Report on the archaeological survey at Gebelein in the 2014, 2015 and 2016 seasons

Wojciech Ejsmond,[1] Julia M. Chyla,[2] Piotr Witkowski,[3] Daniel Takács,[4] Dawid F. Wieczorek,[5] Lawrence Xu-Nan,[6] Vincent Oeters,[7] Taichi Kuronuma,[8] and Adam Grylak[9]

[1,2] Antiquity of Southeastern Europe Research Center University of Warsaw, [2, 5] Institute of Archaeology University of Warsaw, [3] independent researcher, [4,] Faculty of Oriental Studies, University of Warsaw, [6] University of Auckland, [7] Friends of Saqqara Foundation, [8] Tokyo Metropolitan University, [9] Institute of Archaeology University of Wrocław

Abstract: All periods of Egyptian history are represented at Gebelein and it encompasses many kinds of archaeological site found in the Nile valley (that is, cemeteries, settlements, fortifications, temples, rock quarries etc.). The area was a significant centre in the history of ancient Egypt, but its exact role and the reasons for its importance still awaits explanation. That is why the Gebelein Archaeological Project was initiated. The field survey of Gebelein, which started in 2014, aims to recognise the topography of the area and the degree of destruction of the sites and to locate archaeological remains as well as to determine their interpretation and dating. This report outlines the results of work conducted during seasons 2014, 2015 and 2016, which encompassed the archaeological and epigraphic field surveys, geophysical prospection as well as work conducted in the rock-cut chapel of Hathor.

Keywords: Gebelein, mobile GIS, geophysical prospection, archaeological survey, epigraphic survey, satellite imagery, RTI, decorrelation

The term Gebelein refers to a group of archaeological sites [*Fig. 1*] located 28 km southwest of Luxor on the west bank of the Nile in the Qena Governorate of Egypt. It was an important centre; its role as a predynastic proto-state capital is the subject of ongoing debate (Wilkinson 2000: 390–392) and it was a nome capital in Ptolemaic times (Vandorpe and Waebens 2010). It encompassed two towns (Sumenu and Per-Hathor), cemeteries, cult places etc. (for an overview, see Ejsmond 2016). Although, many archaeological missions have worked there (e.g.: Fraser 1893; Schiaparelli 1921; Bergamini 2005), but the results are underpublished and the area, despite its importance, often escapes attention in scholarly debate.

A field reconnaissance was conducted in the spring of 2013 at the sites of Khozam, el-Rizeiqat, and Gebelein (Ejsmond, Chyla, and Baka 2015). The last

site was chosen for more comprehensive investigation in view of the threatening encroachment of agricultural fields [***Fig. 2***]. Recent settlement development has also been observed comparing contemporary satellite images to archival ones and maps as well (Chyla 2017). These observations, along with a lack of information regarding the archaeological topography of the place, are a cause of concern (for an overview, see Ejsmond 2016). Therefore, the aim of the survey is to register and establish the exact location of all recognisable archaeological remains at Gebelein in their topographical and environmental context. Work conducted so far has shown the potential of the area in improving our understanding of different aspects of Egyptian history and culture (for current work, see Ejsmond 2017a; 2017b).

METHODS

Different non-destructive methods were applied in order to collect a range of data and produce precise documentation of the archaeological material.

ARCHAEOLOGICAL SURVEY

Field prospection started with an analysis of available spatial data: CORONA, Landsat, Google Earth, Pleiades satellite

Team

Dates of work: 16–25 February 2014; 25 January–8 March 2015; 8 February–14 March 2016

Director: Wojciech Ejsmond, archaeologist (University of Warsaw; 2014; 2015; 2016)

Field Director: Julia M. Chyla, archaeologist, GIS specialist (University of Warsaw; 2014; 2015; 2016)

SCA representatives: Mamduh Saad Mostafa (2014); Ali Mohamed Ahmed (2015); Mohammed el-Amir Mohammed Ahmed (2016)

Archaeologists: Adam Grylak (University of Wrocław; 2015), Taichi Kuronuma (Tokyo Metropolitan University; 2016)

Egyptologists: Cezary Baka (PCMA; 2014), Mina Ilić (University of Nis; 2016), Vincent Oeters (Friends of Saqqara Foundation; 2016), Daniel Takács (University of Warsaw; 2015; 2016), Lawrence Xu-Nan (University of Auckland; 2016)

Archaeologist/epigrapher: Dawid F. Wieczorek (Institute of Archaeology, University of Warsaw; Institute of Mediterranean and Oriental Cultures, Polish Academy of Sciences; 2015; 2016)

Geologist: Michał Madej (University of Warsaw; 2015)

Geophysicist: Marcin Jakub Ordutowski (Maria Curie-Skłodowska University in Lublin; 2015)

RTI specialist/archaeologist: Piotr Witkowski (independent researcher; 2014; 2015; 2016)

Conservator: Arkadiusz Ostasz (freelance; 2016)

Anthropologist: Marzena Ożarek-Szilke (University of Warsaw; 2015)

Acknowledgments

The season was supported financially by the University of Warsaw Foundation and the Consultative Council for Students' Research at the University of Warsaw. Team members received research scholarships from the Polish Centre of the Mediterranean Archaeology University of Warsaw. Daniel Takács would also like to thank the International Visegrad Fund for enabling his work at the site.

images, and also maps made by Pierre Jacotin about 1800 (Jacotin 1826: Pls 4–5; Chyla 2012; Ejsmond, Chyla et al. 2015). A map based on satellite images of the rock formations of Gebelein was made prior to the start of the survey [see *Fig. 2*].

The site complex is artificially divided into two main areas: Gebelein East and Gebelein West.[1] The dividing line lies along a canal situated between these mounts, where the hills are further broken up into smaller rocks. The following abbreviations are used in the documentation: GW = Gebelein West, that is, the western area, and GE = Gebelein East, the eastern area. Both parts consist of several rocks (R), which are designated with Roman

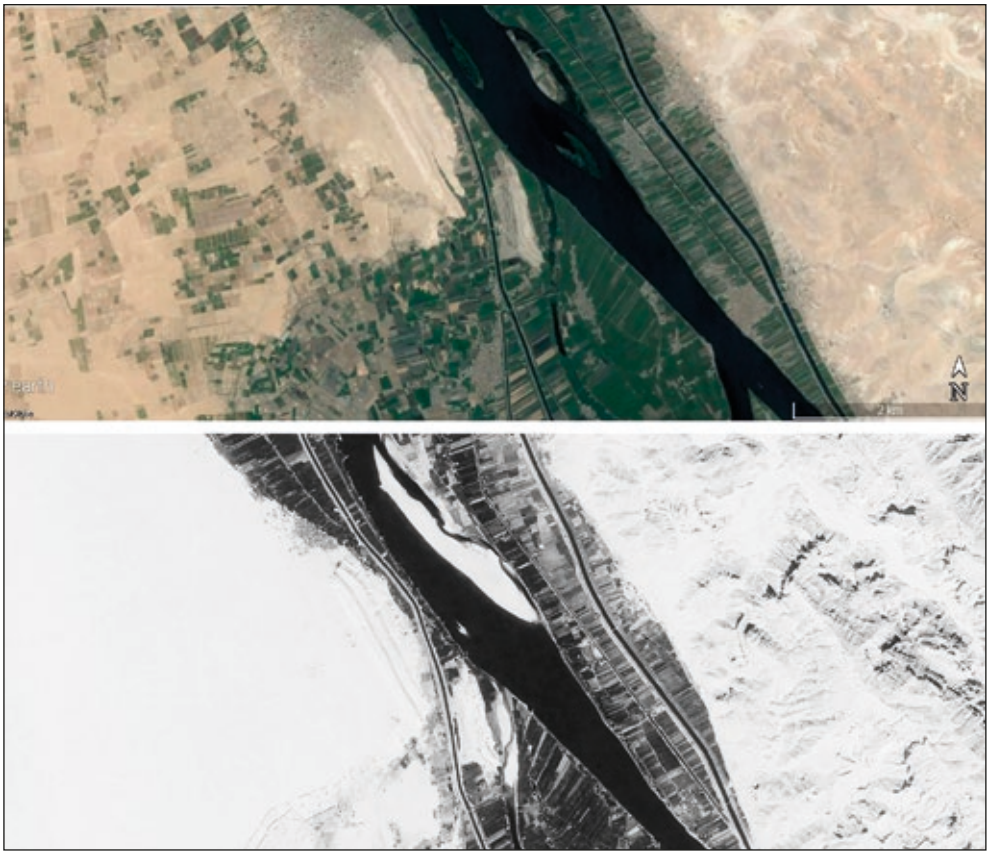
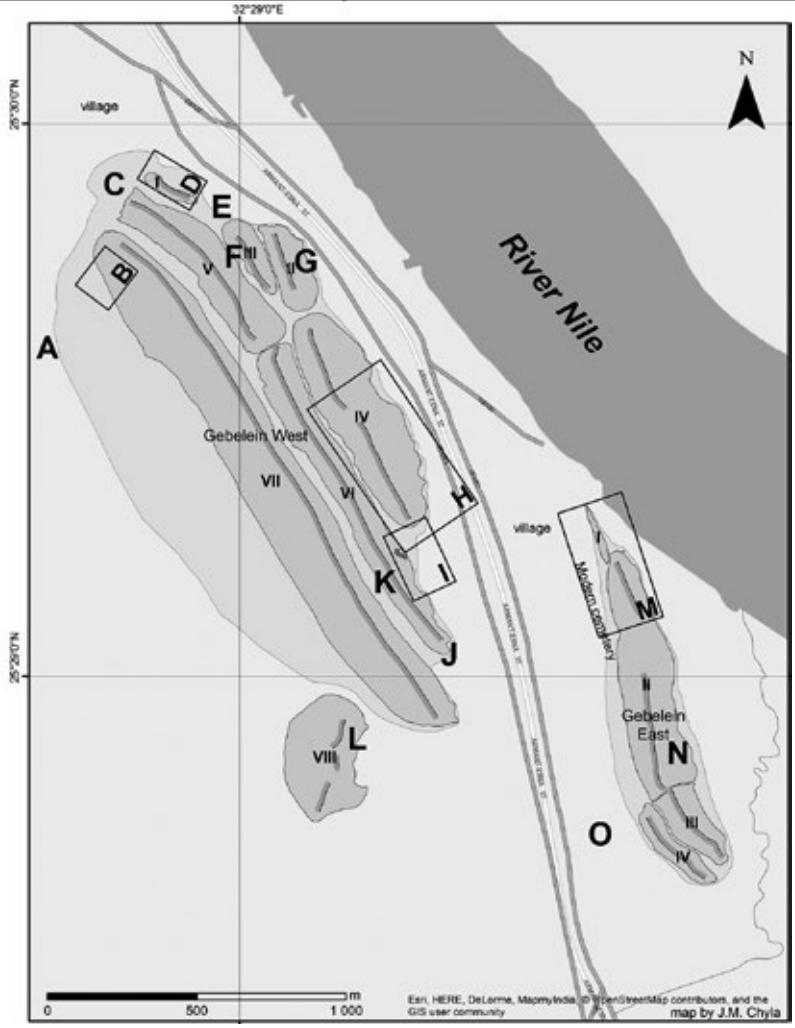


