Lenka Varadzinová, Ladislav Varadzin, Elena A. A. Garcea, Giulia D'Ercole, Jaroslav Řídký, Jon-Paul McCool, Altayeb Abdallah, Bushara Abdallah Adam

# Prehistoric research in the western part of Jebel Sabaloka (spring 2019)[1]

One of the challenges of prehistoric research in general, and in central Sudan in particular, has been the bad state of preservation of the late prehistoric evidence in consequence of post-depositional transformations. Their impacts on the sites have been as diverse as their types. Many late prehistoric sites in central Sudan have been severely altered through reuse of the same locations at later times as cemeteries, with creation of tumuli heaped from surface and subsurface deposits bringing along large-scale destruction of primary contexts and redeposition of finds and, in some cases, even reduction of the entire late prehistoric deposits to mere remnants near the sterile ground (e.g., Caneva et al. 1993; Salvatori 2012). Nevertheless, even sites that have escaped such a vast anthropic devastation of earlier archaeological situations have been affected by varied natural transformations that have caused reduction of archaeological deposits and both vertical and horizontal redeposition of finds (deflation, erosion, biotic processes), homogenisation of the archaeological deposits with obliteration of interfaces between stratigraphic units (biotic processes, subsurface chemistry), and even disappearance or at least degradation of whole categories of both organic and artefactual materials (subsurface chemistry). This has considerably complicated the study of intra- and inter-site patterns of settlement and their dynamics as well as the understanding of the critical cultural developments among the late hunter-gatherers and early food-producers in this region.

This has been the case also of the western part of Jebel Sabaloka explored since 2009 by the Charles University Sabaloka Expedition in a concession extending from the village of Tabya Hassaniya to the south to the village of Al Huqna to the north (fig. 1). In this region, however, the situation has been specific as most late prehistoric sites overlap with rocky outcrops and are situated at elevated positions above the surrounding plain on terraces and platforms delimited by boulders and rocks. This characteristic makes it possible with most sites to determine the maximum extent of the late prehistoric occupation, to investigate the vertical and horizontal structuring of the prehistoric settlements, and to assess the degree of erosion and deflation through marks left on the surrounding rocks and identify the main directions of redeposition of finds through erosion (Varadzinová Suková et al. 2015). Furthermore, the smaller size of some terraces has made them less suitable for reuse in later times as burial grounds and has thus reduced the extent of reworking of the deposits through anthropic actions, preserving at least parts of the original deposits in place. However, where deposits have not been eroded and deflated, they have still suffered from homogenisation through subsurface chemistry increased by the general geological and geomorphological background of the archaeological sites (cf. Almond and Ahmed 1993). Nevertheless, while the stratigraphic units are only rarely discernible directly in the field, our hitherto research has shown that the deposits beneath the surface are largely intact (e.g., Garcea et al. 2020) and offer a substantial research potential.

The complicated archaeological image of the late prehistoric sites in the western part of Jebel Sabaloka was identified for the first time in the 2011 and 2012

1 Affiliation of authors: Czech Institute of Egyptology, Charles University, Prague, Czech Republic: Lenka Varadzinová; Institute of Archaeology of the Czech Academy of Sciences, Prague, Czech Republic: Ladislav Varadzin, Jaroslav Řídký; Department of Letters and Philosophy, University of Cassino and Southern Latium, Cassino, Italy: Elena A.A. Garcea; Institute of Egyptology and Coptology, Ludwig-Maximilians-Universität München, Munich, Germany: Giulia D'Ercole; Department of Geography and Meteorology, Valparaiso University, USA: Jon-Paul McCool; Department of Archaeology, University of Al Neelain, Khartoum, Sudan: Altayeb Abdallah; National Corporation for Antiquities and Museums of the Sudan, Khartoum, Sudan: Bushara Abdallah Adam.

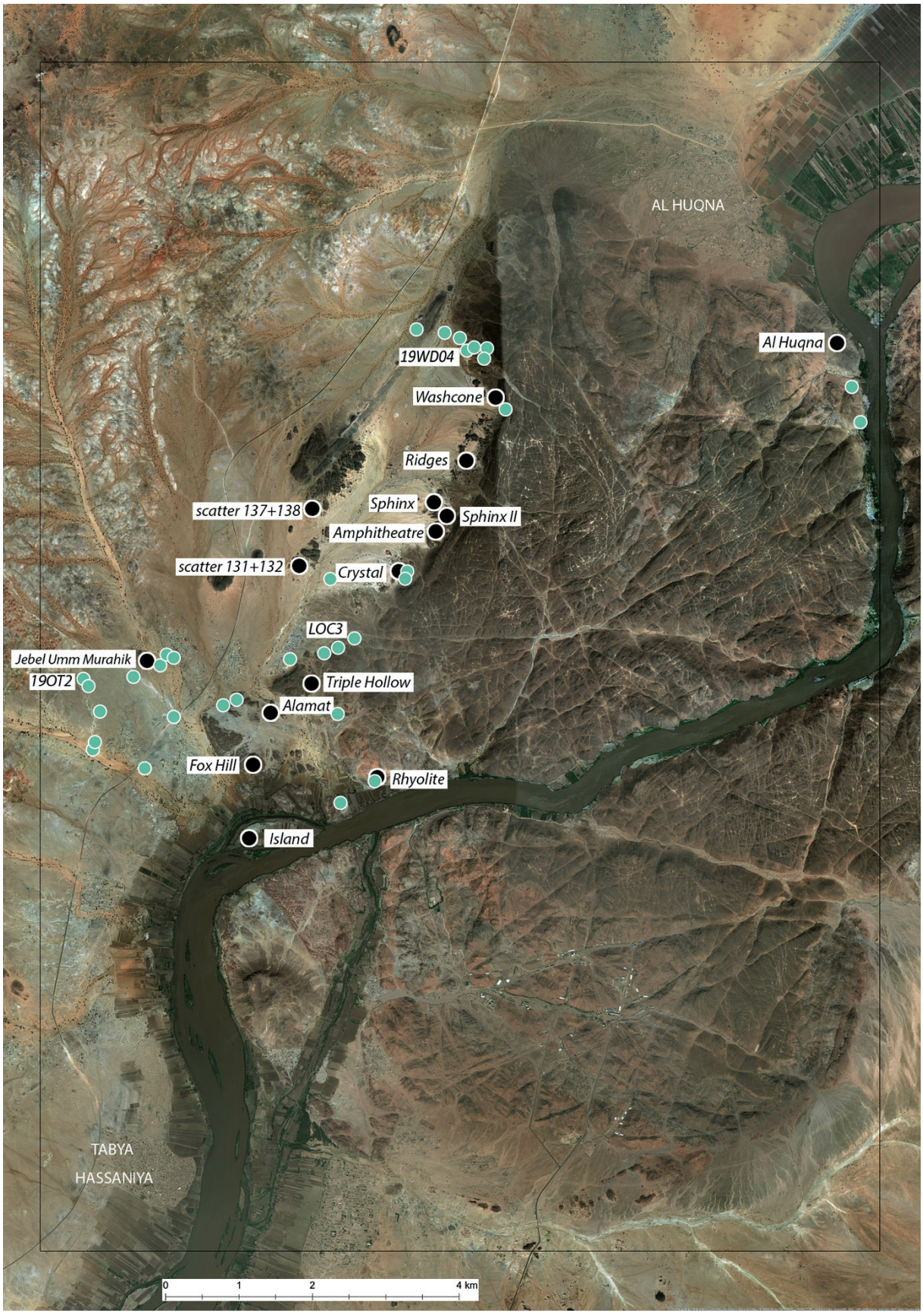


Fig. 1: Map of the western part of Jebel Sabaloka, showing the location of the archaeological sites (black dots) and the palaeoenvironmental research locations (green dots) investigated in 2019 (background: ESRI Base Map – World Imagery Source, Digital Globe; completed by L. Varadzinová, L. Varadzin and J.-P. McCool).

field campaigns when we registered most of the 32 late prehistoric locations known in the region now and conducted the first test excavations on several sites and larger-scale research on two main settlements – *Sphinx* and *Fox Hill* (Suková and Varadzin 2012; Suková et al. 2014). In the autumn of 2014, the entire field season focused on *Sphinx* where we performed detailed investigation of the post-depositional processes and elaborated methods and procedures for exploration of prehistoric sites in the geomorphologically and geologically specific area of Jebel Sabaloka (Varadzinová Suková et al. 2015). In the subsequent field research between 2015 and 2018, larger-scale excavations were performed on the two above-mentioned sites using the improved uniform methodology with the aim to collect good quality data to establish the framework of occupation and material culture developments in this region (e.g., Garcea et al. 2020; Varadzinová et al. 2021).

In 2019, our attention turned again to the other late prehistoric sites with the aim to use the updated research methodology to gather a broad spectrum of comparable datasets required for the assessment of inter- and intra-site variability. The fieldwork took place between 20 February and 17 March 2019 and involved both surface research and small-scale excavation. Alongside, typological, morphological and technological study of pottery collected through systematic surface collection and excavation at selected sites, and of ground stone artefacts collected systematically from *Fox Hill* was performed. Last, but not least, parallel palaeoenvironmental investigation focused on the study of the character and extent of palaeosols in the region and on understanding of the hydrological regime in the area during late prehistory. In this paper, we present the main results of the field research obtained through a portfolio of methods and approaches chosen to cope with the differing degree of alteration of the sites under study through diverse cultural and natural transformations.

