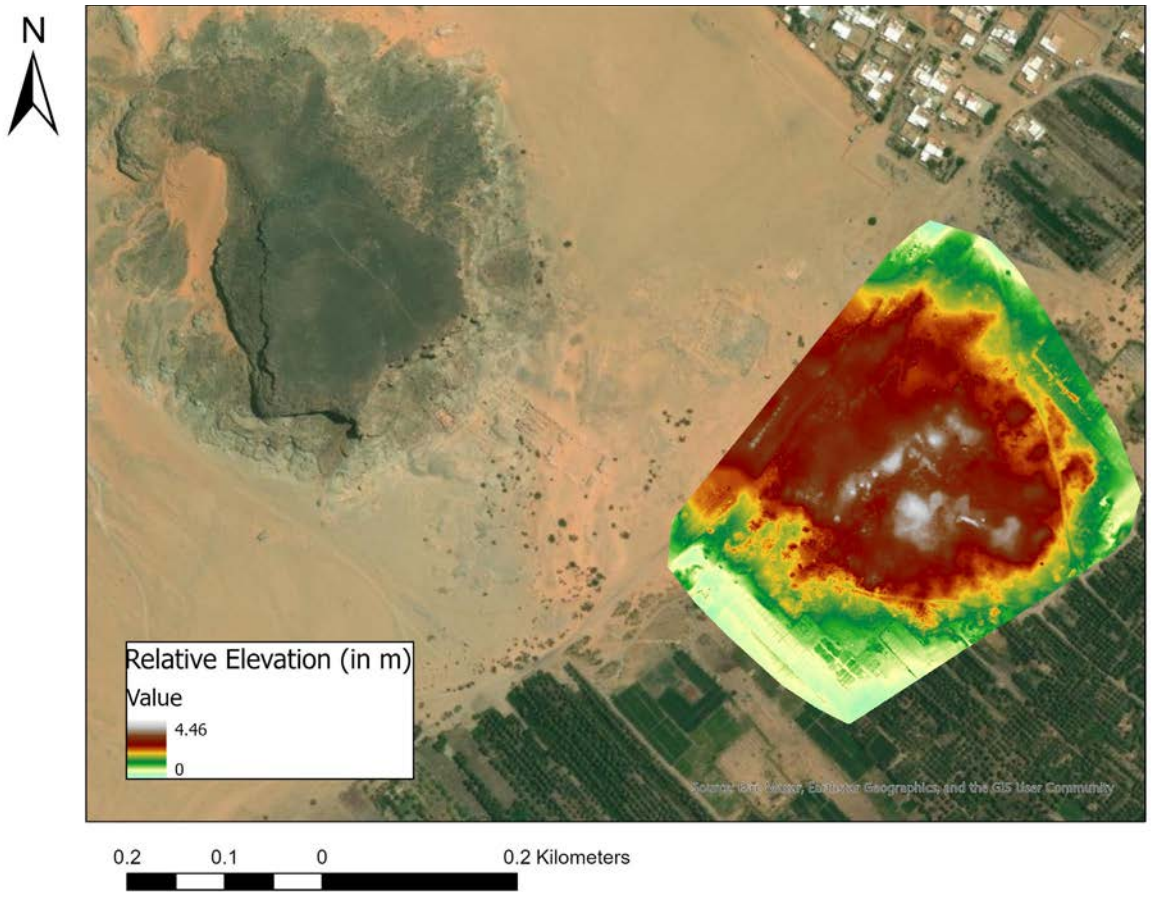


Figure 5. Digital Elevation Model (DTM and DSM) of the East Mound at Jebel Barkal overlaid on satellite imagery. Produced using drone photography and ArcGIS. The flight plan covered a survey area of 10ha. Contour interval is 1m, and resolution is 0.13m (plan by Kate Rose, 2019).

magnetic survey of nearly the entire area of this part of the site, which is now delimited by concrete bollards installed by NCAM in the 2010s. The tough halfa grass that covered much of the site would have interfered with the magnetometer, and it was necessary to cut it all down – a surprisingly arduous task that also scattered a variety of snakes across the mound. Just as Mr. Tucker was leaving Khartoum, the popular revolution that would eventually overthrow Omar al–Bashir began.

The larger magnetic survey (Figure 6) confirmed that areas of the East Mound that were visible to magnetometry comprised a dense urban settlement. Later excavations would show that in fact the magnetometer could only detect remains (mudbrick, red brick, or stone construction) that were within 300mm of the surface. Areas to the south that appear on the plan to be empty of occupation have since been shown to have a deeper covering of sand, with occupation simply not being visible to magnetometry. Narrow GPR transects across the same areas of the site in 2020 detected a similar density of architectural remains.

One of the characteristics of urban settlement generally is a diversity of sizes and forms of architecture that reflect the diversity of activities and social identities that distinguish life in a city. The magnetometry results clearly suggest such diversity.

On the northwest edge of the survey area is a portion of a large construction at least 35m in length (Mag–B4). The remainder of this structure has been excavated as a field school by our colleagues at the University of Dongola at Karima (Mohamed Fath al-Rahman 2024). A nearby structure (Mag–B5) is approximately 34x32m and has the appearance of a single–room temple with an entrance pylon to the south–west and a large courtyard containing interior features; it has been partially excavated as Area C

(see below).

To the southwest of Mag–B5, a large structure about 52x20m and oriented northeast–southwest contains some indications of interior walls (Mag–B6). Along the western edge of this building there is a long linear feature that appears be a street. A structure of similar size but oriented 90 degrees to the previous one is somewhat obscured by modern trash but shows semi–circular features on its south–east side (Mag–B7). Portions of these two buildings and adjacent structures and spaces were excavated as Area B (see below).

The largest and clearest complex is to the east of this area (Mag–B1) and was built on a slightly different orientation compared with the structures to the west, perhaps indicating a different era of construction. It was not clear from the magnetometry results whether this is a complex of structures or a single building, but it covers at least 50m on each side. Kushite buildings that are square or rectangular are often referred to as 'palaces' (summary in Maillot 2016), but there are so many of these structures that they cannot all be royal residences. Mag–B1 and some nearby structures that are considerably less visible on the plan were excavated as Area A (see below).

To the north and northwest of Mag–B1 is an area with some architecture that appears to be obscured by a uniform and hazy grey area. This is an area of the site where windblown sand has accumulated to a height of up to 1m and has obscured the underlying ancient city.

The black and white speckled areas are where the magnetometer picked up signals from modern trash. Despite our significant efforts to remove modern metallic trash from the site, we were clearly not entirely successful in removing trash that was not visible on the surface.

To the east of Mag–B1 is an area of smaller constructions that could be workshops or informal domestic structures. At the east edge of the surveyed area is a portion of a building (Mag–B8) that had been excavated by the Italian team in the 1970s and 1980s (Cataldi Tassoni and Vincentelli 1986), allowing us to tie in our results to previous work. Long linear features to the north of Mag–B8 are modern irrigation channels.

The geophysical survey suggests some degree of site planning, with numerous building quarters with similar orientation separated by long, narrow spaces that indicate streets or alleys. The layout of the city is suggestive of a longer period of organic growth and development, rather than a planned settlement like Hamadab (Wolf 2015; Nowotnick 2022). It is also important to note what is not clearly present in the geophysical results: there is no area that clearly represents an extensive area of domestic housing, and there is no trace of a city wall in the surveyed area.

Surface survey

A small surface survey conducted in 2018 by Tim Skuldbøl collected surface material from four different areas on the East Mound. The collections included numerous Meroitic and possibly earlier potsherds. Finds also included many ground stone tools and lithics similar to those found during our excavations.