Fig. 1. Changes in the Gebelein landscape observed in satellite images: top, from 2016 (Google Earth) and bottom, from 1968 (CORONA) (Processing J.M. Chyla)

[1] These terminologies differ from those used by the Italian Mission, which sometimes referred to Gebelein West as 'Gebelein North' and Gebelein East as 'Gebelein South', or Greater and Smaller Rock respectively (see, e.g., Schiaparelli 1921 and Fiore Marochetti 2010). In this report, as well as other publications of the current project, the terms "Hill" and "Mountain" are used interchangeably as designations of the eastern and western rock formations.



A – Palaeolithic site [***Fig. 3***]
B – area of geophysical and pottery surveys 2015, 2016 [***Figs 3, 4***]
C – northern necropolis [***Fig. 6***]
D – area of the Tomb of Iti, detailed archaeological survey, as well as pottery and anthropological survey, 2015 and 2016 [***Fig. 5***]
E – modern construction site with remains of archaeological features [***Fig. 9***]
F – archaeological survey area, GWR III Area 5
G – artificial elevation and rectangular room [***Fig. 10***]
H – detailed archaeological survey 2014, 2015, 2016 [***Figs 11–13, 16***]
I – detailed archaeological survey 2014, also geophysical survey and anthropological survey [***Figs 14, 17, 19***]
J – detailed archaeological and epigraphic survey area, 2014 and 2015 [***Fig. 22***]
K – archaeological survey 2014
L – niche with Coptic decoration
M – area of detailed archaeological survey 2016, epigraphic survey 2015, 2016 [***Figs 20, 21***]
N – tombs
O – mud-brick Muslim mausoleums

Fig. 2. Gebelein archaeological site complex. Boxes correspond to detailed maps of the investigated area illustrated below as indicated (J.M. Chyla)

numerals (e.g., I, II, III, IV etc.) [see ***Fig. 2***]. All the features, like tombs and other man-made structures, are numbered (e.g., 156). The numbering sequences for GE and GW are separate, for example: GWR IV-164 = Gebelein West, Rock No. IV, Object No. 164.

A GIS application ArcPad was used, combined with the mobile measuring tool MobileMapper 20. All the collected archival data was processed and stored in GIS, which was subsequently converted into a mobile version, allowing the research team to retrieve areas marked as being of interest as a result of an analysis of both published and unpublished data. Mobile GIS not only allows the collected information to be inputted immediately, but can also be used directly on site during the fieldwork (see Wagtendonk and De Jeu 2007; Tripcevich and Wernke 2010; Tzvetkova 2012). A database containing the archaeological features connects features of interest with their positions and descriptive information (Bogacki, Giersz et al. 2010). The exact locations of the features are documented as points or lines with their geographical coordinates. These also include attributes consisting of the hill number, inventory number, and the state of preservation of the features. Additionally, recognised threats, archaeological finds, and the type of the material are described as well (e.g. pottery, bones, textiles etc.). The attributes are categorised as double, false/truth, text and date format, depending on the type of information they describe. Also, the data is connected to photographs of archaeological remains (Ejsmond, Chyla et al. 2015: 618). If needed, additional archaeological features or areas could be mapped using lines demarcating the extent of areas of interest (AOI).

The variety of archaeological features and the poor state of preservation of archaeological sites in Gebelein required a new method for conducting the pottery and anthropological surveys to deal with the material (Chyla, Ejsmond et al. 2017). Every collected potsherd or human bone is numbered and described provisionally with detailed information in the mobile GIS database. Their exact location was documented as points with geographical coordinates. Specialists can complement or correct the data upon examination in a laboratory thanks to the accessibility of the Archaeological Information System that stores all the field information. The information from the pottery or bone examination, for instance, can be correlated with the results of other prospections or field data, such as geophysical survey (Ejsmond, Chyla et al. 2015: 618). This method of surveying is still being tested. The method also provides new perspectives on the interpretation of data distribution and helps to plan efficient paths and focus upcoming surveys and excavations. One can effectively produce a detailed map showing the location of the material and have a more complete image of the researched area. Ultimately, this may be used to reconstruct the history of the occupation of a site in different periods by non-invasive means (although excavation are still needed because they produce different kinds of data).

Magnetic prospection was conducted in two areas [B and I in ***Fig. 2***; ***Figs 4, 17***] using GeoscanResearch fluxgate gradiometer FM 256 with 0.1 nT resolution. The sampling grid was 0.50 m by 0.25 m, giving eight readings per each square meter. These were collected in both parallel and zigzag modes. Additionally, measurements

were taken in 20 m by 20 m squares and covered approximately 1.5 ha. The method was chosen on the presumption that mud brick (used for building in the region) can be easily traced in the predominantly sand and limestone bedrock matrix of the site. This is due to Nile silt, the material from which the bricks were made, being highly magnetic (Herbich 2003: 16; Ordutowski 2016).

EPIGRAPHIC SURVEY

Most of the graffiti were documented by direct tracing on transparent sheets of foil and subsequently photographed. Fragile, cracked and uneven rock surfaces, also poorly lighted, were only photographed due to difficulties with their documentation on foil (reduced shadows, potential damage at points of attachment of the foil to the fragile surface).

Many graffiti and *dipinti* were poorly preserved due to exposure to environmental factors and anthropogenic damage. In order not to contribute to further destruction of the rock surface, as well as to save time, indirect, non-invasive recording techniques were applied, such as direct tracing on digital images (Domingo Sanz 2014; Pagi, Miles, Uueni 2015) generated by RTI (Reflectance Transformation Imaging). The result was the invention of a new technique that combines RTI and color enhancement techniques, and has since been applied to the documentation (Witkowski, Ejsmond, Chyla 2016).

For photography a Canon EOS 500D camera (15 megapixels) and, since 2016, 750D (24 megapixels) was used with the following eqyuipment: different lenses (EF-S 18–55mm f/3,5-5,6 IS and EF-S 60 mm f/2,8 macro USM), tripod, Fomei Panther 600 mini flash, poles, two blackballs, measuring tape and string. Each of the registered sets is composed of 35–90 images (RAW + JPG). The fewer number of images in some sets is due to the inability to create a full hemisphere using the lamp.

ImageJ software and DStretch[2] plug-in were applied for color enhancement of the original images of engraved and painted features. The technique has been used in rock art documentation, as well as in remote sensing analysis (Harman 2008), where it has been proven to produce successful results.

The discovery of overlapping engraved, faded, and almost invisible painted elements in both areas of Gebelein prompted the idea to connect two different techniques, RTI and color enhancement, as a means to enhance image clarity. Consequently, another stage was added to the process of creating an interactive RTI file. The combination of RTI and decorrelation is based on the premise that faded elements will become more visible, making it more likely for additional elements that are not visible to the naked eye to be discerned. Photos are then processed in DStretch or another graphics program (e.g. Photoshop or Gimp). The digitally enhanced images are loaded into RTIBuilder software and a RTI file is created (Witkowski, Chyla, and Ejsmond 2016). The resulting images after the digital enhancement process are still high quality photos without the visual artifacts.

A 3D model of the rock-cut *speos* (for the work, see below) was created in 2015 using various techniques of visua-

[2] ImagesJ website : http://rsb.info.nih.gov/ij/index.html; more on DStrech: http://www.dstretch.com.

lisation, such as exporting the coordinates of each point of the 3D model to a scalar field[3] and applying a radiance scaling shader (see: Vergne, Pacanowski et al. 2010).

ARCHAEOLOGICAL SURVEY

With field prospection still ongoing, the results presented in this paper are only a preliminary description of the different types of features observed and documented in the 2014, 2015 and 2016 seasons. The following presentation accounts for characteristic kinds of archaeological features. Analysis and dating of individual monuments and artifacts takes place simultaneously with field prospection. The processes of dating and interpreting are still ongoing on both the intra- and inter-site scales.

The areas selected for survey, between the two hills and the northern foothill of the West Mount [see ***Fig. 2***], are endangered by agricultural expansion and modern settlement development [***Figs 6, 7***]. The below description of archaeological features starts with the West Mount in the northwest and proceeds south.

GEBELEIN WEST

A concentration of flints was discovered at the top of a mound located west of the Western Hill in the northwestern part of the surveyed area [A in ***Fig. 2***; ***Fig. 3***]. The stone tools can be dated to the late Middle or Late Palaeolithic and their context might be secondary. The center of the site was destroyed by an electric post and its southern part by agricultural fields.

The northern necropolis is a large burial ground located at the northern base and northern slope of the Western Hill.