## Sites

Fifteen sites were covered by the archaeological works in 2019 (fig. 1). Eight of the sites are in the Rocky Cities area in the north-western foothill zone of the Sabaloka massif locally known as Hawawit and Al Hagiba. They are *Amphitheatre* (SBK.W-66)[2], *Crystal* (SBK.W-59), *Ridges* (SBK.W-64), *scatter*[3] 131+132, *scatter* 137+138, *Sphinx* (SBK.W-60), *Sphinx II* (SBK.W-65), and *Washcone* (SBK.W-61). Five are distributed in the Lake Basin area close to the Nile in the vicinity of the village of Al Hugeir Abu Dom: *Fox Hill* (SBK.W-20), *Island* (SBK.W-55), *Rhyolite* (SBK.W-58), and *Triple Hollow* (SBK.W-62). Two more sites are located near the village of Al Huqna at the Sixth Nile Cataract (*Al Huqna*, SBK.W-1) and to the west of the mountain near the village of Al Salhab (*Jebel Umm Murahik*, SBK.W.SS-22), respectively.

While differing in their basic characteristics, the sites also differed in the history of exploration. *Sphinx* and *Fox Hill* had been registered in 2011 and extensively surveyed and excavated between 2011 and 2018 (e.g., Suková and Varadzin 2012; Varadzinová and Varadzin 2017; Varadzinová et al. 2018, 2019). Other six sites had been registered by our team in 2011. Of these, *Washcone* had been briefly surveyed whereas *Crystal*, *Island*, and *Rhyolite* had been briefly surveyed and test excavated in 2011 or 2012 (1 $m^2$) (Suková and Varadzin 2012). *Scatters 131+132* and *137+138* were noted in 2011 but had not been revisited and subjected to any form of survey prior to the 2019 field campaign. Five sites had been registered and briefly surveyed in or after 2012 as locations of importance but had not been subjected to a more detailed survey before 2019: *Alamat*, *Amphitheatre*, *Ridges*, *Sphinx II*, and *Triple Hollow*. *Al Huqna* had been registered by our team as a location featuring the remains of a fort in 2009 (it was referred to as *Wad Mukhtar* in the report for that field campaign; see also Suková et al. 2010; and Suková and Cílek 2012) and by the NCAM as a location with a military and settlement component with surface finds of Stone Age, Neolithic, and undetermined (mixed) dating in 2011.[4] It had been revisited by our team in 2014 but had not been subjected to further survey prior to the 2019 field campaign. *Jebel Umm Murahik* had been registered by the NCAM in 2011 as a location with a settlement and funerary component of Neolithic (*sic*) and undetermined dating.[5] In 2014, the site had been briefly revisited by our team and identified as an Early Khartoum settlement with a considerable

2 The site codes including "SBK.W-" and "SBK.W.SS-" derive from the system established by the NCAM in the framework of their reconnaissance of the area of Jebel Sabaloka in spring 2011 in connection with the planned construction of a dam at the Sixth Nile Cataract, and should be read as "Sabaloka-West" and "Sabaloka-West (Supplementary Survey)". The codes starting from SBK.W-55 are those assigned to the sites since 2011 by our team.

3 The site names involving "scatter" refer to the system established by our team in 2011 to number locations with late prehistoric remains prior to their inclusion into the system established by the NCAM.

4 See the site registrar produced by the NCAM based on their reconnaissance of the area in 2011.

5 This site is included in the same registrar of sites produced by the NCAM in 2011.

Fig. 2: Jebel Umm Murahik, Area A, view from south (photo by L. Varadzin).

exploration potential (fig. 2), but no proper survey work had been performed there before 2019.

## Methods and approaches

*Surface research* focused on recording of characteristics of features, structures, and settlement debris at the studied sites and on assessment of the potential of the sites for further exploration.

*Basic survey* consisted of a walk inspection of previously registered surface scatters or archaeological features. It involved a brief description of their location and character, recording of the categories of finds and features, tentative cultural attribution based on diagnostic pottery and lithic finds, and very general assessment of the site's research potential. Documentation included verbal description and photography.

*Systematic survey* was aimed at collection of qualitative and quantitative data from the surface of the sites selected for comprehensive intra- and inter-site comparisons. The sites were first surveyed and described in detail from the point of view of geomorphology and topography with the general distribution of surface finds and varied features recorded (tumuli, flat graves, other stone structures, bedrock features). Where delimited by bedrock and indicated by clear concentrations of surface finds, separate areas were outlined within individual sites and designated using capital letters. These areas then constituted separate units for the systematic survey. For sites and their individual areas, the elevation, presence and degree of erosion, and direction and course of erosion lines were noted to assess the effect of erosion on distribution of surface finds. Accessibility and intervisibility were also recorded to understand interconnectedness between areas within individual sites and between sites and their surroundings. Detailed verbal description and photographs and plans or sketches were realized. In addition, micro-soundings were made in selected areas to test the presence and character of archaeological deposits or finds.

Subsequently, a detailed surface survey focusing on diverse categories of finds was performed using survey forms. The spatial unit was always a site's area. In each area, it was a one-shot (single-occasion) survey performed by two to four persons over 10 to 50 minutes depending on the size of the area being surveyed.

With *pottery finds*, the quantity (density, including fragmentation) was assessed, represented types were indicated, and cultural attribution was determined or proposed.

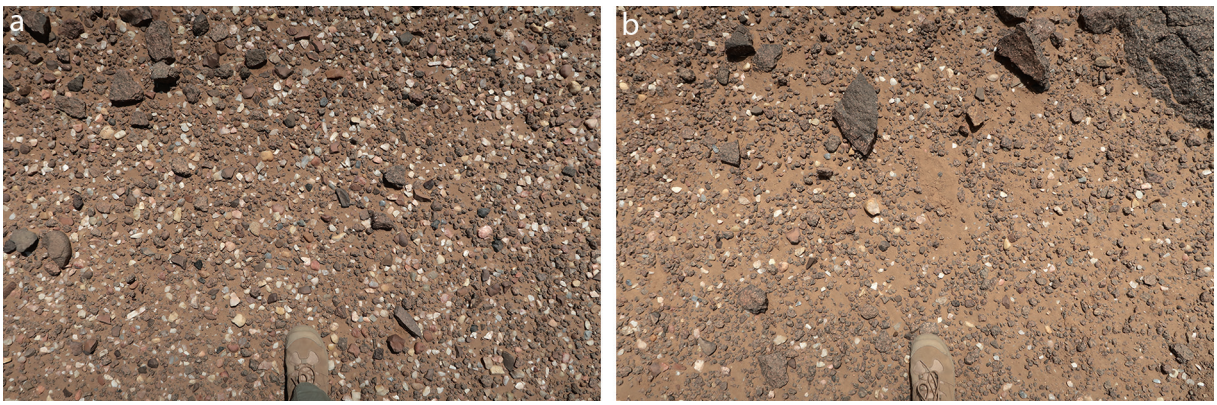


Fig. 3: Jebel Umm Murahik, Areas A and C. Snapshots of surface lithic finds: (a) density 1–2; (b) density 3–4 (photos by L. Varadzin).

With *lithic finds*, quantities were recorded using a scale from 1 (very abundant) to 5 (scarce to absent) (fig. 3), spectrum of raw materials and roughly their percent representation were noted, along with the presence of diagnostic and peculiar pieces (MSA, gouges, etc.).[6]

With *ground stones*, first the quantities for each of the categories represented (e.g., grinding-milling tools, stone rings etc.) were roughly estimated (up to ten, low or high tens, hundreds). Subsequently, we performed ca. twenty-minute random surface collection from each area, with the finds photographed and described on site from the point of view of morphology, preservation (fragmentation), and raw materials.

With *other artefacts* and *ecofacts*, their presence, category (human bones, animal bones, gastropods, bivalves, pigments, decorative objects, etc.) and quantity were recorded.

The finds recorded during the systematic surface survey were left on site after documentation. Sometimes, small samples of lithics and ground stones were transferred to the base camp for more detailed study and documentation.

*Excavation* was aimed at ascertaining the depositional history of individual sites. Composition of sediments and, where visible, also stratigraphy was studied. Trenches were located based on the results of the systematic survey and assessment of the geomorphological and topographical aspects of each site. The excavation employed the method established during previous field campaigns consisting of excavation in standardized levels ca. 50 mm in thickness (mechanical units, MU). These, however, respected stratigraphic units (SU) where ascertained. All levels – natural or arbitrary – were documented by verbal description, photography and drawings, and their depths were recorded using a levelling machine. All trenches were excavated down to bedrock.

The excavated sediment was dry-sieved using a 4-mm mesh and the coarse fraction was sorted for artefacts and ecofacts. For sorting, three strategies were employed. At *Washcone*, it involved all finds. At *Alamat*, *Amphitheatre*, *Crystal*, *Rhyolite*, and *Sphinx* we totally sorted all finds, except for over-abundant lithics that were collected only from one bucket of sediment per excavated level (MU). At *Jebel Umm Murahik*, lithics were collected only selectively from individual MUs owing to lack of time. After completion of field research, all trenches were refilled with the excavated matrix.

Further archaeological material was obtained during the field season by dry-sieving of the loose sediment found around and within three illegally dug pits that were ascertained in the northern part of *Sphinx*. These disturbances measuring 12.39 $m^2$ in total were documented by means of verbal description and photographs and recorded on a general plan of the site. They were refilled using the sieved fine fractions and their surfaces consolidated by the sieved coarse fraction.

## Results

The methods and approaches employed at individual sites were chosen with a view to the history of their exploration, character and degree of their later transformation, their established research potential, and the type of (qualitative and quantitative) data to be collected for the intra- and inter-site comparisons (see tab. 1).