Architectural remains are generally not visible on the surface of the mound, although a stone column drum visible roughly 25m southwest of Mag–B8 certainly suggests more monumental construction can be expected in that area of the site.

Excavation

In excavation seasons after the magnetometry survey, we opened three excavation areas on the East Mound (see Figure 6). By excavation, we mean surface clearance of architecture accompanied by excavation of small soundings. Area A was centred on the clearest large building in the magnetometry plan (Mag–B1). Area B focused on the apparent street next to Mag–B6 and in an area of the site where mudbrick was visible on the surface. Area C (Mag–B5) was located at the possible temple pylon but was only briefly excavated. Post–occupation pitting and trash dumping has continued on the East Mound until today, and this often dug into and removed portions of walls, sometimes making it difficult to define individual

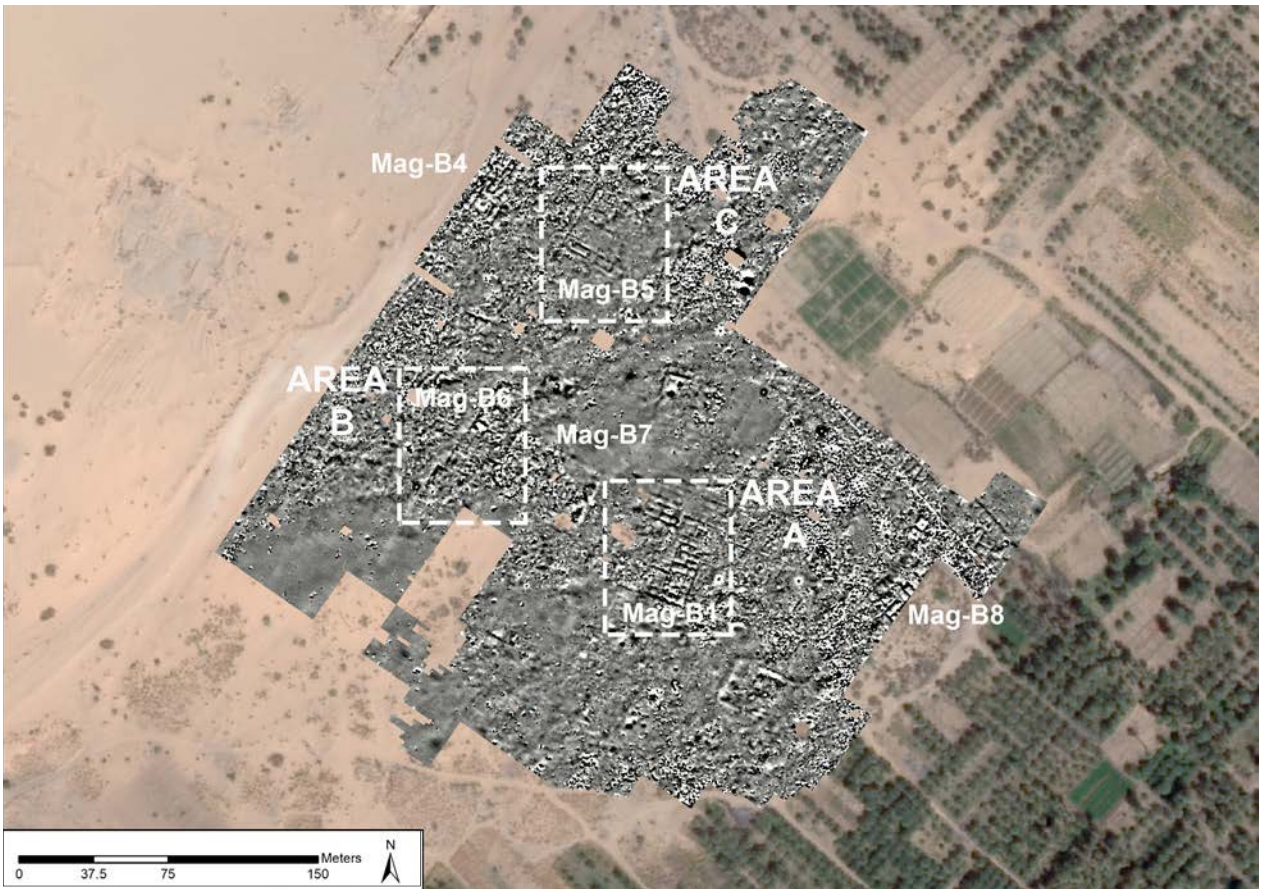


Figure 6. Greyscale plot of magnetic gradiometry survey data of the East Mound, Jebel Barkal. Coordinate grid is UTM Zone 36N (plan by Gregory Tucker, 2018).

buildings during surface cleaning.

Area A

After three excavation seasons, Area A (Figure 7) turned out to preserve the remains of at least four different building levels (Figure 8). The latest of these levels comprised a large structure (B1) dating to the Classic Meroitic period (1st century BC – 1st century AD), preserved only as a casemate foundation for a building that would have been located on a platform (and thus was protected against flooding), with a series of smaller structures built against its north edge. These smaller structures preserved extensive but small–scale cooking features. A separate smaller structure to the southeast (B2) was a freestanding domestic structure, but also with a high density of cooking features.

As most deposits excavated were related to dumping of trash either in or next to buildings, the ceramic assemblage is varied (Figure 9). As analysed by Dobiesława Bagińska and Saskia Büchner–Matthews, it includes Early Meroitic (3rd–2nd century BC) and Classic Meroitic period (1st century BC–1st century AD) vessel types, though sherds from the latter period are most common. The vessels were mostly wheelmade – decorated kraters and storage jars as well as fineware bowls. A few fragments of imported amphorae (Qena ware) from Egypt dating to the 4th–3rd century BC were also recovered. This preliminary dating of the building is confirmed by two AMS dates taken from charcoal found in soundings, which show dates from the mid–2nd century BC to the early 1st century AD (Figure 10).

A number of faience moulds were found in the fills of the foundation platform (Figure 11), suggesting the existence of a faience manufacturing workshop in this area of the site, although it is difficult to be precise about the date of these items. Local faience manufacture during the Napatan period is well

Figure 7. Architecture in Area A (drone photo by Sami Elamin, 2022).