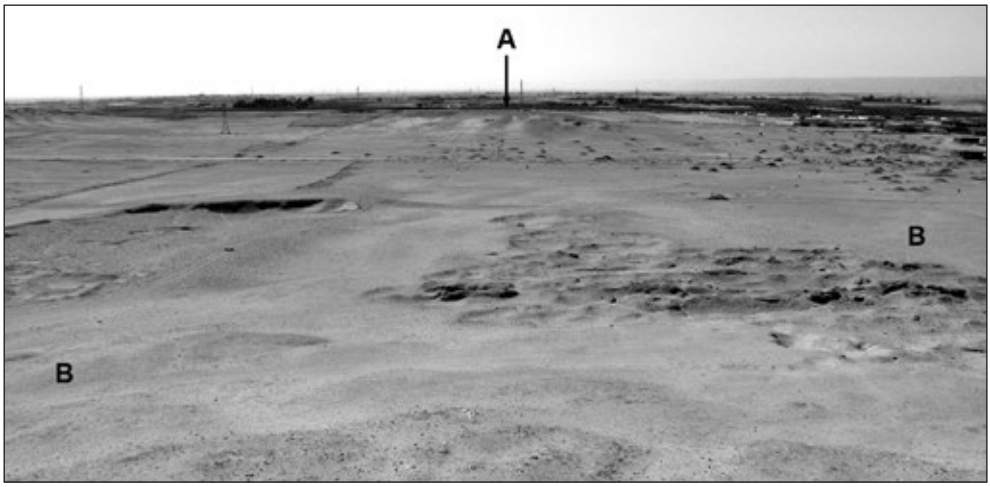


Fig. 3. Northwestern part of the surveyed site looking west; A – location of Palaeolithic site, B – western part of the northern necropolis. B also indicates area covered by geophysical prospection (Photo W. Ejsmond)

[3] See CloudCompare Version 2.6.1 User manual (http://cloudcompare.org/).

The cemetery was probably associated with the nearby town of Sumenu, once located north of the necropolis [C in ***Fig. 2***] and destroyed in the 19th and 20th centuries (Ejsmond 2013: 38–39; Schiaparelli 1921: 27). A pottery survey and geophysical prospection were conducted in the westernmost part of the area (Ejsmond, Chyla et al. 2015; Chyla, Ejsmond et al. 2017) [B in ***Fig. 2; Figs 3, 4***]. Two magnetic anomalies of rectangular shape were identified, while the pottery collected from the surface was largely of Naqada III date. Pottery and archaeological surveys were

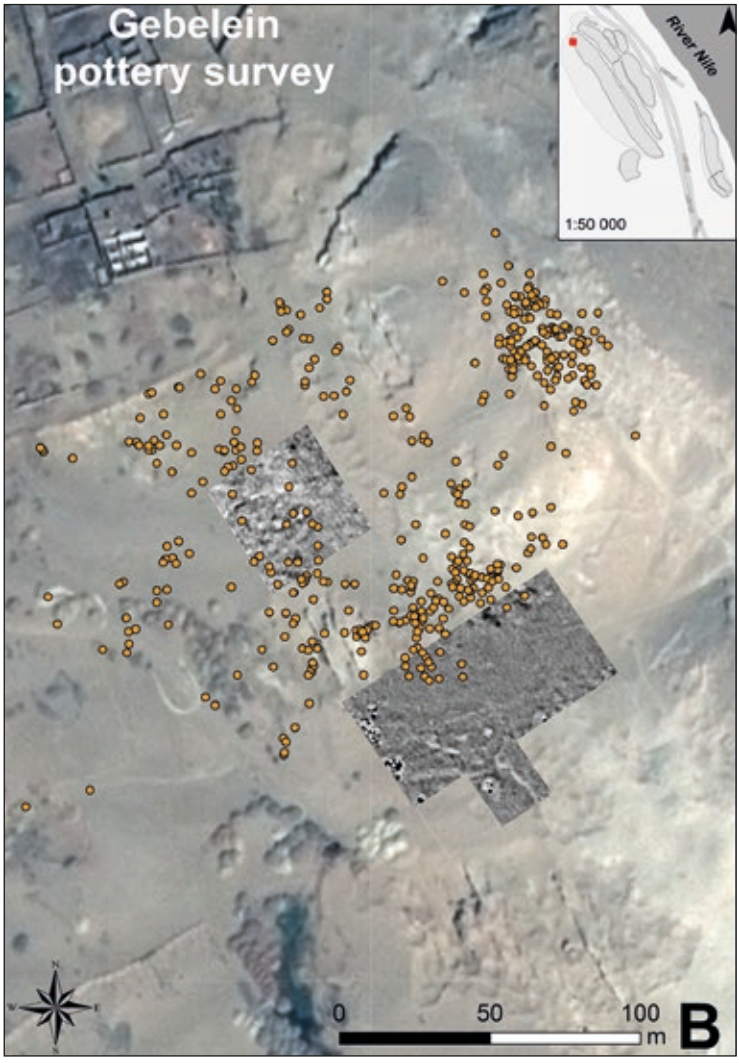


Fig. 4. Area of the geophysical and pottery surveys in 2015 and 2016; dots mark location of collected pottery samples (Map B in Fig. 2) (J.M. Chyla)

also conducted in the eastern part of the necropolis [D in *Fig. 2*; *Fig. 5*]. The central part of the cemetery [C in *Fig. 2*] was destroyed by recent extraction of natural resources; a few archaeological features were noted on the extraction border [see *Fig. 6*]. A comparison of archival and contemporary images shows the exact spot excavated by the Italian Mission in the first half of the 20th century (Ejsmond 2013; Donadoni Roveri 1994: 18–20) [see *Fig. 9*]. Numerous tombs are hewn into Rock I [D in *Fig. 2*; *Fig. 5*; *Fig. 7*]. Most of them are shafts located on the top of the rock and features cut into its slopes. Three tombs deserve mention due to their importance and size. One is hewn into the eastern face of the rock [D in *Fig. 2*;

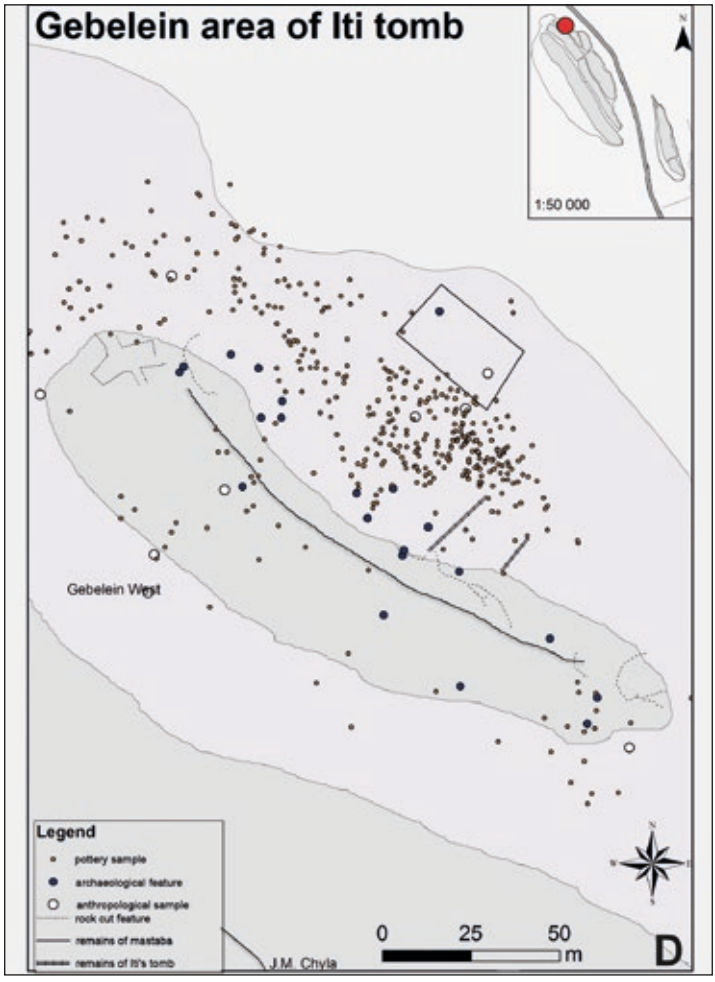


Fig. 5. Tomb of Iti area, detailed archaeological survey area and also pottery and anthropological survey area, 2015 and 2016 (Map D in Fig. 2) (J.M. Chyla)

A in ***Fig. 7***] and consists of one big room connected to a burial chamber by a corridor in its southern part. Another tomb belongs to Iti, an army commander and priest of Sobek from the First Intermediate Period, who was buried there along with his wife Neferu who was a priestess of Hathor (Moiso 2015) [B in ***Fig. 7***]. The structure was excavated in 1911 and rediscovered by the Italian Mission in the 1990s (Bergamini 2005: 38–39). Today, only its outline (or rather negative imprint) in

