UNIVERSITY OF WARSAW | Polish Centre of Mediterranean Archaeology

Title**: Report from field reconnaissance at Gebelein, Khozam and el-Rizeiqat.**

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Journal: *Polish Archaeology in the Mediterranean* 24/1 (*Research)*

Year: 2015

Pages: 265 - 274

ISSN 1234–5415 (Print), ISSN 2083–537X (Online)

Publisher: Polish Centre of Mediterranean Archaeology, University of Warsaw (PCMA UW), Wydawnictwa Uniwersytetu Warszawskiego (WUW)

www.pcma.uw.edu.pl www.wuw.edu.pl

Abstract: A field reconnaissance in the region of Gebelein, Khozam and el-Rizeiqat in 2013 was aimed at obtaining information on site topography and state of preservation, even as it tested mobile GIS devices and remote sensing analysis to improve usage procedures in field prospection. Archival maps and satellite imaging were used to locate archaeological features, analyze changes of landscape and modern expansion of the cultivation zone from the natural alluvial plain into the low desert area.

Keywords: Gebelein, Khozam, el-Rizeiqat, mobile GIS, field prospection, satellite imaging, remote sensing

تقرير الإستطلاع الميداني في الجبلين وخزام والزريقات .

Wojciech Ejsmond, Julia M. Chyla, Cezary Baka

الملخص :إن الإستطلاع الميداني في منطقة جبلين وخزام وزريقات كان يهدف إلي الحصول على معلومات عن طبوغرافية الموقع وحالة الحفظ. وقد إستخدمت أجهزة نظم المعلومات الجغرافية المحمولة وتحليل الإستشعار عن بعد لتحسين إجراءات البحث الميداني وكذلك إستخدمت خرائط أرشيفية وصور الأقمار الصناعية لتحديد المعالم الأثرية و تحليل المتغيرات في الصور الطبيعية للتوسع الحديث في المنطقة الزراعية في السهل الرسوبي في منطقة الصحراء المنخفضة.

POLISH ARCHAEOLOGY IN THE MEDITERRANEAN (*PAM*)
Annual of the Polish Centre of Mediterranean Archaeology, University of Warsaw

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POLISH CENTRE OF MEDITERRANEAN ARCHAEOLOGY
UNIVERSITY OF WARSAW

POLISH ARCHAEOLOGY IN THE MEDITERRANEAN

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RESEARCH

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ABBREVIATIONS

AA	*Archäologischer Anzeiger; Jahrbuch des Deutschen Archäologischen Instituts* (Berlin)
ANM	*Archéologie du Nil Moyen* (Lille)
ASAE	*Annales du Service des Antiquités de l'Égypte* (Cairo)
AV	*Archäologische Veröffentlichungen, Deutsches Archäologisches Institut, Abteilung Kairo* (Berlin–Mainz am Rhein)
BAAL	*Bulletin d'archéologie at d'architecture libanaises* (Beirut)
BAH	*Bibliothèque archéologique et historique* (Paris)
BAR IS	*British Archaeology Reports International Series* (Oxford)
BASOR	*Bulletin of the American Schools of Oriental Research* (Ann Arbor, MI)
BCH	*Bulletin de correspondance héllenique* (Paris)
BdE	*Bibliothèque d'étude* (Cairo)
BIFAO	*Bulletin de l'Institut français d'archéologie orientale* (Cairo)
BSAA	*Bulletin de la Société d'archéologie d'Alexandrie* (Cairo)
BSFE	*Bulletin de la Société française d'égyptologie* (Paris)
CCE	*Cahiers de la céramique égyptienne* (Cairo)
EtTrav	*Études et travaux. Travaux du Centre d'archéologie méditerranéenne de l'Académie des sciences polonaise* (Warsaw)
FIFAO	*Fouilles de l'Institut français d'archéologie orientale* (Cairo)
GAMAR	*Gdańsk Archaeological Museum African Reports* (Gdańsk)
GM	*Göttinger Miszellen* (Göttingen)
IAMS	*Institute of Archaeo-Metallurgical Studies* (London)
JARCE	*Journal of the American Research Center in Egypt* (Boston–Princeton–New York–Cairo)
JEA	*Journal of Egyptian Archaeology* (London)
JGS	*Journal of Glass Studies* (Corning, NY)
JJP	*Journal of Juristic Papyrology* (Warsaw)
JRS	*Journal of Roman Studies* (London)
MDAIK	*Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* (Wiesbaden)
OIP	*Oriental Institute Publications* (Chicago)
OLA	*Orientalia lovaniensia analecta* (Louvain)
PAM	*Polish Archaeology in the Mediterranean* (Warsaw)
PSAS	*Proceedings of the Seminar for Arabian Studies* (London)
SAAC	*Studies in Ancient Art and Civilisation* (Kraków)
SAK	*Studien zur altägyptischen Kultur* (Hamburg)
SAOC	*Studies in Ancient Oriental Civilization* (Chicago)
WVDOG	*Wissenschaftliche Veröffentlichungen der deutschen Orient-Gesellschaft* (Berlin–Leipzig)

