

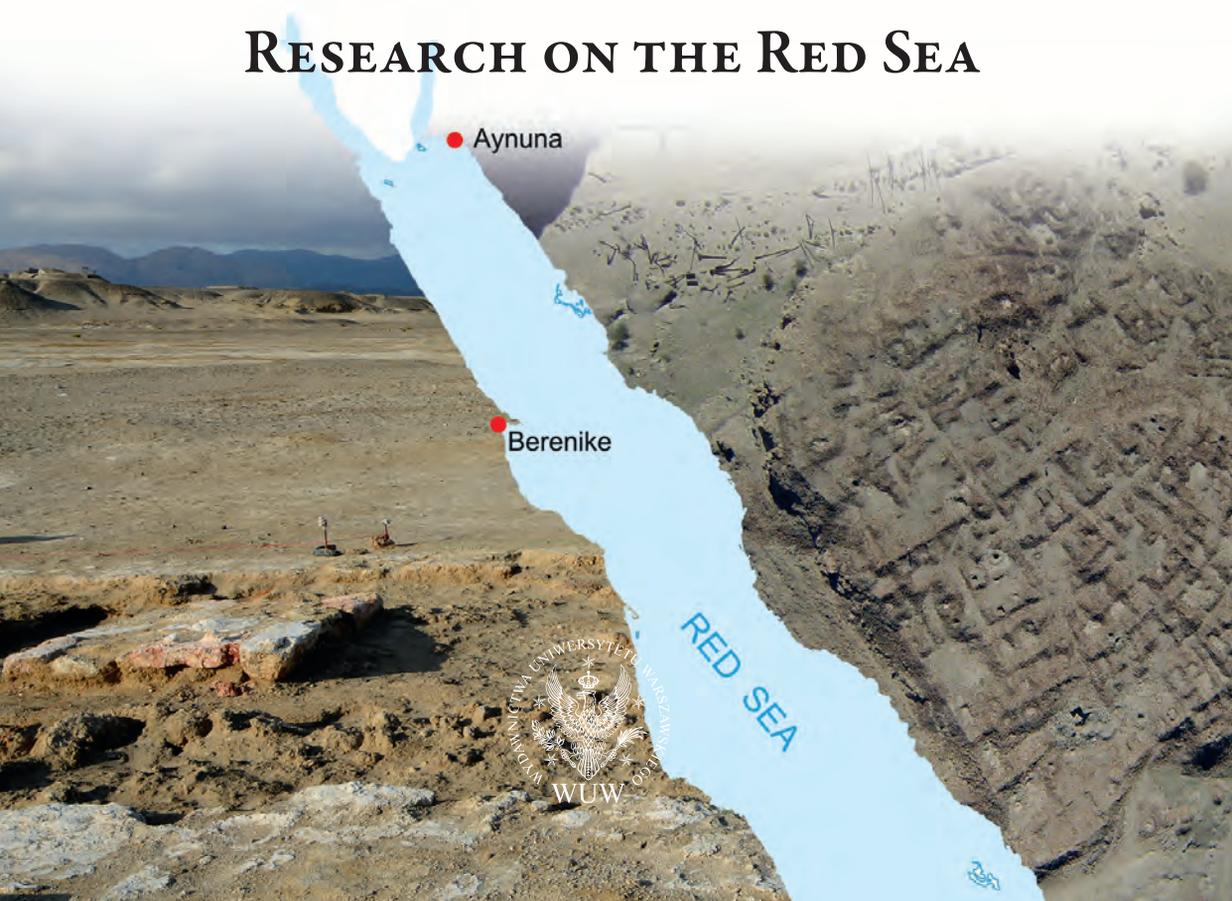
POLISH CENTRE OF MEDITERRANEAN ARCHAEOLOGY  
UNIVERSITY OF WARSAW

# POLISH ARCHAEOLOGY IN THE MEDITERRANEAN

## XXVI/2

SPECIAL STUDIES

### RESEARCH ON THE RED SEA



POLISH ARCHAEOLOGY  
IN THE MEDITERRANEAN

XXVI/2

SPECIAL STUDIES

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

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IN THE MEDITERRANEAN

XXVI/2

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RESEARCH ON THE RED SEA



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## ABBREVIATIONS

<i>AJA</i>	<i>American Journal of Archaeology</i> (Boston)
<i>ASAE</i>	<i>Annales du Service des Antiquités de l'Égypte</i> (Cairo)
<i>BAR IS</i>	<i>British Archaeology Reports International Series</i> (Oxford)
<i>BIFAO</i>	<i>Bulletin de l'Institut français d'archéologie orientale</i> (Cairo)
<i>FIFAO</i>	<i>Fouilles de l'Institut français d'archéologie orientale</i> (Cairo)
<i>GAMAR</i>	<i>Gdańsk Archaeological Museum African Reports</i> (Gdańsk)
<i>JARCE</i>	<i>Journal of the American Research Center in Egypt</i> (Boston et al.)
<i>JEA</i>	<i>Journal of Egyptian Archaeology</i> (London)
<i>JGS</i>	<i>Journal of Glass Studies</i> (Corning, NY)
<i>JJP</i>	<i>Journal of Juristic Papyrology</i> (Warsaw)
<i>JRA</i>	<i>Journal of Roman Archaeology</i> (Portsmouth, RI)
<i>MDAIK</i>	<i>Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo</i> (Wiesbaden)
<i>OLA</i>	<i>Orientalia lovaniensia analecta</i> (Louvain)
<i>PAM</i>	<i>Polish Archaeology in the Mediterranean</i> (Warsaw)
<i>SAOC</i>	<i>Studies in Ancient Oriental Civilisation</i> (Chicago)

# MAP



*The Red Sea in research*

# Berenike and Aynuna: Polish research on the Red Sea

## Foreword

Iwona Zych

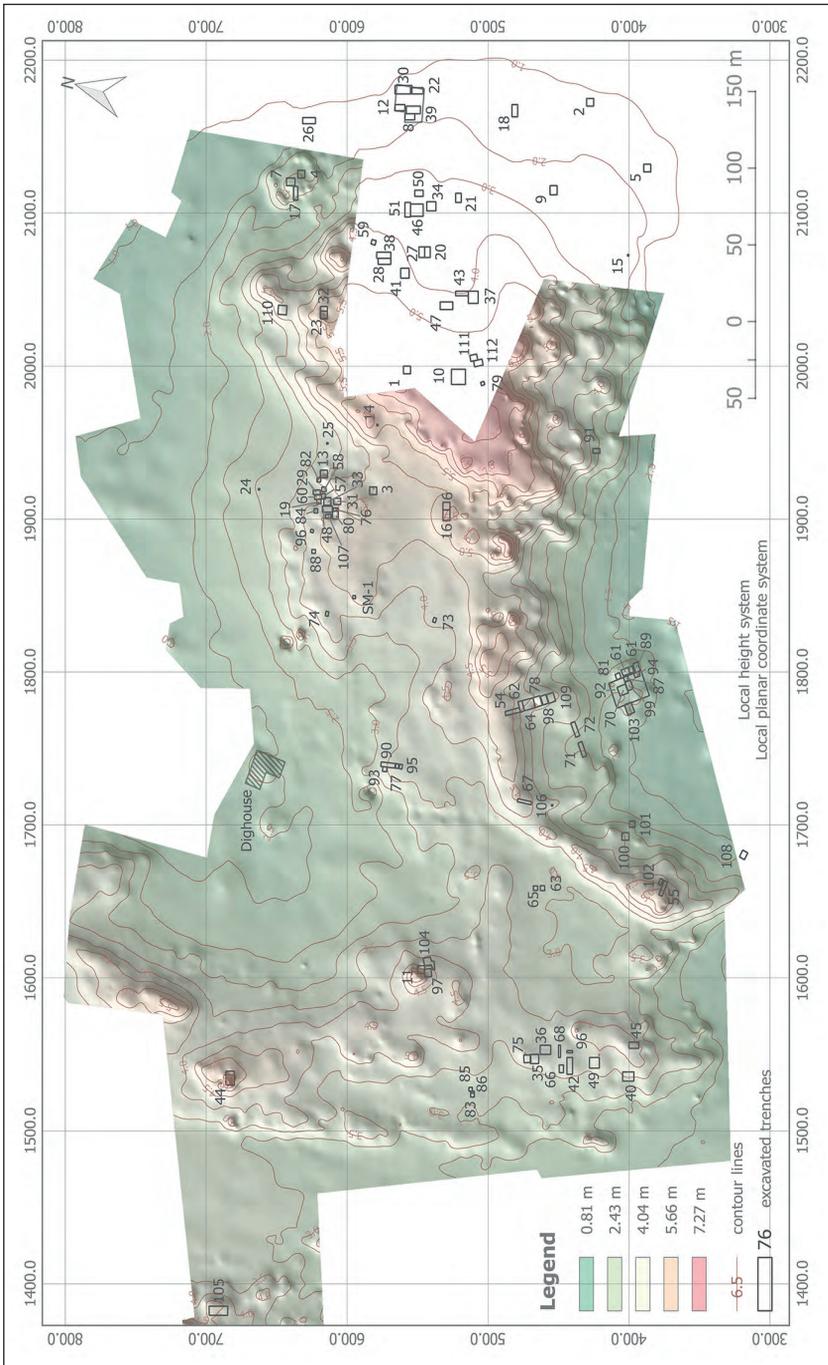
Polish Centre of Mediterranean Archaeology, University of Warsaw

In 2016, the Berenike Project could not go afield. A rudimentary team waited in blocks in Cairo for all the permits to arrive. It must have been like that for the ancient merchants waiting in Berenike for the sailing season to begin, for the ships to come to port after the long monsoon-driven journey across the Indian Ocean and up the Red Sea, for the camel caravans to labor their way across the Eastern Desert.

This time around the permits were delayed for too long and the season was cancelled. Instead, taking advantage of our stay in Cairo, we took the opportunity to present to a Cairene audience of Egyptian and international archaeological professionals a review of Polish research being conducted in the Red Sea region. Beside the work at Berenike, carried out by an American–Polish team, the Polish Centre of Mediterranean Archaeology of the University of Warsaw had also recently initiated a survey and excavation program at the site of Aynuna on the Saudi Arabian coast of the Red Sea, probably identical with the ancient Leuke Kome.

Polish research in Berenike in Egypt started with the invitation from Prof.

Steven E. Sidebotham from the University of Delaware, USA, to reopen the Dutch–American project that had investigated the site over eight fruitful seasons from 1994 to 2001. In 2008, the new Polish–American project, co-directed by Sidebotham and Iwona Zych (PCMA UW), started work with a week-long magnetic survey that picked up on earlier geophysical prospection done in Berenike by the previous team. Since then the Berenike Project has put in seven (at the time of printing) seasons of excavation and one study season recently in September–October 2017, coupled with a number of study periods devoted to the finds in storage in the SCA storeroom in Qift. The work in Berenike is supported by grants from the National Science Center of the Republic of Poland for the investigation of the religious buildings on the site in context of religious practices and beliefs in the “Red Land” (I. Zych, UMO-2014/13/N/HS3/04400) and an exploration of the Hellenistic beginnings and evolution of the port, from military base to international emporium (M. Woźniak, UMO-2015/17/N/HS3/00163). Another important sub-project is Martin Hense’s work



*Plan of Berenike with the location of excavation trenches (PCMA Berenike Project/plan update A. Szeszko, 2017)*

on the Great Temple of Berenike, which kicked off in 2015 with some spectacular finds.

The Berenike Project also acts as an umbrella program for projects in the Eastern Desert, such as the long-lasting survey of the hinterland carried out from year to year by Steven E. Sidebotham, coupled with a survey of the emerald mines and associated settlements in Wadi Sikait and Wadi Nugrus, field directed by Jean-Louis Rivard. Recently, the prehistoric cattle and sheep burial enclosure at Wadi Khashab, discovered by the survey in 2010/2011, has been excavated by a Polish team, Piotr Osypiński (Patrimonium Foundation) and Marta Osypińska (Institute of Archaeology and Ethnology, Polish Academy of Sciences, Poznań), under a grant from the

National Science Center of Poland (UMO-2012/07/N/MS3/04056).

Comprehensive season reports have appeared in the journals *Sahara Journal*, *Journal of Indian Ocean Archaeology*, *Egyptian Archaeology* and PCMA's own *Polish Archaeology in the Mediterranean*; full excavation reports to date have presented the findings of the 2008 and 2009 seasons (2011) and the 2010 and 2011 seasons (2017); seasons 2012 through 2015 are now in preparation, all published in the PCMA Excavation Series.

Polish interest in Aynuna, a port on the other, eastern side of the Red Sea and, in a sense, a sister port for Berenike, started at the invitation of Prof. Ali Al-Ghabban from the Saudi Commission for Tourism and National Heritage and is carried out

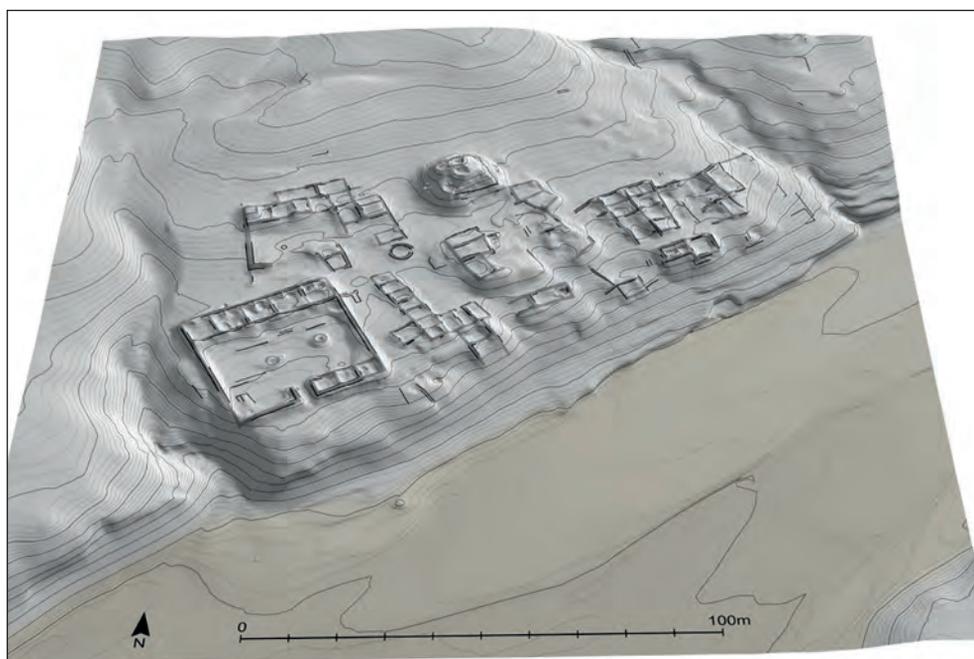


Fig. 2 Plan of Lower Aynuna  
(PCMA Aynuna Project/J. Kaniszewski, 2017)

in collaboration with the Saudi side within the frame of a study of the infrastructure of international trade in the Red Sea area in the Roman period, funded from a Polish National Science Center grant UMO-2014/14/M/HS3/00795. The project is headed by Prof. Michał Gawlikowski and in the seven fieldwork seasons to date has surveyed the immediate environs of the modern port of Khoraiba, which is regarded by some scholars as the site of the Nabatean port of Leuke Kome, known from the historical record. The harbor itself has not yielded much of interest in terms of ancient substance. Instead, the team has focused on an archaeological site located some 3 km away from the shore, in Wadi Aynuna, consisting of at least five large rectangular structures spread over an area approximately 160 m long by 80 m wide. These structures were most probably *caravanserais*. They were all built on a very similar plan, bearing a definite resemblance to a type of monument usually called a *khan*, such as were built in later times along the Darb al-Hajj. Only one of them is complete, a nearly square building (36 m by 37 m), centered on a huge courtyard. Other structures are fragmentary and seem older. The buildings, which seem to have been storage facilities, served a brisk commercial exchange over a long period of time from the 1st century AD through the 8th century AD.

Survey work in the vicinity of the site also uncovered a well preserved town at the top of the plateau. Upper Aynuna, in opposition to Lower Aynuna with the *caravanserais*, appears to have been a settlement of some substance. This small

town stands atop a fossil coral reef (in this being like Berenike). A surface survey and very limited trenching has shown that the two sites, Lower and Upper Aynuna, are contemporary.

The one-day conference mentioned above, entitled “*Imperial Berenike and its antecedents on the Red Sea coast*,”<sup>1</sup> was held on 23 March 2016 in the Ahmed Basha Kemal Hall of the Supreme Council of Antiquities’ main office in Cairo-Zamalek. Speakers included members of the Berenike and Aynuna teams, as well as Hany Abo el Azm, then Director of the Foreign Missions Affairs Department of the Supreme Council of Antiquities, presenting the results of his archaeological survey of the *nawamis* in Wadi Solaf and Ein Huderah in South Sinai. Rounding off the presentation of current archaeological projects in the Red Sea region were poster presentations of the French work in the harbor of Wadi el-Jarf (Pierre Talet, Sorbonne University, Paris) and the mines of Samut in the Eastern Desert (Bérangère Redon, HISOMA, CNRS, and Thomas Faucher, IRAMAT-CEB, CNRS), and the Italian research in Adulis in Ethiopia (Enzo Cocca, Andrea Manzo, Dario Nappo, Valentina Perna and Chiara Zazzaro, University of Naples “L’Orientale”).

The present volume gathers together several of the Berenike and Aynuna presentations from this conference, but it actually opens with a paper on the Indian trade between the Gulf and the Red Sea that was read by Michał Gawlikowski at the workshop *From the Red Sea to the Gulf. New directions in PCMA UW archaeological research*, held at the Uni-

<sup>1</sup> For the conference materials, see <http://www.pcma.uw.edu.pl/2016/02/19/seminarium-imperial-berenike-and-its-antecedents-on-the-red-sea-coast-w-stacji-w-kairze/>

versity of Warsaw on 18–19 October 2013. This is followed by a brief presentation by Karol Juchniewicz of background nautical and topographical studies, the evidence from which may be marshalled in favor of the interpretation of the site as the ancient Leuke Kome of the *Periplus Maris Erythraei*.

It is only natural that with so many more years of research behind it, the Berenike Project dominates the rest of the volume. Marek Woźniak's research into the Hellenistic beginnings of the harbor is presented as an appraisal of the archaeological data for the early fortifications and their role in shaping the new settlement. The environmental conditions for the establishment of the harbor in this spot are investigated in Anna Maria Kotarba-Morley's landscape and seascape reconstruction based on her doctoral program of geoarchaeological research carried out within the frame of the Berenike Project. Iwona Zych gives an overview of the archaeological excavation in the southwestern embayment, taking this material as a point of departure for a "lived experience" picture of the harbor of Berenike in early Roman times — the "Imperial" Berenike at the peak of its development. The archaeological section finishes with Martin Hense's summary of the findings made by the Berenike Temple Project, a convenient collection of information concerning the discovery and exploration of the so-called Serapis Temple. It was after all the first structure in Berenike to be investigated by early archaeologists.

Two of the articles delve into investigations of specific finds. Renata Kucharczyk takes a closer look at the early Roman

luxury glass tableware, which is found both in the harbor trenches and in the early Roman trash dumps. Joanna Then-Obluska reflects on the finds of beads and pendants from the late Harbor Temple and the harbor temenos that was identified in the mouth of the bay that had been the natural landing place of the Berenike harbor. Her interest is in materials, techniques, functions and cultural attribution, the latter of special importance for the study of the ethnical make-up in the town of the late period in the late 4th through early 6th century AD.

Finally, the article by Marta Osypińska and Piotr Osypiński, treating on the human–pet relation in early Roman Berenike, presents new evidence, archaeological and archaeozoological, coming from the excavation of the animal cemetery located in the northern quarter of Berenike, amid the early Roman trash dumps. In Egypt of the Roman period, this particular cemetery finds no evident parallel in view of the fact that the cats and dogs (in the main) buried here were not mummified and appear not to have been treated like the sacred animals of the Nile Valley.

Last but not least, Delia Eguiluz Maestro, the Project's talented field conservator, takes her turn in presenting the challenges she faces in the field and the solutions that can be applied in such difficult desert conditions.