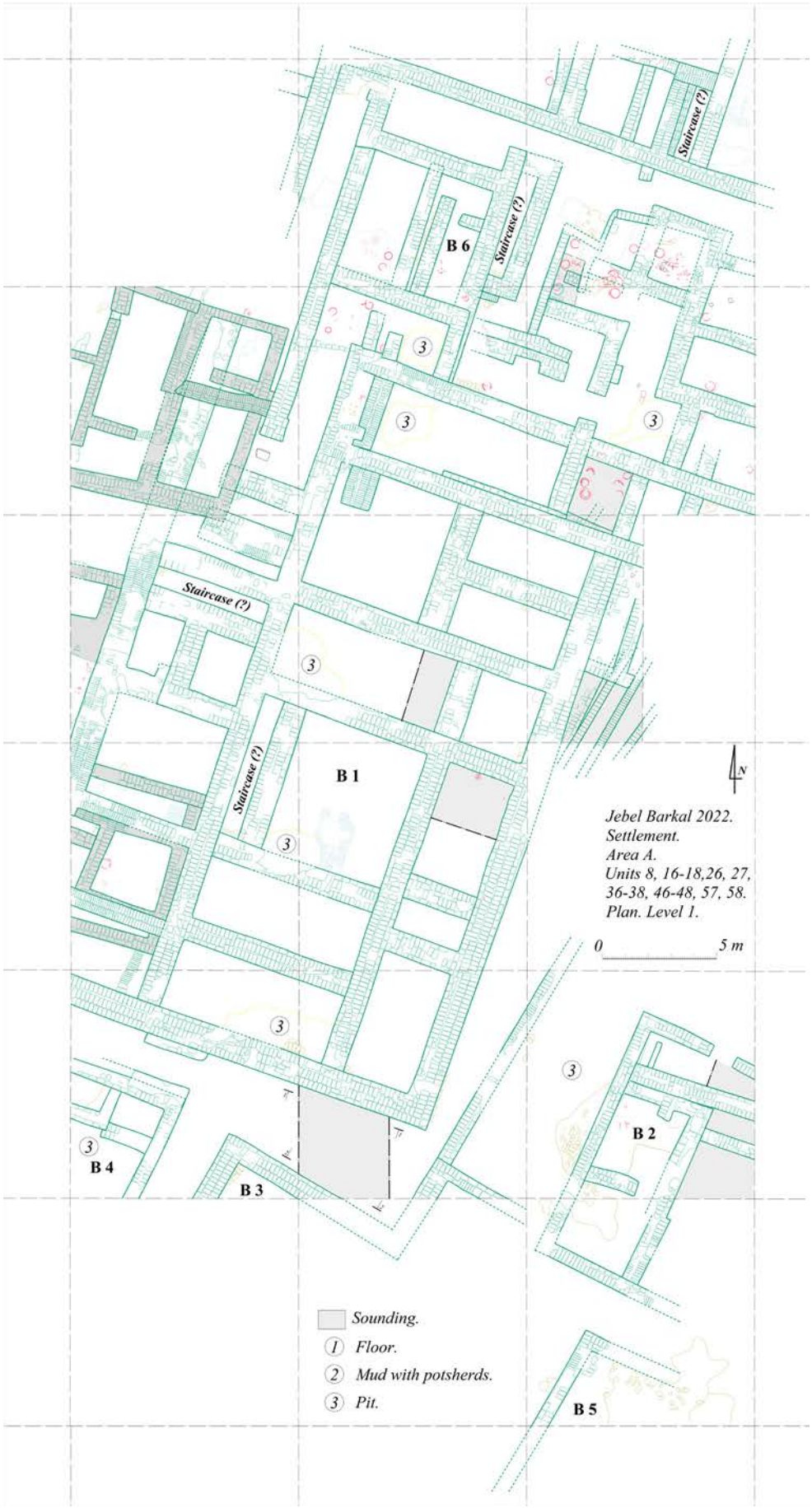


Figure 8. Architecture in Area A (plan by Nadejda Reshetnikova, 2022).

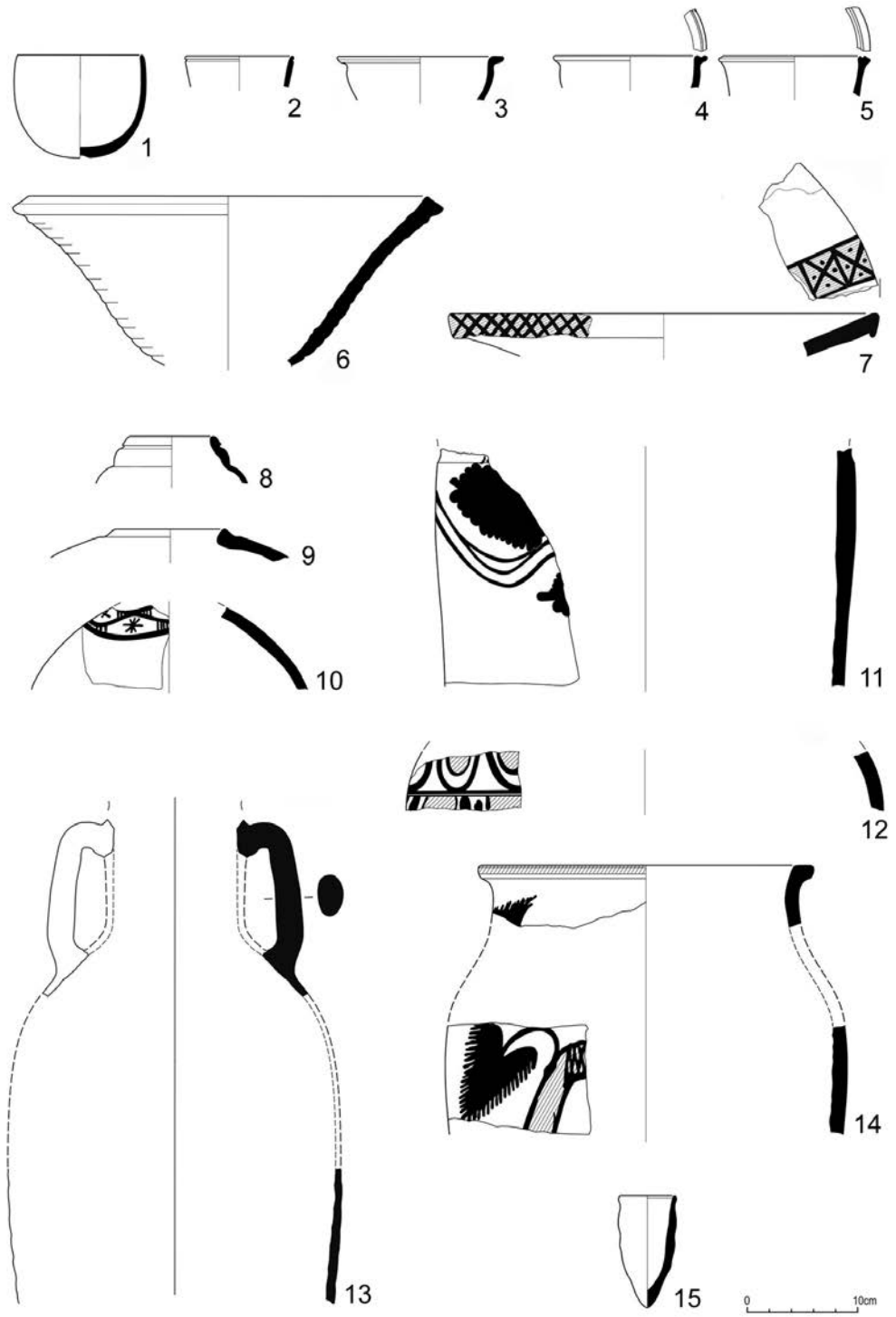


Figure 9. Meroitic ceramics from excavation of the East Mound. No. 2 and 15 are handmade, the remainder are wheelmade (drawings by Dobiesława Bagińska). 1. Bowl (1st century AD); 2. Small bowl, black ware with incised groove under rim (1st century BC/1st century AD); 3. Bowl with ledge rim, semi-fine ware (1st century BC/1st century AD); 4. Bowl with ledge rim, semi-fine ware (1st century BC/1st century AD); 5. Bowl with ledge rim, groove on rim (1st century BC/1st century AD); 6. Large bowl (1st century BC/1st century AD); 7. Large plate with painted decoration (1st century AD); 8. Amphora of marl clay, Qena ware, imported from Egypt (4th-3rd century BC); 9. Storage jar, 'Burma'-type; 10. Jar with painted decoration (1st century BC/1st century AD); 11. Krater with painted decoration; 12. Jar with painted decoration (1st century BC/1st century AD); 13. Amphora, imported from Aswan (1st century BC/1st century AD); 14. Krater with painted grape leaves (3rd–2nd century BC); 15. Bread mould (1st century BC/1st century AD).