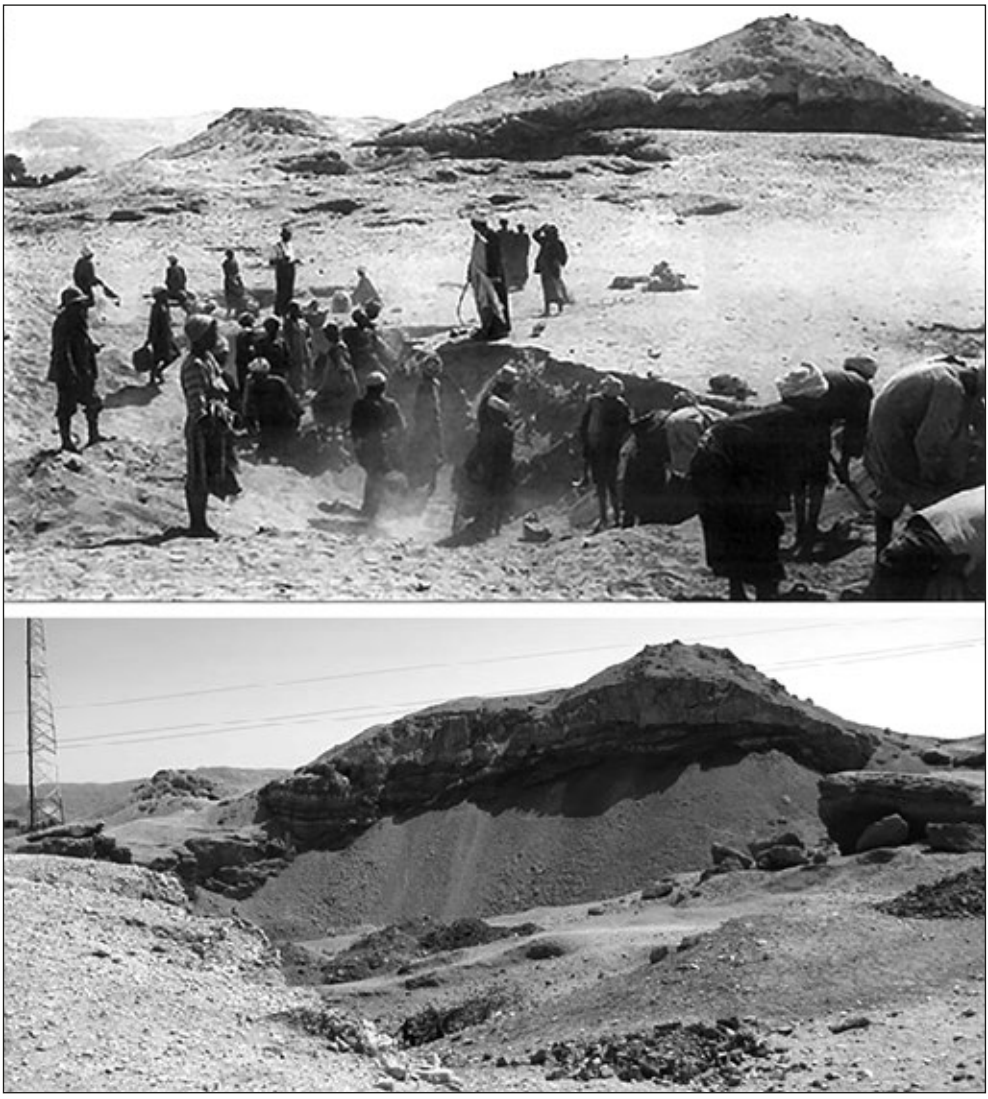


Fig. 6. Central part of the northern necropolis looking southeast: top, during the Italian excavations in the 1930s; bottom, in 2016 (Top, after Donadoni Roveri 1994: 19; bottom, photo W. Ejsmond)

Fig. 7. Eastern part of the northern necropolis: top, looking southeast; bottom, looking west, A – rock-hewn tomb; B – tomb of Iti and Neferu; C – mastaba (Photos W. Ejsmond)

the rock remains. The last one is a mastaba excavated by Egyptian archaeologists, partly documented and published by the Italian Mission (Bergamini 2005: 36–37) [C in ***Fig. 7***]. Only some bricks and two shafts are visible today. The structure is surrounded by pottery sherds.

The area between Rocks I and III contains modern structures [E in ***Fig. 2***]. Outlines of structures (most probably tombs) were documented in the northern part. Several undecorated funerary cones made of clay were found in and around one of the artificial indentations in the rock [***Fig. 8***]. Such finds (see Zenihiro 2009) are usually related to Eleventh Dynasty elite tombs (Arnold 2003: 95) and were also found earlier at Gebelein (Bergamini 2004: 75). The ground in the southern part of the area proved to be disturbed by numerous small depressions between Rocks I, III, and V [F in ***Fig. 2; Fig. 9***]. They may have

Fig. 8. Funerary cones from GWR I (Photo W. Ejsmond)

Fig. 9. GWR III archaeological area 3, looking north (Photo W. Ejsmond)

been associated with some ancient activity, possibly mining for flint. Individual features were difficult to separate and document, hence the collective designation: GWR III Area 3.

Several features were documented on Rock II. However, their interpretation as archaeological features is not always certain, because they follow the geological structure of the rock and it is sometimes

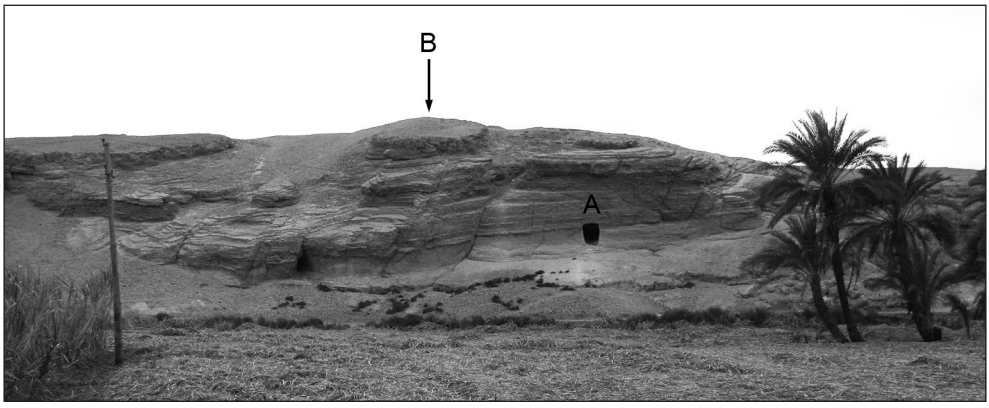


Fig. 10. GWR II, view looking west: A – entrance to the rock-cut feature, B – artificial elevation on top of the rock (Photo W. Ejsmond)

Fig. 11. GWR IV: archaeological area 1 and quarry in the middle part of Rock IV, looking west (Photo W. Ejsmond)

difficult to distinguish manmade from natural. Two should be reported [G in ***Fig. 2***]. The first is located in the eastern face of the rock [A in ***Fig. 10***] and consists of a rectangular chamber with walls that have lost their original surface due to the poor quality of the limestone. There is also a small, narrow corridor in its northwestern corner. The second archaeological feature is located at the top of the rock [B in ***Fig. 10***]. It is an artificial elevation made of stones, soil, and some limestone

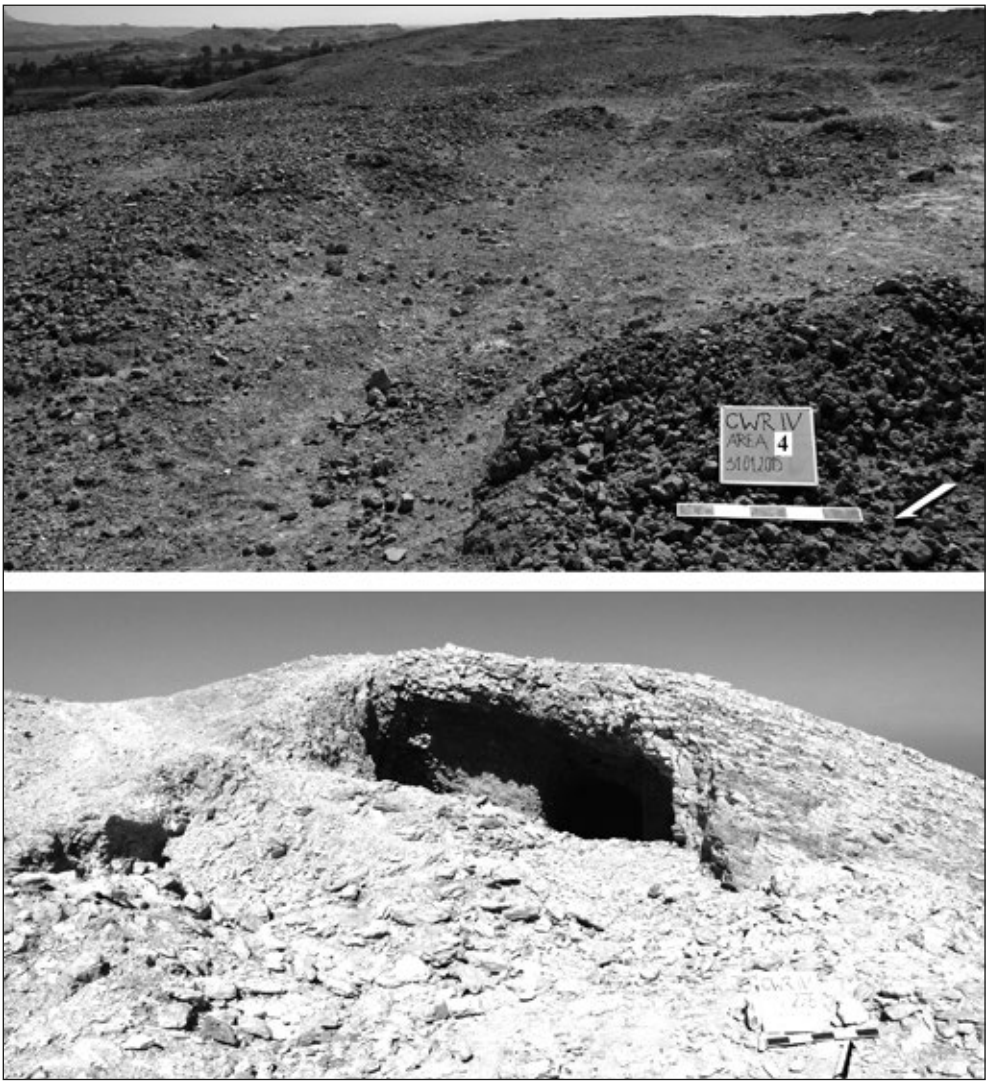


Fig. 12. GWR IV: top, archaeological area 4, looking southeast; bottom, feature GWR IV-276, view from the south (Photos W. Ejsmond)

blocks, the base of which has a rectangular shape. A rectangular shaft is found to the east of the manmade elevation, where there is a depression to the west of this mound, possibly made by the extraction of limestone.

A rock quarry or mine is located further to the south, around the middle of Rock IV [H in *Fig. 2*; A in *Fig. 13*]. It has an open cast and a gallery. The area was used as a camp by the Italian Mission excavating at Gebelein (see Moiso 2016: 94, Fig. 85).

