Statement concerning Sudan

The Kirwan Memorial Lecture

Alloying copper, arsenic and tin – the first crucible evidence from Kerma
Frederik W. Rademakers, Georges Verly, Kylie Cortebeeck, Patrick Degryse, Charles Bonnet, and Séverine Marchi

Reports

A desert Middle Nubian amethyst mining camp at Wadi el-Hudi
Meredith Brand and Kate Liszka

Archaeological survey in the Melhab basin (Agig district), Red Sea region of Sudan: report on the 2023 field season
Amanuel Beyin, Ammar Awad M. Abdalla, Fakhri H. Abdallah Hassan, and Musaab Khair

A fortified site to defend the Kerma basin before the Egyptian conquest
Matthieu Honegger and Jérôme Dubosson

New work on landscapes of the Northern Dongola Reach
Christopher Sevara, Tim Kinnaird, Ahmed El-Ameen Ahmed El-Hassan (Sokhari) and Sam Turner

Kerma settlement Site P5, Northern Dongola Reach: report on the 2023 season
Steve Mills, Stephen Porter, Paul T. Nicholson, Loretta Kilroe and David Buchs

The Meroitic townsitae of Kedurma 2023: new findings from the excavations of the cemetery
Mohamed Bashir and Claude Rilly

Archaeological vegetation mounds in the el-Matas area at the el-Ga’ab depression, Northern Sudan – new discoveries
Mohammed Nasreldein, Yahia Fadl Tahir and Ikram Madani Ahmed

Excavations in the Berber cemetery, the 2022 season and new chance discoveries in the Berber Region
Mahmoud Suliman Bashir

Preliminary report on the excavation of Building 1000 at Naga
Karla Kroeper and Christian Perzlmeier

The Isis Temple at Wad Ben Naga (WBN 300)
Pavel Onderka

Early Neolithic gouges from north-western Butana: new light on contacts between the Nile and its hinterlands
Ladislav Varadzin, Katarína Kapustka and Lenka Varadzinová

Studies

Following the footprints of a jackal from Meroe to London. The origin of British Museum EA68502
Michael H. Zach

Replicating prehistoric Sudan: Anthony Arkell’s object casts
Anna Garnett
Chronology, correspondence analysis, and Lower Nubia in the 3rd century BC: a reassessment of the Meroitic cemetery at Faras
Henry Cosmo Bishop-Wright

Giraffes at Faras – the exchange of goods and ideas across Kush
Loretta Kilroe

Darfur focus
Darfur. Threats and dangers to archaeological sites and possible ways to protect them
Ibrahim Musa Mohamed Hamdon

We are all for Nyala (KAMAN), South Darfur. A note concerning a local initiative to preserve cultural heritage
Ashraf Abdalla

The Centre for Darfuri Heritage at Nyala University: a driver for cultural development
Gafar A. F. Ibrahim

Book reviews

Obituaries

Biographies

Miscellanies

Front cover. Block 1000.0049 from Naga (photograph courtesy Karla Kroper).

Above. Pottery jar with decoration of sorghum heads from BMC 60, Berber (photograph courtesy Mahmoud Suliman Bashir).

Sudan & Nubia is a peer-reviewed journal. The opinions expressed within the journal are those of the authors and do not reflect the opinions or views of the Sudan Archaeological Research Society or its editors.
Archaeological vegetation mounds in the el-Matas area at the el-Gaab depression, Northern Sudan – new discoveries
Mohammed Nasreldein, Yahia Fadl Tahir and Ikram Madani Ahmed

Introduction
Ga’ab el-Matas is the most recently surveyed area in the far-west of the El-Ga’ab depression, located c. 70km west of the Nile parallel to the Dongola Reach. We conducted the first archaeological survey in the Ga’ab el-Matas area in February 2017, during the 7th season of the Archaeological, Ethnographical and Ecological Project of the el-Ga’ab Depression in the Western Dongola Reach 2016-2017. Our survey aimed to report on the existence of archaeological vegetation mounds in the area, and to explore archaeological remains associated with them. Our investigations intended to explore the biological condition of the vegetation mounds, particularly whether they were ‘Live’ or ‘Dead’. Live mounds refer to the living shrubs on their tops, confirming that their roots still reach underground water. In contrast, Dead mounds indicate a shortage of underground water. This region is classified as one of the arid areas of the world (Wickens 1982), but it was used by nomads as well as for cultivation in the past (Barbour 1961, 49), and today there are several agricultural schemes distributed across the el-Ga’ab depression, with underground water Nasreldein et al. 2023 [http://doi.org/10.32028/SN27pp148-158].
accessed using diesel pumps (Mutras) (Tahir 2012, 101).