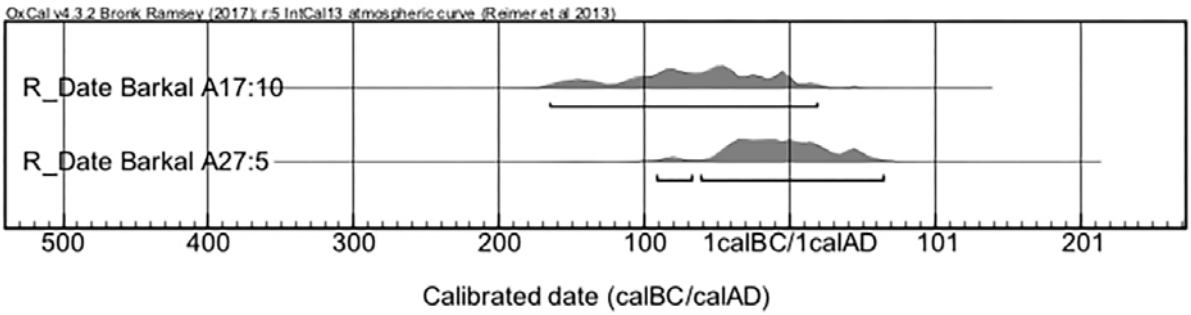


Figure 10. AMS dates from the East Mound Sounding. A17:10 is a sounding between Buildings 1 and 2; A27:5 is fill in Building 1, Room 3. Calibrations are reported at 95.4% probability. Barkal A17:10: Beta–521729, charcoal, 2050 +/– 30 BP (166 cal BC–20 cal AD); Barkal A27:5: Beta–521730, charcoal, 2010 +/– 30 BP (91 cal BC–65 cal AD).

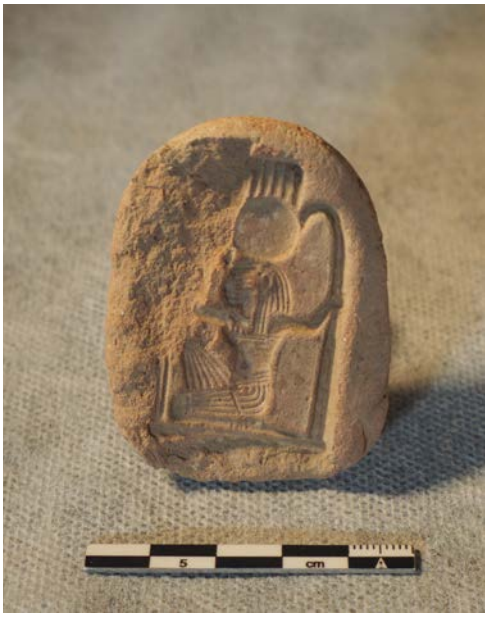


Figure 11. Faience mould depicting the Egyptian god Heh, height 59mm (photo by Henrik Brahe, 2020).

attested in the region of Napata through finds of moulds as well as distinctively local styles from Sanam, El–Kurru, and Nuri (Griffith 1922, 87–88; Howley 2018, 2020; Lacovara 2024).

An alley to the south of Building B1 was a dumping area with significant quantities of faunal remains and fragments of sealing clay (sounding marked in gray on Figure 8). We recovered roughly 3000 lumps of sealing clay, of which about 300 preserved designs of seal rings similar to those found in the Natakamani Palace excavations (Vincentelli 2022; also Hajduga 2021 for related impressions from Selib, 150km downstream).

A scarab seal inscribed with the name Menkheperre was also found in this deposit (Figure 12a, b).[2] The base of the scarab bears a recessed relief consisting of three elements: a striding lion atop an elongated lotus plant, the name of the god Amun, and the name Menkheperre within a cartouche. The impression of the scarab was not found on any of the mud sealings; inscribed scarabs, particularly those that evoke royal or divine figures, often functioned as heirlooms and apotropaic amulets rather than as administrative seals. *Menkheperre* scarabs are remarkably well–documented in both Egypt and Sudan (Jaeger 1982); unfortunately, in most contexts they provide little more than a *terminus post quem* for dating. Scarabs venerating the 18th dynasty king continued to be produced for over a thousand years after his reign (Jaeger 1982; Lohwasser 2013; 2014). Their presence in Nubia during the New Kingdom has been documented at Sai Island (Budka 2017), Soleb (Schiff Giorgini 1971), and Amada (Randall–MacIver and Woolley 1909, 10), as well as in Napatan cemeteries at Sanam (over 30 examples: Lohwasser 2010, 456; also Lohwasser 2012) and Missiminia (Vila 1980, 174, figure 191). Several Menkheperre scarabs were also found in the western cemetery at Meroe (Dunham 1963, Tombs 531, 634, and 760), although these were probably reused heirlooms as scarab production seems to have declined after the Napatan period (Williams 1990, 15). The Jebel Barkal scarab is understandable as a 'memorial' scarab of Thutmose III, probably made during the Third Intermediate or Napatan periods[3] found reused in an early Meroitic context at the East Mound. It is worth noting, however,

[2] Thanks to Taylor Bryanne Woodcock for research on the scarab seal.
[3] The scarab lacks certain New Kingdom diagnostic criteria, such as stylised humeral callosity on the wing cases, making an earlier date unlikely.

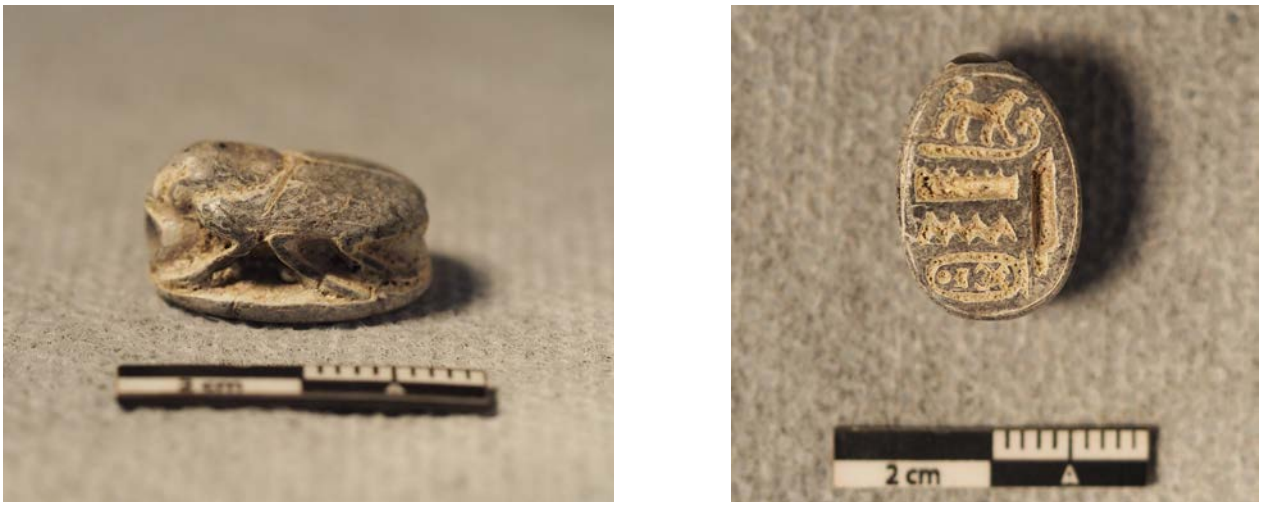


Figure 12 a (left) and b (right). Napatan period scarab seal with memorial inscription of Menkheperre (possibly Thutmose III), length 15mm (photos by Henrik Brahe, 2020).

that there are other potential identifications for Menkheperre besides the praenomen of Thutmose III – Menkheperre has also been tentatively attributed as a praenomen to Piankhy, the founding king of the 25th dynasty, on the Louvre stele C 100 (Eide *et al.* 1994, 47).[4]

Analysis of faunal remains from Area A after the 2019 season by Richard Redding showed that 85.4% (by number of identified specimens, or NISP) were of cattle. The lower–than–expected number of skull fragments suggests that animals may have been butchered in this area of the site but that heads may have been removed. Fusion data for limb elements of cattle show that animals between about 15 and 27 months of age were being butchered, or that they were butchered elsewhere with relatively few heads being brought to Area A. The absence of older cattle or very young individuals suggests this sample is the result of planned offtake from herds not under the direct control of the residents of this area of the site. The high proportion of cattle bones is consistent with reported figures from other sites of the Meroitic period, including El–Hassa, Dokki Gel, Muweis, and Meroe (Chaix 2016, 130).