6 The information collected in the field complements the data collected in 2017 and 2018 in the scope of a specialised surface research through total counts (TC) performed on selected sites by a lithic specialist (*Fox Hill* – 42+4 TC; *Sphinx* – 6 TC; *Rhyolite* – 3 TC; *Island* – 3 TC; *Donkey* – 3 TC; and *Crystal* – 3 TC; see Varadzinová et al. 2018).

| Site name (code) | No. of areas (designations) | Site surface ($m^2$) | General survey | | Specialised surface research | | Excavation | | | Micro-soundings |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Basic | Systematic | Pottery | Ground stones | Area | Trench | Size | |
| *Al Huqna* (SBK.W-1) | not delimited | | yes | | | | | | | |
| *Alamat* (SBK.W-63) | 2 (A, B) | 1,507 | | A, B | A, B | | A | S.1 | 1 $m^2$ | A, B |
| *Amphitheatre* (SBK.W-66) | 11 (A–K) | 10,602 | | A–F, G.1, K | A–G | | G.1 | S.1 | 1 $m^2$ | |
| *Crystal* (SBK.W-59) | 9 (A–I) | 859 | | A–H | B, D | | D | S.2 | 1 $m^2$ | |
| *Fox Hill* (SBK.W-20) | 16 (Terraces T.1–T.16) | 11,648 | | | | T.1, T.3, T.10, T.13 | | | | |
| *Island* (SBK.W-55) | 4 (A–D) | 4,715 | | A, B + part of D | A, B | | | | | |
| *J. Umm Murahik* (SBK.W.SS-22) | 11 (A–K) | 17,078 | | A–C, E, F, H, I | A, F, H | | A | S.1 | 1 $m^2$ | F |
| *Rhyolite* (SBK.W-58) | not delimited | | yes | | total counts in 56 $m^2$ | | n/a | S.2 | 2 $m^2$ | yes |
| *Ridges* (SBK.W-64) | 5 (A–E) | 1,219 | | A–D | A–D | | | | | |
| *scatter 131+132* | not delimited | | yes | | | | | | | |
| *scatter 137+138* | not delimited | | yes | | | | | | | |
| *Sphinx* (SBK.W-60) | 5 (north, centre, south, + two shelters) | 793 | | | | | north | S.11 | 1 $m^2$ | |
| *Sphinx II* (SBK.W-65) | 1 | 582 | | 1 | 1 | | | | | |
| *Triple Hollow* (SBK.W-62) | 1 | 1,635 | | 1 | 1 | | | | | yes |
| *Washcone* (SBK.W-61) | 13 (A–M) | 2,624 | | A–E, G, I–M | A–C, E, L, M | | B | S.1 | 1 $m^2$ | A, L, M |
| Sum total | | | 4 sites | 9 sites / 45 areas | 10 sites / 28 areas + 25 total counts | 1 site / 4 areas | 7 sites | | 8 $m^2$ | |

Tab. 1: Late prehistoric sites (in alphabetical order) explored in 2019, with overview of methods and approaches chosen for individual sites.

On four sites, only *basic survey* was performed. At *Al Huqna*, low quantity of dispersed surface finds (mostly pottery) from the Early Khartoum (Khartoum Mesolithic, ca. 8,500–5,000 BC) and Early (Shaheinab) Neolithic (ca. 4,900–3,800 BC) were noted, but no contiguous surface scatters that would allow for meaningful delimitation of former occupation areas. At *scatters 131+132* and *137+138*, systematic surface research was planned, but could not be carried out due to lack of time. *Rhyolite*, situated close to the Nile on a former Nile terrace, featured many burial monuments (mostly tumuli and box graves) that have entirely altered this site in historical period. Its surface is distinguished by abundant finds of late prehistoric dating[7] in an area of some 7,000 $m^2$ that are intermixed with numerous quartz pebbles and immense quantities of unworked red and grey rhyolites washed from the massive outcrops situated above the site. Due to the massive reworking of this site in the past, it was impossible to perform systematic survey and to delimit accurately the extent of the Early Khartoum and Shaheinab Neolithic occupation, whose presence was signalled by great amounts of pottery and lithics from these periods.[8] In addition, pre-Holocene lithics and post-Shaheinab Neolithic pottery were recorded at this site.

*Systematic survey* was carried out on nine sites. On all these sites, pottery, lithics, ground stones, animal bones, molluscs and ostrich eggshell were recorded if present. The former three categories of finds clearly represent the key fingerprint of the local Early Khartoum and Shaheinab Neolithic occupation, and quantitative differences in their overall representation and in their ratios suggest differing occupation histories of the individual sites and their parts. Using the relative quantities of these finds, it was possible to distinguish main and subsidiary areas within sites, with the former showing larger numbers and balanced representation of all three categories as

7 The abundance and diversity of lithics noted on the surface of this site makes it an unparalleled archive for the study of lithic production and consumption throughout prehistory of central Sudan (e.g., Kapustka et al. 2019).

8 Some understanding of the zones of late prehistoric occupation could emerge from the analysis of the total counts of pottery collected on this site in the scope of a specialised survey of pottery (see *Pottery* below).

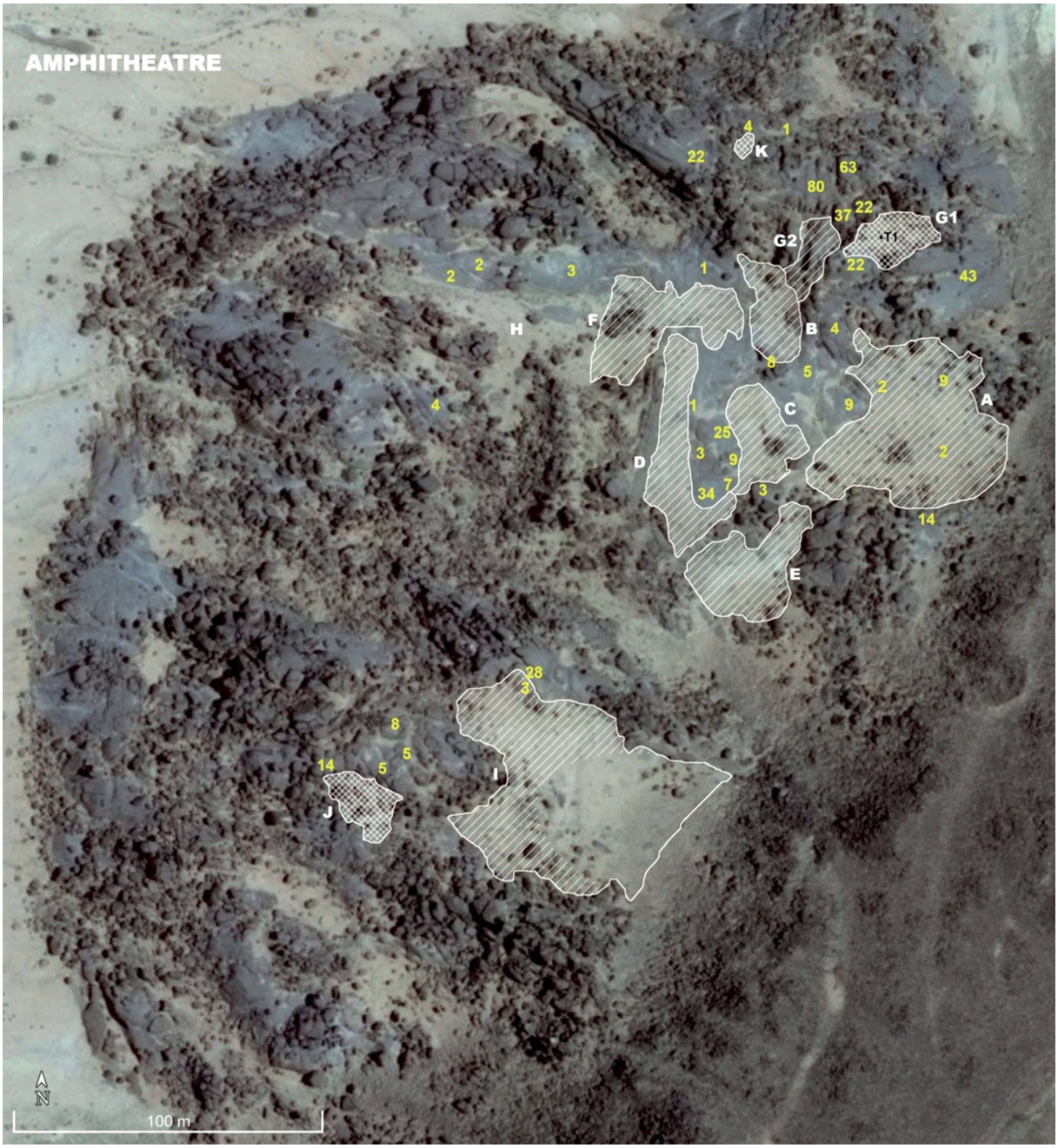


Fig. 4: Amphitheatre. Differentiation of areas within one site: cross-hatching = main area; hatching = subsidiary area; white letters = designation of areas; yellow numbers = numbers of bedrock features (background: Google Earth 2019; drawing by L. Varadzin).

opposed to the subsidiary areas that were characterized by lower numbers and/or uneven representation of one or two of the find categories. Finds from organic materials were rare. The only exception was *Jebel Umm Murahik* where large quantities of animal bones formed a contiguous layer along the long axis of Area F that apparently constituted a refuse area in the past.

Early Khartoum evidence was recorded on all nine sites, including *Island*, previously considered to constitute a solely Neolithic location. Surface finds make two of these sites stand out as locations of importance comparable to *Sphinx* and *Fox Hill* classified as core sites in the early stage of research (see below). These are *Amphitheatre* in the Rocky Cities, with Areas G.1, J and K constituting main areas of Early Khartoum occupation (709 $m^2$ in total; fig. 4), and *Jebel Umm Murahik* at the boundary between the Rocky Cities and the Lake Basin, with Areas A and B constituting an extensive and nearly contiguous main occupation area (3,237 $m^2$ in total; see fig. 2).

As for Shaheinab Neolithic remains, the systematic survey brought to light none in the Rocky

Cities (see also *Excavation* and *Pottery* below) and some evidence at most of the locations in the Lake Basin and on *Jebel Umm Murahik*. At *Triple Hollow* ephemeral evidence (1 sherd) from this period was revealed only through the specialised pottery collection (see *Pottery* below).