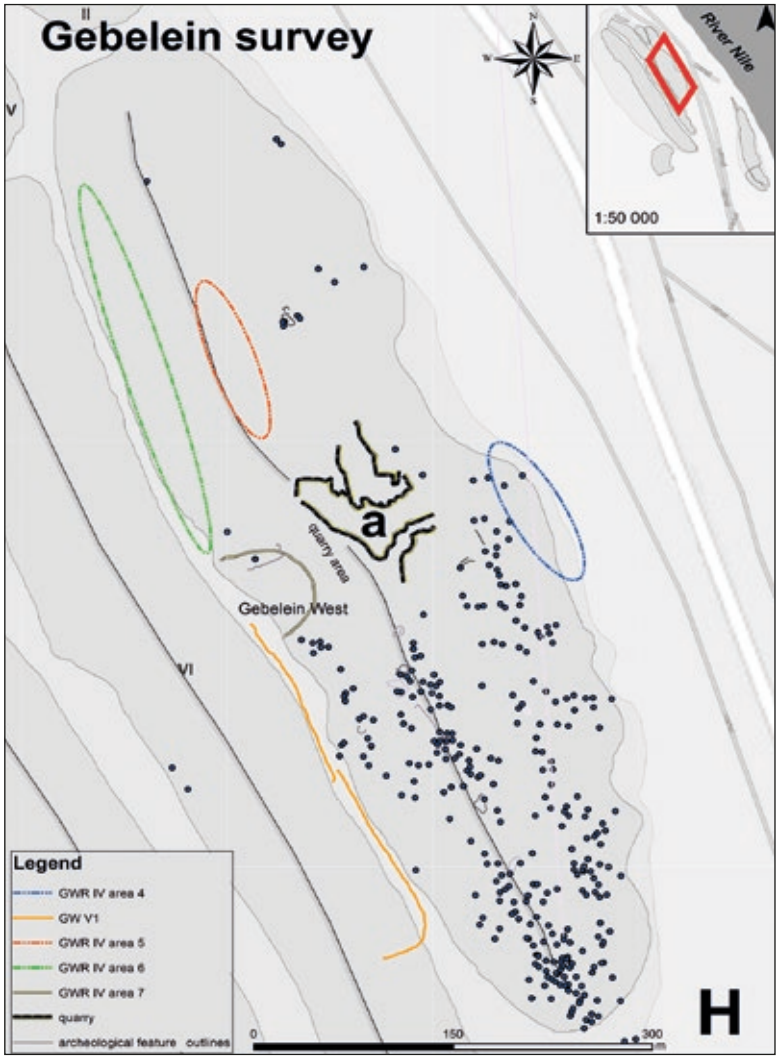


Fig. 13. Detailed archaeological survey in 2014, 2015 and 2016 (Map H in Fig. 1) (J.M. Chyla)

North of the quarry, on top of the rock, there was another area disturbed by numerous small depressions (archaeological area 4) [*Fig. 12*]. A large, southward-facing niche was carved in the eastern slope of the natural round rock formation of the hill with a platform in front of it (GWR IV-276). The platform has three depressions in the southernmost part and is covered with debris. This area, dubbed area 4, yielded numerous artifacts with a preponderance of pottery [*Fig. 12*].

A heavily destroyed area lies to the west of the quarry. Several rock-cut features and niches here resemble the necropolis in the southern part of the rock (see below),

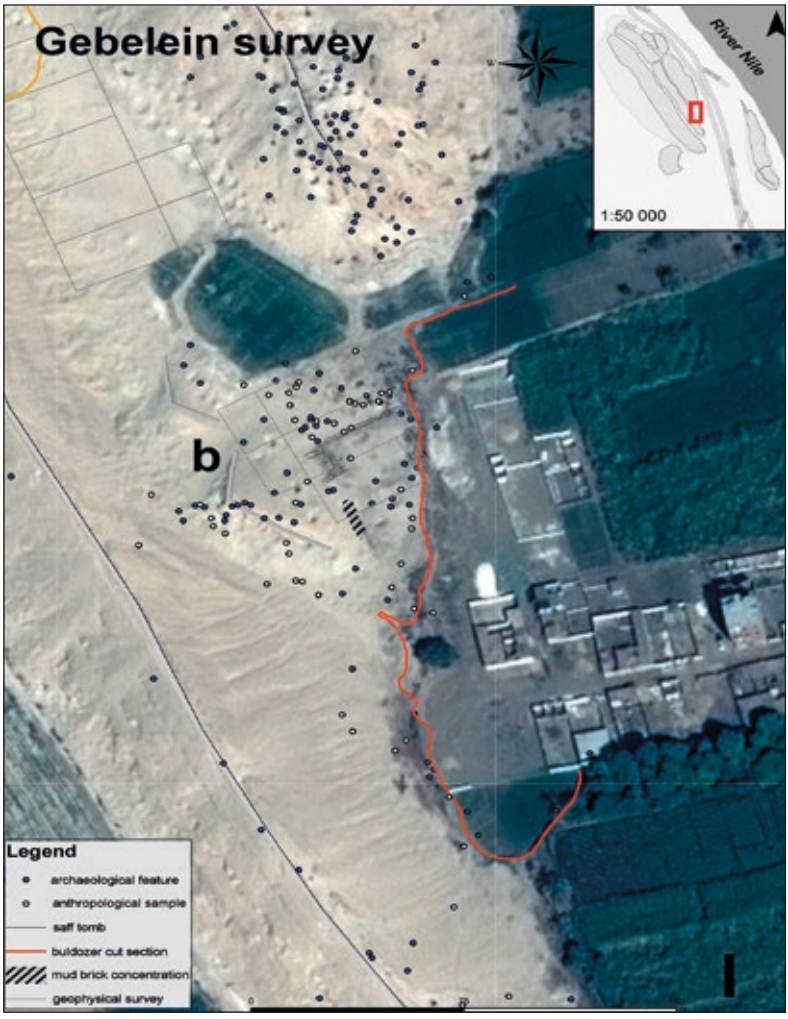


Fig. 14. Detailed archaeological survey in 2014, also geophysical survey and anthropological survey (Map I in Fig. 2) (J.M. Chyla)

but they could also be part of an open-pit mine. The destruction and debris make any interpretation difficult. The same can be said of the poorly preserved features dug or cut in the silt just east of the quarry, at the foot of the eastern part of Rock IV [H in ***Fig. 2***].

Many rock-cut features, mostly shafts, were documented on the hilltop and slopes of the eastern part of GWR IV [see ***Figs 13*** and ***14***]. They are of oblong shape (examples in ***Fig. 15***), in some cases lined with bricks in the top part. These may

Fig. 15. Examples of shafts with mud-brick superstructures: left, GWR IV-131, looking south; right, GWR IV-139, looking east (Photos W. Ejsmond)

Fig. 16. Rock-cut tomb GWR IV-149:top, entrance, view looking west (Photo W. Ejsmond)

signify the presence of superstructures or revetment walls. One or two niches for sarcophagi were occasionally found at the bottom of the shafts. As for shafts located on the rock slopes, bricks were used to level the steepness of the terrain. Human bones, wooden objects (remains of sarcophagi), and scraps of bandages as well as pottery were sighted in the rubble.

Fig. 17. Archaeological area 6 in the central necropolis: top, result of magnetic prospection (A and around A in Fig. 20); below: schematic interpretation of the geophysical survey results (M.J. Ordutowski)

Some of the features located in the area surrounding the quarry may have been connected with the exploitation of natural resources. Most of the features were partly covered or surrounded by soil and rubble. Debris mixed with artifacts, including pottery, bones and brick remains, may reflect slope erosion or remains of the fill from the shafts.

Not all of the features documented on Rock IV are shafts. The large niche with opening facing south contains traces of yellow and white plastering. Two tombs were documented on the eastern slope, each consisting of two rooms and a corridor leading to a chamber. One of them [***Fig. 16***] contained remnants of painted decoration. The spatial relation of the tombs that are concentrated in the southern part of the hilltop and on the slopes needs more attention and further analysis.

Archaeological area 6 was recorded in the valley between Rocks VI and IV [H in ***Fig. 2***; ***Fig. 13***]. In similarity to area 5, the identification and documentation of individual features was practically impossible in view of agricultural encroachment into the valley. Thanks to the efforts of the inspectorate in Esna, this progression of fields has been stopped. Geophysical prospection in this part of the valley

Fig. 18. Feature GWRVI-9, facing east (Photo W. Ejsmond)

produced little in the form of interpretable results in contrast to the area of the *saff*-tombs(Ejsmond, Chyla et al. 2015; Ordutowski 2016) [***Fig. 17***].

A cemetery located in the eastern central part of Gebelein West, where the Italian Mission discovered the *saff*-tomb in 1996 (Bergamini 2005: 34–36) [I in ***Fig. 2***; ***Fig.14***; A in ***Fig. 19***] has been heavily damaged by a section approximately 300 m long bulldozed through it.[4] This damage dates to 2009 as indicated by an analysis of satellite images. The section was dug by a bulldozer. The section cut through at least five graves, the grave pits with human bones protruding from the section wall. These graves are the remains of a bigger necropolis that could still be traced in CORONA satellite imagery of the 1960s (Corona Atlas of the Middle East 2012). The section also cuts through the courtyard of another unexcavated tomb with a portico [B in ***Fig. 19***], marked on the surface by a regular concentration of mud bricks. Lastly, the section reveals a large pit featuring a reversed stratigraphy and accompanied by an embankment, which it is tempting to interpret as a canal. It runs from south to north and along the slope.

Rock-cut features and pits were documented above a concentration of graffiti (see below) in the southern part of Rock VI [J in ***Fig. 2***]. In one instance, a pillar-like feature supports the roof of a rock-cut niche [***Fig. 18***]; in another, a niche was cut out in the middle of the longer axis. These features are surrounded by natural boulders, some of them half-extracted from natural layers. Some of the features suggest that trenches and pits were dug in order to extract massive boulders and/or flint (see also Heldal 2008: 137; Bloxam 2008: 168, fc. 4). The natural resources which were available at Gebelein could have been exploited since prehistoric

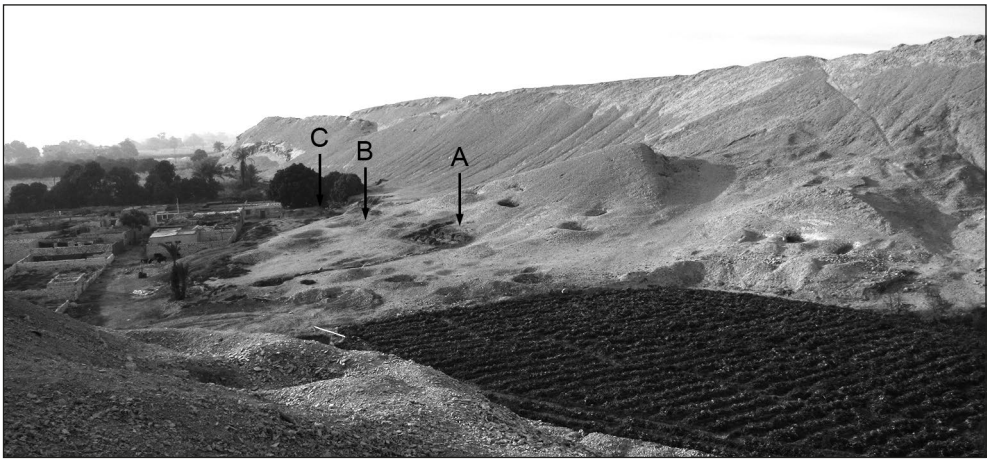


Fig. 19. Central necropolis, looking southwest A – saff-tomb excavated by the Italian Mission, B – saff-tomb, as revealed by geophysical prospection, C – modern trench (Photo W. Ejsmond)

[4] Destruction of antiquities, such as this, is tracked on the website http://www.theantiquitiescoalition.org/the-crime/ (article published in 2017, later deleted).

times (de Morgan 1912: 49), as attested by traces of human extracting activity on the slopes of the Western Hill, at the foot of the hills, as well as on the hilltops.