Vegetation mounds are a desert phenomenon formed by wind-driven and loose sediments accumulating within long-lived phreatophytic shrubs (mainly Tamarix aphylla), creating a hillock with an irregular shape known as Tarabeel - nabkhas or nabkas in Arabic (see, El-Sheikh et al. 2010, 832; Li et al. 2008, 333; Madani et al. 2016, 127; 2018; Pokorna and Pokorny 2013; Rahmonov et al. 2009, 359). They result from wind-driven sediments deposited around desert shrubs, stabilising sediments transported from both adjacent and distant regions (Marston 1986; Melton 1940).

Worldwide, vegetation mounds are found in arid, semi-arid, and subhumid regions (Nickling and Wolfe 1994), including playas (Khalaf et al. 1995; Wang et al. 2008), grasslands (Wang et al. 2006), dune systems (Hesp and Martinez 2008; Nield and Baas 2008), mound fields (Seifert et al. 2009), coastal areas (Tsoar et al. 2009), or evolved from parabolic dunes (Ardon et al. 2009). They form in response to vegetation growth, sediment availability, and wind activity (McKee 1982; King et al. 2006; Nield and Baas 2008; Du et al. 2010).

According to Pokorný and Pokorná (2013), the formative stages of the vegetation mounds are associated with the degradation of the cultural landscape, representing the desiccation and reactivation of aeolian processes after artificial irrigation, providing a useful landmark for studying ancient agricultural schemes and archaeological sites. Several researchers (e.g., Nickling and Wolfe 1994; Tengberg 1994; 1995; Khalaf et al. 1995; Tengberg and Chen 1998) have noted their potential for determining regional climates and environmental changes. Furthermore, the discovery of insects buried inside these mounds indicates it is a rich resource for analysing ancient biodiversity of fauna and flora (Nasreldein 2019).

Study area
The el-Ga’ab area is a depression in the Northern State of Sudan; situated west of the Nile River south of the Third Cataract, parallel to the Dongola Reach. The nearest point to the Nile River is about 6km at its northern end, and the most distant known point before this survey was 60km to the south. Its width varies from 2km to 8km, and it has an area of approximately 700km². It extends for 123km across the Western Desert in a N/E to S/W direction (Map 1) (Tahir 2012; 2013; Mahmoud et al. 2015). The El-Ga’ab project team conducted a systematic field survey from 2013-2015 to investigate the distribution of this phenomenon across the el-Ga’ab depression and to examine the interior structures of these mounds (Madani et al. 2018).

The area was a palaeolake connected to the Nile during the early Holocene and an old basin flooded by the Nile during the Mid-Holocene (Tahir 2012, 99), but is now completely dry. Madani et al. (2015) argued that the larger part of the area is an absolute desert with almost no vegetation because the average annual precipitation is less than 0.1 mm.

Tahir (2009, 28) described the vegetation mounds at el-Ga’ab as ‘unknown mounds consisting of mud and plant remains’, and they have been noted as key features within the El-Ga’ab landscape, typically observed to occur near ancient settlement remains (Madani et al. 2015, 1-7). Excavation in some of these mounds found archaeological remains dating to the Christian (AD 543–1324) and early Islamic periods (AD 1504) (Madani et al. 2018). The discovery of vegetation mounds in such areas demonstrated their importance for archaeological investigations in remote regions.

As a result of pollen grain analyses of animal coprolites preserved within these vegetation mounds, we were able to identify important information about plant consumption in the area during the late Christian and early Islamic periods (AD 1100–1300). Discovery of the common weed Heliotropium parciflorum (Mart.) and wheat (Triticum sp.) provided solid evidence that agricultural activities existed in these deserted areas at this time (Nasreldein et al. 2021). It is likely that these vegetation mounds should be considered distinctive signs and landmarks that indicate ancient settlements and archaeological sites (Nasreldein et
In particular, the presence of the *Tamarix Aphylla* tree (*tarffa* in Arabic), which prefers to grow on irrigated land, within agricultural schemes, and along riverbanks, suggests that these mounds relate to ancient irrigation systems.