Evidence of occupation in post-Shaheinab Neolithic times was attested on all the systematically surveyed sites. At *Jebel Umm Murahik* and at *Amphitheatre*, a substantial historical component was present in the form of funerary structures (tumuli confined to some parts – mainly Areas H and I – of the former site, and diverse types of Meroitic and/or post-Meroitic graves mainly in Areas A, C–F, and I of the latter site). In addition, random surface finds of non-prehistoric pottery were found on these two sites as well as in (some areas of) other locations that lack conspicuous funerary remains. Furthermore, Palaeolithic lithics (mostly MSA, incl. Aterian) identified during the systematic survey on nearly all the surveyed sites indicate human presence in Jebel Sabaloka also during the Pleistocene (fig. 5). Palaeolithic finds were missing only at *Island*, a site situated in the Nile at an elevation too low to be protected from extreme floods during the African Humid Period (Williams 2019).

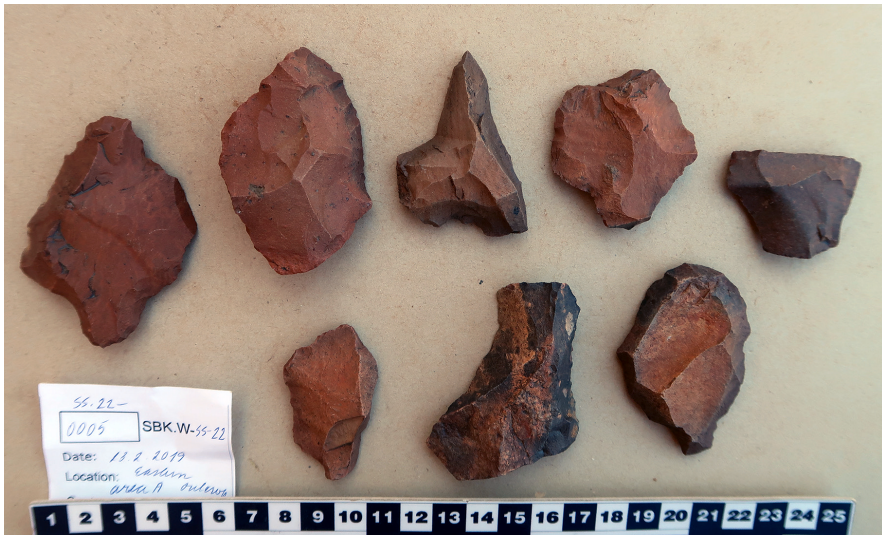


Fig. 5: Jebel Umm Murahik, Area A. Random surface finds of Palaeolithic lithics (photo by L. Varadzinová).

All nine systematically surveyed sites were also found to contain variable numbers of bedrock features similar to finds noted earlier on five other locations studied in 2019. With all occurring on granite, most of the finds were on immovable supports such as bedrock outcrops and immovable boulders and massive slabs (fig. 6). These features occur most often in the form of shallow oval basin hollows (11 sites) and only rarely as circular cup-marks (≥12 cm in diam.; 1 site) or small circular depressions known as cupules (≤7 cm in diam.; 1 site).[9] Of interest is the overlap of large numbers of these features with most of the significant Early Khartoum settlements in the Rocky Cities (on mica-granite) and in the Lake Basin (on microgranite). Movable supports in the form of large pieces of granite with a single hollow or boulders with several oval or circular depressions, on the other hand, are found mostly on the sites that contain also Neolithic evidence. Further research will be devoted to these apparently artificial features and their significance for the understanding of land use and subsistence in the past (see David 1998).

*Excavation* was performed on seven sites. At *Sphinx*, one of the best explored and analysed sites in the research area, the purpose of excavation was to obtain a comparative analytical sample of artefacts and other finds from the so far little explored northern part of the settlement platform. At *Rhyolite*, the excavation was to ascertain the presence and character of late prehistoric deposit beneath the surface layers reworked by the construction of tumuli. The remaining five sites (*Alamat*, *Amphitheatre*, *Crystal*, *Jebel Umm Murahik*, and *Washcone*) were selected for excavation based on the results of the systematic surface survey during the 2019 season. Trenches 1 $m^2$ or 2 $m^2$ in size were excavated down to bedrock, with their depth varying between 0.02 m (minimum depth at *Amphitheatre*) and 0.82 m (maximum depth at *Sphinx*). Except for *Rhyolite*, all the test pits yielded only Early Khartoum remains.

At *Amphitheatre* (fig. 7) and *Washcone* where abundant Early Khartoum finds characterized the surfaces of Areas G.1 and B selected for excavation, respectively, the anthropic deposit was found to have been greatly reduced through erosion and deflation and to contain only few degraded remains of organics due to later geochemical processes. However, there is still some potential for excavation in other areas of these sites, especially at *Amphitheatre* (see fig. 4).

9 The research area also features rock gongs, slicks and singular shallow grooves, which have not been documented systematically as yet, and numerous holes drilled into the vertical walls of rocks, which likely constitute the remnants of building constructions (Varadzin et al. 2017).

Fig. 6: Amphitheatre. Bedrock features in the form of oval shallow basin hollows on immovable granite boulders near the upper part of Area G (photo by L. Varadzin).

Fig. 7: Amphitheatre, Area G.1. Trench 1 after excavation, with only the lowermost relics of cultural deposits preserved (photo by L. Varadzin).

At other three sites, the areas tested were found to contain comparably thick deposits (from 0.51 m at *Crystal* to ca. 0.80 m at *Sphinx* and *Jebel Umm Murahik*) and a broader spectrum of finds that support further exploration of these sites. Furthermore, anthropogenic pits were uncovered at two of the sites – a human burial (B.1) at *Crystal* (fig. 8) and a pit of unknown function (feature F.1) at *Jebel Umm Murahik* (fig. 9). At the latter site, loose human teeth and fragments of a human skull found in the fill of the pit indicate presence of another burial site. At *Sphinx*, where pits and Early Khartoum burials had been found in the southern part and northern shelter (Suková and Varadzin 2012; Varadzinová and Varadzin 2017), no human remains were brought to light in Trench 11 (1 $m^2$) or in the robbers' pits (12.39 $m^2$ in total) explored in the northern platform. This clearly supports the confinement of the Early Khartoum burial ground only to some parts of this site (Varadzinová and Varadzin 2017).

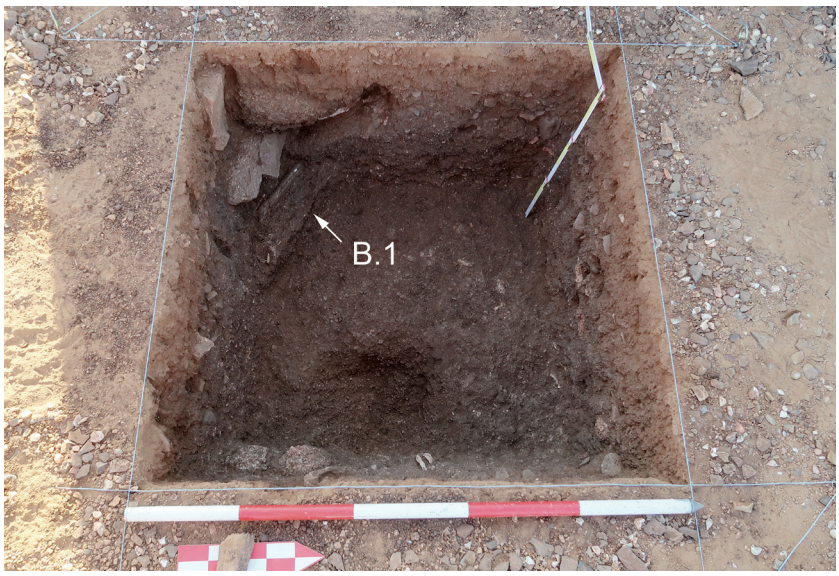

Fig. 8: Crystal, Area D. Trench 2 after excavation, with a human burial (B.1) uncovered in the south-western corner (photo by L. Varadzin).


Fig. 9: Jebel Umm Murahik, Area A. Trench 1 after excavation, with a sunken feature of unknown function (F.1) uncovered in the south-western corner (photo by L. Varadzin).

Two types of deposits were identified in the scope of excavations, with each providing different conditions of preservation of finds:

A. Alkaline deposits rich in carbonates which show better preservation of organic materials and pottery and allow for more detailed understanding of the varied dimensions of late prehistoric occupation. Good examples of these deposits were found in the upper and middle zone of Trench 11 at *Sphinx* (fig. 10) or in the lower zone of Trench 1 at *Jebel Umm Murahik* (see fig. 9).

B. Acidic deposits in which former carbonates had been removed through action of acidic subsurface water likely saturated with manganese and/or iron which subsequently precipitated within the soil. The soil acidification is the cause of lower quantity or complete absence of bones and molluscs as well as marked degradation of pottery from these deposits (see fig. 14). These situations were revealed, e.g., in the lower zone of Trench 11 at *Sphinx* (fig. 10) and in the trenches at *Crystal* (fig. 8), *Amphitheatre* (fig. 7) and *Washcone*.

*Rhyolite* constitutes a peculiar and rather complicated case. Unlike the former ones, this site has been severely altered by cultural transformations. In Trench 2 (2 $m^2$, depth 0.6 m) excavated amidst several tumuli in the centre of the terrace, the late prehistoric deposit was found nearly entirely removed. Only small remnants of the original deposit were detected at a depth of ca. 0.45 m beneath a colluvial sediment redeposited from the sides of the tumuli (fig. 11). In the lower part of the trench, bottoms of four pits (features F.1–F.4) were found to have

been excavated through the late prehistoric deposit before the construction of tumuli, pointing to a more extensive occupation history of this site. This site differs from others in its sedimentary development as it lies atop a former Nile terrace.[10] The geomorphology of the site has been considerably affected by flooding events probably during the early Holocene and by later deflation that took place long before the tumuli were constructed here. It seems that the Early Khartoum settlement, whose remains are found nowadays on the surface of the site, could have been paradoxically situated at higher elevations as compared with the Neolithic occupation attested in the trench.