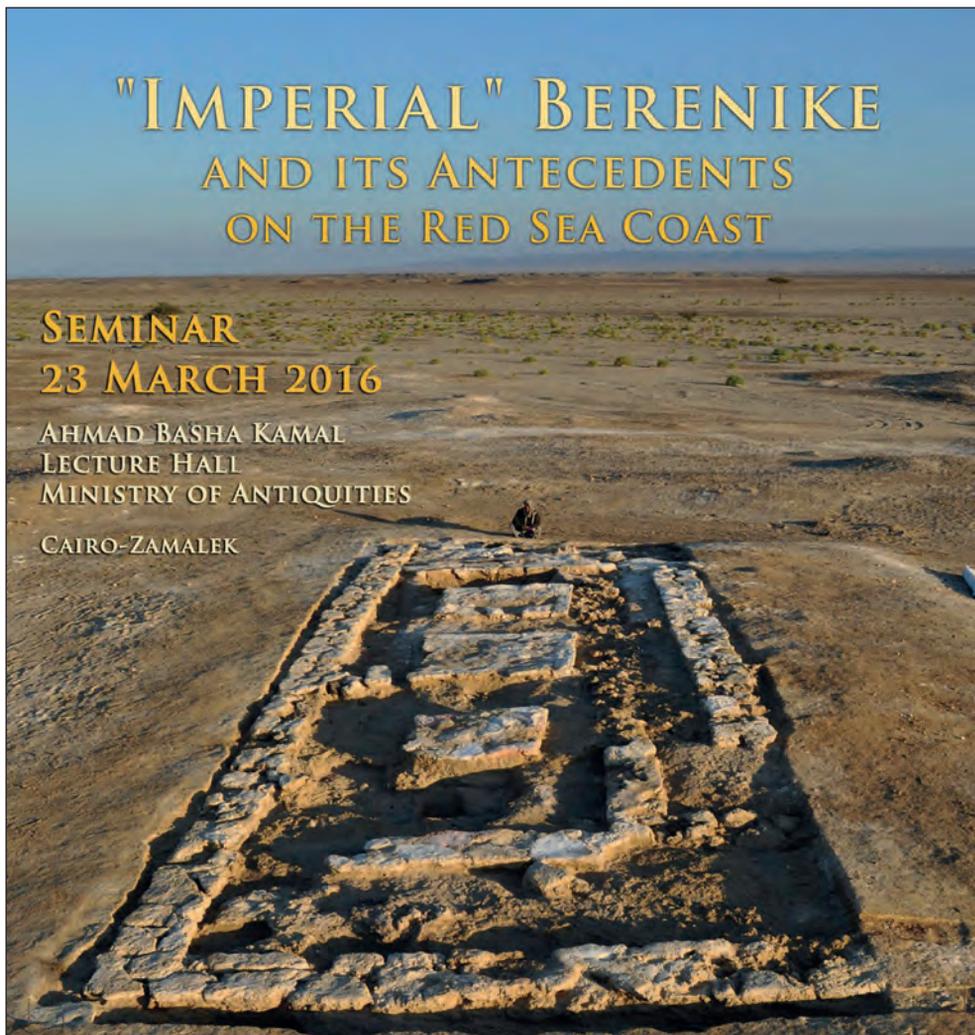
All in all, the volume is a modest but important contribution, giving an idea of the research that is being done in this region by Polish researchers and their international associates within the frame of a developing program of Red Sea and Gulf studies at the Polish Centre of Mediterranean Archaeology.

# "IMPERIAL" BERENIKE AND ITS ANTECEDENTS ON THE RED SEA COAST

SEMINAR  
23 MARCH 2016

AHMAD BASHA KAMAL  
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MINISTRY OF ANTIQUITIES

CAIRO-ZAMALEK

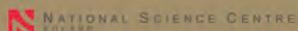


PHOTOS BY STEVEN SIDEBOTHAM



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# Indian trade between the Gulf and the Red Sea

Michał Gawlikowski

Polish Centre of Mediterranean Archaeology, University of Warsaw

**Abstract:** This essay evaluates the relative importance of the maritime trade between the Roman Empire and India along two routes that were in use: one started and ended on the Egyptian coast of the Red Sea, the other at the head of the Gulf. Both continued on land, following the caravan tracks to the Nile valley or through the Syrian desert to Palmyra. The latter land route, longer and presumably more cost-consuming, was used only during the 1st through 3rd centuries AD. The land link with the Far East, the so-called Silk Road, does not seem to have been regularly used. A document from Palmyra allows the value of the trade along the Syrian route to be estimated as much smaller than that of the Red Sea traffic. It could have been mainly of local, Syrian importance, and lasted only as long as political circumstances allowed.

**Keywords:** Indian trade, Gulf, Red Sea, Palmyra

One of the catchwords much used and very much abused in recent research on the foreign trade of the Roman Empire is the 'Silk Road', the alleged land link between China and the Mediterranean. While it is commonly agreed that the name stands for all the various itineraries between the Far East and the eastern Roman provinces, not excluding the sea routes, the public at large inevitably sees it as a caravan track going all the way across the deserts of Central Asia and Iran to the more familiar shores. Either way, it is of course a very heart-warming and politically correct idea, announcing the global economy of our time.

Needless to say, I do not aim to pretend that there were no contacts across these expanses. On the contrary, there is clear

evidence of Chinese imports in the West and of Roman products being appreciated not only in China, but even in Korea and Japan (Raschke 1978; Hübner 2005). Nonetheless, however, there is only one report of a journey from one end to the other, from the Syrian Hierapolis to a place called Sera Metropolis, probably to acquire silk (Bernard 2005; McLaughlin 2016: 188–191). As reported by Ptolemy, after Marinus of Tyre, a caravan had been sent there around AD 100 by a certain Maës Titianos; it came back safely two years later, bringing goods and news. The goods were presumably silk and the news were judged as not very reliable by the geographer. We know nothing of any other attempt to repeat the feat, either before or after.

Moreover, information both about China reaching Rome and about Rome reaching China is so rare and vague that a regular and direct link is highly unlikely.

Is then the Silk Road simply a modern construct? Not, if it is seen as a handy name for commercial contacts between China on the one hand and Central Asia and Iranian lands on the other. The overland traffic between these countries must have made use of camels, presumably of the Bactrian, two-humped variety, and it could have been taken over by the Sogdians (Jäger 2003). We know nothing of overland links with the West (Millar 1998b).

The more direct connection with the West was by sea. Since the early days of Ubaid Culture in the 5th millennium BC, if not earlier, small vessels had plied the Gulf waters on their way to Dilmun, that is Bahrain Island, and to Magan, probably on the Omani coast. Contacts with Meluhha, somewhere in the Indus estuary, are attested later, about 2200 BC (Possehl 2002). Imported commodities reached Mesopotamian cities of the 3rd millennium and were distributed farther out from there. The road between the Gulf and the Mediterranean, the Lower and the Upper Sea to use Sumerian parlance, followed for millennia the course of the Euphrates up to a place from where the distance between the river and the Mediterranean was at its shortest and ran across usually safe, settled country. The Euphrates route made the fortunes of Mari, Aleppo, Ugarit, and Antioch, in various periods from time immemorial up to the early modern age.

The Red Sea route was a relative novelty. True, ancient Egyptians did mount expeditions to Punt and other places, but

these were far from regular (Phillips 1997), although the port in Marsa Gawasis near Safaga was used from the days of the Old Kingdom onward (Bard and Fattovich 2007). The reason for it was seemingly not so much the hardships of desert tracks between the Nile and the sea as the sailing conditions: in the northern half of the sea the northern winds prevail the whole year round, while the southern winds blow mainly in the southern half, approximately up to Jeddah, and only from January to March (Seland 2011). So it was easy to go out but difficult to come back.

Things changed with the Ptolemies, who founded the port of Berenike and used it for sailing to East Africa to bring back elephants, ivory and other exotic goods (Sidebotham 1986; 2011). They also made contact with the South Arabian kingdoms which, in turn, were linked to India by the ocean routes. But this was apparently limited traffic. South Arabia indeed provided frankincense, the “food of the gods”, but it was transported north preferably by land (Peacock and Williams 2007).

The Eastern sea trade expanded greatly with the arrival of the Romans to Egypt [*Fig. 1*]. Strabo (XVII 1.13), who visited Upper Egypt in 26 BC, was told that as many as 120 vessels left each year for India from the port of Myos Hormos, securely identified now with Quseir al-Qadim some 270 km north of Berenike (Bülow-Jacobsen, Cuvigny, and Fournet 1994; Peacock and Blue 2006). A direct link to the Malabar coast in the southern part of India was opened soon after (Casson 1989). Crossing the Indian Ocean directly was made possible by taking advantage of the monsoons: from May to September for the outward and

## RED SEA TRADE

from November to March for the return journeys. The monsoons did not need to be “discovered”, as they had always been well known to peoples living under their sway, and the alleged discoverer Hippalos apparently never existed (Tchernia 1995). It was the opening of the great market of the Roman Empire that encouraged Alexandrian merchants to invest in the far distance ocean trade (De Romanis 1996; Young 2001; Seland 2014a). Up to the 6th century AD they remained busy on the Red Sea routes, bringing pepper and other spices from India, which were themselves in part from farther inland, imported along with Chinese silk. Wine, glass, and red coral, among other rather cheap Roman commodities treasured in the East, went in the opposite direction, although they had to be supplemented with coined gold.

There is no doubt that the Red Sea route provided most of the goods supplied to Rome and its provinces via Alexandria. Yet the Gulf route was not abandoned (Salles 1993). There is enough evidence to show that the traffic on it remained intense. The kingdom of Mesene (Aramaic: Maishan) also called Characene, after its capital Spasinou Charax, founded in the 2nd century BC at the mouth of the twin rivers of Babylonia, was a hub of the Indian trade. In the Roman period, especially in the 2nd century, it controlled large swathes of Lower Mesopotamia (Bowersock 1989). Local and probably also Indian sailors provided essentially the same goods as those brought to Egypt by Alexandrian merchants, and also wood, so bitterly lacking in Babylonia. Some of them went on the canals and rivers as far as the current

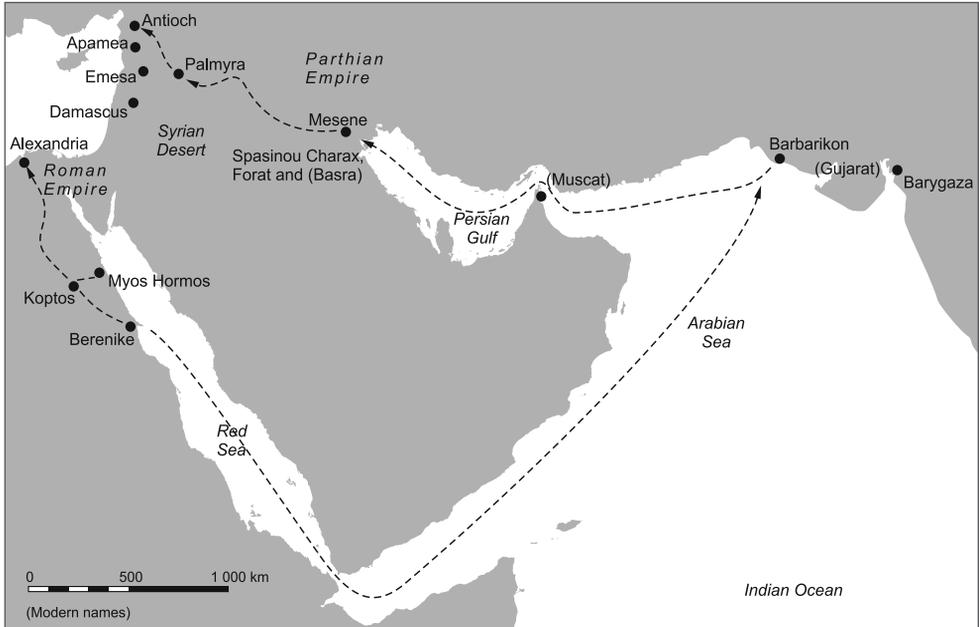


Fig. 1. *The Indian trade routes by land and sea*  
(Modified; original map courtesy of Eivind Seland)

allowed, supplying the Parthian capital Ctesiphon and the neighboring Greek city of Seleucia, no doubt at a lower cost than land transport could have offered. Some went even farther, to Syria, crossing into Roman territory at Zeugma on the Euphrates and ending in Antioch.

There was also a shortcut, a desert track through the oasis of Palmyra sitting halfway between the Euphrates and the Mediterranean (Gawlikowski 1994; Seland 2014b). This isolated place did not play any significant role in the Bronze and Iron Ages, in spite of being mentioned (very sparingly) under the name of Tadmor still used today. The track through it was never much in use except for the first three centuries of our era. And no wonder. Travellers had to carry all their food, water was scarce on the way, and the passage had to be paid off, the nomad chiefs being all too eager to pluck the caravans passing through their country. Even invading armies never risked that passage, always keeping to the river banks.

Things changed in the Roman period when signs of rapid growth appeared and the first monumental buildings were constructed. This change coincided with the first known caravan inscriptions set up by merchants coming safely back from the head of the Gulf (Gawlikowski 1994; Healey 1996). As far as we know, Palmyrene merchants remained attached exclusively to this direction. Among the inscriptions mentioning Palmyrene merchants, only the earliest two, of AD 19 and AD 24, name them as residents of Seleucia (without specifying which one) and Babylon, respectively. Except perhaps for the first of these texts, there is no hint whatsoever of the merchants' possible interest in the overland routes to Iran and beyond.

The flourishing of Palmyra can be attributed only to the track being manned and controlled by the nomads themselves, including people freshly settled in the oasis. Tribal links and neighbourly relations would have resulted in a network based on parentage, alliances and common interest. For a time this network ensured regular flow of desert traffic, short-circuiting the traditional Euphrates route. Shorter but more difficult, the transport via Palmyra must have also been more costly. This was, however, the only way the people of the oasis could take active part in the commercial exchange between the Roman Empire and the East. Their slice of the cake was perhaps thinner and acquired at a greater cost, but they were still partaking in it. The alternative would have been to stay in the backwater, cut off from the wider world.

This backwater thus became a caravan city. The notion was invented by Rostovtzeff (1932) in a book in which he described several ancient sites in modern Syria and Jordan: Petra, Gerasa, Dura-Europos, and Palmyra. Rostovtzeff thought that all these cities flourished in the Roman period because of their participation in the caravan trade. The concept was immediately criticized by Schlumberger (1935; see Dussaud 1936) and later by Millar (1998a); both of them have observed that the name could apply, with some justice, to Palmyra alone. Indeed, explicit mentions of caravans and long-distance trade can be found only in Palmyra, while the other cities Rostovtzeff discussed—and many others—cannot show any evidence whatsoever of such activity. The mere passing of some camels in and out hardly makes for a 'caravan city', even less so, if the caravan movement is

## RED SEA TRADE

only presumed and fails to be supported by any kind of evidence. The name makes sense only, if foreign trade is the reason for a city's existence or if it provides for at least a large part of its economy.

This occurred in Palmyra in the late Hellenistic period when there are signs of fast growth, although the first monumental buildings appeared only in the 1st century BC (G.A. Plattner, *apud* Schmidt-Colinet 2013: 89–103). The development must have been due to a massive influx of new settlers, and these could have come only from the nomad tribes of the Syrian *bādiya*. Indeed, early Tadmor was clearly a patchwork of various tribes and clans,

remaining so until it acquired, in the mid-1st century AD, a civic structure in the form of some institutions typical of the Graeco-Roman world (Sartre 1996).

This change coincided with the first known caravan inscriptions set up by the merchants coming safely back from Charax, the capital of the kingdom of Mesene and an emporium in Lower Mesopotamia, close to the Gulf [Fig. 2]. The merchants of Palmyra remained committed to this direction, whether they went to Charax itself, as they did most of the time, or to the neighboring port of Forat, or to the city of Vologesias which should be placed downstream

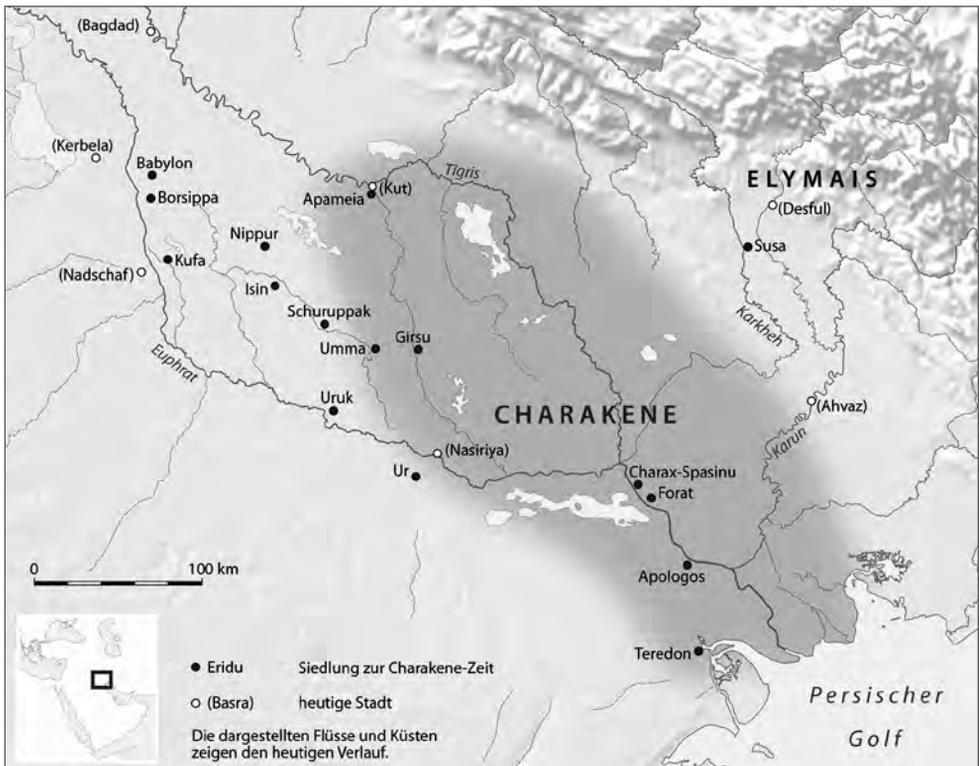


Fig. 2. *The kingdom of Mesene/Charakene*  
(Courtesy Michael Sommer)

from Babylon along the branch of the Euphrates called Nahr Hindiye, the ancient Maarsares (Gawlikowski 1983). The so-called Silk Road, insofar as it really existed as a sustained link with the Far East, was the preserve of the Sogdians and other Iranians, and, inasmuch as it reached the Roman Empire, it would have rather crossed the Euphrates at Zeugma or close to Hierapolis and continued to Antioch. At any rate, Palmyra was not involved.

Most of caravan inscriptions are dated to the 2nd century AD, with the peak in the 130s and 140s (10 inscriptions). These years correspond to the reign of king Meherdat of Mesene, who favored the Palmyrenes, even appointing some of them to high offices in his kingdom. His rule reached the island of Bahrain (Tilwan/Tylos) and the port of Omana (probably el-Dur in Umm al-Qaiwayn). The kingdom also encompassed Southern Babylonia, probably including the city of Vologesias. It seems that the king was a client of Rome until he was removed by his Arsacid cousin in AD 151/152. This dependence started probably in the times of Trajan and of Attambelos VI, the last of the line of native rulers of Mesene (Bowersock 1989). Recently, Andreas Luther (2004) put forward a hypothesis that the whole length of the Euphrates valley was in the same or similar situation in the same years. According to Luther, the city of Dura-Europos was under Parthian suzerainty not only up to AD 164 as is well known, but also after the war of Lucius Verus, depending on an Arsacid client of Rome. This state of affairs would have greatly favored the movement of Palmyrene caravans, but even after Severan annexations, with Roman garrisons established in Kifrin near Ana (Invernizzi

1986), on the island of Bijan and maybe farther downstream, the caravans still passed to Charax, then under direct Arsacid and soon after under Sasanian control. Some sort of understanding must have been reached to keep them going.

Long ago, I suggested that the Palmyra caravans used water transport (Gawlikowski 1988), at least downstream, probably from Dura, the closest point on the river (220 km from Palmyra) and the seat of an important Palmyrene colony (Dirven 1996). Recently, Meyer and Seland (2016) have argued persuasively for the embarkation taking place farther downstream. In any case, this was certainly practical in terms of time and money, and even necessary in the maze of canals and marshes down south. Most of the time, the Palmyrenes sold their goods in Vologesias and other emporia of the kingdom of Mesene. There they purchased exotic products brought by sea from India by local or Indian ships. We know of only two instances of Palmyrene shipowners and of passage of their countrymen on their ships to a land they called 'Scythia', that is, the Indo-Scythian kingdom in Northwest India (Delplace 2003). It must have been an unusual venture. One of these bold adventurers ordered his ship and his camel to be depicted in the tomb of Marona, founded in AD 236 [Fig. 3].