**Results**

**The Ga’ab el-Matas area**

Ga’ab el-Matas is located in the southern sector of the el-Ga’ab depression, 70km from the Nile. The presence of highlnds, mountain chains, dunes and vegetation mounds of the *Tamarix aphylla* trees characterises the landscape. During our survey, we recorded some seasonal *wadis* in the area, known to the locals as the *Wadi Abu Manakheer* and *Wadi Abu Aranib*. The existence of underground water close to the surface helped the growth of Dom palm (*Hyphaene thebaica*) and Tamarix (*Tamarix aphylla*) trees, which are common across the area together with small Acacia trees (*Acacia sp.*) and green grasses (Halfa grass). Moreover, our survey clarified that the soil category was sand-clay loam.

Enormous numbers of vegetation mounds (*Tarbools*) were observed in the area, which made it impossible to count their exact number. For that reason, we explored the high density of this phenomenon in the Ga’ab el-Matas area by tracing their existence using Google Earth and satellite images (Figure 3).

Based on our survey results at Ga’ab el-Matas, the highest concentration of the living vegetation mounds within the entire el-Ga’ab depression is in the el-Matas area, which indicates that the site is one of the lowest parts of the depression. Contour lines and elevation points clarified that the vegetation mounds of the el-Matas area are between 220-230m above sea level. The vegetation mounds in this area differed in shape and size and were generally Live mounds. The elevation of the el-Matas area is 217m above sea level. We excavated a test pit to establish the underground water level. El-Matas appears to be one of the lowest and richest areas of the el-Ga’ab depression based on the results, which revealed underground water at a depth of 0.5m.

Our archaeological survey here revealed one archaeological site at the following coordinates, 18 15.14°N 029 50. 35°E. The structures of the site and surface collection of finds indicate that it is a military campsite probably dating to the British colonial period (AD 1899–1956). The very well-preserved mud-
Figure 3. Satellite image showing the high concentration of the vegetation mounds at the Ga’ab el-Matas area.

Figure 4. Landscape overview of the vegetation mounds at the Ga’ab el-Matas area (photograph by Hamad Hamdeen).
Archaeological vegetation mounds in the el-Matas area at the el-Gaab depression (Nasreldein et al.)

Figure 5. Location of the archaeological military camp at Ga’ab el-Matas to the west of the el-Ga’ab depression.

Figure 6. General view of the military camp at Ga’ab el-Matas (photograph by Hamad Hamdeen).
Figure 7. Detailed view of the wall structures views from the tower walls (photograph by Hamad Hamdeen).

Figure 8. Detailed view of the camp’s structures, view from the residential area (photograph by Hamad Hamdeen).
Archaeological vegetation mounds in the el-Matas area at the el-Gaab depression (Nasreldein et al.)

Figure 9. Satellite image showing the military camp at the Ga’ab el-Matas area.

Figure 10. An overview of all units of the archaeological military camp at Ga’ab el-Matas (photograph by Hamad Hamdeen).
brick buildings show well-planned military construction. The buildings were covered with sand, which ensured high levels of preservation.

The compound consisted of 28 individual rooms in two rows, 14 in each row laid out in parallel to each other, with each room measuring 3x3m. Behind the residential area to the west, there are two big yards surrounded by mud-brick walls; both have the same measurements, 30x15m. To the west of the yards, we found an elevated building consisting of several rooms, which might indicate storage rooms and a watch tower.

Conclusion
Our survey in the el-Ga’ab depression aimed to report on the existence and distribution of the vegetation mounds in the Ga’ab el-Matas area. These mounds have immense value for reconstructing the palaeoenvironment, as they are signs and landmarks for tracing the ancient irrigated agricultural lands and archaeological sites in remote areas.