EGYPT

REPORT FROM FIELD RECONNAISSANCE AT GEBELEIN, KHOZAM AND EL-RIZEIQAT

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Abstract: A field reconnaissance in the region of Gebelein, Khozam and el-Rizeiqat in 2013 was aimed at obtaining information on site topography and state of preservation, even as it tested mobile GIS devices and remote sensing analysis to improve usage procedures in field prospection. Archival maps and satellite imaging were used to locate archaeological features, analyze changes of landscape and modern expansion of the cultivation zone from the natural alluvial plain into the low desert area.

Keywords: Gebelein, Khozam, el-Rizeiqat, mobile GIS, field prospection, satellite imaging, remote sensing

Three Upper Egyptian archaeological sites, namely Gebelein, Khozam and el-Rizeiqat, located in Upper Egypt, were reconnoitred by a team working under the auspices of the Polish Centre of Mediterranean Archaeology, University of Warsaw, the objective being to obtain data on the location, topography, state of preservation and perspectives of research at these sites.

Modern agricultural expansion and rapid settlement development is an ongoing threat to archaeological heritage in Egypt. Many sites are endangered or have been destroyed. Analyses of archival satellite images and old maps can inform on the appearance of archaeological sites before destruction, but locating in the field and documenting the state of individual features known from satellite imagery and maps is possible only with the use of special tools.

METHOD

CORONA, Landsat, Google Earth and Pleiades satellite images have been used in the research (Palmer 2013; Contreras and Brodie n.d.). The CORONA images were taken on 18 November 1968 (camera fore) and 29 July 1969 (camera aft), both from

the KH-4B mission, with a resolution of 1.80 m, cloud-free.[1] Low spatial resolution images: Landsat 1 (from 1972, resolution 60 m) and Landstat 8[2] (from 2013, resolution 30 m) were used as base maps in the Geographic Information System (GIS). Spatial analysis of data in GIS established a zone requiring special attention in view of extensive encroachment of cultivated areas upon the low desert areas outside the Nile Valley. Examination of archival satellite images revealed many archaeological sites at the edge of the low desert and the alluvial plain, because the area was not yet under cultivation at the time. The situation changed presumably around 1975, when pumps with diesel engines were introduced for irrigation on a large scale (Hopkins 1999). In the past thirty years agriculture has spread uncontrollably into areas where archaeological sites are located.

Google Earth images from the last few years were obtained for detailed analysis of the selected three sites located inside the endangered zone.[3] Maps by Pierre Jacotin (1826: Pls 4–5) were registered (Chyla 2012) and used to vectorize agricultural areas and the course of the Nile at the end of the 18th century. The next step was to compare the spread of field zones with the current situation observed in the satellite images (such as Landstat). Jacotin's map was used also to locate villages, towns, archaeological sites and nomad camps. Their position was transferred in GIS from the archival map into modern satellite images.