Some Palmyrenes preferred to take to sea from Egypt. The evidence is meagre but clear (Bingen 1984). There are two Greek inscriptions from Koptos and one Aramaic graffito in Berenike. One of them mentions *naukleroi erythraikoi*, that is shipowners or skippers active in the Indian Ocean, with distinctly Palmyrene names, among merchants of the same origin who boarded their ships or at least entrusted them their



*Fig. 3. A Palmyrene ship in the Gulf; the shipowner and his camel are depicted on the left (Palmyra Museum; photo M. Gawlikowski)*



*Fig. 4. Palmyrene meharists (PCMA Palmyra excavations, CD 66/60/photo M. Gawlikowski)*

merchandise. There is also an isolated document of a Palmyrene traveller on the island of Socotra (Robin and Gorea 2002; Gorea 2012). Most of the relevant sources, however, concern the caravan movement between the Gulf and Palmyra (Will 1992: 57–102; Drexhage 1988; Seland 2014b). Some caravan leaders, Palmyrene residents in the ports of call, and sometimes military commanders were honoured with statues set up in public places (Delplace and Yon 2005). While the bronze figures are long gone, we are left with the accompanying inscriptions. A few sculptures help to visualise these camel-riding merchants and their equipment [Fig. 4]. Unfortunately the merchants, having arrived safely and with profit from Lower Mesopotamia, praised these worthies for “being agreeable to them” and do not mention their merits in more detail. Even so, it is clear that the passage was considered dangerous and that very important interests were at stake: some caravans are said to represent “all the Palmyrenes” and some inscriptions resume motions passed by the city council voting four statues in the four tribal sanctuaries for those particularly efficient in their service to the caravans, such as the famous Soados, a Palmyrene resident in Vologesias (Yon 2002: 100–106).

It has been observed that nothing is known about caravan movement from Palmyra westwards. Scholars have argued that the passage to Emesa (150 km) and on to the Mediterranean (70 km more), must have been uneventful and therefore there was no reason for recognition in the form of honorific statues funded by the city or groups of merchants. But is it certain that they had headed straight to the sea?

Emesa, today Homs, was a great city which flourished at the same time as

Palmyra, so it was assumed that its fortunes paralleled those of Palmyra and that its prosperity was founded on the caravan trade as well (Seyrig 1959). And yet, there are no thriving Mediterranean ports at the end of the road: the closest ones, Tripolis to the south and Arados to the north, were not particularly important in the Roman period. It would not have been so, if one or both of these ports were receiving a sustained stream of merchandise destined for Italy and the Western provinces of the Empire. The great Levantine ports of the time were Gaza, Caesarea, Tyre and Seleucia in Pieria, all of them too far away to be considered as an outlet for the Palmyra trade. The first three obviously served Arabia, Palestine, and Phoenicia, while Seleucia, the port of Antioch and its region, lay at the end of the Euphrates route. It is quite clear that the main port in this part of the world was Egyptian Alexandria and it was via Alexandria that the main bulk of Indian imports was shipped to the Roman West.

A recent important paper by Seland (2011) tries to establish the timetable of maritime expeditions to India and to explain how the Gulf branch could withstand the competition of the Red Sea routes [Fig. 5]. He points out that seasonal winds in the Indian Ocean and the Red Sea allowed sailing from the Indian ports of Barygaza and Barbaricum with the monsoon in November/December, reaching the Red Sea around January, just in time to profit from the southerly winds to sail as far as Berenike. It is now well established (after the Muziris contract, to be discussed later on) that the imported goods were transported under seal on camelback from Berenike to government storage facilities in Koptos on the Nile.

RED SEA TRADE

When customs procedures were not too long, wares could arrive in Koptos already in March, yet high water, allowing safe passage of heavy ships downstream, did not start until August. Once in Alexandria, after further formalities, the goods were ready to be shipped overseas some time in September, already close to the end of the sailing season in the Mediterranean.

Sailing with the same monsoon to the head of the Gulf, ships could reach Charax also in January. The long overland route to Palmyra could see the caravans arrive there in March (if winter conditions allowed the passage). Coincidentally, most of the inscriptions marking the successful outcome of a journey are dated, whenever the month is named, in March and April.

Seland opines that the import tax was to be paid in Antioch and therefore the

goods had to be transported there in time for the beginning of the sailing season. This, in spite of the long overland passage of about 1400 km, would give the Syrian road an advantage in comparison with the 380 km route from Berenike to Koptos.

This scenario is entirely plausible, except for the alleged necessity to pass through Antioch to pay a 25% tax on value imposed by the Roman administration on Oriental imports. While we know now that this tax was paid in Alexandria, this is by no means sure for Antioch in Syria. That country shared with Egypt the old Hellenistic system of separate contracts for the reception of taxes and duties in different custom-houses, and not of overall contracts covering a whole province or even several neighboring provinces as prevailing in the West (De Laet 1949: 331–339). We

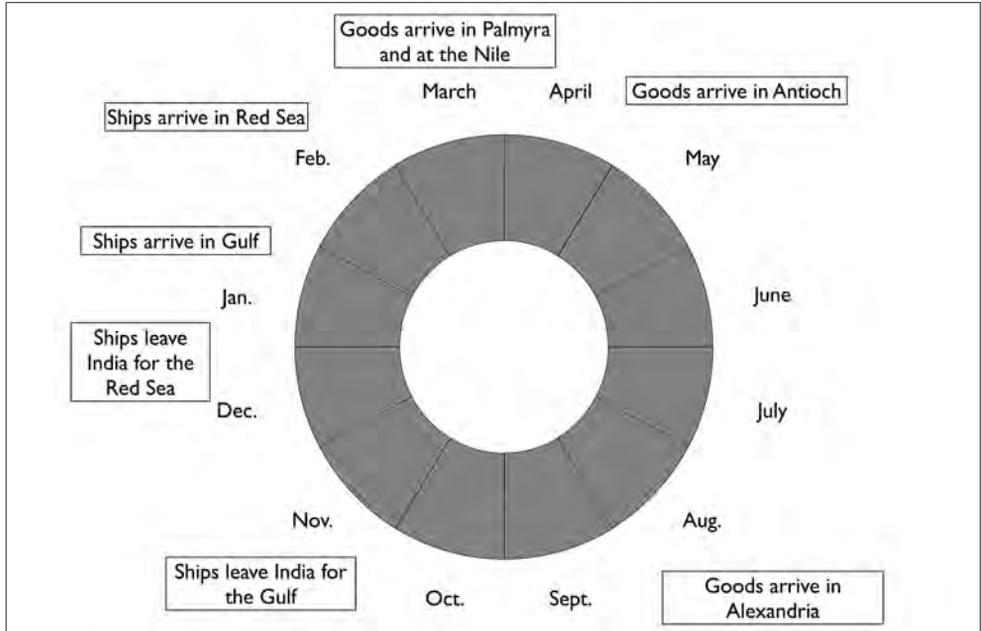


Fig. 5. Calendar of the Indian trade (Courtesy Eivind Seland)

know the names of several freedmen agents residing in 1st century Palmyra. Had they been busy with collecting local tolls only, there would be too many occasions to skip the massive quarter-tax between Palmyra and Antioch. Later, two Roman citizens honored with statues set up in the Agora: M. Aemilius Marcianus Asclepiades in AD 161 (Delplace and Yon 2005: 182–183) and L. Antonius Callistratus in AD 174 (Delplace and Yon 2005: 161) are explicitly described as collectors of the quarter tax. Asclepiades was also a councilor of Antioch, a circumstance not sufficient to prove that the seat of his tax-office was there. Palmyra, on the other hand, was a very suitable place to levy taxes on goods brought by caravans from the East; another office of that type was located in Zeugma on the Euphrates. Posts in some of the Levantine Mediterranean ports were involved only in internal tolls (Sartre 2001: 819–821). While the Muziris contract (Thür 1987; Casson 1990) shows that in Egypt the merchandise was sealed upon arrival in the Red Sea ports, kept in government storehouses in Koptos and carried to Alexandria by water, such precautions were more difficult to apply on the long land route through Syria.

Moreover, we now have positive proof of the quarter-tax being levied in Palmyra. An inscription scratched in a dark place on a wall in one of the tower tombs, which the author's son Piotr, then 13, discovered being just tall enough to see it at his eye-level, was interpreted in the original publication some 30 years ago as a money-lending operation (Gawlikowski 1986). Recently, Federico De Romanis (2004) provided a different interpretation of the text, which struck me immediately as obviously correct: the author of the

inscription was the quarter-tax collector and he put down the precise tax amount he was dealing with at the moment. It must remain a mystery why he scribbled his accounts in the family tomb.

The sum is important and quoted with a bookkeeper's precision: 3728 talents, 16 minae, 5 tetradrachms 1 drachm and 2 obols. It was dealt with in one month, which is not named. The sum is referred to with a word otherwise unattested, 'rbw' (*arbu'a?*), clearly linked to *rb'* (*rub'a*), translating the Greek *tetarte* (Riccardo Contini *apud* De Romanis 2004: 472). De Romanis thinks that this term designated the total value of imposable goods (*τιμή*); if it were a mere variant of the other word, meaning 'one quarter', then the imposed value would be of course four times bigger than the calculated tax (*τέλος*).

We are fortunate to be able to compare this account with another document, the already mentioned papyrus known as the Muziris contract (P. Vindob. 40.822, SB XVIII 13167). This text concerns merchandise brought to Berenike from South India on a ship called "Hermapollon" (Thür 1987; Casson 1990). The load's value was estimated at 1154 talents 2852 drachms. This is less than one third of what the man in Palmyra accounted for in one month.

Neither of these two documents can be dated. They can be compared only with data collected by Pliny the Elder between AD 50 and 77, which may be roughly contemporary or earlier, even by a century or more. As often quoted, Pliny deplores the expense of at least a hundred million sesterces every year for the wares of India, China and Arabia. "So much cost us pleasures and women!", he laments (Plin. *Nat.* XII 18, 84). In another passage, he

mentions the sum of 50 million sesterces for the Indian goods alone, brought to Egypt and sold at Rome with a hundred-fold gain. Various scholars have taken these round numbers at face value, supposing them to be sourced from relevant imperial officials as the taxable volume of imports (Veyne 1979; Tchernia 2011: 15–17 and 301–303). Others have seen them merely as a symbolic figure to illustrate the moral indignation of the author.

Calculated in sesterces for the sake of this comparison, the load of the “Hermapollon” was worth 27.7 million and the sum noted in Palmyra amounted to slightly below 89.5 million.<sup>1</sup> So the scandalous expense, allegedly sustained every year by the Empire, would be worth just a little less than what four ships could bring to Berenike and not much more than the imports passing through Palmyra in one month. As noted above, it was reported by Strabo, a close friend of the governor of Egypt Aelius Gallus, hence presumably well informed, that 120 ships were going to India every year from the port of Myos Hormos alone. There is no reason to think that the traffic was diminished during the following century. Rather to the contrary, with Berenike doubling the stakes. If the load of the vessels mentioned by Strabo was comparable to that of the “Hermapollon”, the Roman imports from the East on that sea route would have been worth about three billion sesterces, and not the paltry one hundred million reported by Pliny. The discrepancy is so huge that the passage of time cannot account for it. Obviously, Pliny’s numbers have no relation to reality. We may safely disregard his virtuous alarms, also because any credible estimation of the

alleged loss should consider the balance of payments, while we have no idea of the value of Roman exports and of prices paid in India for Roman imports. Anyway, the very notion of overall commercial balance in international exchange seems never to have occurred to ancient authors. Even supposing that these 100 million represented the value of bullion exported, it would be a fraction of the value of imports as indicated in the direct sources just quoted.

Elsewhere however Pliny gives the Roman prices of exotic goods per pound and there is no reason not to believe him on that occasion. For instance, black pepper from Southern India was worth 4 denarii (Plin. *Nat.* XII 28), long pepper from Northern India 15 denarii, cassia (that is cinnamon bark from South China) 50 denarii per pound. Precious oils of nard or malabathrum could sell at as much as 300 denarii (Plin. *Nat.* XII 123), but they may have been refined in the Empire from imported leaves of these Indian plants, worth only 40 to 75 denarii per pound. A British Army manual of the 19th century recommends not exceeding 300–400 lb (135 to 180 kg) as a camel charge (Leonard 1894, quoted by Seland 2011). This corresponds to 400–540 Roman pounds.<sup>2</sup> So, if the whole amount of what the tax agent in Palmyra estimated at 22.37 million denarii was the value of black pepper only, it would have had to be brought by an improbable caravan of ten to fifteen thousand camels. More expensive spices, such as cassia, would require from 800 to 1100 animals to be transported, and even the most valuable oils of nard and malabathrum

<sup>1</sup> Counting 24,000 HS to one talent, 400 HS to a mina, and 4 HS to a drachm.

<sup>2</sup> There go 2.2 British pounds (453.6 g), but 3 Roman pounds (327.5 g) to 1 kg.

would call for from 135 to 185 camels. We have no idea of the silk price, but it was certainly high. Of course the weight of the most expensive precious stones or pearls was negligible. One can conclude that only the very costly wares were imported and even so several hundreds of camels were involved in the month accounted for by the man in Palmyra. It seems highly likely that it was one of spring months when caravans arrived from the Gulf with goods brought by ship with the winter monsoon. For the rest of the year the highly taxable Eastern imports could well have been negligible.

Even if the travelling season lasted longer, and even if the Palmyra account represents only the quarter-tax collected and not the value to be imposed, the volume of imports via the oasis would be many times lower than through the Red Sea. There is no doubt that Rome and Italy obtained their supplies from Alexandria. If the Palmyrene traders were delivering their goods to the coast, those destined for the West would be forwarded to Alexandria anyway, as this was the usual and fastest way to go to Rome from the Levantine coast. But, as Ernest Will (1992: 83–84) has already observed, we do not have any information about merchants from Palmyra present in the West. A few individuals, soldiers disregarded, who happened to leave a trace of their presence there seem to have been rather humble folk.

Meanwhile in Palmyra, caravan merchants enjoyed high esteem, quite in contrast to the disparaging attitude toward trade and merchants prevailing in Roman society in general. Roman elites and the public at large looked down upon tradesmen, always suspecting them of

cheating and profiteering (Tchernia 2011: 9–11; Morley 2007: 82–85). Not so in Palmyra, where the city Agora functioned as a kind of hall of fame exhibiting well over one hundred statues of great men and notables. Only the accompanying inscriptions remain, some of them fragmentary, but 73 texts preserved the names and/or qualities of the honorands (Delplace and Yon 2005). Only 14 of them were Romans, either imperial family, governors or army officers; in the case of the remaining 69 the occupation of the men was named in 45 instances: 17 civil servants, eight soldiers of local origin and as many as 20 caravan leaders or protectors. The latter were usually honored by merchants forming a caravan which has arrived safely and profitably from Lower Mesopotamia, but in some cases by the city council voting for four statues in the four tribal sanctuaries for those particularly efficient in their service to the caravans. Clearly, such people were greatly respected as major benefactors of the community. Nowhere else in the Empire do merchants have comparable social status and the same kind of attention is paid to their interests.

The flagrant fact that all the caravans we know of are those which came back from Mesene and the Gulf proves sufficiently that the so-called Silk Road traversing the Parthian and later the Sasanian empire was entirely disregarded by the Palmyrenes. They just skirted the borders of Parthian territory.

If we know nothing about caravans from Palmyra going West, is it because such tracks were safe and did not call for special protection, as usually supposed? Maybe we can go a step further and assume that there were simply no large caravans on the roads to Emesa, Apamea or Damascus. A caravan

bound for the Gulf was, of necessity, an association of many merchants putting their means together to secure a large host of animals of burden, an adequate armed escort, and a leader to deal with local powers along the way. To go West, every merchant could do on his own with a few camels and men. Those who did so were not necessarily the same people right back from the East. More likely, they were retailers, distributing exotic wares, and such local produce as the oasis could offer. Once the quarter-tax was paid by the Eastern caravan, these tradesmen (*pragmateis*, as distinct from wholesale *emporoi*) had only to pay the exit tax of 3 to 13 denarii per camel depending on the load.

They probably headed for local fairs (*panegyris*, Aram. *shuq*), held periodically in many places all over the country (de Ligt 1993: 70–75). Most available information in this respect concern Palestine where at least eight big markets were held under imperial privilege of tax exemption (Safrai 1994: 243–255). The most important was the “Fair of the Terebinth” at Mambre near Hebron. However, Syria was certainly home to many other seasonal fairs, not so well documented. For the Orontes valley, that is, the cities of Emesa, Arethusa, Epiphania, Apamea, to say nothing of smaller places, Palmyra would probably have been a better source of Oriental produce than Alexandria through the intermediary of the Levantine ports. The same could be true even of Damascus. For all this we have just one cryptic remark of Galen, recently discovered by Fergus Millar (1998a: 134): somewhere along the Phoenician coast the famous physician was offered Indian *lycium*, said to have arrived on camelback, which convinced

him that the plant was genuine; for Millar, it came via Palmyra. As for Antioch and its hinterland (the famous ‘dead cities’ not yet fully developed at the time), there is a good chance that it would have been supplied mainly via the Euphrates route and partly by sea from Alexandria. It seems to me that Palmyra could not have sustained direct competition with Alexandria on the Mediterranean sea routes. There is not the slightest hint that it ever tried.

Later on, after Palmyra’s end, we have precious testimony of the great fairs of the mid-4th century at Batnae (Ammianus XIV 3.3) and in Amida (Ammianus XVIII 3.3), both in Roman Mesopotamia. There, says Ammianus, great crowds assembled every year in early September to exchange products provided by the Indians and Chinese (*Seres*) and brought “by land and sea”. It could mean that both the overland and the Euphrates routes were used, the latter even more so, because in another passage the same author (XXIII 3.7) mentions Callinicum (the last Roman fortress on the Euphrates, at its confluence with the Khabur, today Buseira) as a place very well provided with every merchandise. All this must have come through Persian territory. The Red Sea route was apparently meeting the demand of the Roman market, and the Gulf route was definitely closed to Roman merchants. Callinicum is named again under Theodosius, together with Nisibis and Artaxata in Armenia, as the only allowed passages on the Persian frontier. The points of contact were limited to these places, all three in the north, apparently in order to protect the Red Sea route that the Romans still controlled (Winter 1987). The Palmyra shortcut was never used again.

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# The port of Aynuna in the pre-Islamic period: nautical and topographical considerations on the location of Leuke Kome

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**Abstract:** The trade facility in Wadi Aynuna, as well as the adjacent settlement and tentative location of an ancient port are believed to be the ancient Leuke Kome, a Nabatean port which connected Petra with the Red Sea trade network. In this brief paper the author reviews some data that bring light to bear on the issue of the nautical challenges posed by sailing conditions in the Red Sea, their potential influence on the maritime trade, and the importance of Aynuna as a port in northern Arabia which, taken together, support with greater strength the identification of this location with the Leuke Kome from the ancient written sources.

**Keywords:** Leuke Kome, Red Sea, Nabateans, maritime trade, caravans, Aynuna

In 2014, the Saudi Commission for Tourism and Antiquities and the Polish Centre of Mediterranean Archaeology launched a new archaeological project in the northwestern region of Saudi Arabia, spearheaded by Prof. Michał Gawlikowski (PCMA) and Dr. Abdullah al-Zahrani (SCTA). By the spring of 2016 the team had carried out three seasons of archaeological survey and excavation work at Wadi Aynuna, supported by Dr. Ali Al-Ghabban from the SCTA.

The excavation follows from a research grant focused on the subject of the “Indian Trade” between the Mediterranean in general terms and India and its infrastructure during the Roman period.<sup>1</sup> The trade facilities in Wadi Aynuna as well as the adjacent settlement and the tentative location of an ancient port are believed to be the Nabatean Leuke Kome, connecting Petra with the Red Sea trade network [Fig. 1].

Leuke Kome is mentioned in two ancient sources, the *Periplus Maris*

<sup>1</sup> At the time of press the project, funded from a Polish National Science Center grant UMO-2014/14/M/HS3/00795 and run by the Polish Centre of Mediterranean Archaeology University of Warsaw, is still underway with more seasons planned for 2018 and 2019.