Sheep, goats, and pigs are almost absent. Birds, however (4.5%) were a notable component of the assemblage. Wild fauna included the presence of Addax antelopes and gazelles (2.7% by NISP), which were being hunted in nearby desert areas and consumed in this area of the site. Fish were consumed rarely (0.1%). A small number of hare bones (1.4%) may also be the result of local consumption.

Area B

In 2022, we opened up two new areas on the site while continuing work in Area A. Our primary focus was Area B, which was situated over the linear feature on the magnetometry plan that we interpreted as a street (Figure 13). It happened also to be a large, flat area in which a number of grey mudbrick walls were visible on the surface or covered only by a very thin layer of windblown sand.

We determined that this was indeed a street delimited by buildings on either side running northeast-southwest (roughly parallel to the current course of the Nile as well as the present dirt road across the site). During the course of two excavation seasons (Figures 13–14), we cleared over 70m of a continuous line of exterior building walls running along the east side of the street. Buildings on the west side of the street have slightly differing orientations but define a street of up to 6m in width together with a number of smaller plazas.

[4] Reisner also attributed Menkheperre to Shebitqo, on the basis of Menkheperre cartouches found in one of the horse burials at El-Kurru (Pope 2014, fn. 39), although this attribution is doubtful.

Figure 13. Street and adjacent buildings in Area B (looking northwest), with the Jebel Barkal Museum in left background and the city of Kareima in the right background. Excavation in Area C is visible to the far right (drone photo by Sami Elamin, 2022).

A sounding 0.4m deep excavated across the street showed trampled sherds and compacted surfaces. It also showed that the buildings had been renovated or rebuilt several times mostly along the same line, suggesting that some form of authority or community social agreement was maintaining the width of the street.

A seeming cross–street headed to the northwest was in fact a space between buildings that was used as a dumping area, particularly for broken ceramic vessels. However, a narrower alleyway leading to the southeast (immediately north of Building B13) had been blocked by a door whose sandstone door socket remained in place.

We excavated a significant portion of one building intensively (Figure 15: Building B13). This structure was the exception to maintaining the line of the street, as its northwestern wall extended over 1m into the street. The building is roughly 10m along one side; the other exterior dimension has not yet been defined but would have been more than 10m in length. Inside this building nearly all excavated rooms contained a concentration of small–scale cooking features, mostly cooking pots set into floors.

To the south of the excavated area, our excavations and several smaller tests showed that the preserved surface of ancient remains slopes down significantly, but is covered by windblown sand, making the current ground surface essentially flat.

The ceramics from Area B are largely Meroitic in date, similar to what was found in Area A, with a seemingly greater representation of Early Meroitic ceramics (4^{th}–2^{nd} century BC). Most ceramics in both areas are essentially surface finds rather than representing a stratified sequence, which does not yet exist for this area of Kush (cf. Nowotnick 2022 for Hamadab) and remains an important goal of our potential

Figure 14. Architecture in Area B (plan by Nadejda Reshetnikova, 2023).

future work at the site. Interestingly, despite the undoubted importance of Jebel Barkal during the Napatan period, very few Napatan sherds were found in the upper levels of Areas A and B.

To investigate the stratification of this area, and also as an attempt to understand the overall depth of deposit on the East Mound, we excavated a small sounding (2x3m) to a depth of 1.5m within Building B13. This showed four occupation levels: two of the Meroitic period, a level with cultural remains and no architecture, and a lower occupation layer that produced clearly Napatan pottery with a majority of the assemblage being imported wheelmade Egyptian jars dating to the 7th century BC. This demonstrates the existence of a Napatan occupation of the East Mound. A hand auger core showed that cultural material

Figure 15. A portion of Area B, showing Building B13 in the foreground, an alleyway blocked by a door (with preserved pivot stone) on the right, and a portion of the long street in the background (drone photo by Sami Elamin, 2023).

continued at least 0.6m lower, making the depth of cultural deposit in this area of the site more than 2m, representing at least 500 years of occupation.

Neither Area A nor Area B have shown what we would expect of a domestic occupation area. In particular, the total absence of spindle whorls and other textile–related tools suggests that the structures being excavated did not house whole family units. This observation brings the high density of cooking features and ground stone tools that were likely related to food preparation into clearer focus – the excavated structures were producing food for a greater number of people than resided in the structures themselves.

There are some further hints of Meroitic administration in the East Mound, although found in relatively small numbers. A series of ceramic sherds reshaped in geometric forms may have functioned as tokens.

A single ostracon with a Meroitic inscription (Figure 16) was also recovered. According to a preliminary study by Jochen Hallof, the Meroitic inscription on the ostracon seems to be complete. Large spaces above and below the text show that it only contained a single line of text. A large space on the right suggests that this letter is the beginning of the inscription. The situation is less clear on the left side, but the reading of the inscription also suggests it ends there.

The inscription reads as follows:

p i n b l 6

The word *pinbl* can be analysed as a kind of noun, as suggested by its ending in the article -l. The stem of the noun is therefore *pinb*, a word not attested so far in other Meroitic inscriptions. It is followed by the numeral 6. The inscription can be ‘translated’ as ‘the 6 pinb’ and interpreted as a kind of receipt about a

Figure 16. Meroitic ostracon from Area B, length 110mm (photo by Henrik Brahe, 2022).

Figure 17. Copper alloy seal ring of the Meroitic period depicting an elephant - surface find next to Area B (photo by Suzanne Davis,

certain object and its quantity. Such inscriptions are common for ostraca. The date of the inscription is noteworthy because it was written in the 'archaic' palaeographic period, which would date to the 2nd or 1st century BC.

A stray surface find of a bronze seal ring with a design of an elephant (Figure 17) shows a connection of sealing activity to Area A, despite the relative scarcity of sealing fragments from Area B. It is also similar to two Meroitic seals depicting elephants found at Selib, some 140km downstream of Barkal (Hajduga 2021, 162).

Across the western part of Area B, a series of parallel linear features (Figure 18) were found to be remains of burials of the medieval (Christian) period. In total, 14 skeletons or skeletal remains were exposed and nine of these were investigated by a team led by Abagail Breidenstein. An additional number of potential burials including a Christian box grave were also identified, but not excavated. It is likely that the burials are connected to the houses built inside the outer courtyard of the Temple of Amun. The linear organisation of the cemetery, the burial form (pit inhumations) and skeletal position (NW–SE oriented

Figure 18. Medieval Christian period burials of an adult and a child just under the surface

Figure 19. Photo of Area C looking west (drone photo by Sami Elamin, 2022).

and crossed arms or legs) are like that observed at the Christian cemetery at El Kurru (Skuldbøl *et al.* 2016).

Area C

Area C was located over a clear architectural signature in the magnetometry plan (Mag–B5) that looked like it could have been a pylon of a small temple. The area also had the advantage of being located along the line of the long street in Area B (see Figure 13) and we hoped to locate the northern end of the street.

The short investigation of this area made it clear that while the magnetometry had correctly identified walls in the area, they did not clearly form the pylon of a temple (Figure 19). More work will have to be done in this area to understand the surviving architectural remains.