The field survey gave opportunity to test the usefulness and the possibilities of GIS applications combined with mobile measuring tools such as Trimble Juno and MobileMapper 20. The collected archival data was processed and stored in GIS and afterwards converted into a mobile version. The research team used it to locate sites visible on Jacotin's map in the field. Mobile GIS allowed not only to use, but also to update collected information directly on the sites, during the fieldwork. The research generated effective use of available GIS technology and mobile

Team

Dates of work: March–April 2013

Director: Wojciech Ejsmond (independent)
MSA representative: Abd el-Hady and Ali Mohmed Ahmed (Esna Inspectorate)
Archeologists: Cezary Baka (student, Université Paris-Sorbonne), Julia M. Chyla, GIS specialist (UniGIS, Jagiellonian University in Kraków)

1 CORONA imagery was orthorectified by the Center for Advanced Spatial Technologies, University of Arkansas and US Geological Survey, and published as a "CORONA Atlas of the Middle East" on the website: corona.cast.uark.edu.

2 Orthorectified Landsat imagery is available online from the NASA Global Land Cover Facility at: glcf.umd.edu/data/landsat.

3 For Gebelein, the images were taken on 9 September 2002, 26 December 2005, 31 December 2005, 7 February 2007, and 10 July 2009; for Khozam, on 5 March 2005, 31 January 2006, and 17 July 2009; for el-Rizeiqat, on 9 September 2002, 31 December 2005, 7 February 2007, and 15 June 2009. Resolution of all images was 0.50 m. In case of Gebelein, additional Pleiades satellite images provided by Astri Polska were used. Images were taken on 9 February 2013, with resolution 0.50 m with four bands, including near infrared.

software during various stages of research: desk-based assessment, data collection, but also post-processing of the collected field evidence, and quick and efficient presentation of preliminary results (see Tripcevich 2004; Wagtendonk and De Jeu 2007).

SITES

GEBELEIN

Research at the Gebelein site complex [*Fig. 1*] started with an analysis of the present local topography, archival maps and contemporary satellite imagery. Ancient written sources and results of previous fieldwork were studied as well leading to the suggestion that the toponym "Gebelein" referred to this particular archaeological complex, a region enclosing different types of sites from different periods (Ejsmond 2013).

Analysis of near-infrared satellite images of Gebelein showed specific vegetation features in the fields surrounding the hills. These were interpreted as traces of an old riverbed and channels, considering that written sources from the Late and Greco-Roman periods referred to numerous waterways in the Pathyris region (Meeks 1972; Vandorpe and Waebens 2009: 25, Fig. 10). Some of the features were verified during the reconnaissance in 2013. Also, archaeological features observed both on satellite images and during the field survey were documented with the use of mobile GIS. For example, concentrations of tombs and a lithic site were added to the site database and GIS plan. The survey demonstrated the extent of destruction to archaeological sites resulting from agricultural cultivation. Analysis of the Google Earth historical images evinced destruction of a Palaeolithic archaeological site between 2009 and 2013.

The reconnaissance helped to understand the description of archaeological research conducted at the end of the 19th and in the first half of the 20th century, and located some Pre- and Early Dynastic sites (Ejsmond 2013). Registering Jacotin's map, combined with satellite imagery, showed the location of two ancient settlements: one to the north of the western mountain and the other at the western foot of the eastern mountain. In the 18th century, both sites seem to have formed koms, but on CORONA images from 1968 they were no longer visible. It suggests that they have been destroyed. *Sebakh* digging had been confirmed for this area by earlier researchers (e.g., de Morgan 1912: 49) and this could have well been the reason for their disappearance.

The site marked in the north of Jacotin's map may be identified as the ancient Egyptian Sumenu, called by the Greeks Crocodilopolis, "City of Crocodiles, which holds in honour that animal" (Strabo 17.1.47). The Predynastic settlement "of which the stratum of ashes remains" was also reported there (Donadoni Roveri 1990: 23). Some 3 km north of Gebelein, in the village of al-Mahamid Qibli, part of an Eighteenth Dynasty temple was unearthed (Bakry 1971). The temple was dedicated to the god Sobek, venerated in the form of a crocodile. In 1908 L. Lortet and C. Gillard bought two Pre- or Early Dynastic stone knives, with handles ornamented by depictions of crocodiles (Lortet and Gaillard 1909: 232–234). From el-Rizeiqat came a stone model of a boat from more or less the same period, featuring the head

of a crocodile at one end (Emmons et al. 2010: 74–75, Fig. 68). These discoveries confirm the veneration of the crocodile god in the Gebelein region from an early period in ancient Egyptian history.