*Erythraei* (Casson 1989: 61–63) and Strabo's *Geography* (Strab. 16.4.22–24) and identifying it with the modern Aynuna continues to excite a vivid academic discussion (Kirwan 1984; Gatier and Salles 1988: 186–187; Nappo 2010; Durand 2012: 88; Pedersen 2015: 126). El Wajh, a small port approximately 200 km south of Aynuna along the coast of Arabia,

is usually considered as the other likely location, based on an interpretation of the two written sources. Practical issues concerning sailing in the Red Sea are not taken into account in the scientific discourse on the location of this Nabatean port, and this is a serious failing considering the tremendous impact of the natural environment of this narrow

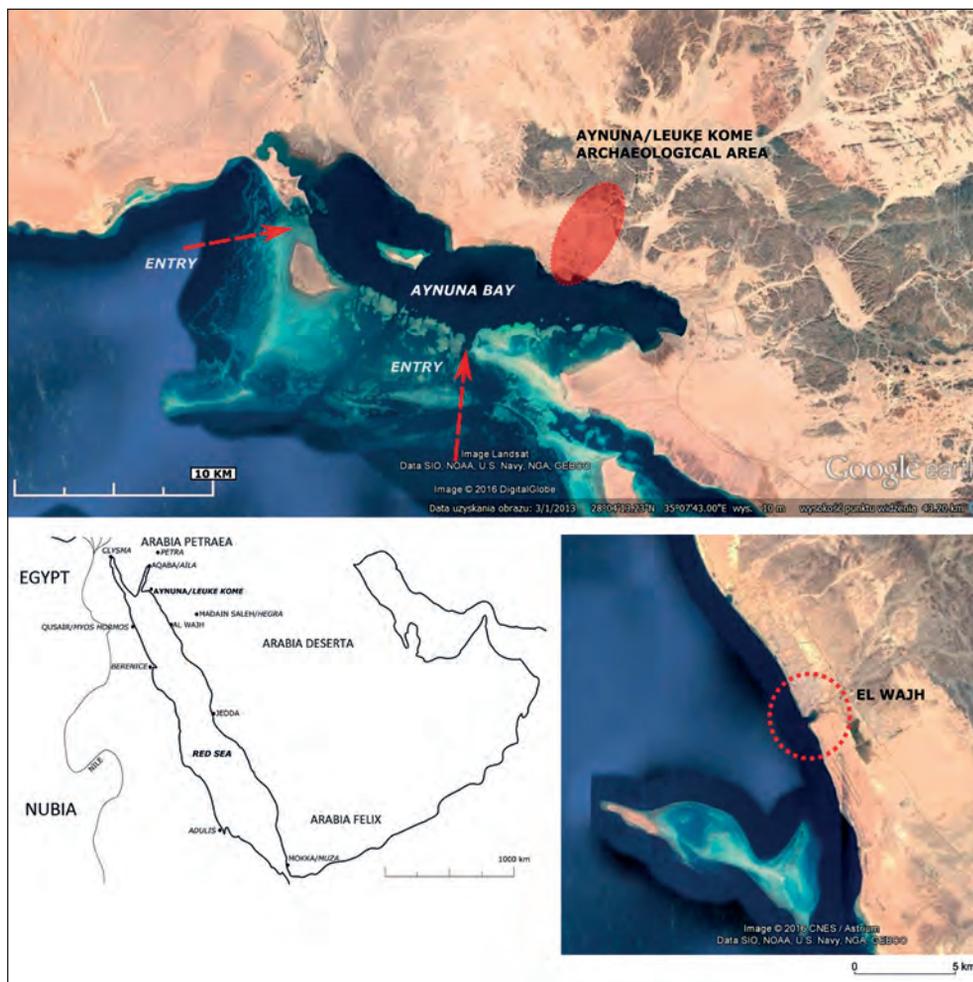


Fig. 1. Aynuna Bay (top) and El Wajh cove (above right); inset, map of the Red Sea and Arabia (PCMA Aynuna Project/© Google Earth, processing K. Juchniewicz)

branch-off of the Indian Ocean on the interpretation of the historical topography and archaeological sites located on the coast.

In the absence of any actual reports on the nautical conditions and sailing vessels of the period, the present discussion focuses on a careful consideration of the available sources that can tell us something about sailing in the Red Sea and its technical circumstances during the period in question. Archaeology has little to give in this respect still, although there is promise of change in new discoveries (see Whitewright 2008). The need for navigating along such difficult shores leads to a fair assumption that merchant ships were of a type known later

as “dungiyeh”, equipped with an Arab-type sail or so-called lateen/settee rig. This issue, however, will not be addressed in greater detail in this paper, bringing to the fore rather the testimonies of people who actually sailed the Red Sea and left accounts of their journeys. Captain Robert Moresby was an unquestionable authority on this topic having spent four seasons sailing back and forth along the Red Sea for the East India Company. A vivid report of this was left by one of his officers, Lieutenant J.R. Wellsted (1838). Of some importance is also a brochure printed in 1872 by the United States Hydrographic Office containing sailing directions for steamers and sailing vessels on the Red Sea (Kropp 1872).

## SAILING CONDITIONS IN THE RED SEA AND THE GULF OF SUEZ

The Red Sea, 1932 km long and approximately 350 km wide at the longitude of Massawa and the Farasan Islands, narrows gradually to 180 km at the point where it branches into the Gulf of Suez and the Gulf of Aqaba. In the south, it narrows abruptly to 29 km at Bab al-Mandab. Its shores are more or less parallel and fairly straight. The coastal zone is rather shallow and full of reefs, whereas considerable depths are reached within a few kilometers offshore (Braithwaite 1987: 25).

There are two main seasons in the Red Sea basin, roughly corresponding with the Northern hemisphere's “winter” and “summer”. Cooler weather occurs usually in mid-October (in the northern part even earlier) and lasts until mid-April. Maximum daily temperatures in January

oscillate around 20°C in the north and 29°C in the south. In July, the temperatures are approximately 10–15°C higher, respectively. In winter, conditions seem to be relatively mild, while the summer is most uncomfortable, high temperatures being combined with extensive humidity to make all activity most difficult during the day and failing to provide any relief at night (Edwards 1987: 47–48).

In the main body of the Red Sea, between the latitudes of 16°N and 26°N, the mean annual wind speed is less than 10 knots and gales are rare. Especially in summer and autumn, up to 85% of winds are of Beaufort force 4 and less (which equals 0–16 knots). To the north of 26°N it is windier than in the central zone. The mean annual wind speed is above 10 knots, strong winds of Beaufort force 5–6 usually

accounting for some 25% of instances (rising to 35% in September). Occasional gales of Beaufort force occur throughout the year (Edwards 1987: 49–51).

Kropp (1872: 21) stated that the dangers connected with navigating the main body of the Red Sea used to be overrated. Data presented above seem to corroborate his comment when consi-

dering sailing between the latitudes 16°N and 26°N, long passages and weather conditions accounting for the chief hardships to ancient sailors. Nonetheless, safe navigation in this area demanded the utmost attention of vessel crews. Kropp's observation was generally corroborated in later research by Elaine Morgan and Stephen Davies (1995: 26).

## SAILING CONDITIONS IN THE GULF OF AQABA

In the Gulf of Aqaba weather conditions are somewhat rougher than in the main body of the Red Sea. Northern winds make for approximately 50% and northeastern for 20% of all winds blowing there. In winter, a minor northwestern component is present, while southern winds are rare. Average wind speed is about 10–15 knots, possibly rising to 40–45 knots (northern directions) and 28–33 knots (southern directions). Gales are more frequent during the winter months. They can reach 45 knots and blow over several days. Changes of wind directions can occur within less than one hour (Reiss and Hottinger 1984: 36).

Strong winds, on top of significant seasonal currents and steep waves of an average height of 1.50 m, can make the sailing conditions very rough (Manasrah, Lass, and Fennel 2006: 221). Additionally, safe havens are very rare and the shores are bristling with reefs for most of their length.

The entry to the Gulf of Aqaba, reported by Wellsted (1838: 126–129), gives insight into the challenges of sailing through the Strait of Tiran. In this context the bay of Aynuna appears as the last truly safe point on the Arabian shore for vessels going north and the first haven for those coming from the north.

## AYNUNA

The bay of Aynuna is in itself very spacious. It is approximately 20 km wide and 5 km long [Fig. 2], sheltered from the northern winds by the mainland. A range of small islands and coral reefs protect it from the open sea, preventing waves from entering the bay. There are two passages for entrance, the one in the north still serving as the main passage. According to 19th century accounts, this 2 km wide passage could accommodate even large ships like a frigate, if accompanied by a pilot. The other passage to the south is narrower, only

0.5 km wide and, according to the local fishermen, is used in emergency or in good weather only, although it is also quite safe.

The Aynuna bay offers very good anchorages along its shore. The most convenient place, however, is the modern port of Khoraiiba [Fig. 3]. A small promontory built up from the material washed out from Wadi Aynuna protects it additionally from the northern winds and small waves sweeping through the bay. The land there slopes gently towards the sea, the shore is sandy and the sea itself is



*Fig. 2. The Aynuna Archaeological Area  
(PCMA Aynuna Project/© Google Earth, processing K. Juchniewicz)*



*Fig. 3. Port of Khoraiba  
(PCMA Aynuna Project/aerial photo J. Kaniszewski)*

about 5 m deep for about 100 m. The site is perfect both for stranding boats on the beach and for anchoring them offshore.

Wadi Aynuna was first investigated in 1981 by the Saudi Arabian Comprehensive Survey Programme, which reported a pottery assemblage of clearly Nabatean/Roman date as well as later (Ingraham et al. 1981: 76–79). Later, it was also visited and described by Ali Al-Ghabban from the Saudi Commission for Tourism and Antiquities (Al-Ghabban 2011: 182–183). The wadi runs about 4 km inland and sites are clustered on both sides. No traces of ancient structures except

for some ruins of a water conduit of unknown date can be observed in the port of Khoraiba [see *Fig. 2*]. The 19th-century seafarers' accounts paint a picture of humble buildings of mud brick and reed (Wellsted 1838: 162–163; Burton 1878: 133–137). Just where the wadi comes down from the inland plateau, on the right (western) bank, there is a group of buildings typical of structures used for the storage of goods. This complex, currently investigated by a Polish–Saudi team, may have been an emporium located close to the port [*Fig. 4*].



*Fig. 4. The emporium of Leuke Kome  
(PCMA Aynuna Project/aerial photo J. Kaniszewski)*

## WADI 'IFAL: TRADE ROUTE BETWEEN AYNUNA AND PETRA

Its location in the northernmost regions of the Red Sea make Aynuna an excellent stop on the land route connecting Nabatea with the rest of Northern Arabia while avoiding at the same time the hardships of the Gulf of Aqaba. A relatively good road, approximately 300 km long, ran from the Red Sea through Wadi 'Ifal to Aqaba and farther on along the Wadi Arabah to the Nabatean capital of Petra [Fig. 5]. The route through Wadi 'Ifal was used also in the Islamic period, as part of the “Egyptian

Pilgrim Route” to the Holy Cities. It crossed the mountains, but was relatively easy and safe for caravans. Stopovers, with fresh water available, were at Haql, Al Sharaf, Al Bad and in Wadi Aynuna. The stretch of the route between Aqaba and Petra was well known as *Via Nova Traiana* and was used by the Roman army. Assuming that a fully loaded camel can make 30–40 km per day (Seland 2015: 46), a caravan moving from the Red Sea must have taken 8–9 days to reach Petra.

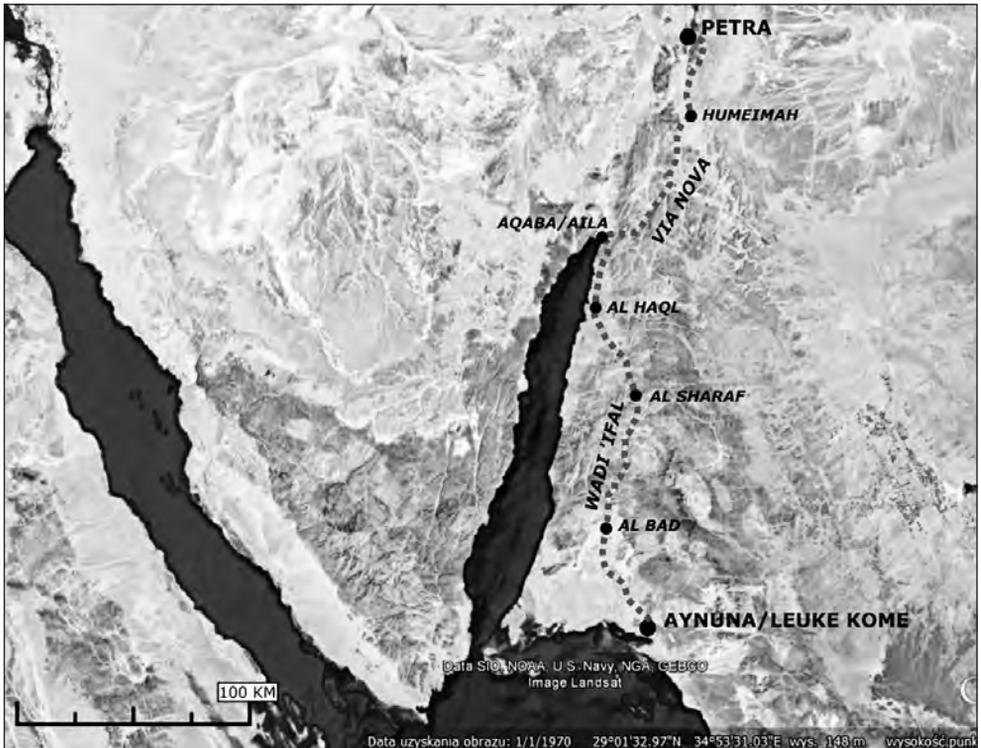


Fig. 5. *The Aynuna–Petra trade route*  
(PCMA Aynuna Project/© Google Earth, processing K. Juchniewicz)

## EL WAJH

Of the various places identified with ancient Leuke Kome the small port of El Wajh appears to be a most likely contender. Its location almost directly opposite Myos Hormos at the site of modern Qusair al-Qadim perfectly suits the description in the *Periplus*.<sup>2</sup> Burton saw some considerable ruins at El Wajh (Burton 1879: 219–233), but an extensive archaeological survey carried out by Ingraham in 1981 did not reveal any Nabatean/Roman remains (Ingraham et al. 1981: 78). According to Wellsted (1838: 184), Sharm el-Wajh is a small cove good only for small vessels. Drinking water was available from wells located a few miles away from the shore. Later detailed observations of the port by Kropp (1872: 23–24) pictured it as not spacious enough for even moderate-sized

vessels to maneuver in; when northwestern winds were blowing the sea was high and tall waves set into the harbor basin. Burton is said to have excavated a temple there in the 19th century (Durand 2012: 88), a temple which he referred to as *Gasr Gurayyim Sa'id*, that is, Palace of Sa'id the Brave (Burton 1879: 218, 222–233). However, the mouth of Wadi Hamd and the site of the temple lie about 50 km to the south of El Wajh cove.

A brief visit to El Wajh in the winter of 2016 corroborated these descriptions. The port is small and it is hard to imagine it could have accommodated 130 transport vessels with 80 warships, a fleet commanded by the Roman prefect of Egypt Gaius Aelius Gallus to transport his army to Leuke Kome (Mayerson 1995: 17).

## CONCLUSIONS

It has been argued that sailing upwind beyond Jiddah, which is the northern limit of fairly steady southern winds in the Red Sea, was difficult for ancient merchants aiming for the northernmost regions of the Red Sea, hence their decision to reload onto camels at Jiddah at the farthest and continue the journey overland (Facey 2004: 9–11). Whitewright is more convincing when he argues that maritime experience in the Roman period was such that it allowed ships to navigate to all parts of the Red Sea (Whitewright 2007: 87). Even if large ocean vessels are assumed to have stopped at Jiddah because of the prevailing wind conditions, it is presumptuous to think that only overland caravan transport was

eschewed from this point. Cargoes could very well be reloaded onto smaller vessels and shipped to their ports of destination and Leuke Kome could have been one such harbor.

A very preliminary analysis of the pre-Islamic ruins in Wadi Aynuna leads to the conclusion that the cluster of buildings in Lower Aynuna functioned as a storage facility for goods brought to the port at Khoraiba by ship. Once on shore, they were transported by camel caravans to Aila/Aqaba and then to Petra. Still, there are issues to be considered. Why should a storage facility be located 3 km away from the port and why in the first place goods would have been stored there instead of

<sup>2</sup> For the identification of Myos Hormos, see Peacock 1993 and Whitcomb 1996.

being shipped on smaller vessels further north to the port of Aqaba?

Accessibility of water and pastures for camels is the simplest answer to the first question. Both were easily available in the valley of Aynuna and the caravan station would have been located halfway between the port and the camel pastures. Moreover, the site was protected by the nearby settlement in Upper Aynuna.

Regarding the second issue, two factors come into play: time and risk. Sailing conditions in the Gulf of Aqaba, with the sudden gales that could last for days, coupled with treacherous reef-lined shores made the journey fraught with danger. In 1833, it took the British ship *ss. Palinurus* under Captain Robert Moresby six days to sail from the mouth of the Gulf to Aqaba and that only on the second try. Moresby spent four years charting the northern part of the Red Sea for the East India Company and he had no doubt that the Gulf of Aqaba was dangerous to sail. Lateen/settee rigged vessels, known probably as early as the 2nd century AD (Whitewright 2009: 102) were capable of sailing even in such a narrow stretch of sea, although it might have been regarded as risky and time consuming. The inland trade route through Wadi 'Ifal cut by half the time to reach Petra and was perfectly safe. Decisions in this regard would have been business-driven and safety-oriented for sure.

Sailing all the way to Aqaba is another issue to be considered. The *Periplus*, whether by mere chance or not, speaks of Leuke Kome and not Aqaba/Aila, which is clearly the port of Petra. Aqaba/Aila is not even mentioned there. It seems to have been of minor importance for international trade, possibly because of the risky location

in terms of navigation. Aynuna/Khoraiba however was the last safe point on the way from the south, still ensuring fairly comfortable sailing conditions. The real challenge started in the Tiran Strait. The port of Aynuna with its excellent anchorage and its safe and easy connection via an inland route to the rest of the Nabatean kingdom, allowed this dangerous stage of the voyage to be avoided. Modern accounts of sailing conditions in the Gulf of Aqaba indicate that caravans could reach Petra in half the time and without any additional risk.

Identifying Leuke Kome has been the topic of numerous scientific discourses and it is beyond the scope of this paper to study the pros and cons of all the diverse views and arguments. What should be pointed out in this context is the topographical question. Generally speaking, two locations of Leuke Kome are considered: Aynuna and El Wajh. The most important source for Red Sea topography is definitely the *Periplus Maris Erythraei* where Leuke Kome is clearly described as the "port of Petra". There would be no reason for merchants to stop in El Wajh and take a roundabout route through the Hegra, which incidentally is not mentioned at all, to reach Petra, when Aynuna offers a good and safe anchorage, and an excellent connection with the capital of the Nabateans.

The only advantage of El Wajh, and a contested one at that, is its situation opposite Qusair/Myos Hormos, corresponding thus to the description in the *Periplus*, which says that Leuke Kome is to the east of this port. However, while the *Periplus* seems to be quite accurate in its descriptions, it shows a surprising generality in the case of Leuke Kome: an approximate distance ("two or three days

sailing”) and not very exact directions (“to the left of Berenike”). Moreover, there is no mention of the goods that were traded in this port, a component usually present in descriptions of other ports. It has been recently argued that the author of the *Periplus* had never been in Leuke Kome personally, making his description of the harbor unreliable at best (Bukharin 2012: 110–124). No material indicating Nabatean presence in El Wajh has been recorded so far, while the temple at Wadi Hamd, found by Burton, is too far away (“one long or two short marches”, Burton 1879: 220 ) to be linked with the port and was rather part of the main route connecting this part of the coast with

Al Hijr (ancient Hegra, modern Mada’in Saleh), an important Nabatean city in the interior. The author of the *Periplus* expectedly did not mention Hegra as it would have been a major land stop on the way to Petra. The subordinate route from El Wajh went 50 km south before turning east–northeast toward the desert city.

The location of Aynuna on the contrary suits most of the topographical directions regarding Leuke Kome in the *Periplus* and given by Strabo (Gawlikowski forthcoming). The safe anchorage and the convenient land connection with Petra make Aynuna a strong contender for identification with ancient Leuke Kome.