Deep niches, partly filled with sand and stones, are located on the southern slope of Rock VIII facing south [L in ***Fig. 2***]. They were plastered and painted, the decoration in one case consisting of crosses and faded inscriptions in Coptic.

GEBELEIN EAST

Research on the East Mount started from its northern part, where the ancient town of Per-Hathor (Pathyris during the Ptolemaic period) was located (Ejsmond, Chyla, Baka 2015: 267–268; Vandorpe, and Waebens 2010) [M in ***Fig. 2***; ***Figs 20***, ***21***]. Satellite images of the area were analysed with the NVDI index and photointerpreted, resulting in the

Fig. 20. Archaeological survey area in 2016, epigraphic survey in 2015 and 2016 (Map M in Fig. 2) (J.M. Chyla)

identification of several crop marks in the fields west of the modern village. Further field research and geophysical survey are needed to determine whether these crop marks hint at the remains of an ancient city. Part of the archaeological features on the East Hill were photographed and documented, and an epigraphic survey was initiated along with the documentation and conservation of a rock-cut chapel (see below).

A trench about 112 m long and 27 m wide was noted at the western foot of the Eastern Hill [M in ***Figs 2; 20***]. It was excavated in 2016 to accommodate the extension of a modern Muslim cemetery. Several anthropogenic layers and features were documented in the two sections, but they are difficult to interpret and date; they could just as easily be the remains of the ancient town of Pathyris as of modern settlement or burials. Letters N and O in ***Fig. 2*** mark the locations of the pharaonic and Muslim cemeteries respectively. These have yet to be surveyed. It should be kept in mind that it is often difficult to distinguish natural from anthropogenic features when they follow natural geological formations in the area. More importantly, research has demonstrated that the shafts and tombs have not been published before and are seldom mentioned whether by scholars or by travelers (e.g., *Les fouilles* 1930: 235; Lane 2000: 393).

Fig. 21. Northern part of GER II, location of ancient Pathyris, archaeological area 1, looking north (Photo W. Ejsmond)

EPIGRAPHIC SURVEY

Two main concentrations of graffiti were located during the survey [J and M in ***Fig. 2***]. The first was on the southern slope of GWR VI in the southern part of Gebelein West [J in ***Fig. 2***; ***Fig. 22***]. Many depictions can be dated to prehistoric times, a few inscriptions to the pharaonic period and possibly later. By combining RTI and colour enhancement techniques, more reliable results have been produced in terms of detecting the graffiti as well as *dipinti* that were not visible *in situ* due to their poor state of preservation and bad lighting conditions [***Fig. 24***]. A graffito with the name of Ramesses IV is dated to his first regnal year and likely refers to a previously unknown expedition (Wieczorek 2015). Other rock drawings represent animals (e.g., oryxes, dogs) and there is one depiction of the god Min (dated tentatively to the Nineteenth Dynasty; Jean-Guillaume Olette-Pelletier, personal communication). A adhacent depiction may be similar in nature, but it is too badly damaged to be easily deciphered.

The other grouping of inscriptions was located in the eastern part of Gebelein East (GER II-2) [M in ***Fig. 2***; ***Figs 20; 23***], near the site of the Hathor temple. Some hieroglyphic graffiti mentioning the god-

Fig. 22. Rock with inscriptions (southern part of GWRVI) (Photo P. Witkowski)

dess Hathor 'Lady of Gebelein' were noted along a steep rocky slope on the western side of a path leading to a small cave (noted but not published in Morenz 2010: 143). So far five groups of inscriptions (documented as panels) were discovered.

A graffito done with charcoal was documented in the southern part of Rock IV [H in *Fig. 2*]. It represents a human figure in frontal view. Several graffiti were also found on the northern face of Rock II.

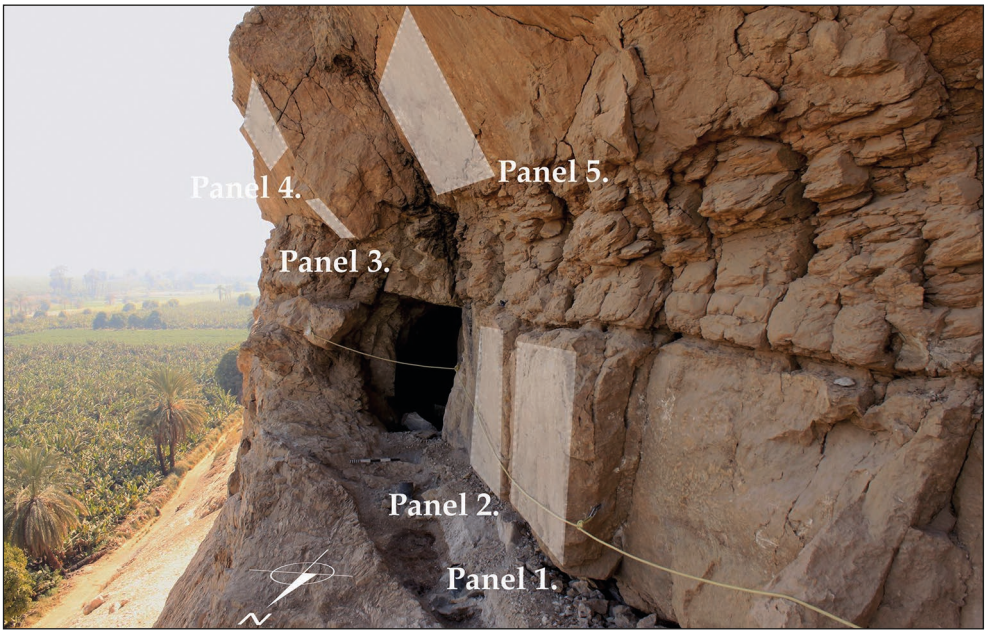


Fig. 23. Location of panels of hieroglyphic graffiti mentioning Hathor 'Lady of Gebelein' on the GER II shelf (Photo D.F. Wieczorek)

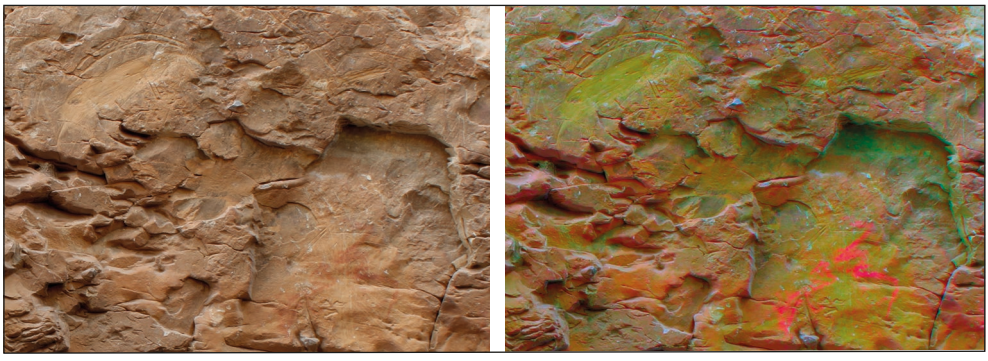


Fig. 24. Comparison of photographic documentation with the original image after using decorrelation (Photos P. Witkowski)

SPEOS

The previously not documented rock-cut chapel (*speos*) dedicated to Hathor 'lady of Inerty (i.e., Gebelein)', located in the northern part of the Eastern Hill (GERII-1) [M in ***Fig. 2***; ***Figs 20; 25***], is badly damaged. Fieldwork in this feature merits a separate discussion, as it involved a combination of epigraphic, archaeological and conservation work.

The entrance to the structure is located on the eastern face of the hill, about 3 m above the current ground level. The *speos* consists of a broad vestibule and a second chamber. The latter has a perpendicular axis in the east–west direction (as compared to the vestibule's north–south axis). The inner chamber has a chapel façade on its west wall with a rock shelf in front of it. At the eastern end of both the north and south walls there are two openings with similar rock-carved shelves below them but without

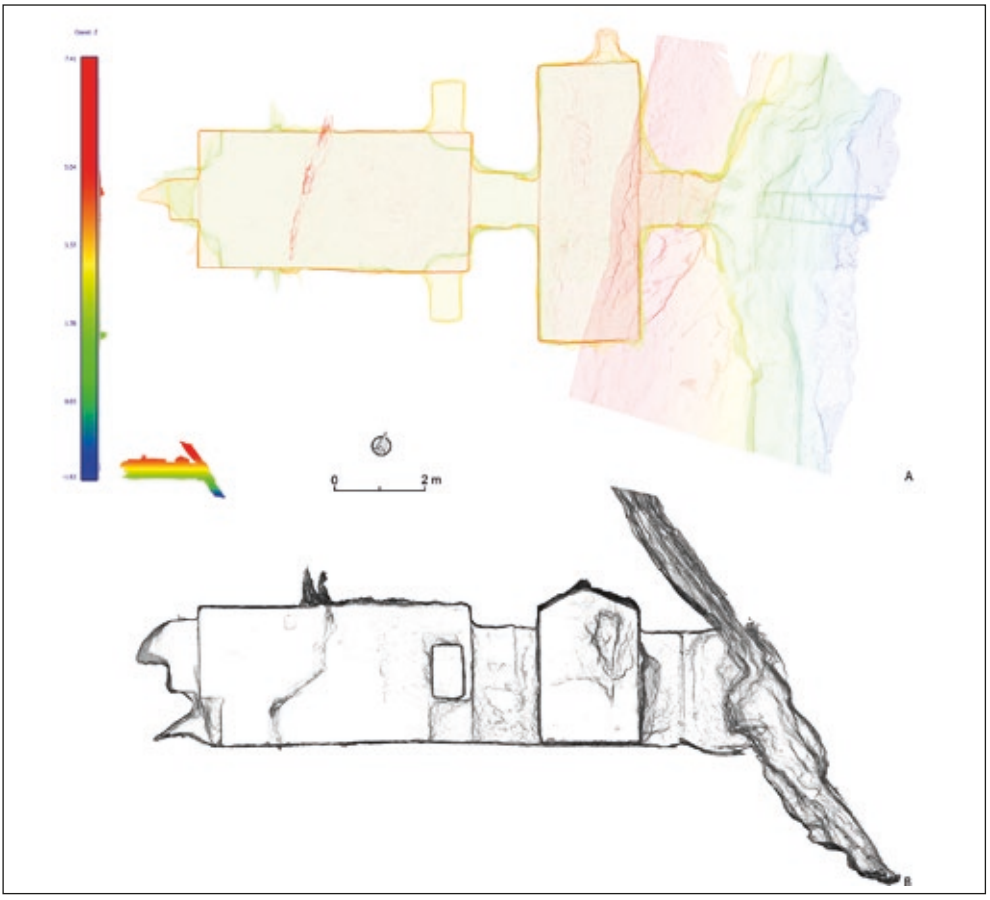


Fig. 25. Rock-cut chapel (speos) of Hathor before removing the fill from the bottom part: plan and section looking north (Model P. Witkowski)

chapel façades. In the western part of the inner chamber, sunken reliefs have survived on the north, west, and south walls [*Figs 26* and *27*].