The southern site can be attributed to Per-Hathor, also called by the Greeks Pathyris or Aphroditopolis. It is attested by the cult of the goddess Hathor (whom the Greeks identified with Aphrodite) in the local temples. One sanctuary was found on the top of the eastern mount; the second was a small speos on the eastern foothills of the same mound (Donadoni Roveri 1990: 23; 2001: 7–8; Morenz 2009). Jacotin's georeferenced map showed the location of the kom, which could also be seen in photographs taken by the Italian excavators at the beginning of the 20th century. There the kom is visible as a small elevation of darker earth with some vegetation. The rest of the settlement was located on the peak of the eastern mound and on its western slope (Donadoni Roveri 1990: 23).

The village of Haut, which on Jacotin's map is located north of the eastern mound of Gebelein, may have derived its name from the hieroglyphic *Hwt*, an abbreviation of full names like *Hwt-Shm*, meaning mansion (Megally 1991). Late and Ptolemaic period mansions were located in this area on the grounds of an analysis of papyri

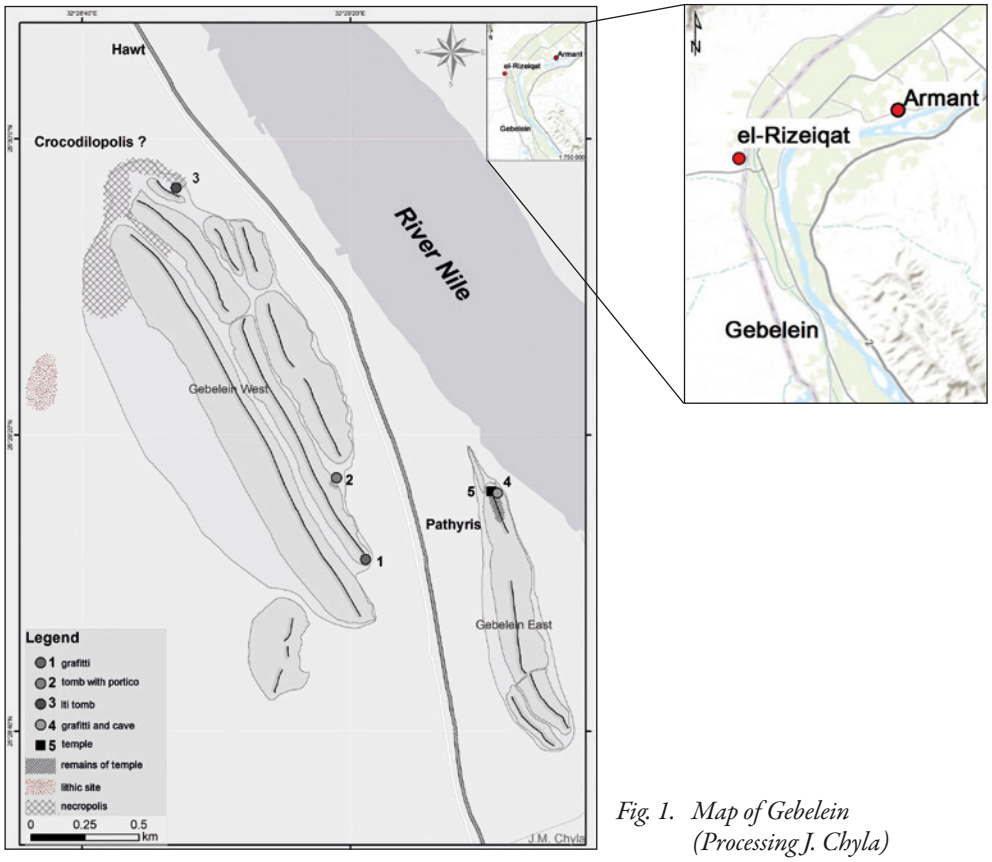

Fig. 1. Map of Gebelein (Processing J. Chyla)

evidence (Meeks 1972: Pls I, IV). Nowadays a contemporary settlement stands in this particular location, making an archaeological survey impossible.

Field research revealed the presence of some graffiti at the southern edge of the western mound. Their date spanned a time from the Predynastic Period (depictions of gazelles and giraffes) to the Nineteenth Dynasty at least. One of them was a large commemorative graffito from the first year of the reign of Ramesses IV (Wieczorek 2015).