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# Shaping a city and its defenses: fortifications of Hellenistic Berenike Trogodytika

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**Abstract:** Key information on the location, size and dating of the Ptolemaic fortifications of Berenike Trogodytika comes from archaeological excavations carried out in 2013–2015, following the 2012 season when the presence of military architecture in the Red Sea harbor was first discovered and identified (Woźniak and Rądkowska 2014). Sections of a thick wall constructed of gypsum anhydrite blocks on a wide foundation were recorded in the northern part of the site (trenches BE-13/90 and BE13-93). The wall was part of the defenses protecting the harbor from the north, the only land access to the site through marshy ground on the fringes of the so-called “northern lagoon”. Further work in trenches BE14-97 in 2014 and BE15-104 in 2015 uncovered the remains of a well-preserved early Hellenistic fortified city gate, built of gypsum anhydrite blocks and chunks of coral. The complex has no parallel at present anywhere in the Red Sea region. A series of shallow basins interconnected by pipes made of truncated necks of early Hellenistic amphorae, found east of the gate, probably collected rainwater. The water function? of the gate was confirmed further by a large basin or cistern, about 1 m deep, abutting the complex on the southwest. A subterranean network of four rock-cut chambers was discovered at the bottom of the internal gate chamber. A corridor in the east wall of the gate shaft, with a covered channel in the floor, led off to the northeast, in the direction of a rectangular anomaly observed on the magnetic map, a possible second rock-cut shaft.

**Keywords:** Hellenistic/Ptolemaic fortifications, Berenike, harbor, Red Sea, water installations

The search for the Ptolemaic town fortifications advanced significantly in 2013 with the recognition of magnetic anomalies observed on a geophysical map of the western part of Berenike Trogodytika (Woźniak and Rądkowska 2014: 516–523, for the map, see Herbich

2007: 24, Fig. 3-4). These were identified as a large fort, verified by excavation in 2012 (trenches BE12-83, BE12-85 and BE12-86).<sup>1</sup> The excavators were attracted by an unidentified linear structure made of anhydrite blocks, fragments of which were visible on the surface in the northern

<sup>1</sup> Excavations of the remains of the northwestern tower in the northern courtyard of the fort were conducted in 2012 in order to reject the original industrial identification in lieu of the defensive character of this large building. The results of earlier archaeological work conducted by the Berenike Project in several places in the fort in 2000, 2001 and 2010 were reanalyzed in the light of the changed interpretation and presented in the first of three articles on the subject (Woźniak and Rądkowska 2014).

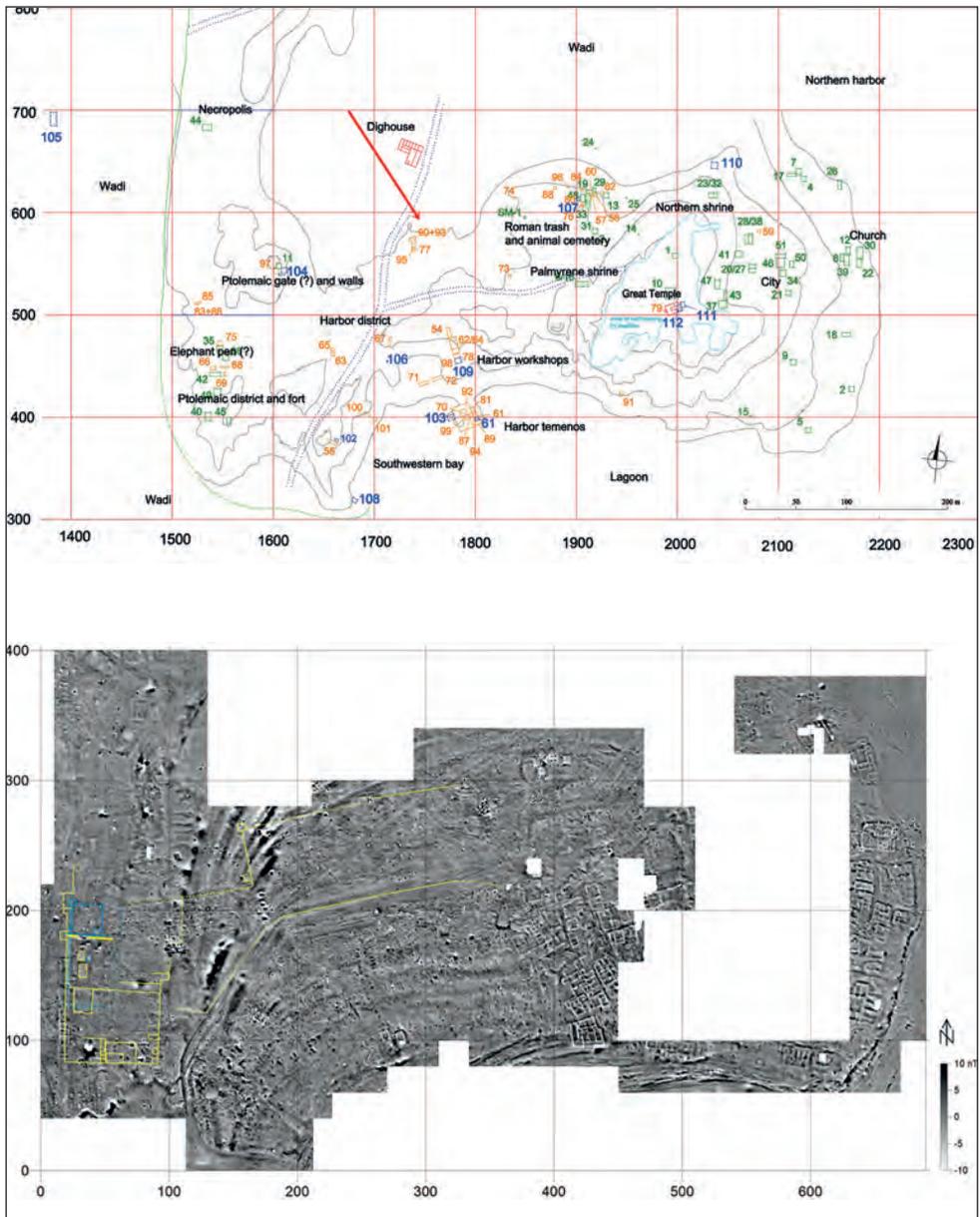


Fig. 1. Reconstruction of the main lines of the Hellenistic fortifications, the fort and the north wall with the south “harbor” wall, based on an analysis of magnetic anomalies; top, map with location of trenches with remains of Hellenistic military architecture (PCMA–University of Delaware Berenike Project/magnetic map processing T. Herbich, R. Ryndziewicz and D. Świąć, 2014; interpretation M. Woźniak and J. Rądkowska; plan B. Wojciechowski, updated A. Szeszko)

part of the site (north of the presumed Hellenistic and early Roman harbor). The nature of the building material suggested an early date for this structure, Hellenistic or early Roman. The dating was corroborated by the results of excavation in the area directly to the south of it, interpreted as a Hellenistic dump with a small quantity of early Roman material (trenches BE11-77, BE14-95).

Excavation in 2013 (trench BE13-90 and its extension BE13-93) [Fig. 1 top] revealed clusters of highly eroded blocks of anhydrite in more or less regular alignment [Fig. 2]. Stretching from east-northeast to west-southwest, these assemblages usually consisted of one course (two courses survived only in a few places) and were from 0.50 m to 1.50 m wide. The

most interesting observation about the unearthed clusters of blocks and fragments of partly slaked anhydrite of various size was that they lay on the northern edge of a 2.50-m-wide strip of sand, which was, in fact, a large robber pit. It ran the same course as a stretch of anhydrite blocks suggesting that the two features were in some way connected. Lying at the bottom of the robber trench was a stretch of wall, one-meter wide, composed of blocks of diverse sizes, and broken fragments of anhydrite on a footing that was 1.60 m wide and made of the same material. The remains were at a depth of more than 1.50 m. Two of the largest blocks, both regular and quite well worked, measured 0.50 m in length and width, and were 0.30 m thick; a third block was 0.70 m long, 0.35 m wide and 0.20 m



Fig. 2. Remains of the northern Hellenistic defensive wall: view looking east (PCMA–University of Delaware Berenike Project/photo S.E. Sidebotham)

thick. The other fragments were smaller and less regular.

The best-preserved eastern half of the uncovered wall clearly displayed its zig-zag course, with the northwestern end situated about 1.50 m to the northwest of the southeastern one. Apart from a 2.50-m-long stretch (measured from the eastern face of the turn), stone robbers had completely destroyed the excavated portion of the northwestern part of the wall. All that remained were a few small (about 15 cm in diameter) and irregular pieces of anhydrite and one large fragment (about 0.80 m long, 0.60 m wide and 0.40 m thick) which must have broken off from one of the huge blocks that had formed this part of the structure. Moreover, the lower part of a smaller robber pit, of earlier date than the main one and running perpendicular to it, indicates the possible existence of a smaller structure branching off in a southeasterly direction from the middle of the northwestern part of the uncovered wall. This pit was partly visible in the lower part of the southern cross-section of the trench BE13-93, next to the point where it joined trench BE13-90. The present position of the trenches and the size of the main robbers' pit precluded an investigation of this tentative structure.

Tracing the uncovered fragment on the magnetic map of the site placed the structure in the middle of the length of a linear structure which further on, that is, northeast of trenches BE13-90 and BE13-93, runs straight on northeast for several dozen meters and disappears under a thick layer of early Roman rubbish (Sidebotham and Wendrich 2007: 44–54; Sidebotham and Zych 2011: 12–13) [Fig. 1 bottom]. Southwest of the above-

mentioned trenches the structure (once probably a wall, now only its negative) runs directly west-southwest for about 120 m, then makes a 90-degree turn to the south-southeast. After about 45 m it turns back west-southwest and finally, after about 100 m, reaches the northeastern corner of the northern courtyard (*tetrapyrgion*) of the large fort building (Woźniak and Rądkowska 2014: 517–521). Evidence from the geophysical map suggests the existence of two additional square features, one at the first turn (approximately 5 m x 5 m) and a second at a corner to the southeast. It remains uncertain whether these are towers or other structures.

Judging by the uncovered fragment, the whole of this structure was probably a stone wall. Its outline, visible on the geophysical map, suggests that it could have been the north defense wall of Hellenistic Berenike. First, it cuts through the rocky plateau where the fort stood (Harrell 1998: 121–131; Sidebotham and Wendrich 2007: 30; Woźniak and Rądkowska 2014: 516–523), forming the eastern part of its north wall, to the east of the northeastern corner of the *tetrapyrgion*. Then it runs more or less along the southern border of the flood plain, south of the northern lagoon. Its northeastern part probably adjoined the northern extent of a circular reef on which the Roman city was built later on. The remains unearthed in trench BE-10 (north of the so-called Serapis Temple) suggest that some unidentified buildings could have existed there already in the Hellenistic period (Sidebotham and Wendrich 2007: 56). This hypothesis is confirmed by the fact that the defense walls appear to protect this area from being accessed from the northwest (that is, the terrain with shallow waters and possibly

land that was flooded only temporarily),<sup>2</sup> which also indicates that some buildings existed there not only in the late Hellenistic period, but earlier as well.

This northern circuit turned the whole area between the wadi west of the fort and the northern lagoon and the open waters of the bay into a kind of inner city deployed on two elevated points: a rocky plateau occupied by the fort, and a circular reef on which the Roman city (and a Hellenistic residential quarter) stood, connected by a sandbank lying to the north of the southern lagoon. Surrounded by water on three sides, it was accessible by land only from the northeast by crossing the plateau. Rubbish dumps containing an abundance of pottery dated to the 3rd–1st century BC (R. Tomber, personal communication) occupied the sandbank bounded on the north by the middle section of the defense wall and on the south by an unidentified structure of earth and stone (referred to in reports as a “ridge”) encircling the southwestern bay.

Results of the geophysical survey also indicated the existence of several linear structures, probably walls, inside the said ridge. The longest one is located the farthest to the north and corresponds to the northern and northwestern edges of the earth-and-stone ridge observed on the surface. The position and length of

this feature suggest its function as a wall enclosing the area of the harbor lying on the northern bank of the southern lagoon (Sidebotham and Zych 2011: 23, Fig. 3-4, 26, Fig. 4-2). The anomalies traced on the magnetic map place the eastern end of this structure by the western edge of the reef on which the Roman city was built later,<sup>3</sup> while the southwestern end turns at a 270-degree and runs straight west as far as the east wall of the fort. This position could point to its Hellenistic origin since the fort went out of use at the end of the Hellenistic period and most of it was pulled down at the beginning of the Roman period to salvage building material (Woźniak and Rądkowska 2014: 522). Pending future archaeological investigation, the feature may be hypothesized as a parallel wall to the northern circuit, protecting the city from the direction of the harbor.

Hellenistic structures continued to be excavated in 2014 in Berenike, in the area directly to the south of a prominent mound composed of layers of drifted sand and ash, mixed with pottery and small fragments of anhydrite. The mound was enclosed, at least from the east and south, by a low wall (about 0.80 m high), measuring from 0.50 m to 0.55 m in width and built of porous white stone.<sup>4</sup> It separated the new trench BE14-97 (which adjoined

<sup>2</sup> Today the area north of the site is a low-lying wetland similar to the shores of modern lagoons surrounding the site, which are no longer inundated, but which lie just beyond the reach of the highest waves. It would have been regularly submerged at high tide in antiquity, even if the ground was no more than half a meter lower. Geological testing revealed thin alternating layers of gritty windblown sand and steel blue silt characteristic of shallow lagoon bottoms at a depth of approximately 0.70–0.60 m below the present ground level. There are no visible archaeological traces in all of the area to the north and northeast of the site (i.e., north of the line of early Roman and Hellenistic rubbish dumps), which could attest to the presence of wetlands there once.

<sup>3</sup> The wall may have continued southeast for about 60 m, along the western edge of the reef in the direction of the northern bank of the southern lagoon, but this cannot be ascertained due to the presence of later buildings in this area.

<sup>4</sup> It is clear from an analysis of the magnetic map that wall 004/009 was the south side of a square structure enclosing the mound of ash and pottery. The north wall of this feature is buried under drifted sand and ash spilling out from the mound, while the east one was partly uncovered in trench BE96-11 (locus 003).



*Fig. 3. Remains of the fortified northern gate of Hellenistic Berenike Trogodytika, view from the northwest. In the foreground, the western “pylon” with the destroyed remains of a retaining wall protecting the northern portal of the gate against sand and water. Main chamber of the gate behind the pylon, enclosed by later walls and with the northern and southern thresholds raised to protect it (PCMA–University of Delaware Berenike Project/photo S.E. Sidebotham)*

*Fig. 4. (opposite page) Remains of the fortified northern gate of Hellenistic Berenike Trogodytika: top, view from the east; bottom, view from the southwest (PCMA–University of Delaware Berenike Project/photos S.E. Sidebotham)*

*Top, foreground: earthen installations for accumulating rainwater with early Roman graves cut into them. In the background, the rebuilt east wall of the inner chamber of the gate (the only remains of the original first phase of the wall are the four large blocks in its central part). In front of it stands a late Hellenistic east wall built of small irregular stones. It was erected already after the destruction of the east curtain wall, which had originally run between the first Roman grave seen in the foreground and the northeastern corner of the trench where the human scale is seen.*

*Bottom: a large pool (not yet explored) seen in the foreground and to the north of it, the inner chamber of the gate with the western “pylon”. The main west curtain wall is visible in the top left corner and in front of it there is the footing of the rampart connected with the northwestern corner of the “pylon”. East of the “pylon”, the wall blocking the northern portal, raised twice; note the threshold.*



it from the south) from the older trench BE96-11, which had been opened inside the mound in order to examine its structure and contents (Sidebotham and Wendrich 1998: 101–108) [see *Fig. 1* top]. The wall was marked as locus 009 in BE14-97 and as locus 004 in BE96-11. Excavations in 1996 demonstrated that it was founded on layers of ash mixed with sand and potsherds, and that it was most probably a kind of fencing built around the mound (Sidebotham and Wendrich 1998: 104). Lack of any other structures inside the area enclosed by walls 003 (in trench BE96-11) and 004/009 (in the new trench) would support this interpretation.

Trench BE14-97 was opened on the southern side of the mound because traces of a massive structure built of large fragments of anhydrite and coral could be seen there under a thin layer of loose sand mixed with grey ash. After exploration, the structure (locus 005 in trench BE14-97)

was cautiously identified as a solid western “pylon” of a fortified gate from the Hellenistic period [*Figs 3, 4*].

Well-dressed blocks of anhydrite used in the southern and western faces of the structure were of considerably different size. The ones in the southern face were smaller in the upper part (about 0.37–0.43 m long and 0.15–0.24 m high) and bigger in the lowest two courses (0.43–0.60 m long and 0.39–0.49 m high). Blocks in the western face measured 0.33–0.50 m in width, 0.25–0.32 m in height and about 0.50 m in length. In the outward faces, northern and eastern, smaller and more roughly-hewn fragments of anhydrite were mixed with large, up to 0.50 m long, fragments of coral heads. The core of the “pylon” was filled with small chunks, 15–20 cm in diameter, of anhydrite and coral bound with some kind of mortar, probably yellow clay, which can be obtained from the nearby wadi. On the



*Fig. 5. Hellenistic pottery found in the fill of the negative of the east curtain wall (PCMA–University of Delaware Berenike Project/photos S.E. Sidebotham)*

outside, the “pylon” measured 2.10 m going north–south and 3.40 m from east to west; the preserved remains rose 1.44 m above the level of the plateau on which it was founded.

The northwestern corner of the “pylon” was originally truncated to allow for the founding of a 0.95-m-wide wall (locus 049), which runs west parallel to the main curtain wall (locus 022 in BE14-97). Only the lowest course of blocks has been preserved *in situ*. The blocks vary in size, the biggest ones (0.40–0.45 m by 0.40 m) forming the southern half of the wall. The western cross-section of trench BE14-97 revealed the presence of a kind of *proteihisma*, about 1.00–1.50 m high, built on this wall. At some point, but already after a “fence” (locus 004/009) had been built around the pile of ash, probably to lessen the burden on this wall, the *proteihisma* collapsed to the south under the pressure of huge amounts of ash and drifted sand which had accumulated to the north and northwest of the western “pylon” of the gate. Since only a short stretch of this wall has been excavated to date, it is not clear yet whether it was a standard-type *proteihisma* or a retaining wall protecting the main curtain wall against accumulating sand.

The southeastern corner of the “pylon” was structurally connected to a wall (locus 017), the northern part of which was about 0.60 m long N–S and at 1.20 m E–W twice as wide as this wall’s southern part (1.34 m long N–S). Judging by the way the blocks were hewn, it seems that the southern part was raised later (maybe reconstructing

a destroyed fragment?), possibly not long after the end of the first building phase. The anhydrite blocks, of which it was built, were even bigger than the ones used in the “pylon” (0.40–0.68 m high, 0.48–0.80 m long and 0.40 m wide). The northern part of this wall was more massive than the southern, even before the above-mentioned rebuilding, probably because it jutted out to the front of the 0.70-m-wide main curtain wall (marked as 022).

This curtain wall extends west to a point where two parts of wall 017 converge. Although the stretch uncovered in trench BE14-97 was only 2.40 m long, an analysis of the magnetic map and results of ground probing<sup>5</sup> indicate that it continues west for about 60 m, then turns south and joins the wall which encircled the northwestern tower of the *tetrapyrgeion* of the Hellenistic fort in the second phase of its functioning (Woźniak and Rądkowska 2014: 516–520).

About 2.20 m south of the southern face of the “pylon” another massive wall joins with wall 017, marked as locus 029 in trench BE14-97. Its western part was built mainly of anhydrite blocks, while the eastern one of cut fossil coral heads. As was the case with the other walls of the gate unearthed in this trench, the blocks varied in size, ranging from 0.12 m to 0.38 m in height, 0.20 m to 0.48 m in length and 0.10–0.15 m to 0.30 m in width. The western part, built of anhydrite blocks of more or less uniform size, could be the remains of the first phase of the building.

Remains of the western edge of the inner gate portal are clearly visible in wall

<sup>5</sup> Remains of a wall believed to be a continuation of curtain wall 022 were surveyed on the surface in several places in the area west of the Hellenistic gate and to the north of the fort excavated in 2012; it could indicate better preservation than in trench BE14-97. Taken into consideration together with the results of ground truthing and probing with steel rods, this may imply the presence of some large stone structures to the west of the gate (and possibly also to the east), probably additional towers related to the curtain wall.