Archaeobotanical analysis

Thirteen archaeobotanical samples from Area A (2020 season) and ten samples from Area A and B (2022–2023 seasons) have been analysed by Anna den Hollander and Dorian Fuller. In total, 91 samples of varying sizes comprising c. 1500 litres of soil were processed. Contexts sampled included floors, hearths and submerged jars. Charred remains were separated from the heavy residue by bucket flotation over a 250µm mesh. The heavy residue was dry sieved and sorted into bone, ceramics, building materials, artefacts, and metal. Sample sizes ranged from 3 litres to 25 litres in 2020, with in total 244.2 litres of soil being analysed. In 2022–2023, sample sizes were increased to 60L wherever possible. Until now a total of 116 litres have been analysed, quantified and fully identified while an additional 25 samples were assessed representing 265.5 litres.

Preservation of the archaeobotanical materials at the site was relatively poor, a fact that can be deducted from the high proportion of fragmentary materials in the overall assemblages (2020 season: c.47% and 2022–2023 seasons: c.45% respectively of the total assemblage is made up of unidentifiable fragments). Desiccated material is virtually absent from the assemblages, which is noteworthy, and implies that there

was sufficient rainfall and Nile flooding in the Meroitic or subsequent periods to prevent dry preservation conditions.

The assemblages showed that the main economic crops include summer cereals (millets) and winter cereals (wheat and barley). Millets include the rare Sorghum bicolor, occasionally represented as chaff, Setaria (possibly S. sphacealata, a former foxtail cultivar in Nubia: Fuller 2004; Fuller and Edwards 2001), and Echinochloa sp., most likely a wild/weedy barnyard grass. The larger–grain cereals included six row, hulled Barley (Hordeum hexastichum), the most prevalent, and wheat (Triticum), probably emmer wheat (Triticum cf. dicoccum). The relative scarcity of sorghum was interesting, which is a summer crop more commonly grown further south in ancient Kush (Fuller and Lucas 2021). Whether this difference is due to climate differences, cultural differences, or the area of Barkal that we have sampled remains to be seen.

The pulses included lentils (*Lens culinaris*). Fruits and nuts include dates (Phoenix dactylfera) and fragments of fruit and nut shells including Ziziphus sp. One cotton seed (*Gossypium sp.*) was found. Weedy crops include small grass grains (Poaceae, with the occasional Lolium sp.), weeds of the Trifolieae tribe, a carpetweed (Aizoaceae: Zaleya petandra), weeds from the Amaranthaceae family, and the Malvaceae family. Seeds of the umbrella thorn Acacia (Acacia cf. tortilis) were also recovered.

Napatan Palace Area (B1200)

While the focus of our excavation at Barkal has been to identify areas of urban occupation, it remains a priority to connect the known area of temples and palaces to the broader urban settlement. Furthermore, there remain unresolved questions about the temple and palace area. For example, the earliest Egyptian occupation was a *menenu* (fortress) according to the stele of Thutmose III found at Barkal (dating to about 1432 BC; Kendall and El–Hassan 2017, 162). Based on comparison with other Egyptian fortresses of the New Kingdom built in Nubia, this would have been a walled settlement that encompassed a temple. The main Egyptian temple at the site – dedicated to Amun – is clearly visible, and its probable earliest phase as a mudbrick shrine to Amun has also been identified in the same location (Kendall and El-Hassan 2017). No enclosure of New Kingdom date has yet been found at Barkal.

Moreover, a 2006 magnetometry survey conducted by Thomas Goldmann and Pawel Wolf as a part of Tim Kendall's project found what appeared to be an outer wall of the Napatan Palace (B 1200) that had not been excavated or documented by Reisner, suggesting both that there could be a significant part of the palace that has not yet been excavated, and also that B1200 was a square structure like Meroitic palaces rather than a rectangular one as earlier plans suggest.

We aimed therefore to attempt a Ground Penetrating Radar (GPR) survey in the area of the temples and Napatan palace. Although it is significantly more expensive, GPR presents several advantages over magnetometry. Firstly, it can normally provide data from significantly deeper under the surface. There are trade–offs between the survey depth and the resolution of the results, but in general the GPR team reached a depth of nearly 2m with this technique. Secondly, whereas magnetic survey produces a single scan of all features identified, regardless of depth, GPR produces 'slices' that show features at a single depth. Furthermore, GPR being based not on magnetic fields but on relative density, it has the potential to identify different types of underground features. At the same time, the visibility of features in both techniques can differ in specific environments and with particular construction materials. Thus, we began our GPR survey in 2020 with a short test conducted by Burkart Ullrich and Rudi Knieß of the German company Eastern Atlas.

The 2020 GPR results from the Napatan palace area confirmed what the magnetometry had shown: there was a large area of the palace, defined by an outer enclosure wall, that had not been documented by Reisner's excavations (Figure 20).

An opportunity to conduct a more comprehensive GPR survey was available in the 2023 season by the filming of the National Geographic documentary *Lost Cities Revealed with Albert Lin*, which generously funded a significant expansion of the GPR survey. It did not clearly locate the New Kingdom town wall, but it did confirm and expand our knowledge of the area around the palace, in particular showing that the palace was not an isolated structure but was rather surrounded by a dense urban settlement (Figure 21).

Pawel Wolf, assisted by Kate Rose, began excavation in this area in 2023 to test the GPR results, date the structures, and get some sense of the depth of deposits (Figure 22). The uppermost layer comprised an outer enclosure wall for the Napatan palace, and two large houses ('villas') built on the other side of the street. Ceramics suggest a late Napatan date (late 4th century BC) for these constructions.

A sounding (BP23–05) showed that these villas were only preserved to a depth of 1-2 brick courses. There were two earlier phases, which were stratigraphically earlier than a burned layer, which is almost certainly the destruction of the level of the palace built by Aspelta, as found during the previous excavation of Palace B1200 (Kendall and Wolf 2007). This destruction was dated to around 600BC. The two earlier constructions found in our excavations as well as a number of finds within the lower horizons of the streets dividing them from the palace walls of B1200 would therefore appear to extend into the 25th dynasty period (*c.* 700BC).

The total depth of deposit we were able to document this season was just over 2m in depth before reaching what appeared to be natural sediments. Thus, the depth of deposits and sequence of occupational periods in this area are comparable to what we found in the East Mound.