Other graffiti noted during the reconnaissance were located on a rock wall by a path leading to a small cave, just next to the spot where the temple of Hathor had stood once at the top of the eastern mound (Vandorpe and Waebens 2009: 19, Fig. 8). The graffiti encompass several inscriptions of different length, mentioning "Hathor, Lady of Gebelein", and were dated by Ludwig Morenz to the Eighteenth Dynasty, but not published (Morenz 2009: 199).

The present research supported the preparation of an Archaeological Information System for Gebelein, which consists of the following data: satellite images, archival maps, field data, results of satellite analysis and photographs. AIS is open, meaning that new data and results of analysis can be added on a continuous base.

The collection of data showed significant progressive changes of the landscape in the Gebelein area, taking place within the past 200 years. As said above, fields and settlements have progressed several kilometers into the desert and spread between the two mountains of Gebelein, where ancient sites have been reported. This situation caused destruction and endangered many archaeological objects.

KHOZAM

(known also as Khizam) [*Fig. 2*]

According to Stan Hendrickx a number of small cemeteries could have existed in the vicinity of the village of Khozam, but their exact location is unknown (Hendrickx 1992: 199–200) save for some graves, which were reported around the tomb of "Banat el-Berrei" ("Girls of Berrei") (Shehata 1990). The necropolises were dated to the Badarian culture(?), Naqada I–III and probably dynastic times(?) (Hendrickx 1992: 199–200; Hendrickx and van den Brink 2002: 361).

The site was excavated repeatedly by different scholars, who did not leave a sufficient account of their work. Hendrickx reported about 700 tombs, mostly simple pits (Hendrickx 1992: 199–200; Hendrickx and van den Brink 2002: 361) as well as a mud-brick structure with several female figurines present (Ucko 1968: Nos 111–127). Most recently, Rabia Zaki Ahmed Shehata (1990) described the threats and the poor preservation of the necropolis near Banat el-Berrei. The plan published in 1990 was translated into the GIS system and used to locate the area of one of the cemeteries described by Hendrickx. The area of the former site is under cultivation, save for a small Islamic graveyard, approximately 100 m southeast of Banat el-Berrei.

Near Banat el-Berrei the reconnaissance revealed some pottery in the section through the embankment of the Luxor–Cairo road, next to the tomb of Banat el-Berrei. It indicates that a part of the site may have been preserved beneath the road. The alternative is that earth from the cemetery was used to build the embankment. Pottery was also noted around the tomb of Banat el-Berrei.

According to Hendrickx, there should be three cemeteries in the area of Khozam: 1) near the mausoleum of 'Benat el-Beri'; 2) north of Khozam, east of the grave of 'Benat el-Beri', 4 km from the Nile; 3) south of the village, located 6 km from the Nile (Hendrickx 1992: 199). They were situated far from the area cultivated at the end of the 19th century, but within, and on the fringe of present-day fields. The rapid agricultural development in Upper Egypt threatens to have fields and new settlements introduced in these areas in the nearest future. The survey made an effort to locate these cemeteries in order to increase their chances for being protected.

An analysis of CORONA and Google images revealed areas of disturbed surface at the mouth of Wadi Berrei (A and B on the map). One such location, placed approximately 2 km east of Khozam village, was selected for field reconnaissance. It fits the location of the third cemetery mentioned above. Human activity was recorded in the form of some flint, as well as pottery from the Early Dynastic Period and the Old Kingdom (dated by Dr. Teodozja I. Rzeuska from the Polish Academy of Sciences) in the vicinity of many pits and remains of digging. These artifacts are difficult to interpret, making it difficult to confirm the location of a necropolis on their grounds. However, it is very likely that the discovery of the artifacts supports Hendrickx's opinion concerning the localisation and dating of the necropolis. There is also a general map, published by Jacques de Morgan (1897: 38, Fig. 19), which shows the location of predynastic sites in the Luxor area, includ-