029, 2.00 m to the east of the point of its convergence with wall 017. The eastern part of this portal was dismantled, together with the original threshold (if it ever existed), during reconstruction of the eastern part of the gate, possibly at the same time when changes were made to wall 017. It was then rebuilt with a new threshold raised about 0.70 m above the level of the old one. The threshold was made of regular, middle-sized, badly eroded fragments of anhydrite and coral, which in some places on its upper surface were apparently bonded with liquid lead poured over them. A hole in the inner western corner may have served as a door socket and the western end of the threshold curves southwards, which suggests that the doors set in the inner portal opened in that direction. Rebuilding of the inner portal and the eastern part of the gate could point to a temporary abandonment of the building after the first phase of its existence in the 3rd century BC. This lapse is difficult to date.

Similar traces of rebuilding are visible in the construction of the east (locus 016 in BE15-104) and north (locus 038 in BE14-97) walls of the inner chamber of the gate and in its outer portal.

Two phases can be distinguished in the construction of the wall uncovered on the eastern side of the “pylon”, which is in a way an extension of its inner, southern face (locus 038 in BE14-97). The structure founded directly on bedrock (locus 038/2) constitutes the first phase. It was about 0.50 m high and 0.45 m wide, and was built of large well-hewn blocks of anhydrite, measuring from 0.40 m to 0.50 m in

height and 0.50 m in length, their width cannot be measured, though. Its eastern part clearly shows that it had been inserted into the northern portal of the gate. Originally, this portal probably had neither doors nor threshold and was about 2 m wide. It extended between the eastern edge of the “pylon” and the eastern end of wall 038/2 where two stacked stones constitute the only remains of the eastern edge of the first northern portal. Another stack of two well-dressed blocks of anhydrite shows that this portal was narrowed by about 0.50 m soon after its completion. The objective perhaps was to limit the amount of sand blown inside the gate with the northern wind, but presumably it was not effective considering that the portal was completely blocked with a wall not long afterwards. This wall (038/2) was probably a kind of high threshold which protected the inside of the gate from the sand. Other changes in the construction of the gate were similarly attempts to protect it from sand blown in with the strong northern winds, especially in winter, and washed down from the western plateau.

After the northern portal had been blocked with wall 038/2, a kind of retaining or protective wall of unknown height was built to secure the portal and the inner chamber from the sand once and for all. It extended from the northwestern corner of the “pylon” for about 1 m to the north and then ran east in front of the whole portal, almost exactly below a much later wall (004/009) (Sidebotham and Wendrich 1998: 103, Pl. 3-81).<sup>6</sup> When it reached the northwestern corner of the non-existent

<sup>6</sup> It was shifted, however, about 0.25–0.30 m to the south, which is why it could not be seen in the southern cross-section of trench BE96-11. This difference in the course of the two walls, and the weight of the eastern part of wall 004 pressing onto the uneven ground could have caused this part of wall 004, together with a fragment of the retaining wall underneath it, to slide down into trench BE96-11, which after excavation was filled only with sieved and untamped sand mixed with ash.

eastern “pylon” of the gate, it turned north and this fragment is visible as wall 003 in the eastern cross-section of trench BE96-11 (Sidebotham and Wendrich 1998: 103, Pl. 3-81, 105, Pl. 3-82). Effectiveness of this new wall, at least for some time, can be observed clearly in the western and northern cross-sections of trench BE96-11 (Sidebotham and Wendrich 1998: 110, Pl. 3-85). One can see a sand dune about 0.60 m high, accumulating gradually in a corner formed on its northern side. Soon, however, ash, debris and broken pottery began to be dumped there, leading to a high mound of ash that is still visible in this spot today.

Although the retaining wall protected the portal for some time, it fostered changes to the construction of the whole building. In order for the portal to be accessible from the east, the eastern “pylon” had to be pulled down. Its only remains, still visible today on the surface as well as on the magnetic map, consist of a layer of crumbled fragments of anhydrite and plaster dust which was uncovered in 2015 on the spot where the “pylon” had stood once. A large part of the east wall of the gate was also pulled down. A few massive and well-dressed, but eroded blocks of reddish anhydrite, visible in the central part of the wall, are the only remains of the original construction. Materials obtained during the dismantling of these structures could have been used to build the retaining wall. It seems that this reconstruction may have been related to the above-described changes to the southern and eastern parts of the gate.

Excavations in 2015 suggested the reason for this persistence in protecting

the inner gate chamber from drifting sand. Entrances to four small (0.80–1.10 m wide and 1.50–1.60 m long) rooms or chambers were found inside the rectangular chamber of the gate, about 2.00–2.50 m below the preserved tops of walls and approximately 1.50 m below the level of bedrock forming the plateau (the interiors have yet to be explored) [Figs 6, 7]. Two of these rooms were hewn in the north wall of the chamber and two directly opposite in the south wall. All the entrances had flattened arches and the ceilings sloped sharply towards the back at an angle of approximately 45° [Fig. 7 left].

An equally interesting structure was discovered in the southeastern corner of the main chamber. A narrow and low (0.60–0.65 m in width and 1.03 m in height) opening cut in the east wall leads to a tunnel which extends east for approximately 7 m and then makes a 35° turn to the northeast [Fig. 8]. The tunnel runs on in that direction but only 2 m could be explored in the 2015 season; the tunnel is blocked by sand fill, which most probably fell inside through a “skylight” cut in the vault. A narrow drain, 0.30 m wide and 0.40 m deep, was cut into the floor of the tunnel on its right side and covered with stone slabs. Interpretation of anomalies traced on the magnetic map suggests that the tunnel could have linked the inner chamber of the gate with another square structure measuring 5 m by 5 m. A large crater of sand, visible around this feature on the map and on the surface,<sup>7</sup> indicates that it was most probably a shaft of similar construction as the chamber of the gate.

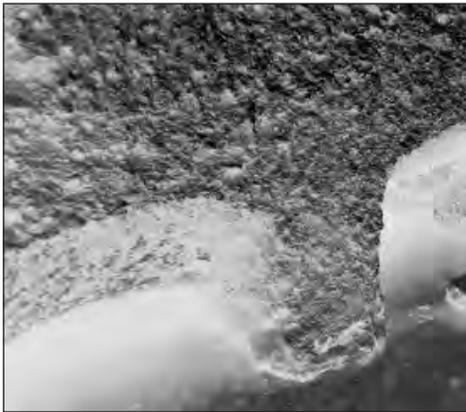
<sup>7</sup> A thick white line is clearly visible on the magnetic map running along the northern and eastern edges of this structure. It is usually interpreted as evidence of high magnetism of the object it surrounds. However, experience from Berenike shows that such lines can also appear around features hewn in hard bedrock and filled with soft, slightly magnetic drifted sand. The clear outline of this square structure located to the northeast of the gate is enclosed by a “halo” devoid



*Fig. 6. Inner chamber of the Hellenistic gate, view from the west. In the foreground, top of the rubble heap in the partly-explored sandy fill (PCMA–University of Delaware Berenike Project/photo S.E. Sidebotham)*

The presence of a big pool lined with a 5-cm-thick layer of hydraulic mortar, close to the southwestern corner of the Hellenistic gate, could indicate that these structures were associated with water which

was probably brought to town from wells located somewhere at the foot of the nearby mountains.<sup>8</sup> A heavy stone counterweight found in the sandy fill of the inner chamber of the gate and two massive stones jutting



*Fig. 7. Inner chamber of the Hellenistic gate: top, entrances to the unexplored small underground rooms with sloping ceilings (shafts or entrances to rooms located deeper) in the south and north walls and a slightly higher opening in the east wall leading to a tunnel; left, close-up of the top of one of the entrances in the northern wall (PCMA–University of Delaware Berenike Project/photo S.E. Sidebotham)*

of anomalies. This area on site appears as a depression measuring 15 m in diameter and filled with soft and loose drifted sand. Thus the “halo” is probably the edge of the crater of sand sliding into the shaft. The size of the crater suggests a considerable depth of the shaft itself.

<sup>8</sup> Such practices are well attested for the Roman period, both in written sources and in archaeological finds (Sidebotham 2011: 71, Pl. 6-1, 80, 87–124).

out from the “pylon”, which were a foundation for a structure as yet unidentified, can also suggest a water function(?) of the installations inside the gate. The counterweight was probably part of a crane or a lift mounted on the stones projecting from the south wall of the “pylon” and used for lifting water stored in the underground chambers and for pouring it into the pool by the gate. The underground tunnel could have been both a passage linking two cisterns and an overflow channel used either to keep the water level stable or to transfer it between the two structures.

Another interesting installation, presumably used for collecting and dis-



*Fig. 8. Tunnel in the east wall of the inner chamber of the Hellenistic gate: top, view toward the back end where it turns to the northwest; thick salt efflorescence covers the walls; right, sunken part of the channel cut into the floor of the tunnel inside the chamber of the Hellenistic gate and covered with thin stone slabs (PCMA–University of Delaware Berenike Project/photos M. Woźniak)*

charging rainwater, was discovered east of the gate. A number of shallow (approximately 0.10 m deep) basins/pools was uncovered in trench BE15-104, east of a late wall (locus 015) dated to around the 2nd–1st century BC [Fig. 4 top]. They were dug out in the clayey ground and separated by low earthen ridges equipped with a kind of overflow openings made of the cut-off necks of two Hellenistic amphorae (dated to the 3rd–2nd century BC), the rims of which abutted each other. The “pools” extend to the east of the walls of the gate along the robbers’ pit, most probably marking the location of the east curtain wall. Thick salt efflorescences, covering the bottoms of the basins/pools, as well as the clayey layers in which they were made, in addition to the overflow openings indicate that the whole set was a primitive, though probably effective, installation for collecting rainwater. It has not been determined yet where this water was discharged, though certainly not to the chamber of the gate. It could have been collected in underground reservoirs of the shaft visible on the geophysical map or in another cistern which has yet to be found.

The fill of the chamber of the gate consists mainly of thick layers of gritty aeolian sand sinking to the south. The presence of the above-described structures and the absence of any levels of use could indicate that a kind of wooden platform was used for passing through the gate. It was presumably mounted on the thresholds with the help of a wooden load-bearing structure, a likely trace of which is a rectangular socket in the lower part of the east wall of the chamber where a beam rested. The platform was probably fixed permanently, though it may have also been possible to raise it or draw it back (to the

south), if the need to close the gate arose.

After crossing the platform over the deep “cellar/cistern” the traveler found himself most likely in a kind of small inner gate courtyard. Only a small part of it in its latest phase has been uncovered. It was cobbled with rounded stones and much eroded potsherds. Such courtyards, surrounded by walls with wall-walks, were a common feature of Hellenistic city gates (McNicoll 1997: 31), although in big cities their structure was naturally much more complex.

On the right side of the courtyard (looking south from the entrance) was the said big pool or kind of cistern, separated from it by locus 048 in trench BE15-104. Although it has not been yet fully explored, its capacity can be estimated at 10,000 liters at least. This huge structure was enclosed by anhydrite walls: locus 048 from the east (0.60 m thick) and locus 029 from the north (0.70 m thick). Excavations in the 2015 season established that it extended to the west and northwest farther than initially projected, being bordered on the west by wall 048 and from the north by curtain wall 022. At some point the pool was divided into two parts by the extension of the southern part of wall 017, either to better withstand the pressure of water or for some other reason. An approximately 5-cm-thick layer of pinkish and gritty hydraulic mortar covered the walls of the pool, while two such layers were used on the bottom. Its size suggests that water stored there was intended not only for the soldiers standing guard at the gate, but also for arriving travelers.

The most interesting characteristic of the fortified gate uncovered in trenches BE14-97 and BE15-104, apart from its construction, was the fact that it was not

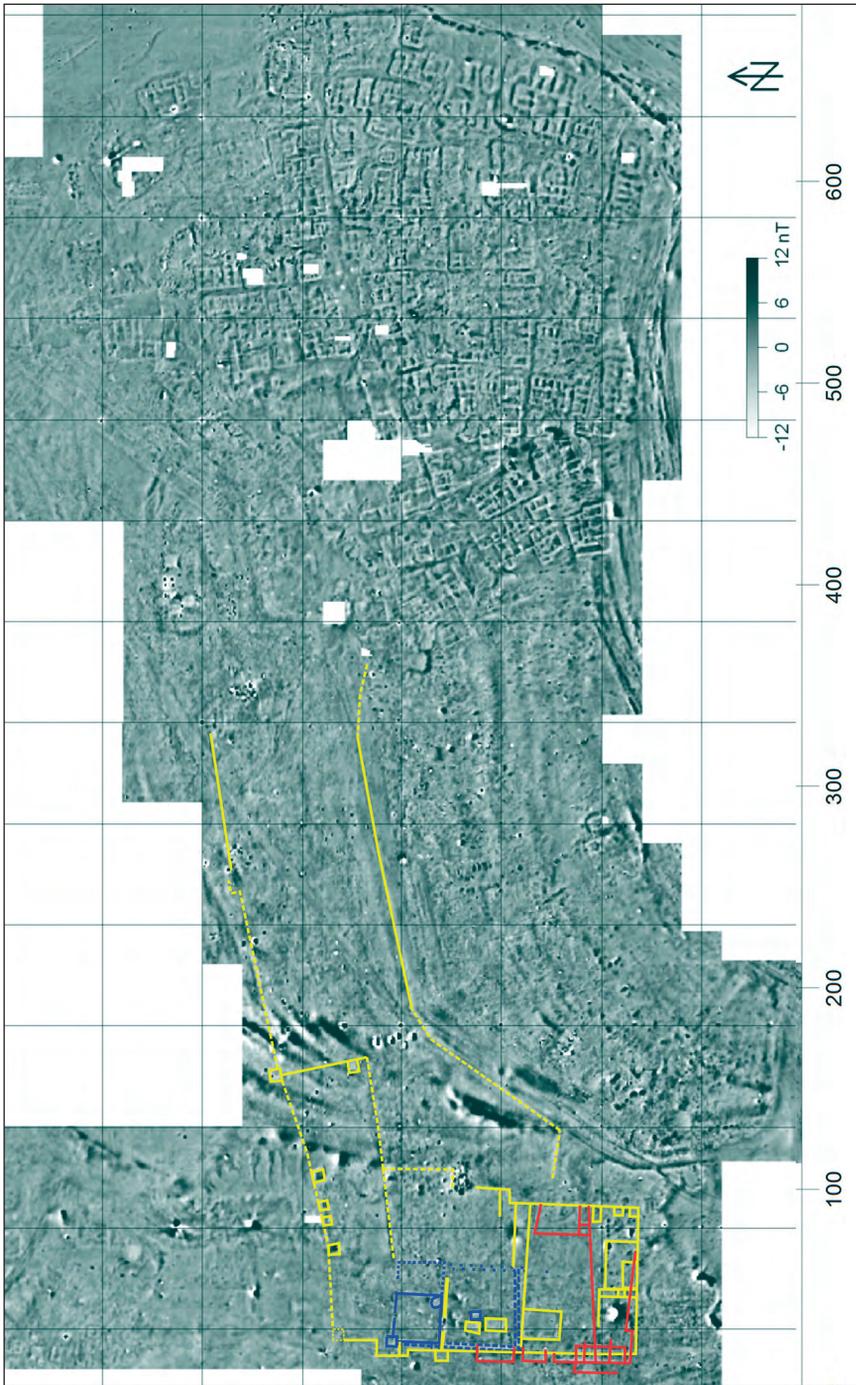


Fig. 9. Full reconstruction of the Hellenistic fortifications of Berenike Trogodytika. On the left, the Roman city which probably stood on the ruins of the eastern part of Ptolemaic Berenike (Map processing I. Herbich, R. Rymdziejewicz, D. Święcib; interpretation M. Woźniak, J. Rądkowska)

aligned with the walls discovered in 2013 in trenches BE13-90 and BE13-93. The geophysical map clearly shows that there were two lines of defense walls in this part of the foreground of the fort and that the gate belonged to the outer one [Fig. 9]. The space between them was 30 m wide and could have been a kind of courtyard used for inspecting the caravans arriving from the Nile Valley or for forming convoys which set out from the city/base with goods and animals brought ashore

from the ships anchored in the harbor. Although the Hellenistic fortifications and buildings discovered to date in Berenike are impressive and unique in the region,<sup>9</sup> they constitute only a modest fragment of the great Ptolemaic city/base. Each season of excavations brings new discoveries and expands our knowledge of what life looked like in the first Hellenistic harbor to be examined archaeologically on the Red Sea and in the whole of East Africa.

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<sup>9</sup> No remains of Hellenistic architecture have been uncovered to date during excavations of any of the port cities on the Red Sea coast. It is also the only preserved example of Ptolemaic city defense architecture from the territory of Egypt proper (the remains of fortifications in Alexandria date from the Roman or even Mamluk period). Significant examples of fortified features from the Hellenistic period are known from the Eastern Desert, but these are military forts and fortified *hydreumata*, not cities (Redon and Faucher 2015; Brun et al. 2013).

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# Port town and its harbours: sedimentary proxies for landscape and seascape reconstruction of the Greco-Roman site of Berenike on the Red Sea coast of Egypt

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**Abstract:** Berenike Trogydytica was one of the key harbours on the Red Sea coast during the Ptolemaic and Roman periods and was a major trade and exchange hub connecting the Indian Ocean and the Mediterranean. Berenike's geographical position was extraordinarily propitious owing partly to its natural harbours, protected against the prevailing northern winds, as well as its location in the vicinity of an ancient viewshed, the large peninsula of Ras Benas. This paper discusses how multifaceted geoarchaeological approaches to the study of ancient ports can contribute to a better understanding of the mechanisms and logistics of maritime trade, as well as fluctuations in its quality and quantity. It also sheds new light on the significance of the effect that local and regional palaeoclimatic, landscape, seascape and environmental changes had on the development and decline of the port, and its changing role within the Red Sea–Indian Ocean maritime network.

**Keywords:** Greco-Roman, ancient harbour, port of trade, geoarchaeology, Red Sea, Indo-Roman trade, maritime trade

*History loves a paradox, and there can be none greater than a taste for spices being responsible for the exploration of our planet. Sovereigns pledged their prestige, and navigators risked their lives, not in the quest for gold or the thirst for power but to redirect the distribution of a few inessential and today almost irrelevant vegetable products.*

John Keay, *The Spice Route* (2005)

The archaeological site of Berenike Troglodytica (275 BC–6th century AD), located on the Egyptian Red Sea coast, served as a port on the spice and incense routes that linked the Mediterranean world (specifically the Roman Empire) to India, Southern Arabia and East Africa (e.g. Sidebotham 2011). In the Greco-Roman period the site was at the cutting edge of what was then the embryonic global economy, ideally situated as a key node connecting Indian Ocean and Mediterranean trade for almost 800 years. It is now located in an arid, marginal, hostile

environment but the situation must have been very different 2300 years ago.

Given the importance of the port town over such a long period of time, it is perhaps surprising that very little is known about the foundation, evolution, heyday and subsequent decline of this city, or the size, shape, and capacity of its harbour/s. The intention of this paper is to briefly address this shortfall in our knowledge and to examine the drivers behind the rise and fall of this port city, and to explore the extent to which the dynamics of physical landscape were integral to its story.

## THE SITE AND ITS HISTORY

Berenike Troglodytica, ancient port of trade on the western coast of the Red Sea, was situated in a prime geographic position at the distal end of the influence of the monsoon wind. It was located some 300 km upwind from the Roman Red Sea port of Myos Hormos<sup>1</sup> and 825 km south of Arsinoe and Clysma (near Suez),<sup>2</sup> as well as 260 km east overland from Syēnē (Aswan) and 12 days by the Eastern Desert caravan route to Coptos (Quft), both riverine ports on the Nile. The city of Berenike was sited just south of the large peninsula of Ras Benas, which offered protection from the elements. During the Roman period it was strategically connected with Alexandria on the Mediterranean, the

capital of Roman Egypt, by three separate routes: across the Eastern Desert, along the Nile, and to the north up the Red Sea.