These decorations are the main aim of the epigraphic and conservational works of the *speos*. They have been traced onto transparent foils as well as photographed and processed with RTI technology starting from season 2015 and continued into 2016. The RTI technique allowed the enhancement of features that are no longer visible to the naked eye or otherwise very difficult to see.

Conservation treatment initiated in 2016 protected the fragile carvings. Salt encrustations were removed mechanically, using brushes, water, and cotton wherever possible, uncovering additional elements of the decoration.

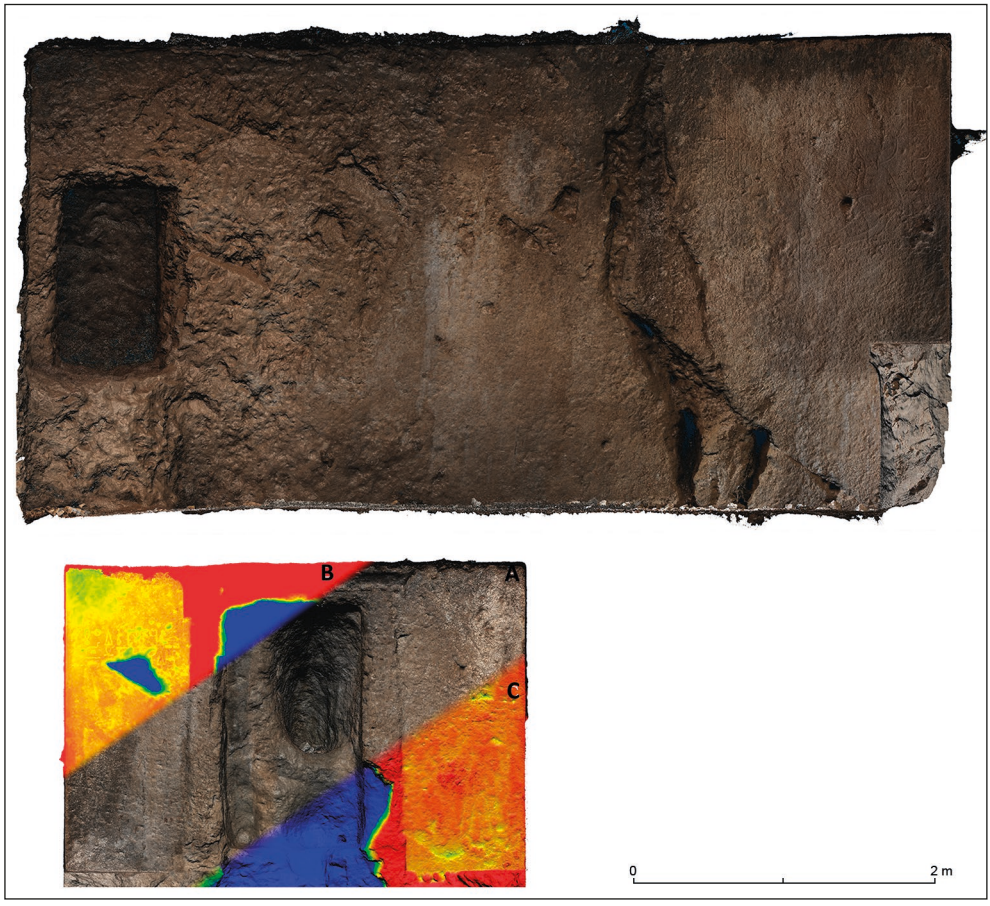


Fig. 26. Examples of different methods of visualisation: top, 3D model of the south wall in the rear room of the speos; bottom, the same simple 3D model (A) compared to images of the wall after applying the scalar field technique – without using information about the orientation of normals (B) and using it (C) (Visualisation P. Witkowski)

Once the carvings were traced with the help of RTI images, the decoration program became more apparent; of particular interest is the representation of the goddess Hathor 'Lady of Inerty' with an offering table in front of her (Takács, Ejsmond et al. 2015; for the most current description of the *speos*, see Takács 2016) and a figure of a pharaoh presenting offerings to her on the south wall [see ***Fig. 27***]. The scene is mirrored on the north wall, featuring a possible male deity (most probably the Theban Amun-Ra). The two wall panels flanking the centrally placed chapel façade on the west wall depict the figure of a king being greeted by a deity. There is also a photograph of the inner chamber of the *speos* showing the rock shelf and the floor in front of the main niche in an intact form. The image was made by François Olivier on January 1, 1993.

Archaeological works conducted inside the *speos* so far have been aimed at cleaning the floor area and documenting the layout. The latter was carried out by traditional measuring techniques and supplemented by photogrammetry. Data were inputted then in the Geographical Information System (GIS), which allowed the plan of the chapel to be created in a fast and accurate manner [***Fig. 25***]. A grid system of 1 m by 1 m squares aligned east to west inside the *speos* was implemented for the cleaning work. Each square was cleaned and documented with the relevant artifactual data. The composite rubble (approximately 30 cm high throughout the *speos*) proved to be of modern origin (e.g., plastic items found practically on the original walking level). Two major intrusions in the floor (at least the west one is modern) were discovered in the course of the cleaning; they remain to be cleared.

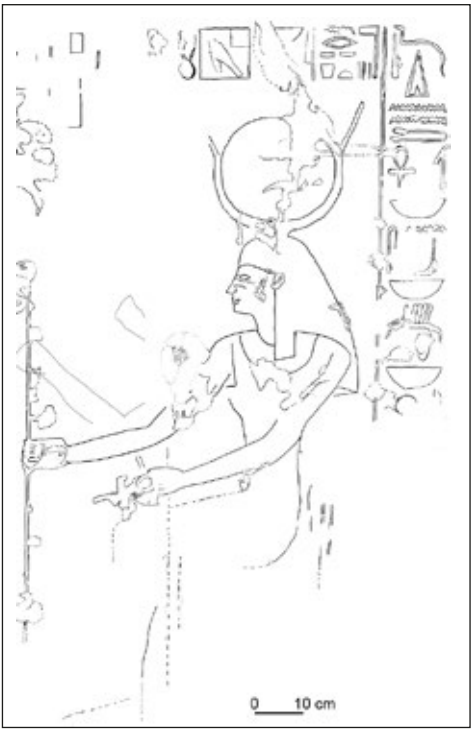


Fig. 27. Image of Hathor 'Lady of Gebelein' on the south wall of the speos (Drawing D. Takács)

CONCLUSION

Over the course of three survey season (2014, 2015 and 2016), the Project documented a total of 430 manmade features. Eight archaeological areas were noted, wherever individual archaeological features could not be distinguished satisfactorily with available surveying techniques.

The main outcome was an assessment of the damage to the archaeological substance in the Gebelein area and identi-

fication of endangered areas. Full digital documentation of recorded sites is in the case of Gebelein the main method of protecting its archaeological heritage from complete destruction and is crucial for the reconstruction of past landscapes (Chyla 2015). Cooperation with the local inspectorate of Esna and Armant afforded improved protection of archaeological sites in the area.

Dealing with urgent conservation issues caused by the progressing destruction of the archaeological heritage in the Gebelein area, the Project developed a new approach to field survey methodology, designed to handle the huge amount of collected field data and the different kinds of artifacts for specialist examination, while bringing into the analysis all of the archival data from earlier research.

After these three seasons, the Gebelein area with its evidence of practically uninterrupted human occupation from prehistoric to modern times, has demonstrated its great value for further research. Only a small part of the findings has been published so far (Wieczorek 2015; Takács, Ejsmond et al. 2015; Takács 2016), but there are still many features and inscriptions that have never been published and can shed new light on different periods in Egyptian history and culture.