Fig. 10: Sphinx, Northern part. Northern section of Trench 11 after excavation, with grey-coloured deposit (SU2 and SU3) in the upper and dark sediment (SU4) in the lower zone of the trench (photo by L. Varadzin).

Fig. 11: Rhyolite. Trench 2 after excavation, with a thick layer of redeposited rhyolite fragments and late prehistoric finds, remnants of a late prehistoric deposit cut by two sunken features (F.2 and F.4), and a small test pit (ca. 0.30 m in depth) dug into the geological foundation of the site – the former Nile terrace sediments (photo by L. Varadzin).

In table 2, we summarize the data gathered since 2011 on the former human occupation of the fifteen sites covered by this report. In the early stage of our field research, we characterized the late prehistoric settlement landscape in the western part of Jebel Sabaloka as consisting of three categories of sites: core sites, minor settlements, and task sites (Suková and Varadzin 2012). Using the data collected in 2019 and considering the varied post-depositional transformations, this three-level hierarchy can be now revised and a new classification of sites can be proposed. The former core sites and minor settlements are replaced by *category A sites* (11 cases in the studied sample) that are characterized by elevated positions on terraces and platforms of granite hills or on former Nile terraces (*Rhyolite*), greater size (600–17,078 $m^2$), substantial density and quantity of the three main categories of finds (lithics, pottery, ground stones), and presence of intact anthropic deposits attesting to a longer-term or repeated occupation. These sites can also contain faunal remains (animal bones, molluscs), bone implements, and decorative or other artefacts on organic materials or minerals, and human burials. Before sites were included in this category, we carefully considered the effects of post-depositional processes, including the subsurface chemistry we pointed to above. The former task sites are now replaced by *category B sites* (4 cases in the studied sample) that

10 A section through the terrace sediments was cleaned and documented for palaeoenvironmental and palaeohydrological reconstructions in the eastern terrace slope (see fig. 17e and "Palaeoenvironmental investigations" below).

| Zone | Site | Early Khartoum site category | Main areas at cat. A sites ($m^2$) | Shaheinab Neolithic presence | Other evidence | | | | Bedrock features | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Palaeolithic finds (lithics) | Historical period | | | Immovable supports | | | Movable supports |
| | | | | | | Surface finds (pottery) | Funerary structures | Non-funerary structures | Oval basins | Circular cup-marks | Small cupules | |
| | *Al Huqna* | B | | ephemeral | (+) | (+) | | (+) | | | | |
| Rocky Cities | *Amphitheatre* | A (complex) | 709 | | + | + | + | | + | | | |
| Rocky Cities | *Crystal* | A (complex) | 512 | | + | + | (?) | | + | | | |
| Rocky Cities | *Ridges* | A (complex) | 413 | | + | + | | | + | | | |
| Rocky Cities | *sc. 131+132* | B | | | (?) | (?) | | | (+) | | | (+) |
| Rocky Cities | *sc. 137+138* | B | | | (?) | (?) | | | | | | |
| Rocky Cities | *Sphinx* | A (complex) | 793 | | (+) | (+) | | | (+) | | | |
| Rocky Cities | *Sphinx II* | A (simple) | 582 | | + | + | | | + | | | |
| Rocky Cities | *Washcone* | A (complex) | 830 | | + | + | (?) | | + | | | |
| | *J. Umm Murahik* | A (complex) | 3,237 | ephemeral | + | + | + | | + | | + | |
| Lake Basin | *Alamat* | A (simple) | 1,507 | ephemeral | + | + | (?) | | + | | | |
| Lake Basin | *Fox Hill* | A (complex) | 1,669 | significant | (+) | (+) | (+) | (+) | (+) | (+) | | (+) |
| Lake Basin | *Island* | B | | moderate | | + | (+) | | + | | | + |
| Lake Basin | *Rhyolite* | A (simple) | ? | significant | + | + | (+) | | | | | (+) |
| Lake Basin | *Triple Hollow* | A (simple) | 1,635 | ephemeral | + | + | | (+) | | | | (+) |

Tab. 2: Synthesis of results of the 2019 field research in the western part of Jebel Sabaloka (see fig. 1 for location of the sites): + = presence; (+) = presence ascertained during previous fieldwork; (?) = uncertain presence (due to insufficient fieldwork, or excavation required to confirm the character of the remains); funerary structures = tumuli, box graves, and other types of funerary monuments; non-funerary structures = military installation (Al Huqna) and simple stone settings and surface features; immovable supports = bedrock outcrops and immovable boulders and massive slabs (classes I and II of David 1998); movable supports = large blocks or slabs requiring special effort to transport and smaller blocks transportable without special equipment by four persons or less (classes III and IV of David 1998).

constitute ephemeral locations with small artefact scatters, low density of finds, and absence of intact subsurface deposits. These sites are at the same time characterized by absence or marked underrepresentation of one or two of the three main categories of finds (pottery, lithics, ground stones). Among category A sites, we further distinguish between sites containing only main occupation area(s) (*simple category A sites*; 4 cases in the studied sample), and *site complexes* at which main area(s) are clearly accompanied by subsidiary area(s) of a character similar to category B sites (7 cases in the studied sample). This new classification is elaborated only for the Early Khartoum evidence. The Shaheinab Neolithic remains are mostly found deflated on surfaces of sites that prevents more nuanced categorization. However, *Fox Hill* and *Rhyolite*, both of which feature large quantities of finds and preserved deposits, clearly stand out as the most significant locations in the research area during the Shaheinab Neolithic.

## Pottery

Pottery analysis had a prominent role during the 2019 season. The analytical work was designed according to two phases. The first phase was carried out by E. Garcea and the second phase was conducted by G. D'Ercole who continued the analysis within the same research project.

Aims of this year's pottery analysis included twofold activities, one in the field and the other in the house of the mission in Al Hugeir Abu Dom. Field activities aimed at setting archaeological sites and ceramic assemblages within their natural topographic and cultural contexts. Activities in the house focused on the study and classification of the ceramic assemblages collected in the field with a selection of a restricted number of samples to be exported for specific laboratory analyses (optical microscopy, chemistry, gas chromatography, analyses of seed impressions) and detailed documentation by drawing and professional photography.

Systematic surface collections and/or test trenches were conducted at six sites in the Rocky Cities (*Amphitheatre*, *Crystal*, *Ridges*, *Sphinx*, *Sphinx II*, and *Washcone*), at four sites in the Lake Basin area (*Alamat*, *Island*, *Rhyolite*, and *Triple Hollow*), and at *Jebel Umm Murahik* to the west of the mountain and the Lake Basin (see tab. 1). In most cases, the collection covered the entire surface of the site (or area) and was carried out by one to four persons in about 10 to 30 minutes (depending on the size of the surveyed area and the number of people engaged). Only at *Rhyolite*, where large amounts of raw stone materials (rhyolites, quartz pebbles) and finds virtually covered the surface of the former Nile terrace, the method of total counts in 22 sectors of 2 $m^2$ in size on a 130-metre linear transect and in three squares of 4 $m^2$ each was employed to record the pottery

Fig. 12: Rhyolite. Linear transect 1 × 130 m across the site delimited for total counts of pottery (photo by L. Varadzin).

profile of this site (fig. 12). The collection of pottery was indiscriminate and included all sherd types and sizes located in the given time in order to capture the history and character of occupation of the locations as accurately as possible. The pottery assemblages collected during the survey were assigned specific assemblage numbers, entered into the database of finds, and were brought back to the base camp for the purposes of classification and documentation.

The study of the surface material in the base camp involved first sorting of the material into prehistoric and non-prehistoric finds. The latter group was set aside for classification by another specialist, and the main attention further focused on the prehistoric assemblages. The analysis was performed by both analysts according to a uniform standardised classification system, which had been broadly and successfully used for other ceramic assemblages, including those collected during previous excavations at *Sphinx* (2014, 2015) (Garcea et al. 2020). The classification system considered decorative techniques and motifs, tempering materials, and surface treatments. All data were entered into a relational database realised on a Microsoft Access platform.

A total of 6,903 potsherds from ten of the surveyed and/or excavated sites with a total weight of 48.85 kg) were studied by both analysts. During the first phase of the pottery study, most of the material was derived from surface collections at nine sites while the second phase was particularly focused on the material retrieved from test pit excavations at four sites (see tab. 3).[11]

Prehistoric ceramic assemblages from each site/trench were first divided into unclassifiable, undecorated, and decorated sherds and each group was processed separately. With regard to the assemblages from surface collections, apparently undecorated sherds showing deteriorated surfaces were included in the unclassifiable group as it was impossible to

11 The pottery assemblages collected in two areas of *Island* could not be included in the analyses due to a lack of time to cope adequately with their large quantity (7 large bags collected) and considerable diversity as to periods and types. For this reason, the material was only sorted into prehistoric (Early Khartoum, Shaheinab Neolithic), non-prehistoric, and uncertain (possibly prehistoric, possibly Late Neolithic) groups at the start of the second phase of pottery study and set aside for detailed analysis during one of the next field campaigns.

| Site | 1st phase (Garcea) | | 2nd phase (D'Ercole) | | Total | |
|---|---|---|---|---|---|---|
| | Surface | Trench | Surface | Trench | Sherds | Weight (g) |
| *Alamat* | 353 | 149 | | | 502 | 3,487.0 |
| *Amphitheatre* | 1,016 | | 1 | 16 | 1,033 | 10,527.3 |
| *Crystal* | 367 | | | 546 | 913 | 5,104.9 |
| *J. Umm Murahik* | 984 | 1,041 | | | 2,025 | 11,909.0 |
| *Rhyolite* | 335 | | | 358 | 693 | 3,951.9 |
| *Ridges* | 257 | | | | 257 | 1,781.0 |
| *Sphinx* | | | | 524 | 524 | 4,048.8 |
| *Sphinx II* | 383 | | | | 383 | 3,984.0 |
| *Triple Hollow* | 219 | | | | 219 | 2,125.0 |
| *Washcone* | 280 | 74 | | | 354 | 1,934.0 |
| Sum total | 4,194 | 1,264 | 1 | 1,444 | 6,903 | 48,852.9 |

Tab. 3: Number of sherds included in the pottery analysis during both phases of the field research, including the total weight of the material for study. The assemblages studied entirely are shown in grey.

assess whether their plain surface was due to erosion or other post-depositional agents. The assemblages from the surfaces and/or trenches at nine sites were studied entirely.[12] From *Amphitheatre* and *Rhyolite*, on the other hand, where remarkable quantities and diversity of classifiable finds were collected from the surface, only unclassifiable sherds were counted in the given time and the classifiable ones were included in the material to be exported and studied in detail abroad.