The geographic location and landscape setting of Berenike—the starting point of the *Periplus Maris Erythraei* (Schoff 1912/2010; Casson 1989)—was well-suited for a commercial port, even taking into consideration the difficulties in developing a large trading enterprise in the marginal hinterlands of the Empire. These difficulties included restricted access to fresh water, food and other essential resources. Therefore, it is fair to say that the demand for exotic goods would have been a leading factor in sustaining the site's growth and popularity, with the wealth

<sup>1</sup> The passage from Berenike to Myos Hormos (approximately just over 200 nautical miles allowing for tacking) could take up to 5.5 days with VMG of 1.5 knots (Velocity Made Good – describes the relative speed of the vessel directly to windward and was observed as a good measure of sailing capabilities of vessels during replica trials in Scandinavia [Englert 2006: 39; Whitewright 2007: 84]), and a minimum of 32 h; with a high average long distance speed of 6.2 knots (Whitewright 2007: 85).

<sup>2</sup> Contrary to conventional belief, Whitewright proves (2011: 14–15) that the sophisticated and efficient rigs fitted on Mediterranean vessels of the Imperial period were capable of sailing upwind (i.e., using brails for reefing and changing the shape of the sails, and the use of a new sail type, the *artemon*, to stabilise the vessel on an upwind course; cf. Arnaud 2011), equating them in performance, if not marginally superior, compared with the lateen/settee rig. This means that such vessels could have been capable of sailing upwind towards the Northern Red Sea sites ports as Clysma and Arsinoe.

of archaeological material recovered from Berenike confirming the cosmopolitan character of the city. This transitory space, situated at the crossroads linking the Indian Ocean and the Mediterranean with East Africa, Arabia, and India, brought together country folk, merchants, sailors, priests, officials, soldiers, quarry workers and slaves

from across the world. Inscriptions found at the site show the use of at least 12 languages (Sidebotham 2011: 74–76) and coexistence of a number of different cults and religions (Rądkowska et al. 2013). Taken together, it is vivid testimony to the international and multicultural character of the city.

## ANCIENT SOURCES AND PORT LOCATIONS

An extensive body of ancient literature testifies to commercial and seafaring activities around the rims of the Red Sea and the Indian Ocean, proving maritime contacts between these disparate lands and continents. The most complete collection of work available consists mainly of Classical Mediterranean writings of Greco-Roman tradition, such as Herodotus, Strabo, Pliny, Ptolemy, Aelian, Plutarch, Diodorus, Megasthenes and others (discussed in e.g. Majumdar 1960; McCrindle 1901/1991; Young 2001). The best known of these accounts include the *Periplus Maris Erythraei*— hereinafter referred to as the *PME* (Schoff 1912/2010; Palmer 1951; Huntingford 1980; Casson 1989), Ptolemy's *Geographike Hyphegesis* (Berggren and Jones 2000; Curry 2005), Strabo's *Geographica* (Dueck 2010; 2011), Pliny's *Naturalis Historia* (Healey 2004), and accounts by Cosmas Indicopleustes in his *Topographia* (McCrindle 1897/2010).

Only a few descriptions of Berenike's harbour have been preserved in ancient texts. For example, at around AD 22 Strabo indicated that 'convenient landing-places' (*καταγωγὰς ἐπιτηδείους*) existed in Berenike, suggesting that the site then had an anchorage or roadstead, rather than a port with a significant harbour (he refers to the city as being *ἀλιμενον* – harbourless).

He recorded: "thence one crosses an isthmus, which extends to the Red Sea, near a city Berenicê. The city has no harbour, but on account of the favourable lay of the isthmus has convenient landing-places" [*Ἐντεῦθεν ἐστὶν ἰσθμὸς εἰς τὴν Ἐρυθρὰν κατὰ πόλιν Βερενίκην, ἀλιμενον μὲν τῇ δ' εὐκαιρία τοῦ ἰσθμοῦ καταγωγὰς ἐπιτηδείους ἔχουσαν*] (*Geogr.* 17.1.45, emphasis added).

Conversely, the *PME* (AD 40–70) mentions: "Of the 'designated' ports on the Erythraean Sea, and the market-towns around it the first is the Egyptian port of Mussel Harbour. To those sailing down from that place, on the right hand, after eighteen hundred stadia, there is Berenice. The harbours of both [Berenike and Myos Hormos] are at the boundary of Egypt, and are bays opening from the Erythraean Sea" [*Τῶν ἀποδεδειγμένων ὄρμων τῆς Ἐρυθρᾶς θαλάσσης καὶ τῶν περὶ αὐτὴν ἐμπορίων πρῶτός ἐστι λιμὴν τῆς Αἰγύπτου Μυὸς ὄρμος. Μετὰ δὲ αὐτὸν εἰσπλέοντων ἀπὸ χιλίων ὀκτακοσίων σταδίων ἐν δεξιᾷ ἢ Βερενίκη. Ἀμφοτέρων δὲ οἱ λιμένες ἐν τῷ ἐσχάτῳ τῆς Αἰγύπτου κόλποι τῆς Ἐρυθρᾶς θαλάσσης κείνται*] (*PME* 1, emphasis added). According to this text, the 'designated harbour/cove' (*ἀποδεδειγμένων ὄρμων*) seems to have been located in an 'open bay' (*κόλποι*), most probably referring to Berenike's lagoon.

Some 50 years after Strabo's comment, around AD 77, Pliny the Elder wrote that Berenike had by that time a proper harbour, noting: "from the city of Berenice, situated upon a harbour of the Red Sea, ... and distant from Coptos by 12 days" [*inde Berenice oppidum, ubi portus Rubri maris, ... totum a Copto Berenicem iter duodecimo die*

*peragitur*] (NH 6.26.103, emphasis added). Pliny does not mention anything specific or special about the location of this port city (*oppidum*), and so one can only speculate whether he realised that it had a 'typical' harbour (*portus*) such as those that he, as a well-travelled military and public officer, would have been more accustomed to.

## EXCAVATIONS IN THE HARBOUR AREA

One of the major objectives of the renewed Polish–American excavations at Berenike was to investigate the area believed to have been Berenike's southwestern port (Sidebotham and Zych 2011). A geophysical magnetic survey and targeted test excavations were carried out in this area prior to the augering and georadar survey work as part of the geoarchaeological programme undertaken by the author in 2011–2013 seasons.

Initial excavations in the harbour area were aimed at testing the hypothesis that the 'Crescent-shaped Ridge' was a harbour jetty or a wharf in the early Roman period (see *Fig. 2* top for location). Trenches BE09-55 and BE10-67, which crossed the top of the ridge, did not, at this stage of excavations, provide any direct evidence to support their definite connection with the early port. However, evidence from trenches BE09-54, at the northern edge of the ridge (Sidebotham and Zych 2011:

27–43), and its extensions BE10-62/64 and BE11-78, as well as later fieldwork in BE11-71 and BE11-72, as well as BE14-100 and BE14-101 (Sidebotham and Zych 2017a; forthcoming), suggest the presence of an area with features dated to the 2nd century AD and resembling a ship repair workshop (see 'Ship Maintenance Area' in *Fig. 2* top), which could have been located in the vicinity of the 'Southern Port' investigated in the 2011 season.

The 6,600 m<sup>2</sup> area around what is believed to have been the 'Northern Anchorage' was targeted for further investigation, including augerhole and geophysical surveys in the 2012 season. This was based on data derived from excavations in trenches BE98-23 and BE99-32 (located to the southwest), and BE97/98-17, BE96-7, BE95-4 (to the southeast) with purported evidence of the wharf (for further references, see Sidebotham 2007: 74–75).

## LANDSCAPE AND GEOMORPHOLOGICAL SETTING

Berenike is situated on top of Quaternary sediments only ~9.5 km east of the foothills of predominantly metamorphic mountains, incised by numerous east-west running wadis that drain to the Red Sea

[*Fig. 1*]. The site is located in the catchment area of three wadis, which also serve as major sources of sediment transported to the site: Wadi Mandit, Wadi Umm Salim al-Mandit and the northern branch

of Wadi Kalalat to the west; with a large Wadi Abu Greyah, connecting from the north-northwest (Harrell 1996: 100–101) [Fig. 3]. These wadis have a significant effect on the environment of Berenike, serving as the main source of material in-flux to the site and forming transport routes connecting the site to the hinterland. Tidal *sabkha*<sup>3</sup> surrounds the site from the east and south, adjoining the lagoon on the east and southeast [see Fig. 3].

Local seascape at Berenike comprises a wide range of geomorphic features, such as coastal shelf and coral reef, the ‘Lagoon’, the ‘Southern Promontory’ (an uplifted reef outcrop joined to the mainland

by a tombolo<sup>4</sup>), and the ‘Southwestern Embayment’ (also known as the ‘Southern Port’) [Fig. 2 bottom].

Since the mid 1990s, pioneering geological work by James A. Harrell from the University of Toledo was carried out at Berenike and in its hinterland. Subsurface coring of natural deposits around the site in the *sabkha* area (see Fig. 4, transects in pink) was supplemented with a survey in the mountains and around the quarries, as well as detailed study of the mineralogical assemblages (Harrell 1996; 1998; 2001; 2007; Harrell and Storemyr 2009). Harrell’s works laid the foundation for this geoarchaeological research.

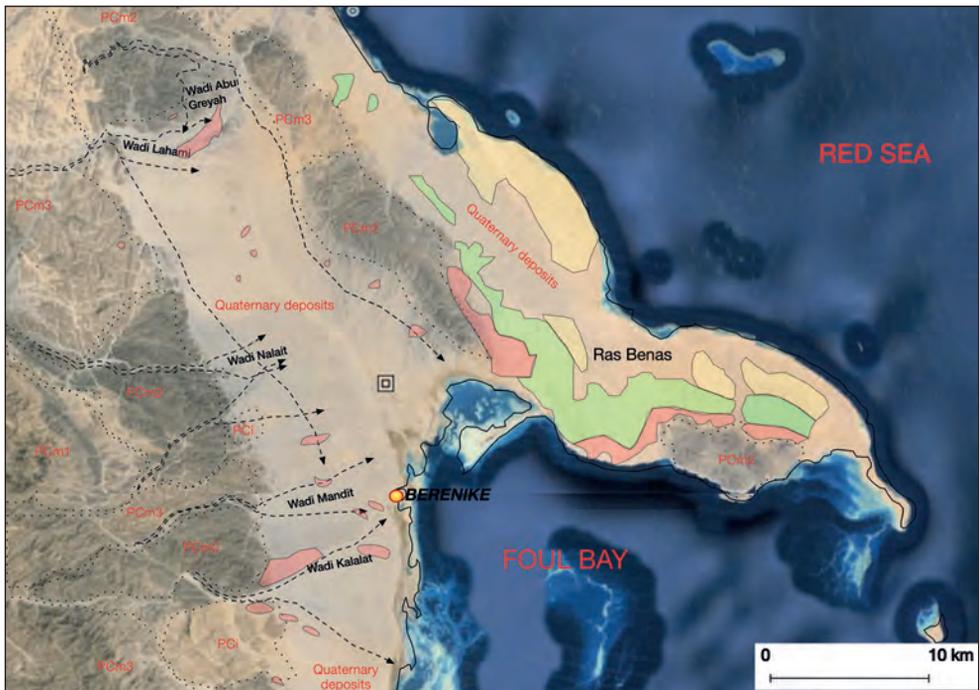
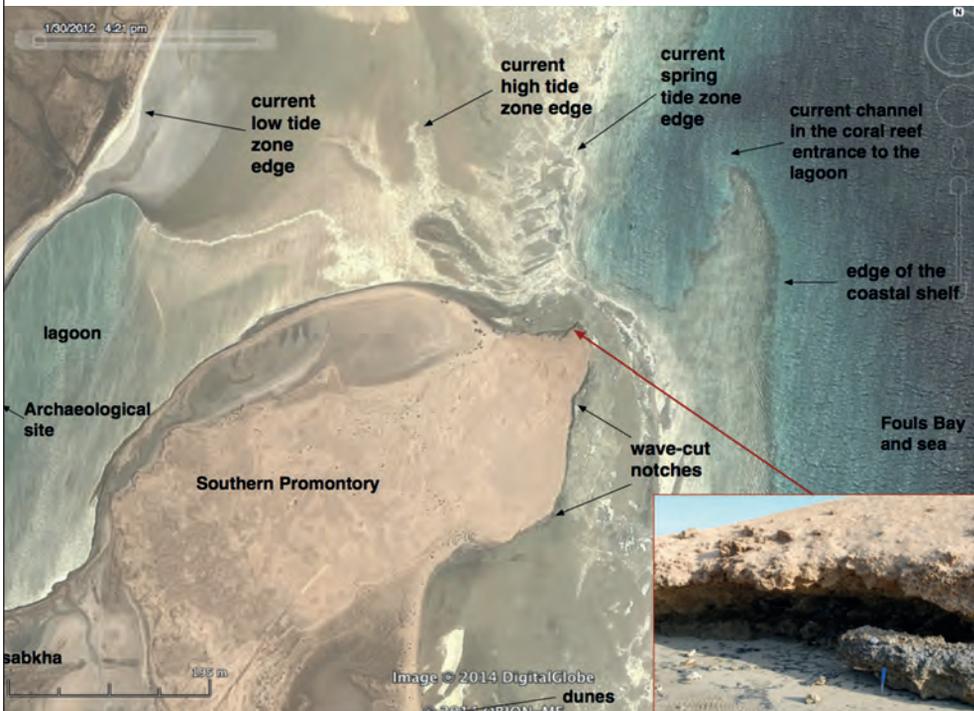


Fig. 1. The regional geological context of the location of Berenike, showing rock formations and wadis (Drawing A.M. Kotarba-Morley 2013, after Harrell 1996)

<sup>3</sup> It is essentially a supratidal salt flat characterised by evaporite-carbonate deposits with some siliciclastics.

<sup>4</sup> A depositional landform in which an island is attached to the mainland by a narrow piece of land such as a spit or a bar.



## AIMS OF THE RESEARCH

Despite Berenike playing such a significant role in maritime trade during the Ptolemaic and Roman periods and the transshipment of African and Eastern goods to the Mediterranean, the Red Sea and the Indian Ocean regions, only very limited focused research was undertaken prior to the fieldwork in 2011 in order to elucidate

the location, size and capacity of its harbour basins, and the processes involved in the inception, evolution and eventual decline of the port town that developed around it. Based on field observations it became clear that changes in the local landscape and regional climate, however minor, must have played a crucial role in the rise and fall

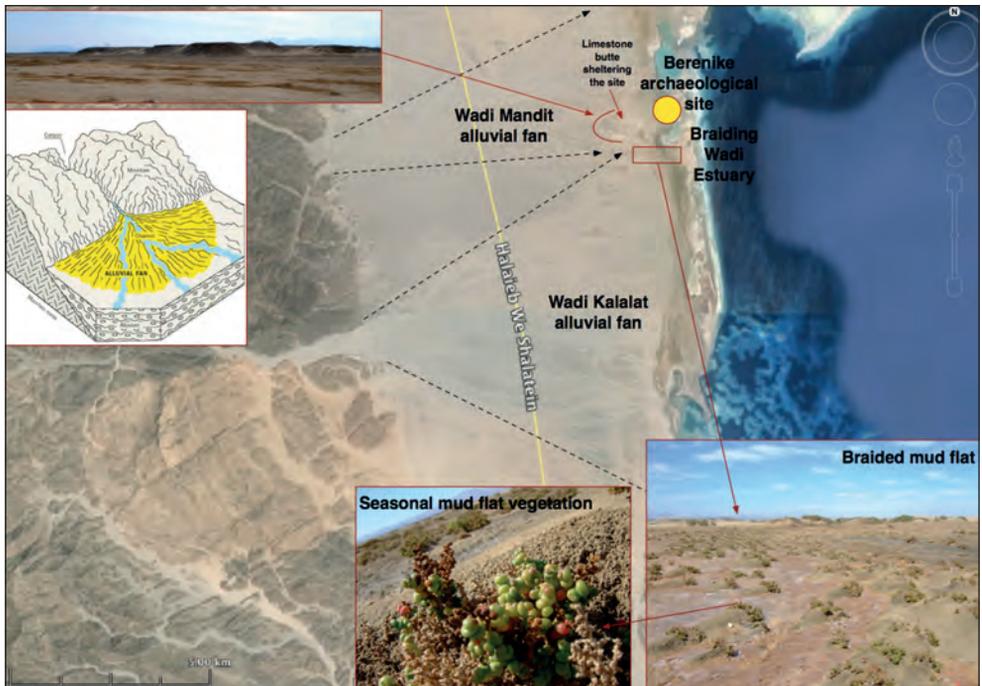


Fig. 3. Satellite image of alluvial fans of Wadi Kalalat and Wadi Mandit that feed into Berenike. Insets: (anti-clockwise from top left) view of limestone buttes from the east; model of a braided alluvial fan; seasonal mud flat vegetation in the estuary of one of the wadi delta channels; braided mud flat just south of the Southwestern Embayment, separated from it by the Crescent-shaped Ridge (Modified from Google Earth; inset photos A.M. Kotarba-Morley 2013)

- ◀ Fig. 2. (opposite page) Satellite image showing location shot of the current entrance to the lagoon and tidal zones; inset, mid-holocene highstand wave-cut notch; top, satellite image of the setting of the port, marking the extent of the Ptolemaic and early Roman harbor lagoons and location of major parts of the town (Modified from Google Earth; processing and inset photo A.M. Kotarba-Morley 2012)

of this port, situated in such a dynamic, marginal environment. This variability would have also dictated the levels of maintenance and adaptation required to keep the port of Berenike operational. Therefore, a systematic geoarchaeological survey on site was deemed necessary.

Palaeoenvironmental and palaeoland-scape data from geomorphological surveys, augering and sedimentological analyses, recovered from the site between 2011 and 2013, served to reconstruct the dynamics of the site in its landscape setting during Ptolemaic and Roman occupation. This research intended to elucidate the landscape and site formation processes that shaped Berenike, providing information about how its inhabitants responded to environmental changes. The final palaeoenvironmental reconstruction used both cultural (historical) and scientific (archaeological, geoarchaeological) data sets to assess the correlation—if any—between environmental change and socio-political events.

Ascertaining how the past coastlines were shaped, and whether this was by horizontal (deposition or erosion) or vertical (uplift or subsidence) movements, or via anthropogenic processes, is extremely important to enhance our understanding of archaeological visibility and the issue of presence or absence of a port in any given location. As the actual existence

and the exact location of an alleged harbour at Berenike was a debatable issue at the start of this research, the research programme developed by the author was focused on establishing the ancient port location. Moreover, it was aimed at developing a better understanding and appreciation of Berenike's landscape setting through the study of subsurface sediment composition and their vertical stratigraphy. This component of the research was designed to situate the site within the dynamics of the local landscape whilst complementing the ongoing archaeological excavations.

Therefore, the augering (coring) was designed with a number of aims in mind:

- i. to locate the southern Ptolemaic and early Roman harbour basin of Berenike, and to establish whether the assumed 'Northern Anchorage' actually existed;
- ii. to establish where the late-period port could have been located;
- iii. to delineate the boundaries and spatial extent of this/these ancient harbour/s;
- iv. to demarcate their shape, size, depth and aspect (including understanding of relative sea level (RSL) change);
- v. to understand the sedimentological history of this area, and use the changes in sediment delivery to the site as a proxy for studying environmental changes in Berenike (Kotarba-Morley 2015a; 2015b).

## METHODS

Altogether ten transects, with 89 augerholes, were cored, sampled and analysed during the 2011 and 2012 seasons. In 2011, a series of six inter-crossing transects, BE11-T01–06, were augered. Augerhole (AH) transects BE11-T05 and BE11-T06

were roughly aligned west-southwest–east-northeast (west–east according to the site grid). Transects BE11-T01, BE11-T02, and BE11-T04 were oriented generally north–south, whilst BE11-T03 followed the northeast–southwest direction [*Fig. 4*].