Wojciech Ejsmond
PhD Candidate, Antiquity of Southeastern Europe Research Center, University of Warsaw
00-497 Warsaw, Poland, ul. Krakowskie Przedmieście 26/28
wojtek.ejsmond@wp.pl

Julia M. Chyla
PhD Candidate, Antiquity of Southeastern Europe Research Center, University of Warsaw
Institute of Archaeology, University of Warsaw
00-497 Warsaw, Poland, ul. Krakowskie Przedmieście 26/28
julia.chyla@gmail.com

Piotr Witkowski
pwitk@wp.pl

Daniel Takács
Department of Egyptology, Faculty of Oriental Studies, University of Warsaw
00-497 Warsaw, Poland, ul. Krakowskie Przedmieście 26/28
danielviktor.takacs@gmail.com

Dawid F. Wieczorek
Institute of Archaeology, University of Warsaw
00-497 Warsaw, Poland, ul. Krakowskie Przedmieście 26/28
dawidfelikswieczorek@gmail.com

Lawrence Xu-Nan
University of Auckland
lxu049@aucklanduni.ac.nz

Vincent Oeters
Friends of Saqqara Foundation
v.oeters@saqqara.nl

Taichi Kuronuma
Tokyo Metropolitan University
taichi.kuronuma@gmail.com

Adam Grylak
Institute of Archaeology, University of Wrocław
to_ja_adamski@wp.pl

REFERENCES

Arnold, D. (2003). *The encyclopaedia of Ancient Egyptian architecture*. (S.H. Gardiner and H. Strudwick, trans.). London: I.B. Tauris

Bergamini, G. (2004). Gebelein (Luxor). *Ricerche Italiane e Scavi in Egitto*, 1, 73–81

Bergamini, G. (2005). Museo Egizio-Turin (Italy): The 1999 field activities at Gebelein. *ASAE*, 79, 33–39

Bloxam, E.G. (2009). New directions in identifying the significance of ancient quarry landscapes: four concepts of landscape. In N. Abu-Jaber, E.G. Bloxam, P. Degryse, and T. Heldal (eds), *QuarryScapes: Ancient stone quarry landscapes in the eastern Mediterranean* [=*Geological Survey of Norway Special Publication* 12] (pp. 165–183). Norway: NGU, Geological Survey of Norway

Bogacki, M., Giersz, M., Prządka-Giersz, P., Małkowski, W., and Misiewicz, K. (2010). GPS RTK mapping, kite aerial photogrammetry, geophysical survey and GIS based analysis of surface artifact distribution at the pre-Hispanic site of the Castillo de Huarmey, north coast of Peru. In R. Reuter (ed.), *Remote sensing for science, education, and natural and cultural heritage* (pp. 121–130). Oldenburg: EARSeL. Retrieved from http://www.earsel.org/symposia/2010-symposium-Paris/Proceedings/EARSeL-Symposium-2010_2-10.pdf [accessed: 15.01.2017]

Center for Advanced Spatial Technologies. (2012). *Corona Atlas & Referencing System*. Retrieved from http://corona.cast.uark.edu/index.html [accessed: 15.01.2017]

Chyla, J.M. (2015). Possibilities of conservation and reconstruction of archaeological sites through digitalization. In K. Piotrowska and P. Konieczny (eds), *Condition.2015 conservation and digitalization: Conference proceedings* (pp. 165–168). Gdańsk: National Maritime Museum

Chyla, J.M. (2017). How can remote sensing help in detecting the threats to archaeological sites in Upper Egypt? *Geosciences*, 7(4) (issue 94), 1–12

Chyla, J.M., Ejsmond, W., Kuronuma, T., and Xu-Nan, L. (2017). Pottery and geophysical survey – preliminary remarks on new approach to the field prospection. In P. Chudzik, W. Ejsmond, and P. Janik (eds), *The 3rd PhD Candidates' Conference at the Antiquity of Southeastern Europe Research Centre, University of Warsaw: Cultural Heritage Research. University of Warsaw, 9th of June 2017*. Extracts (pp. 58–59), Warszawa: Antiquity of Southeastern Europe Research Centre, University of Warsaw

de Morgan, H. (1912). Report on excavations made in Upper Egypt during the winter 1907–1908. *ASAE*, 12, 25–50

Domingo Sanz, I. (2014). Rock art recording methods: from traditional to digital. In C. Smith (ed.), *Encyclopedia of global archaeology* (pp. 6351–6357). New York: Springer New York

Donadoni Roveri, A.M. (1994). La località gli scavi, le scoperte. In A.M. Donadoni Roveri, E. D'Amicone, and E. Leospo, *Gebelein: il villaggio e la necropoli* (pp. 1–28). Turin: Artema

Ejsmond, W. (2013). Some remarks on topography of Gebelein archaeological site complex in Pre- and Early Dynastic Period. *GM*, 239, 31–42

Ejsmond, W. (2016). *Gebelein: An overview*. Warsaw: Antiquity of Southeastern Europe Research Centre University of Warsaw; Scientific Association for Ancient Egypt 'KeMeT' University of Warsaw

Ejsmond, W. (2017a). The Nubian mercenaries of Gebelein during the First Intermediate Period in light of recent field research. *Journal of Ancient Egyptian Interconnections*, 14, 11–13

Ejsmond, W. (2017b). The Gebelein Archaeological Project 2013–2016. In M.C. Guidotti and V. Rosati (eds), *Proceedings of the XI International Congress of Egyptologists, Florence, Italy, 23–30 August 2015* (pp. 182–185). Oxford: Archaeopress

Ejsmond, W., Chyla, J., and Baka, C. (2015). Report from field reconnaissance at Gebelein, Khozam and el-Rizeiqat. *PAM*, 24/1, 265–274

Ejsmond, W., Chyla, J.M., Witkowski, P., Wieczorek, D.F., Takács, D., Ożarek-Szilke, M., and Ordutowski, J. (2015). Comprehensive field survey at Gebelein: preliminary results of a new method in processing data for archaeological site analysis. *Archaeologia Polona*, 53, 617–621

El-Aziz, A.O.A. (2013). Monitoring and change detection along the eastern side of Qena Bend, Nile Valley, Egypt using GIS and remote sensing. *Advances in Remote Sensing*, 2(3), 276–281

Fiore Marochetti, E. (2010). *The reliefs of the chapel of Nebhepetre Mentuhotep at Gebelein (CGT 7003/1-277)* [=*Culture and History of the Ancient Near East* 39]. (K. Hurry, trans.). Leiden: Brill

Fraser G. (1893). El Kab and Gebelein. *Proceedings of the Society of the Biblical Archaeology,* 15, 496–500

Harman, J. (2008). *Using decorrelation stretch to enhance rock art images*. Retrieved from http://www.dstretch.com/AlgorithmDescription.html [accessed: 28.06.2015]

Heldal, T. (2009). Constructing a quarry landscape from empirical data. General perspectives and case study at the Aswan West Bank, Egypt. In N. Abu-Jaber, E.G. Bloxam, P. Degryse, and T. Heldal (eds), *QuarryScapes: Ancient stone quarry landscapes in the eastern Mediterranean* [=*Geological Survey of Norway Special Publication* 12] (pp. 125–153). Norway: NGU, Geological Survey of Norway

Herbich, T. (2003). Archaeological geophysics in Egypt: the Polish contribution. *Archaeologia Polona*, 41, 13–55

Jacotin, P. (1826). *Carte topographique de l'Égypte et de plusieurs parties des pays limitrophes levée pendant l'expédition de l'armée française, par les ingénieurs-géographes, les officiers du génie militaire et les ingénieurs des ponts et chaussées: assujettie aux observations des astronomes*. Paris: Imprimerie de C.L.F. Panckoucke

Lane, E.W. (2000). *Description of Egypt: Notes and views in Egypt and Nubia*. (J. Thompson, ed.). Cairo: American University in Cairo Press

Les fouilles de la mission italienne d'archéologie. (1930). *CdE*, 5, 233–234

Moiso, B. (2015). The tomb of Iti and Neferu. In C. Greco (ed.), C. Fordham (trans.), *Museo Egizio* (pp. 62–79). Modena: Franco Cosimo Panini

Moiso, B. (2016). *La storia del Museo Egizio*. Modena: Franco Cosimo Panini

Morenz, L. (2010). *Die Zeit der Regionen im Spiegel der Gebelein-Region. Kulturgeschichtliche Rekonstruktionen* [=*Probleme der Ägyptologie* 27]. Leiden–Boston: Brill

Ordutowski, J. (2016). Rezultaty pomiarów magnetycznych na cmentarzyskach w Gebelein (Górny Egipt) [Results of magnetic prospection of cemeteries at Gebelein (Upper Egypt)]. *Medżat – Studia Egiptologiczne*, 4, 33–39 [in Polish with English summary]

Pagi, H., Miles, J., and Uueni, A. (2015). Re-illuminating the past. Introduction to reflectance transformation imaging. *Daguerreotype Journal*, 2, 15–21

Schiaparelli, E. (1921). La missione italiana a Ghebelein, *ASAE*, 21, 126–128

Takács, D. (2016). *Rock-cut cult place from the New Kingdom at Gebelein* (unpubl. MA thesis). University of Warsaw

Takács, D., Ejsmond, W., Chyla, J.M., and Witkowski, P. (2015). Hatshepsut's speos at Gebelein – preliminary conclusions on the unpublished temple. *GM*, 247, 117–120

Tripcevich, N. and Wernke, S.A. (2010). On-site recording of excavation data using mobile GIS. *Journal of Field Archaeology*, 35(4), 380–397

Tzvetkova, J., Nekhrizov, G., and Kecheva, N. (2012). Mobile GIS and the perspectives for archaeological surface surveys in Bulgaria. In A.S. Morintz and R. Kogălniceanu (eds), *Survey in archaeology, often a neglected science: Proceedings of the II Archaeological Symposium, Giurgiu, October 23rd–26th, 2011* (pp. 55–82). Giurgiu: Pelican Publishing House

Vandorpe K. and Waebens S. (2010). *Reconstructing Pathyris' archives. A multicultural community in Hellenistic Egypt* [= *Collectanea Hellenistica* 3]. Leuven: Peeters

Vergne, R., Pacanowski, R., Barla, P., Granier, X., and Schlick, C. (2010). Radiance Scaling for versatile surface enhancement. In *Proceedings of the 2010 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games* (pp. 143–150). New York: ACM

Wagtendonk, A.J. and De Jeu, R.A.M. (2007). Sensible field computing: evaluating the use of mobile GIS methods in scientific fieldwork. *Photogrammetric Engineering & Remote Sensing*, 73(6), 651–662

Wieczorek, D.F. (2015). A rock inscription of Ramesses IV at Gebelein. A previously unknown New Kingdom expedition. *EtTrav*, 28, 217–229

Wilkinson, T.A.H. (2000). Political unification: towards a reconstruction. *MDAIK*, 56, 377–395

Witkowski, P., Chyla, J.M., and Ejsmond, W. (2016). Combination of RTI and decorrelation – an approach to the examination of badly preserved rock inscriptions and rock art at Gebelein (Egypt). In S. Campana, R. Scopigno, G. Carpentiero, and M. Cirillo (eds), *CAA2015: Keep the revolution going. Proceedings of the 43rd annual Conference on Computer Applications and Quantitative Methods in Archaeology* (pp. 939–944). Oxford: Archaeopress

Zenihiro, K. (2009). *The complete funerary cones.* Tokyo: self-published