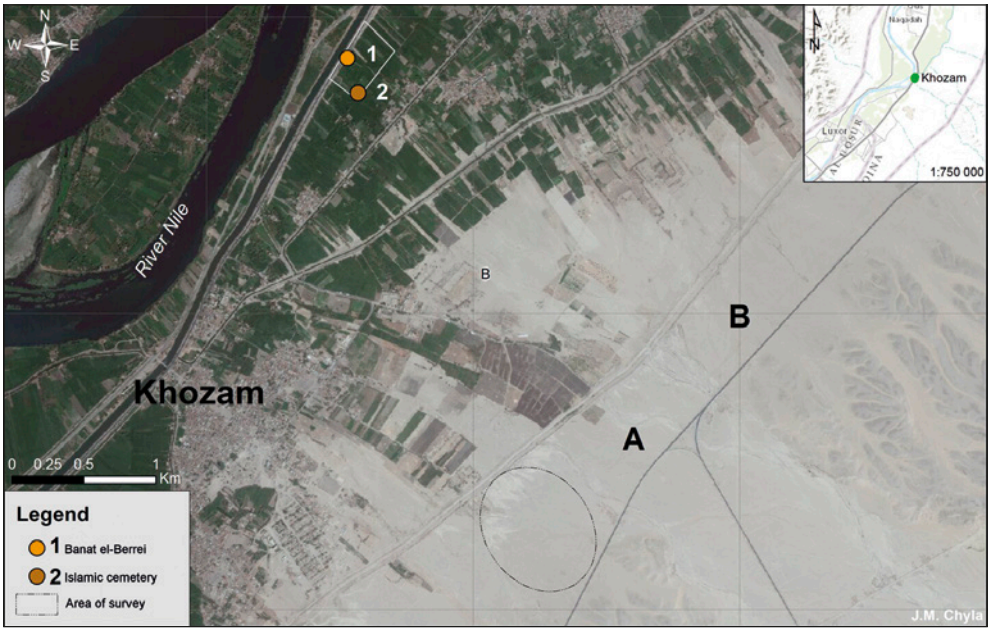

Fig. 2. Map of Khozam marking areas A and B (Processing J. Chyla)