As the pottery analysis and evaluation is only to be completed after export of the selected samples and material to Europe, no more than a tentative overview of the character and significance of the material studied during the two phases can be offered in this report.

### *First phase*

Considering that the total quantity of the assemblages from the surface collections at *Amphitheatre* and *Rhyolite* is not currently available, table 4 shows the count of the assemblages from the other sites investigated (through surface survey and excavation) in the first phase of the field research, including the total number of studied sherds, their total weight and the average weight per sherd.

Most of the studied pottery assemblages could be assigned to the Early Khartoum (Mesolithic) period. In the Rocky Cities, all the pottery from both the surface and the anthropic deposits at the five sites investigated during the first phase indicates an exclusive presence of Early Khartoum evidence. By contrast, in the Lake Basin and to the west of it, the Early Khartoum pottery still largely prevails on the surface and was solely present in the excavated deposits. However, some Shaheinab Neolithic specimens occur on the surfaces at all investigated sites in this area with 0.5% at *Jebel Umm Murahik* (fig. 13), 0.5% at *Triple Hollow*, and 2.4% at *Alamat*, suggesting that Neolithic groups were more attracted to the Lake Basin than to the Rocky Cities, although their settlements were apparently more temporary than the Early Khartoum ones.[13]

The average weight per sherd considerably varies from site to site, indicating variable degrees of fragmentation of the ceramic containers. This possibly suggests different preservation conditions and taphonomic processes.

If the Shaheinab Neolithic assemblages are separated from the total assemblages, the Early Khartoum assemblages alone confirm the high variability of the average weight per sherd in the different sites (tab. 4).

12 Most of the finds are now deposited in the mission's container in the premises of the NCAM in Khartoum; only a small portion of the sherds were selected for export.

13 Let us pinpoint in this connection that at *Jebel Umm Murahik* and *Triple Hollow* the Neolithic evidence would have remained undetected if only systematic survey and excavation, without specialised surface collections of pottery, were performed.

On the other hand, the Shaheinab Neolithic assemblages seem to show higher standardisation in the relation between the number of sherds and their weight with an average weight per sherd around 8 g (tab. 4), even though larger assemblages would be needed to be statistically relevant.

Tempering materials were of mineral origin in the Early Khartoum assemblages and of mineral and occasional organic origin in the Shaheinab Neolithic samples. Mineral tempers were generally small (1 mm), with no appreciable variations in size, but their frequency could vary, resulting in fine to medium up to coarse textures depending on the quantity of the tempering materials. Among others (e.g., decorative motifs), surface treatments were one of the discriminating variables distinguishing Early Khartoum from Shaheinab Neolithic pottery, the latter typically having burnished and polished surfaces.


Fig. 13: Jebel Umm Murahik, Area H. Surface finds of Neolithic pottery (photo by L. Varadzinová).

*Second phase*

The main task of the second phase of pottery study was to analyse the assemblages excavated at four sites: *Amphitheatre*, *Crystal*, *Rhyolite*, and *Sphinx*. At *Amphitheatre* and at *Rhyolite*, varied cultural and natural transformations had severely altered the sites. In the case of *Amphitheatre*, severe erosion and deflation had left for exploration only a considerably reduced anthropic deposit (depth in the trench was between 0.02 m and 0.28 m; see fig. 7) that yielded only a very small assemblage of 16 sherds. Similarly, at *Rhyolite*, only a small amount of mostly Neolithic sherds was retrieved from the

| Site | Early Khartoum assemblages | | | Shaheinab Neolithic assemblages | | |
|---|---|---|---|---|---|---|
| | Total sherds | Total weight (g) | Average weight per sherd (g) | Total sherds | Total weight (g) | Average weight per sherd (g) |
| *Alamat* | 490 | 3,388 | 6.9 | 12 | 99 | 8.3 |
| *Crystal* | 367 | 3,275 | 8.9 | | | |
| *J. Umm Murahik* | 2,014 | 11,820 | 5.9 | 11 | 89 | 8.1 |
| *Ridges* | 257 | 1,781 | 6.9 | | | |
| *Sphinx II* | 383 | 3,984 | 10.4 | | | |
| *Triple Hollow* | 218 | 2,117 | 9.7 | 1 | 8 | 8.0 |
| *Washcone* | 354 | 1,934 | 5.5 | | | |
| Sum total | 4,083 | 28,307 | | 24 | 197 | |

Tab. 4: Pottery assemblages studied entirely during the first phase of the field research, with indication of the number of sherds, total weight and average weight per sherd separately for the Early Khartoum and Shaheinab Neolithic assemblages from the same locations.

relics of what appears to have been a late prehistoric deposit that had been first disturbed by excavation of pits of unknown function (features F.1–F.4) and, more importantly, subsequently almost entirely removed by the construction of tumuli in post-Meroitic times (see fig. 11). Notwithstanding, both assemblages have some information potential. For the time being, however, its evaluation is postponed until the completion of analysis of the finds deriving from the surfaces of these sites sampled during the first phase of the field research.

The other two collections studied during the second phase come from two Early Khartoum sites situated in the Rocky Cities, both of which have a good potential for exploration and, more importantly, for extending the understanding of occupation and exploitation of the western part of Jebel Sabaloka during late prehistory.

### Sphinx (SBK.W-60), Trench 11

The pottery assemblage from Trench 11 (1 $m^2$, 0.68 $m^3$; see fig. 10) at *Sphinx* was made up of 524 potsherds, of which 268 were unclassifiable (either very small sherds or sherds whose surfaces were very badly preserved). 138 out of the 268 unclassifiable sherds came from the surface layer (SU1).

Sherds from the surface were quite small (in comparison with the subsurface units) and were always badly preserved (either eroded or with a strong patina due to post-depositional processes taking place in the anthropogenic deposit). In most cases, we were unable to indicate any surface treatment. It is possible that some sherds were burnished on the surface (inside and/or outside) but this was no longer visible. Therefore, it was generally preferred not to indicate the surface treatment in the database.

Most of the ceramics coming from the upper layers/units of the deposit (mainly SU2 and SU3 corresponding to the alkaline type of deposits mentioned above; see fig. 10) appeared to have a silty patina which looked like a kind of natural coating and whose alkaline nature may have helped the preservation of the sherds. Some sherds also showed a carbonaceous patina or "crust" on them. The silty alkaline patina was not present on the material from the lower units of the deposit (SU4) where more acid environment resulting from repeated action of water above the rocky bedrock was detected by the archaeologists and confirmed by the geomorphologist (fig. 10).

The ceramics from Trench 11 was exclusively mineral tempered. Impressions from seeds or from other organic matter (plant fibres) were occasionally visible on the surfaces of some sherds, but they never characterized the fabric. Mineral inclusions were mainly small (<1 mm), angular-shaped and with a medium to low sphericity. Most of them were quartz, feldspar, and mica. The frequency of inclusions was significant and allowed distinction between different textures. A paste can be defined as "medium" if it has a common frequency of inclusions even when those inclusions are smaller than 1 mm. Fine pastes/textures are characterized by small, rare inclusions. Finally, pastes were considered to be coarse when the inclusions were small-sized but made up a high proportion of the fabric (see fig. 14). A few sherds also contained medium-sized (between 1 and 2 mm) inclusions.

Most of the ceramics from Trench 11 were decorated with the rocker impression technique and showed packed zig-zags motifs (fig. 15: 1–4). Only four sherds were decorated by incision – three of them showed a wavy line pattern (fig. 15: 6) and one had single incisions made by a stylus. Four sherds were decorated with the alternately pivoting stamp technique by using a double pronged instrument and only one sherd was decorated by simple impressions. The wavy line decoration seemed to be associated with rims and possibly with relatively fine containers. The dotted wavy line (DWL) motif (fig. 15: 5) was recognized on 20 sherds, occasionally in combination with packed zig-zags (fig. 15: 7–8). Most of the DWL decorations came from SU1 or SU2. Only three sherds with DWL were from SU3 (of which one was from Locus 1). The combs used for the rocker technique had a length that could vary from 5 up to 34 mm (average 15 mm) and a maximum number of 12 teeth. The structure of the decoration was generally continuous. Only a minor number of sherds showed banded or panelled decorations.

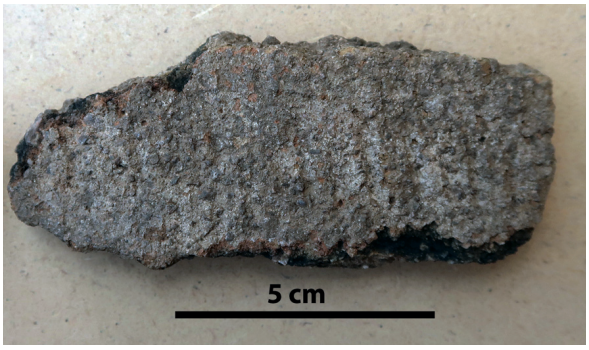


Fig. 14: Sphinx, Trench 11. Large fragment of pottery with gritty coarse texture rich in mineral inclusions found in the acidic deposit in the lower part of the trench (MU7/SU4), markedly altered in consequence of subsurface chemistry (photo by L. Varadzinová).