Geomorphology

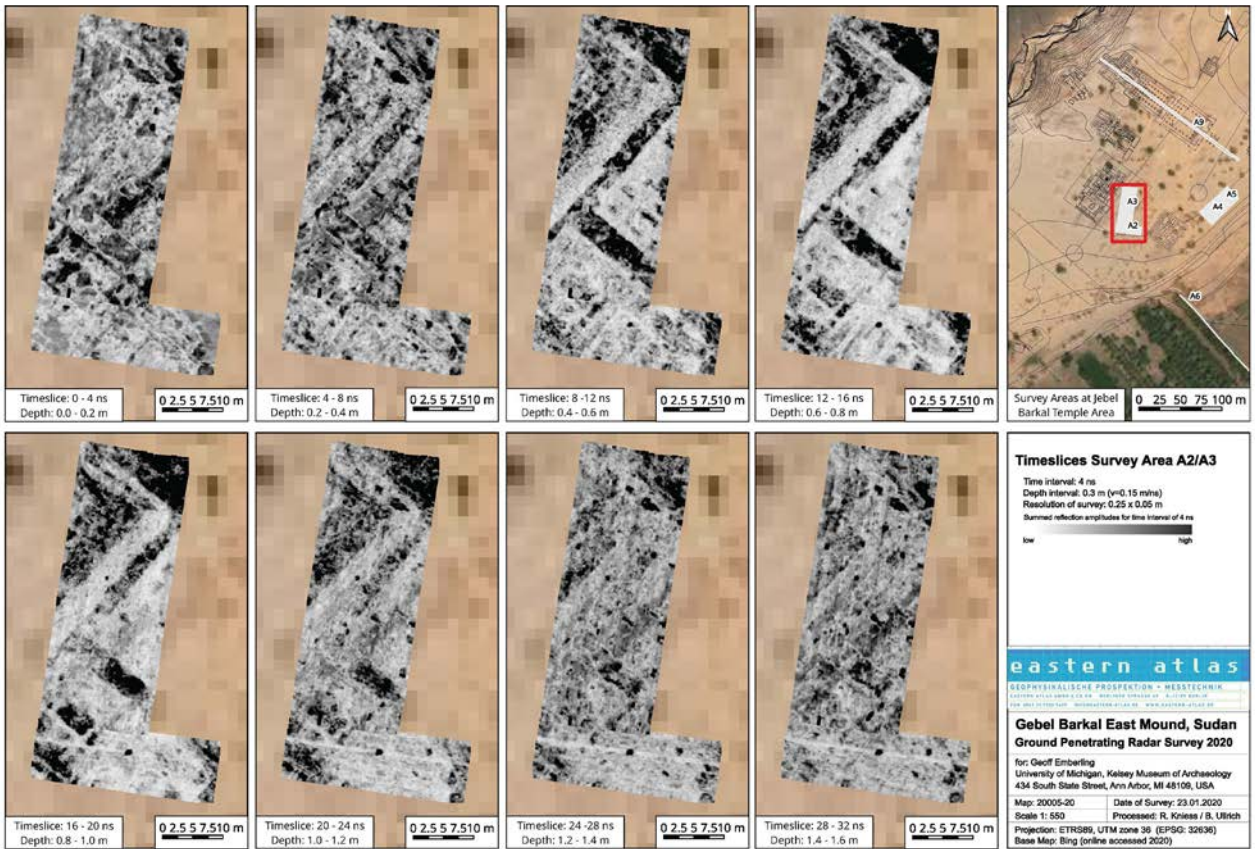


Figure 20. Ground Penetrating Radar 'slices' of about 200mm depth showing the area east of the Napatan Palace B1200. A large wall of the palace becomes clearly visible 0.4m under the surface and fades into natural deposits by 1.4m in depth (image: Eastern Atlas, 2020).

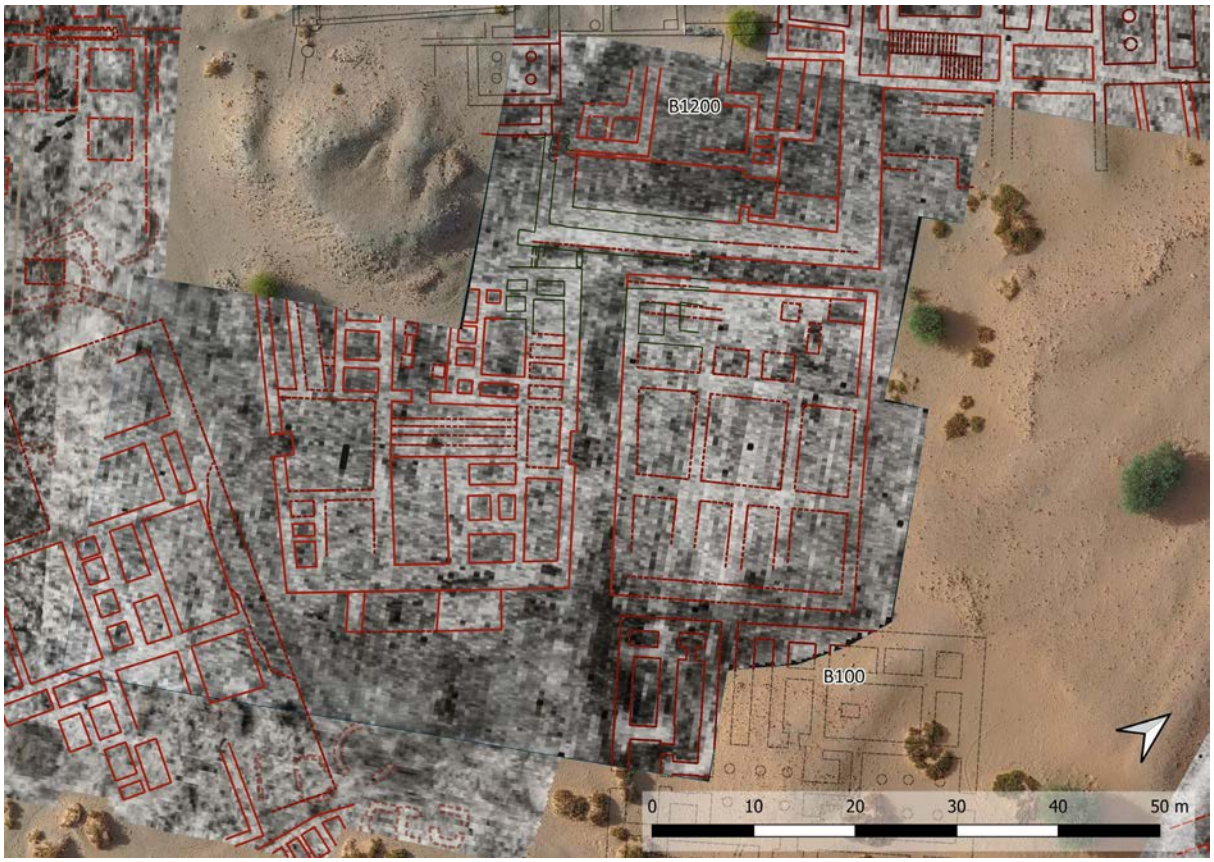
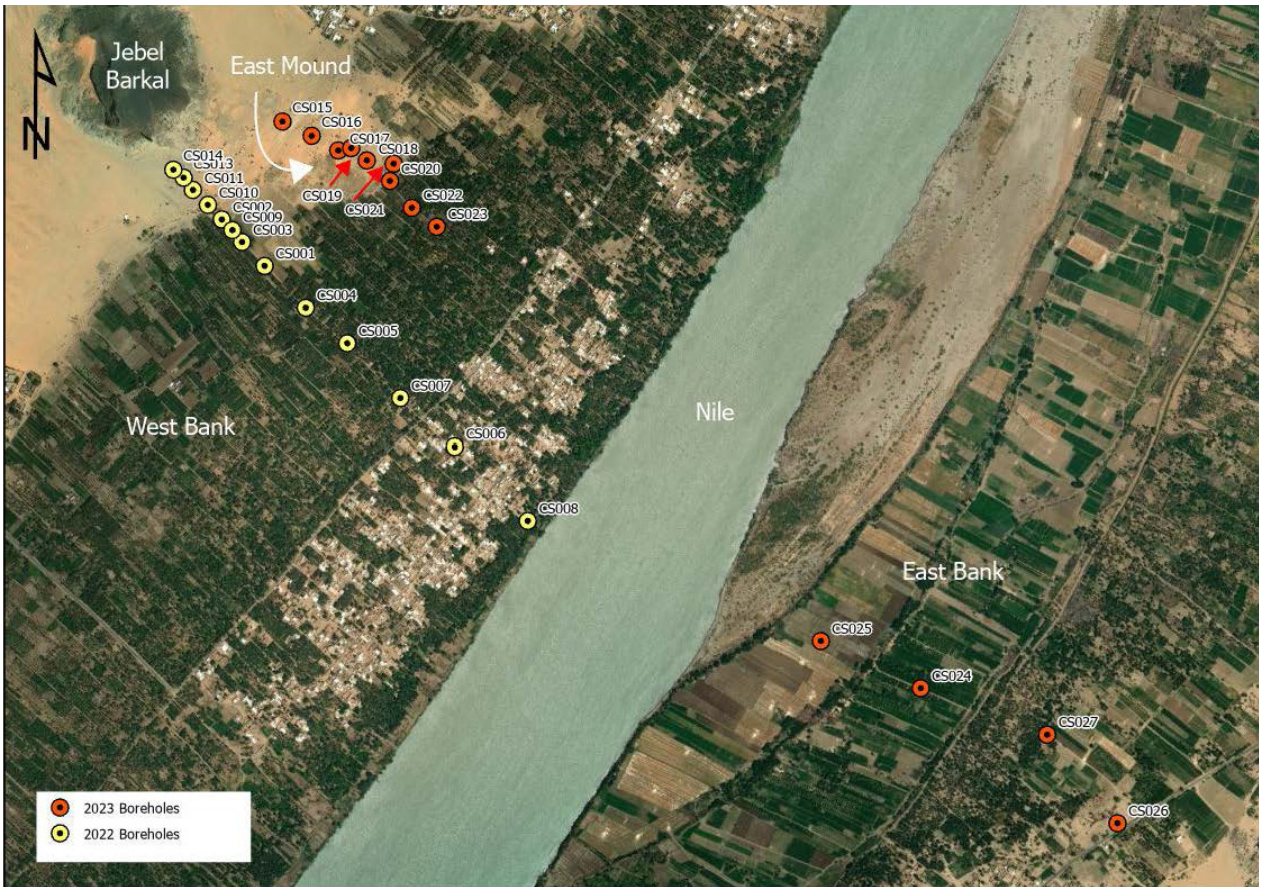