Several authors (e.g., Nickling and Wolfe 1994; Tengberg 1994; Khalaf et al. 1995; Tengberg and Chen 1998) considered the vegetation mounds a good indicator of wind erosion and land degradation. Based on our field survey across the El-Ga’ab depression, we concluded that the vegetation mounds are remarkable indicators to trace the existence of ancient settlements and archaeological sites in deserted areas, and their topography is valuable for understanding ancient settlement patterns (Pokorný and Pokorná 2013; Madani et al. 2015; 2016; 2018; Nasreldein et al. 2021). Consequently, they are of immense value for planning future large-scale archaeological surveys in Sudan (Nasreldein et al. 2023). The excavated vegetation mound in Um Hilal, for example, revealed buried archaeological remains including pottery, animal bones, and fireplaces dating to the early Islamic era (AD1504) (Madani et al. 2016). Another example comes from the el-Hayz region of the Bahriya oasis in Egypt, where the vegetation mounds were found to contain buried mud-brick structures dating to the Roman and early Medieval periods (AD500) (Pokorný and Pokorná 2013).
The particular vegetation on the Live mounds supports their association with ancient settlements, as trees such as Tamarix (Tamarix aphylla) – (tarffa in Arabic), prefer to grow in agricultural areas. The large numbers of vegetation mounds found in the El-Ga’ab depression indicate that the area was inhabitable and provided an attractive location for agricultural and grazing activities (Madani et al. 2018; Nasreldein et al. 2023). This supports the idea that the palaeoenvironment and landscape of the el-Ga’ab depression were very different from the desert of the present day (Nasreldein 2019). Indeed, the existence of the vegetation mounds is identified as a sign of ancient water channels and wetter environmental conditions by the Remote Sensing Field Guide, which is an authoritative internet source of information about desert geomorphology compiled by the Desert Processes Working Group (U.S. Army Topographic Engineering Centre).

Study of these mounds revealed an archaeological site in the Western Sudanese desert approximately 70km from the Nile River. We identified the site as a desert military camp, and based on objects from surface collection, the site probably belongs to the British colonisation period (1899-1959). Nevertheless, we are still uncertain about the exact date and function of the camp as it is located in a remote area far away from inhabited areas and whether it was constructed for trade, mining, or protection activities is uncertain. Further investigation and excavation of the site could reveal more aspects about the site and its purposes.

Acknowledgements
The authors would like to express their sincere gratitude to the el-Ga’ab project team members for their help and support during our field survey; Hamad Hamdeen, Huda Abdallah, Fatima Idris, Osman Khalil, Sara Mamon, Rayan Mahjoub, Shiraz Mohamed, and Hala Hassan. Our special gratitude goes to our inspector Amal Attia (NCAM). Special thanks go to the project’s drivers, Modathir Abd El Hameed and El Nour Ahmed Tayeb. The first author would also like to thank the German Academic Exchange Programme (DAAD) for supporting his research stay in Germany, during which it was possible to prepare the manuscript for this article.

References
King, J., W. G. Nickling and J. A. Gillies. 2006. 'Aeolian shear stress ratio measurements within mesquite-dominated landscapes of the Chihuahuan Desert, New Mexico, USA', Geomorphology 82(3), 229–244 [https://doi.org/10.1016/j.geomorph.2006.05.004].

Li, Z., S. Wu, J. Dale, L. Ge, M. He, X. Wang, J. Jin, R. Ma, J. Liu and W. Li. 2008. 'Wind tunnel experiments of air flow patterns over nabkhas modeled after those from the Hotan River basin, Xinjiang, China (I), Non-vegetated', Frontiers of Earth Science in China 2(3), 333–339 [https://doi.org/10.1007/s11707-008-0019-8].


Melton, F. A. 1940. 'A tentative classification of sand dunes and its application to dune history in the southern high plains. The Journal of Geology 48(2), 113–174 [https://doi.org/10.1086/624871].

Nasreldein, M. 2019. The Archaeobotany of El-Ga’ab Depression – Western Dongola, A Case Study Vegetation Mounds [M.A Thesis]. University of Khartoum, Faculty of Arts, Department of Archaeology.


Archaeological vegetation mounds in the el-Matas area at the el-Gaab depression (Nasreldein et al.)


Tahir, Y. F. 2009. *The Archaeological, Ethnographical and Ecological Project of El Ga’ab Basin in Western Dongola first season report*. University of Khartoum, Faculty of Arts, Department of Archaeology.