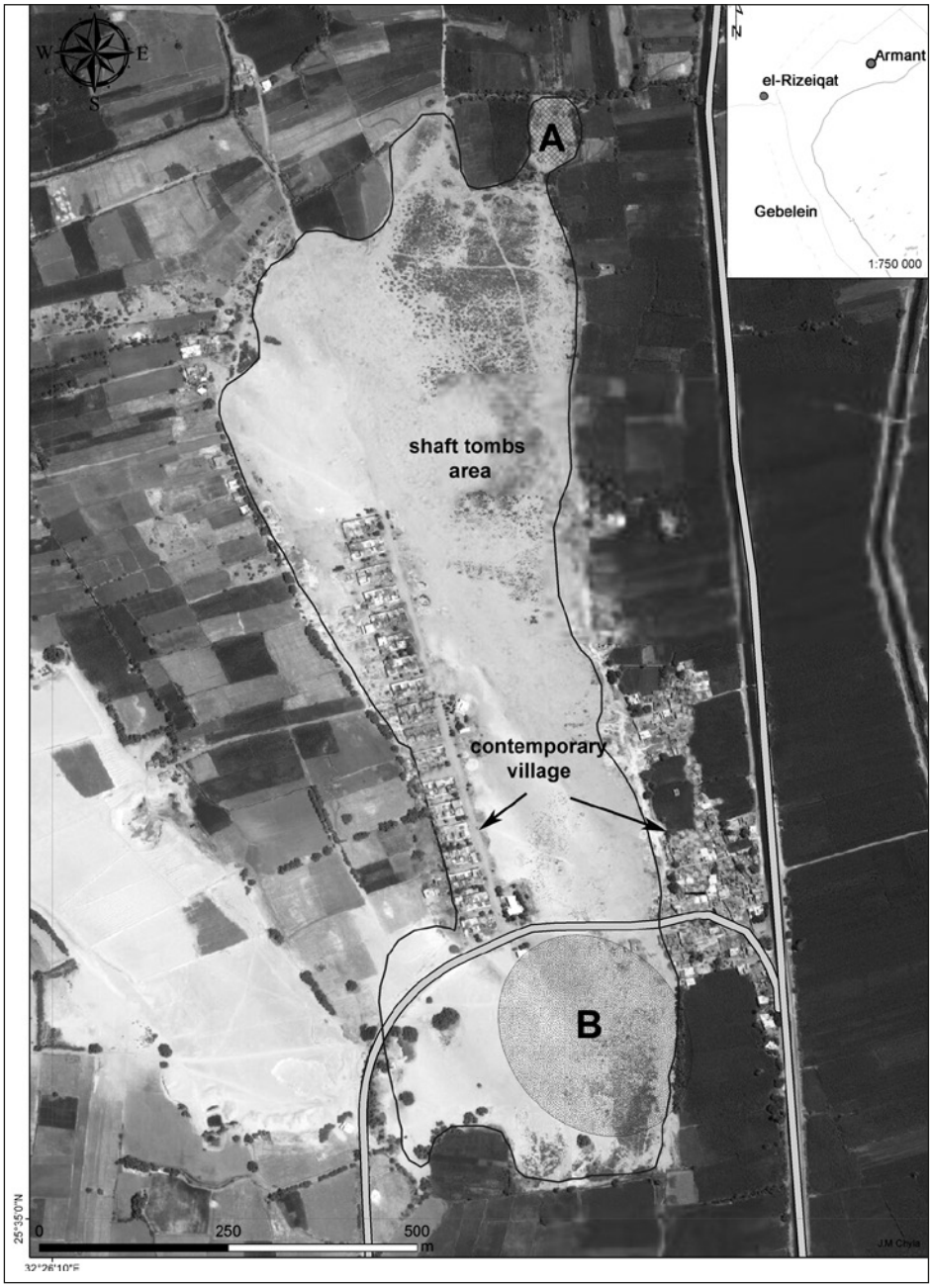

Fig. 3. Map of el-Rizeiqat (Processing J. Chyla)

ing Khozam. The position of the site fits the described location, but the map is very general.

EL-RIZEIQAT [*Fig. 3*]

The site was heavily looted at the end of the 19th century (Lortet and Gaillard 1909: 201–208, 239; de Morgan 1912: 49; Weigall 1910: 296–297). The cemetery is dated to the Naqada II period (Hendrickx and van den Brink 2002: 361), but also contains later burials from the Thirteenth–Eighteenth Dynasties (Weigall 1910: 296). Arthur Weigall estimated the number of graves at several hundred, writing: "[The tombs] mainly consist of mud-brick structures in the form of a deep rectangular shaft, from the bottom of which a vaulted burial-chamber leads; wide rectangular pits lined with bricks, and entered by a sloping passage or stairway at one end; and other well-known forms" (Weigall 1910: 269). Some stelae dated to the early Middle Kingdom, and executed in a homogenous style, are attributed to the el-Rizeiqat–Gebelein area (Rosati 2004).

The site extends along a longitudinal axis. Currently, cultivation has destroyed the oldest (Neolithic/Predynastic) part of the site in the south. It is possible that this part of the necropolis was also partly destroyed by the extraction of clay and sand. Lithic tools were found at the southern edge of the site and the northern part yielded rectangular shafts and other structures, which fit Weigall's description (1910: 269).

El-Rizeiqat is in better condition than the two earlier mentioned sites, although during the field survey many looted and destroyed graves were observed. Nowadays the biggest threat to the site is irrigation which has resulted in a rising water table in the area and the effectively spreading wild vegetation at the site.

ACKNOWLEDGMENTS

The team members would like to thank Prof. Karol Myśliwiec and Dr. Zbigniew E. Szafrański, as well as the Research Center in Cairo, branch of the Polish Centre of Mediterranean Archaeology of the University of Warsaw for their help and support. The season could not have taken place without the financial help of the University of Warsaw Foundation and the Consultative Board for Student Research of the University of Warsaw.

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ISSN 1234–5415 (Print), ISSN 2083–537X (Online)

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University of Warsaw Press
00-497 Warszawa, Poland, ul. Nowy Świat 4
www.wuw.pl; e-mail: wuw@uw.edu.pl
Internet Bookshop: www.wuw.pl/ksiegarnia

Printed in Poland

POLISH ARCHAEOLOGY IN THE MEDITERRANEAN

Published annually since 1990

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ISSN 1234-5415

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PAM XXIV/1

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