Figure 21. 2023 GPR survey of the area around Napatan Palace B1200 with interpretation showing the extensive architecture around the palace (image by Pawel Wolf, 2024).

Figure 22. Photo showing the newly exposed outer eastern wall of Napatan Palace B1200, an intersection of two streets, and corners of two large 'villas' (drone photo by Sami Elamin, 2023). The photo was taken before soundings were made into several spaces within and around the buildings.



We have also begun investigating the relationship of the city at Jebel Barkal to its natural environment, particularly the connection between the city and the Nile, important of course as a source of water for people, animals, and crops, but also as a means of economic, military, and ritual transportation. Currently, the temple of Amun stands 1.4km from the main Nile channel, too far presumably for the city to have easily been supplied with water from the Nile in antiquity. Reisner's excavation of the temple area did find several round features that he interpreted as wells (Dunham 1970, 10, 85, plan V; additional wells are mentioned in Reisner's field diaries), but that could only have been a partial solution. Moreover, the possibility of ritual processions of statues of the gods from the Amun Temple (B500) should be considered. The current processional way leading out from the main entrance of the temple as currently understood is quite short – just six kneeling ram statues (three on each side) were found *in situ*, marking an entrance of approximately 14m in length. By comparison with the New Kingdom temple at Soleb (which was the source of the ram statues, brought to Barkal by Piankhy), whose processional way extends nearly 45m and is lined by approximately 44 ram statues (Schiff Giorgini 2003, figure 21), the Amun temple at Jebel Barkal would seem to have had its processional way significantly reduced. Was this due to the closer proximity of a Nile channel?

In 2022 and 2023, a geomorphology team led by Jan Peeters worked at the site to start evaluating aspects of its changing landscape (Figure 23). In 2022, a transect of cores showed that in the past the Nile flowed right next to the area of the Amun Temple and within about 100m of the Jebel (i.e., at CS014 and CS015 in Figure 23), but optically stimulated luminescence (OSL) dates showed that this activity had already ended during the Early Holocene (*c.* 8000BC), well before the earliest known occupation of the site. In 2023, this transect was extended to the eastern bank of the Nile, because studying both riverbanks is essential to get a complete picture of changes of the Nile system as recent work in the Theban region in Egypt has

successfully shown (Peeters *et al.* 2024).

We also began a new transect in 2023 to relate the settlement to other geomorphological and site formation processes. This transect ran roughly from the Natakamani Palace, through the occupation of the East Mound, and into the Nile floodplain into what is now date palm groves. These cores showed that the East Mound settlement had been built on wadi and Nile deposits, which provided a useful perspective on further excavation on the East Mound. While areas in the centre of the East Mound appear to preserve settlement to a depth of roughly 3.5m (i.e., at CS017), toward the eastern edge of the mound, the depth of occupation diminishes towards the Nile's floodplain (i.e., at CS023).

Conservation of the Temple Area

As noted above, there had been very little conservation work done in the area of the temples at Barkal since Reisner's excavations of 1916–1920. Some repairs had been made with cement and some stone blocks were reset in an attempt to restore and stabilise columns in the Amun Temple (B500) and the Osiris–Dedwen Temple (B700), but we have not been able to locate records documenting this work. Some of the repairs may have been made during the Anglo-Egyptian administration, while additional restoration seems to have been carried out by NCAM in the 1970s or slightly later.

Our conservation team led by Suzanne Davis and Elmontaser Dafalla conducted a preliminary condition assessment in 2019 but did not hold a full conservation field season until the winter of 2023. During that season, we worked primarily in B700, a temple dedicated to Osiris–Dedwen and built by Atlanersa and Senkamanisken (7th century BC), with a small Meroitic chapel added at the back of the building, where it abuts the jebel. In the 2023 season, we developed a plan for the temple's conservation; documented and numbered all significant fallen blocks; reset fallen blocks where possible using a lime–sand mortar; filled the floor of the temple's chapel and its two large, colonnaded rooms to their original levels (burying undecorated stone blocks under the sand fill); filled undercuts in the walls; added new sandstone paving

Figure 24. Photo of Temple B 700 at the end of the 2023 season (drone photo by Sami Elamin).

Figure 25. Sami Elamin conducting a community engagement event for children at Jebel Barkal, April 2024 (photo by Mohamed Ahmed Abbas).

in front of the Meroitic chapel, to create a stable area for visitors to stand during tours; and removed old concrete repairs to several columns, replacing them with lime–sand mortar repairs that are softer and more compatible with the ancient Nubian sandstone (Figure 24).

Our grant also included funding towards building a ring of concrete bollards around the site to restrict and channel vehicle access, as well as working on removing Reisner's excavation dumps from the site.

Community Engagement

A significant part of the conservation project was developing a new programme of engagement with the communities around the site. In 2022 Rebecca Bradshaw and Tohamy Abulgasim began by organising visits from nearby schools to the site and initiating conversations with residents of Barkal Tahet, Barkal Fowk, Abasseya, and the town of Karima. There was a fair amount of accumulated resentment that despite all the years of Sudanese and international archaeological work at the site, some local residents said we were the first to come and ask about local perspectives on the site. This is not entirely true – certainly there had been some local conversations around heritage (Faiz Hassan Osman 2004; Baloula 2020) – but it reflected a local feeling of not having been consulted about decisions directly affecting land use, particularly as the current site boundary was established in the 2000s. As one local resident said, 'we don't want you to think for us; we want to think together about the site'.

During a second season of community engagement in winter 2023, we began assembling a community advisory board that would engage with the site and contribute to its protection (fuller discussion in Bradshaw *et al.* in press).

Since the outbreak of civil war in Sudan in April 2023, our collaborative team structure and the flexibility of our funders has allowed us to continue with some of our community engagement activities, thanks largely to the energetic presence of Sami Elamin and his colleagues at Jebel Barkal (Figure 25; see

Figure 26. Members of the team, 2023 (photo by Henrik Brahe).

also Davis and Emberling 2023). On behalf of our large team of Sudanese archaeologists and community members as well as international scholars (Figure 26), we hope for a return to peace in Sudan.

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