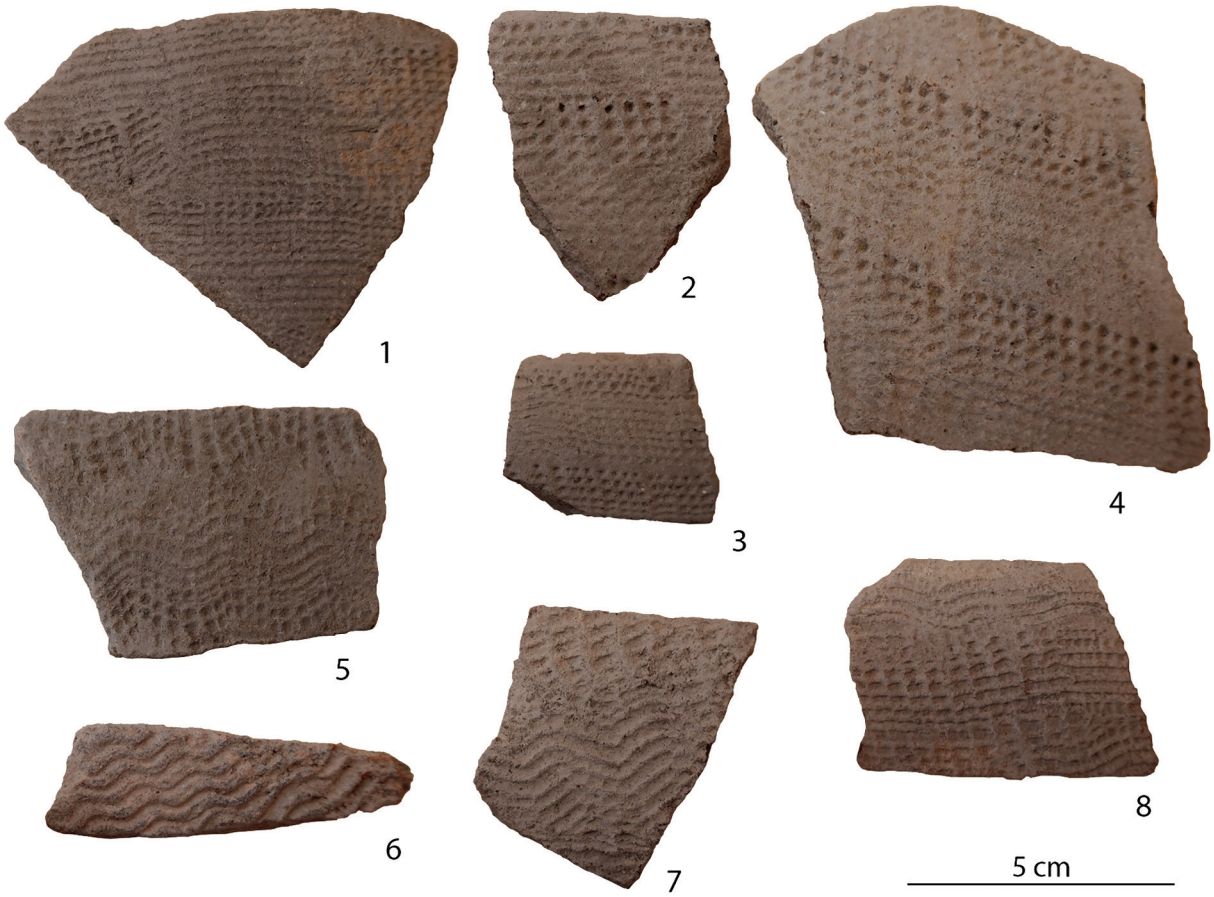


Fig. 15: Sphinx, Trench 11. Early Khartoum pottery. 1–4 – Rocker impression, packed zig-zags; 5 – Rocker impression, dotted wavy line; 6 – Incision, wavy line; 7–8 – Rocker impression, dotted wavy line combined with packed zig-zags (photo by L. Varadzinová).

## Crystal (SBK.W-59), Trench 2

The assemblage from Trench 2 (1 $m^2$, 0.51 $m^3$; see fig. 8) at *Crystal* was made up of 546 potsherds, of which 363 were unclassifiable. Differently from Trench 11 at *Sphinx*, the unclassifiable sherds were distributed equally in all layers of the deposit.

All in all, the state of preservation was worse than in Trench 11 at *Sphinx*. Most of the sherds were very tiny and fragile and decorations were poorly preserved. Furthermore, effects of post-depositional processes could be recognized on ceramic surfaces from this trench as well. The pottery from the upper part of the deposit showed a sandy and brownish appearance (see fig. 16) while sherds from the lowest units were darker possibly in consequence of higher amount of manganese concentrated in the lower portion of the deposit. None of the ceramics from this trench showed the grey silty patina which characterized the material from the alkaline type of deposit in Trench 11 at *Sphinx*.

Information on textures and inclusions are comparable with that from Trench 11 at *Sphinx*. At *Crys-*


Fig. 16: Crystal, Trench 2. Fragments of pottery from the upper part (MU2/SU2) of the trench decorated with the rocker technique (photo by L. Varadzinová).

*tal*, however, it was possible to tentatively distinguish among two different fabrics (possibly corresponding to two different recipes): one sandy gritty fabric (with common to frequent small mineral inclusions – mainly quartz, mica, and feldspar); and one silty dense fabric (with only rare mineral inclusions and more mica). Both fabrics were found on all types of sherds irrespective of their thickness or the portion of the vessel, therefore the silty fabric (fine with rare inclusions) was also associated with very large and thick sherds. This latter fabric seemed to be more resistant than the sandy fabric. As observed in Trench 11 at *Sphinx*, most of the fractures looked dark grey or black possibly due to the natural composition of the clay itself (with higher levels of manganese or lower iron contents) or because the firing could have occurred under reducing conditions. Some sherds from this trench are from bottoms of vessels or from large, possibly heavy-duty containers, whereas, in comparison with Trench 11 at *Sphinx*, the number of rims seemed to be lower. However, this data could be easily related to the poorer state of preservation of the pottery from this site.

Rocker stamp was again the most common among the decorative techniques recognized in the assemblage, being mainly associated with zig-zag motifs made of dots (fig. 16). Wavy lines incisions were found only on five sherds (two from MU2/SU2, one from MU4/SU3, and two from MU6/SU3). Three sherds were decorated with simple impressions (one from MU2/SU2, one from MU4/SU3, and one from MU5/SU3). Four sherds showed dotted wavy line decorations (three from MU2/SU2 and one from MU3/SU2). Among them, one sherd might have arch-shaped DWL motifs.

Fig. 17: Fox Hill, Area 1. Variously shaped abraders/rubbers. Left – crescent and quadratic forms; centre – abrader with a groove; right – conical pointed abraders (photo by J. Řídký)

## Ground stone

Ground stones (macro-lithic artefacts) were studied in the field to evaluate surface finds from *Fox Hill* dated to the Early Khartoum and Shaheinab Neolithic and to compare them with the Early Khartoum assemblages from *Sphinx* studied earlier (Řídký 2017). The study and documentation were performed by J. Řídký between 10 and 16 March 2019. With a view to the findings of previous research at *Fox Hill* (Suková and Varadzin 2012; Varadzinová et al. 2018, 2019), the main attention was paid to four terraces of the site, richest in all kinds of artefacts and ecofacts: Terraces 1, 3, 10, and 13. Of these, Terrace 3 appears to have been the least affected by cultural or natural transformations as compared with the other areas (burial mounds on Terrace 10, settlement features on Terrace 13 – see Suková and Cílek 2012; Suková and Varadzin 2012; increased erosion on Terraces 1 and 13 – see Suková and Varadzin 2012; Varadzinová et al. 2019).

The field research consisted of the following steps: 1) repeated collecting of surface ground stones (including blanks and flakes) from the individual areas by one to three persons; 2) ordering of the different morphological and functional types of artefacts into separate groups; and 3) morpho-metric documentation of individual groups (in more detail from Terrace 3), with assessment of the state of preservation of all individual finds. In total, 872 artefacts were ordered into three main groups: grinding-milling tools (lower and upper grinding stones), rubbers/abraders, among which three main shapes were identified, and bi-conically perforated stone rings.

*Grinding-milling tools* represented the largest group (e.g., Jórdeczka 2011; see also Řídký 2017). Of 835 pieces in total, 460 were upper and 375 were lower grinding stones (querns). The highest number of both types came from Terrace 3. There were two main types of lower stones – with flat working part and with basin-like working part. Upper grinders were classified morphologically as oval, quadratic, and irregular, among which several sub-types can be discerned according to the outline in longitudinal and transverse sections. The oval-shaped upper grinding stones were the best preserved.

Fig. 18: Fox Hill, Area 1. Above – unfinished stone rings; below – fragments of finished stone rings (photo by J. Řídký).

Altogether 24 *rubbers/abraders* were found, coming from all four areas (fig. 17). Three main shapes were identified: quadratic forms (n=10), of which three were of narrow prolonged shape and two bore a groove on their body; crescent forms (n=8); and pointed forms (n=5). One small fragment could not be morphologically determined.

In the four study areas, 13 *stone rings* were found and two more come from Terrace 2. These artefacts were broken to pieces and none of them was complete. Moreover, probable semi-finished specimens were identified as well – they were recorded in all the study areas and had the form of broken, bi-conically perforated upper stones (fig. 18).

For production of ground stone tools mainly sandstones and quartzites of different colours and composition were used. Only in few cases, porphyritic rhyolite was identified.

Preliminary comparison between the assemblages from *Fox Hill* and from *Sphinx* revealed presence of the same types of functional groups on both sites, but differences in artefact density and quantitative representation of morphological classes and in raw materials. The data acquired during the field campaign significantly extend our existing evidence that makes it possible to elaborate a more precise classification of late prehistoric ground stone tools in Sabaloka and in central Sudan.

## Palaeoenvironmental investigations

Limited pedestrian survey was conducted by J.-P. McCool between 4 and 15 March by starting at the modern village of Al Hugeir Abu Dom and continuing away from the Nile to the north and west (see fig. 1). The purpose was to try and identify sediment or soil remnants from the terminal Pleistocene and early Holocene that could provide ecological information for areas near the Nile, but beyond direct influence of river, and to better elucidate regional geomorphic relationships. Specific emphasis was placed on defining the degree to which the outwash cones from the Sabaloka upland could act as a sedimentological and pedological archive. Based upon visual and topographic assessment they appeared likely alluvial fans and were expected to comprise relatively thick deposits, but after repeated investigations, it was found that there is only a thin <1.5 m mantel of outwash sediment or developed palaeosols that overlay a highly weathered schist or gneiss bedrock. Significant effort was also expended in studying a sediment terrace at the western edge of the modern floodplain just upstream of the Nile's entrance to the main gorge area. This terrace is capped by an Early Khartoum and Shaheinab Neolithic occupation site (*Rhyolite*, SBK.W-58 – see above), and likely represents an alluvial history for the terminal Pleistocene and early Holocene, something which is rare within the Nile Valley. General results are presented based on general area and represent field interpretation and summary from 37 different excavated geoarchaeological pits, exposed profiles, and surface exposures.

### *Outwash cones*

The outwash cones which slope gently down from the upland regularly have a layer of cobbles 1 m or less overlying degraded bedrock in their upper reaches (e.g., fig. 19: a). Toward the outer margins of the outwash cones a vertic palaeosol up to 1 m in depth lied directly on the degraded bedrock (e.g., fig. 19: b). The modern surface has a cobble lag of material washed out from the upland.

This relationship is interpreted as the result of bedrock planation and accumulation of surface cobbles during the hyperarid glacial period resulting from infrequent, but intense flash flood events. During the African Humid Period (AHP) a wetter climate and environment promoted sediment accumulation and the development of a vertic palaeosol in the lower extents of the wash cones. This soil became inactive after the termination of the African Humid Period with periodic erosion due to wind, and rare wash

events from large storms that carried cobbles from the Sabaloka uplands. Calcium carbonate has accumulated in the degraded bedrock, the buried cobble layer, and in the lower portions of the palaeosol (fig. 19: b). Dating these deposits to the AHP is based on an OSL sample collected in 2014 from a similar landscape position which had an age of 8.6 ± 1.2 ka (location 14DFN in McCool 2019). To confirm the date of the palaeosol at this location, an OSL sample was collected from 19WD04.


Fig. 19: (a) Location LOC3 showing cobble accumulation directly over weathered bedrock; (b) Location 19WD04 showing palaeosol; (c) Carbonate veins in degraded gneiss; (d) Location 19OT2, with palaeosol accumulated over rounded gravels; (e) Nile terrace sediments at the eastern edge of *Rhyolite*; (f) Modern Nile sediments accumulated near where the Nile exits the Sabaloka gorge (all photos by J.-P. McCool).

### *Non-wash cone pits*

Pits investigated to the direct west of the river showed calcium carbonate accumulation in bedrock as carbonate veins which can be readily observed in stream cuts (e.g., fig. 19: c). A degree of palaeosol development was observed in a small number of wadi bank and excavated profiles, but the number of exposures was limited and the sediments had no acid reaction indicating the absence of calcium carbonate. These sediments, including the basal rounded gravels, and soils could possibly be former fluvial deposits (fig. 19: d) derived from both high and low energy river flows or they could equally be the result of outwash from the higher terrain located to the west composed of Nubian Sandstone. Sediment geochemistry from across the study area will be compared to constrain sourcing, but current interpretation is that these are sediments trapped during a wetter environmental period with settings similar to the distal ends of the outwash cones with concurrent pedogenic development. The spatial boundary between areas with carbonate accumulation and those lacking carbonates may be due to the unconformable contact between the underlying gneiss basement rock and the Nubian Sandstone that increases in thickness to the west, but this remains an open research question.

### *Fluvial records*

In order to better constrain local versus non-local sediment sources, and changes in riverine carbonate oxygen and carbon isotope signatures, modern and past fluvial records were investigated using trenching and profile cleaning. A terrace approximately 8 m above the modern Nile River floodplain was profiled using multiple exposures to gain a continuous record (fig. 19: e). These sediments displayed vertic soils in the lower depths which graded to stratified fine sands and silts in the upper portions of the profiles. Three OSL samples were collected from across the profiles to try and constrain the local fluvial geomorphological development.

Modern Nile sands and silts were collected near where the river exits the gorge to the north (fig. 19: f). These stratified sediments consisted of light brown silts and fine sands, often displaying ripple marks. Small proportions of smectite clays were present in some layers indicating slower water depositional environments. All sediments collected likely represent only the more recent fluvial record (less than 1,000 years) but will enable a comparison against that from the gorge entrance dating to earlier periods. In total, this fluvial record is intended to allow better distinction between fluvial versus local sediments using geochemical fingerprinting techniques and will be directly relatable to existing research into riverine sedimentary characteristics in Sabaloka (see Lisá et al. 2012).

## Summary and conclusion

During the 2019 field campaign, a broad spectrum of data required for an in-depth assessment of quantitative and qualitative characteristics of the studied sites was collected using a combination of various methods and approaches. Of these, the systematic surface research using a uniform protocol seems to be a very effective method in respect of time, means and results as it captured all significant phases of occupation of the sites and provided many new data for evaluation of variability between and within sites. Specialised extensive collections of pottery indiscriminately from larger areas were found capable of capturing also very ephemeral evidence of occupation, which might have otherwise escaped our attention. In comparison, intensive pottery collections, such as time-consuming total counts or trenching and sieving, provide very precise but spatially restricted information that must be evaluated using comparatively detailed data on the surface or subsurface transformations of archaeological contexts. On the other hand, extensive collections are unable to capture variability within one and the same area. For some areas, it doesn't reasonably matter, but in specific cases more precise idea on distribution of surface finds is indispensable.

The 2019 field campaign brought significant findings and observations that both extend and deepen the understanding of the former human occupation of the entire research area. First of all, it was possible to revise the tentative Early Khartoum settlement hierarchy and propose a new classification of sites consisting of two main categories, one with a likely residential function for some time (category A) and the other constituting ephemeral locations and task sites (category B). Also, we identified two new major Early Khartoum settlements – *Amphitheatre* in the Rocky Cities and *Jebel Umm Murahik* between the Rocky Cities and the Lake Basin – with a significance possibly comparable to that of *Sphinx* in the Rocky Cities and *Fox Hill* in the Lake Basin. This is fundamental for further research into possible zonation in land and site use and settlement and subsistence strategies during Early Khartoum occupation of the region.

The presence of human burials was confirmed on one or possibly two new Early Khartoum sites – at *Crystal* in the Rocky Cities and at *Jebel Umm Murahik*. The existence of three or four hunter-gatherer burial sites in the rather small area and within sight of each other (the burial sites are separated by between 1 km and 4.2 km) – opens new questions on the stability of settlement, character of residential groups, and social relations between and within the local Early Khartoum human groups in the western part of Jebel Sabaloka (Varadzinová and Varadzin 2020).

In the Rocky Cities, all methods and approaches used for the study of the sites brought to light only Early Khartoum evidence, thus confirming our earlier proposition on abandonment of the Rocky Cities and confinement of settlement during the Shaheinab Neolithic to the Lake Basin closer to the Nile. Except for *Fox Hill* and *Rhyolite*, where anthropic deposits have been preserved, the Neolithic remains on other sites in the area are found only on the surfaces in consequence of deflation and erosion. Small numbers of Neolithic finds on the latter sites indicate that their occupation by early herders was rather ephemeral.

Of significance is also the extension of the archaeological map of Sabaloka by new evidence dated to the Palaeolithic (mostly MSA) and historical periods. They are attested on nearly all sites investigated in this season by random finds of lithics for the former and in the form of funerary and non-funerary features or ephemeral pottery finds for the latter period. This evidence has a considerable potential for enriching the understanding and discussions of the past human presence in central Sudan and, together with the apparently complex and changing environmental settings of all sites, will be given adequate attention in our field research in the years to come.

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Zusammenfassung

Im Frühjahr 2019 wurden fünfzehn spätprähistorische Stätten im westlichen Teil des Jebel Sabaloka untersucht, die seit 2009 von der Sabaloka-Expedition der Prager Karlsuniversität erforscht wurden. Ihr Ziel ist es, ein breites Spektrum vergleichbarer Datensätze zu sammeln, die für die Bewertung der Variabilität zwischen und innerhalb der Stätten in dieser Region erforderlich sind. Die Feldarbeit umfasste sowohl Oberflächenuntersuchungen als auch Ausgrabungen in kleinem Maßstab unter Verwendung einer aktualisierten Forschungsmethodik, die von unserem Team für die Erforschung der spätprähistorischen Stätten in dieser speziellen Region entwickelt wurde. Daneben wurden typologische, morphologische und technologische Untersuchungen von Keramik- und Steinschliffartefakten ausgewählter Fundstellen durchgeführt. Die parallelen paläoökologischen Untersuchungen konzentrierten sich auf die Untersuchung der Beschaffenheit und Ausdehnung der Paläosole in der Region und auf das Verständnis des hydrologischen Regimes in diesem Gebiet während der späten Vorgeschichte. In diesem Beitrag berichten wir über die wichtigsten Ergebnisse der Feldforschung. Sie wurden durch eine Reihe von Methoden und Ansätzen erzielt, die zur Bewältigung der Herausforderungen eingesetzt wurden, die sich aus dem unterschiedlichen Grad der Veränderung der spätprähistorischen Stätten im Zentralsudan durch verschiedene C- und N-Transformationen ergeben.