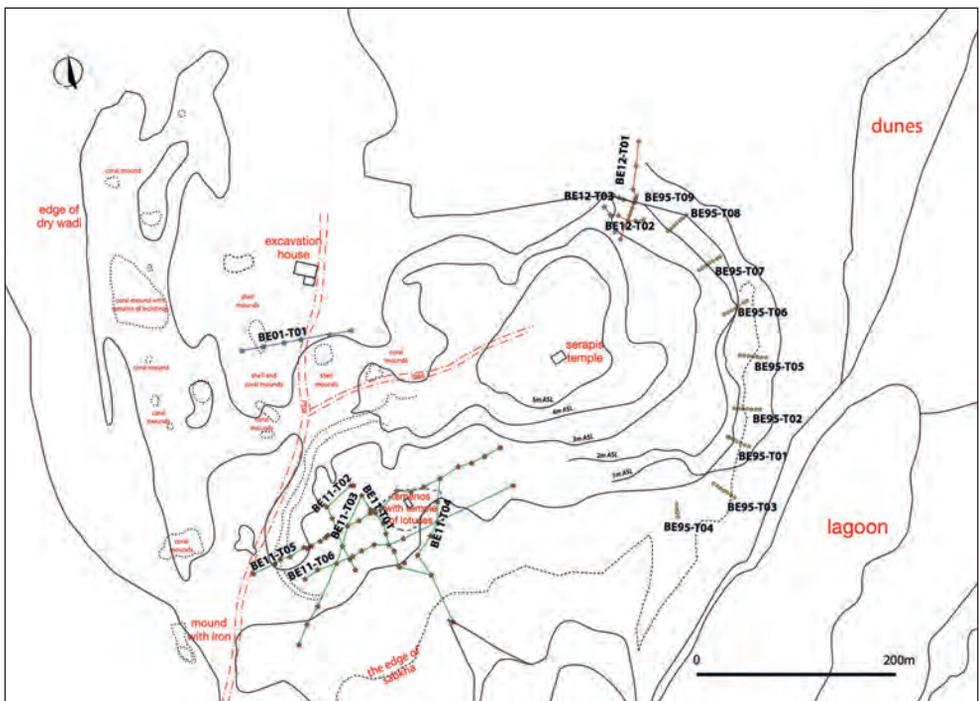
These transects were drilled to:

- i. locate the purported infilled Ptolemaic and early Roman 'harbour basin' (AH36, AH37 and others to the north);
- ii. delineate the braided channels of the alluvial fan of Wadi Kalalat (AH52, AH53) in order to establish the depth of sedimentation caused by fluvial influx over time;
- iii. delineate the crescent-shaped coral reef ridge that was thought to have been the wharf of the 'harbour basin' (AH2-4, 43, 54) and to establish its origin; and also to understand whether it was originally a natural structure adapted for use by harbour facilities or whether it remained a natural feature

of the landscape throughout the use of the port;

- iv. define and delineate the so-called 'island' in the middle of this possible basin (AH20-24 and AH31-34) on which a *temenos* with late 5th-6th century AD temple (also called the Lotus Temple in early reports) is located.

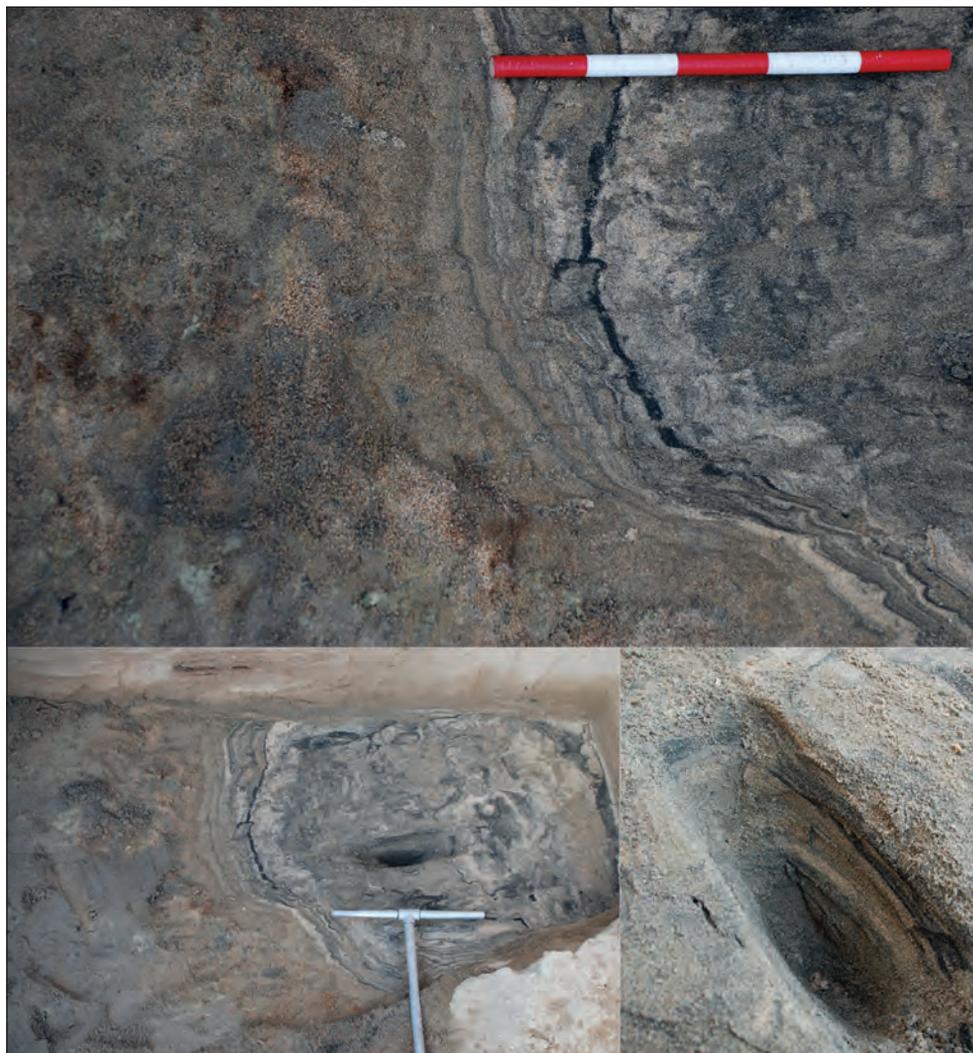
Geoarchaeological sampling of archaeological trench sections was undertaken in trench BE11-71 due to its significance for understanding changes in the palaeo-shoreline (see trench bottom in *Fig. 5*). Each context (cultural and natural) was sampled after cleaning and drawing the profile. About 100 g of sediment was



*Fig. 4. Map of the site showing baseline plan and coring transects from Harrell's 1995 and 2001 surveys and the author's 2011 and 2012 surveys (PCMA-University of Delaware Berenike Project/drawing A.M. Kotarba-Morley 2013)*

sampled and analysed from each context. After sampling from the section, a small test-pit was excavated at the base of the trench through the laminated beach deposits, and this material was sampled at high-resolution (every 2 cm). An auger-

hole was cored at the bottom of this trench to extend the vertical sedimentological profile. Geomorphological, GPR and pedogenic surveys were also conducted on site and those will be published separately.



*Fig. 5. Remains of a laminated tidal beach underlying hearths uncovered in trench BE11-71; top and bottom right, detailed views (PCMA–University of Delaware Berenike Project/photo A.M. Kotarba-Morley 2011)*

Table 1. Groups of facies and their descriptions (continued on pages 72, 74, 76, refer Figs 6 and 7)

Colour code on transect	Group	Name	Description	Includes facies
	I	Modern (natural)	The most recent period of sedimentation at the site and its environs. These processes may be ongoing, relating primarily to windblown sedimentation, but with exposures of colluvial sequences in some areas.	A: modern dune sand (orange brown, oxidised, loose, very poorly-sorted, coarse sand; occurs in BE11: AH1, 2, 4-21, 25, 26, 29, 30, 42, 43, 48, and 51) J: modern inter-tidal sands/inter-straified fine (yellowish, loose, very clean and homogenous, well-sorted, medium to fine sand; occurs in BE11: AH23, 36) U: modern dune/aeolian deposition (light to olive brown, very loose, fine sand with coarser grains inclusions; occurs in BE11: AH29 and 31-33) W: modern colluvium (pale brown, organic, medium to fine silty sands; occurs in AH1) V: sub-recent windblown/dune sand (very pale brown to light yellowish-brown, loose, fine to medium silty sand with some clay; occurs in BE11: AH1) A2: modern windblown (greyish, poorly-sorted, compressed but friable to loose, calcareous, fine silty material with coarse quartz inclusions; occurs in BE12: AH1-10, 12-15, and 18-20)
	II	Archaeological levels	Direct evidence of human exploitation of the landscape and the port city.	E: pottery layer and E1: burnt pottery and hearths; early Prolemaic(?) layer with burnt and water-abraded pottery and hearths (dark to rusy brown, densely packed and slightly compacted, organic silty sand; occurs in BE11: AH5?; 6; 7-14, 16, 17?; 18-20, 39-41, 46-47) AA-AM: archaeological layers (occur in BE11: AH2-6, 42, 43, 49, 50)
	III	Exposed stable ground surface (occasional background archaeological signal)	Facies likely to be broadly equivalent chronologically to archaeological levels. These facies represent periods of stability, with gradually accreting ground surfaces. This group acts as a part of the landscape surrounding Berenike, but not necessarily as part of the archaeological landscape of the city.	D: terrestrial windblown sand mixed with anthropogenic detritus and occasional colluvium (light grey to brownish-grey, extremely friable but moderately compact, homogenous but very-poorly sorted, laminated, medium to coarse sands and fine silty sands; occurs in BE11: AH5?; 16-18, and 20) P: wadi influx but transitional/relic land surface with aeolian and colluvial influence and occasional wadi influx (dark greyish- to olive-brown or light grey, poorly-sorted, fine to coarse silty sand; occurs in BE11: AH4?; 8-14, 41-43, 46, 51-54) R: mixed transitional (dark greyish-brown, loose to friable, medium sand; occurs in BE11: AH38-41, 46, 47, 51) B2: colluvium and sporadic human activity (olive brown, consolidated but friable, poorly-sorted, medium silty sand; occurs in BE12: AH1-7, 10, 12-14, 19, and 20) G2: transitional silty colluvium on margins of high ground (greyish, loose to friable, poorly-sorted, silty material frequent gravel, broken shells and very occasional calcified granules; occurs in BE12: AH7; 19, 20)

Table 1. (continued from page 71)

Colour code on transect	Group	Name	Description	Includes facies
	IV	Fluvial (wadi systems, marginal and proximal)	Interaction with the fluvial systems in close association with the site. Three main wadi systems drain the mountain ranges to the west, and it is likely that there was variable input of these fluvial systems to the basins and low lying areas around Berenike.	T: fluvial into <i>sabkha</i> system/marginal <i>sabkha</i> -wadi interface (pale olive, loose but friable and brittle, highly oxidised, coarse sand; occurs in BE1: AH55) C2: ferruginous transitional (olive brown, compressed but friable, organic and ironised, medium silty sand; occurs in BE12: AH1-3, 6, and 14-17) H2: ferruginous wadi material (reddish-brown, ironised layer of very organic silty sand; occurs in BE12: AH3, 6, 13, and 14) J2: distal wadi sands (grey, dense, fine sand; occurs in BE12: AH16, and 17) M2: inwashed wadi material with ferruginous clay and mica (reddish-brown, iron-rich, ferruginous silty sand with clay lenses and with mica inclusions; occurs in BE12: AH3)
	V	Flood event (pooling)	Unusual facies, a category unto itself. The fine-grained sediments of this facies bear witness to a time when large quantities of standing water were present at various locations on the site. It is not possible to say whether this relates to a period of higher sea level (and ultimate regression), a period of increased precipitation, or is indicative of large flash flood events. The latter is thought most likely.	F: flood event and water pooling (greenish, compacted, pure, homogenous, well-sorted, clay; occurs in BE1: AH17, 18, and 21) Modern analogue middle facies from BE12-T04
	VI	<i>Sabkha</i> (infilled embayment, gypsiferous)	Associated with <i>sabkha</i> formation. Infilling of the low-lying areas around the site, and subsequent surface gypsum formation (via tidal or capillary action) provide large, levelled areas of potentially periodically inundated salt and gypsum flats.	B: relict <i>sabkha</i> surface (light grey to light brownish-grey, loose, poorly sorted, fine to medium silty sand with salt; occurs in BE1: AH4, 11, 14, 16-18, 42-45, 51, and 53-54) N: evaporitic/calcareous gypsiferous surface (white, moderately compressed and friable, very well-sorted, clean and homogenous, chalky calcareous layer of silt with clay; occurs in BE1: AH33, 34, 38-41, 46, and 48) O: calcareous fine aeolian sand possibly with marine influences (light grey, loose and calcareous, clean and homogenous, fine sand with some silt and high content of heavier minerals (black manganese grains); occurs in BE1: AH9, 10, 12-15, 19, 20, 25-30, 41, 46, and 48)

(continued on page 74)

Fig. 6. Transects BE11 with radiocarbon dates location. The distance between each auger-hole or section is presented on the horizontal axis (and above its interpretative allocation to a particular functional zone of the site), and on the vertical axis represents the depth of the interventions. The 0 – meeting point of X- and Y-axis has been established as the current MSL. Note that the vertical scale on each transect is exaggerated to allow a more legible representation of stratigraphic logs in each augerhole and to pick up topographic changes in transects. For groups of facies, see Table 1 (Design, drawing and digitizing A.M. Kotarba-Morley)

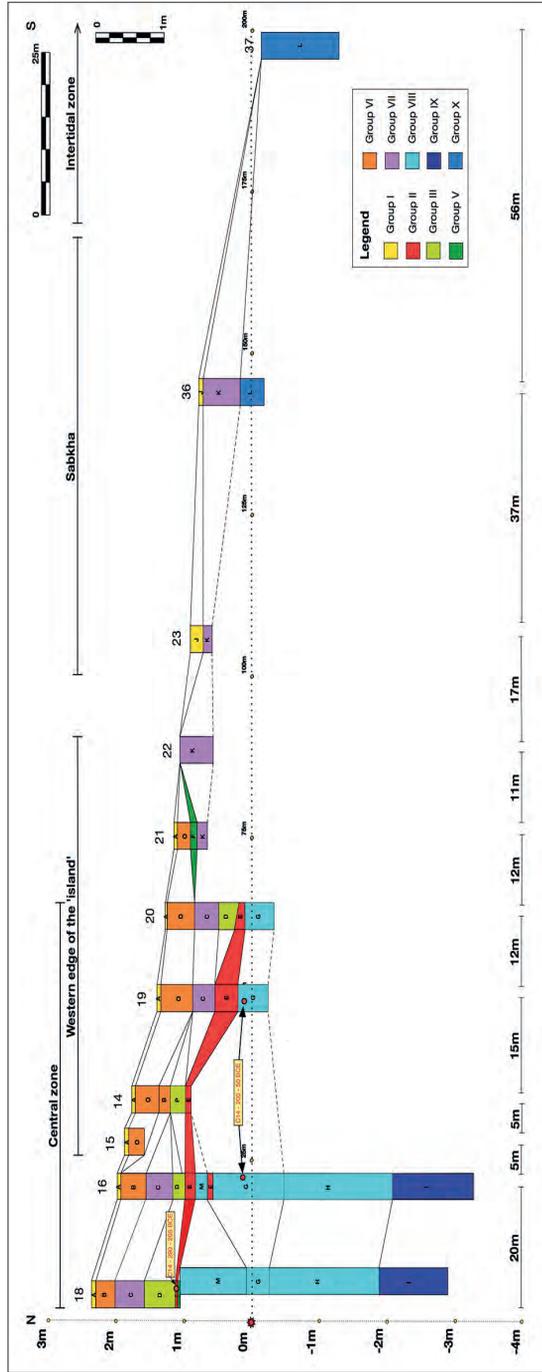


Fig. 6.A. Transect BE11-T01 (for location, see Fig. 4)

Table 1. (continued from page 72)

Colour code on transect	Group	Name	Description	Included facies
	VII	Beach facies (not inundated)	Sediment facies that lie above the high water mark and are indicative of beach sediments. As such they are largely stable and potentially useful for human exploitation in the form of careening/beaching/landing areas. These areas are prone to marine influence and could sporadically flood during exceptionally high tides or storm surges.	C: beach sands at margins of the <i>sabkha</i> (brown, loose to friable, poorly sorted, medium silty sands with marine inclusions; occurs in BE11: AH4; 16–20, and 44–45) K: beach sands (dark grey to yellowish, clean and homogenous, well-sorted, medium sand; occurs in BE11: AH21–23, 33, 34, and 36) S: relic ground surface with notable marine activity (light olive to light yellowish-brown, loose, poorly-sorted, medium to coarse sand with shells; occurs in BE11: AH12, and 47) I2: modern beach sand (pure white, compressed but loose, clean and homogenous, very organic medium sand; occurs in BE12: AH16)
	VIII	Inter-tidal (tidally inundated, stratified)	The facies of this group were inundated on a regular (probably daily) basis and therefore display a much stronger marine influence. Waxing and waning of the tides often produces finely stratified sediments, such as recorded in facies of this group, which are caused by the winnowing of lighter material due to wave action.	G: inter-tidal, intermittent inundation (dark olive brown/very dark grey to black, loose/friable to waterlogged, fine to medium silty sand; occurs in BE11: AH7–13, 16–20, 39–41, 46, 47, and 53) H: inter-tidal environment with proximal backwater influences (dark grey to very dark grey, waterlogged, medium to fine silty sands often fining upwards; occurs in BE11: AH9–11, 13, 16, 18, 39, 40, and 46) M: laminated dark and light beach sands/deposits (dark blackish and light yellowish, interstratified and laminated layers, well-sorted, fine to medium sand; occurs in BE11: AH10, 11, and 16–18) D2: shallow marine/inter-tidal <i>sabkha</i> modern analogue top facies from BE12:T04 (dark greyish to brownish, dense, fine to medium silty sand; occurs in BE12: AH1, 2, 6–7, 12–17, and 20)
	IX	Lagoonal/backwater (low-energy)	Low-energy, shallow to moderate depth deposition in a backwater or lagoonal environment. Lagoons such as these are present near the site today, close to the present day coastline.	G: inter-tidal, intermittent inundation (dark olive brown/very dark grey to black, loose/friable to waterlogged, fine to medium silty sand; occurs in BE11: AH7–13, 16–20, 39–41, 46, 47, and 53) H: inter-tidal environment with proximal backwater influences (dark grey to very dark grey, waterlogged, medium to fine silty sands often fining upwards; occurs in BE11: AH9–11, 13, 16, 18, 39, 40, and 46) M: laminated dark and light beach sands/deposits (dark blackish and light yellowish, interstratified and laminated layers, well-sorted, fine to medium sand; occurs in BE11: AH10, 11, and 16–18) D2: shallow marine/inter-tidal <i>sabkha</i> modern analogue top facies from BE12:T04 (dark greyish to brownish, dense, fine to medium silty sand; occurs in BE12: AH1, 2, 6–7, 12–17, and 20)

(continued on page 76)

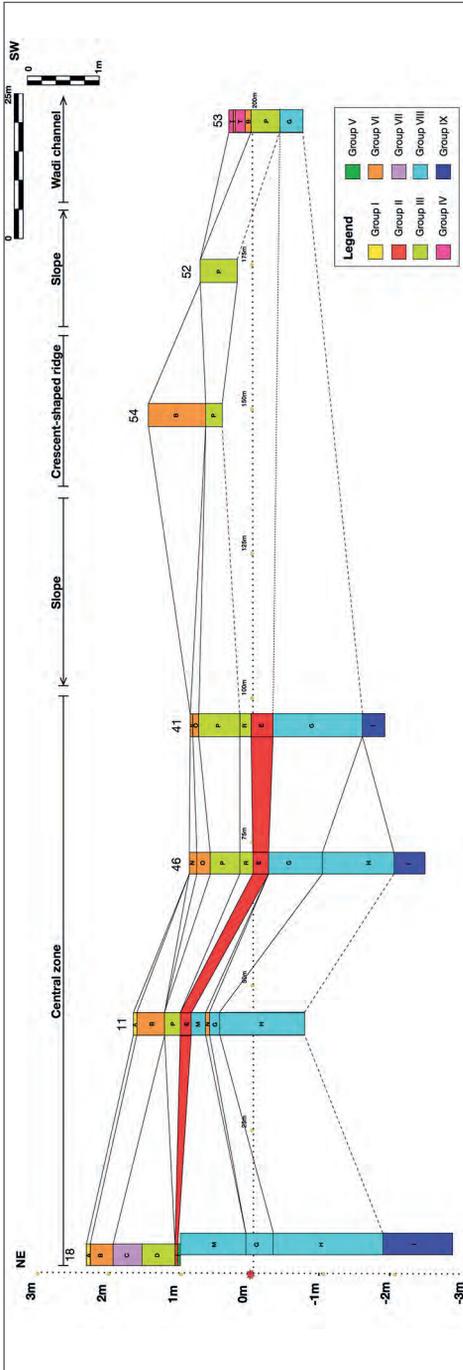


Fig. 6B. Transect BE11-T03 (for location, see Fig. 4)

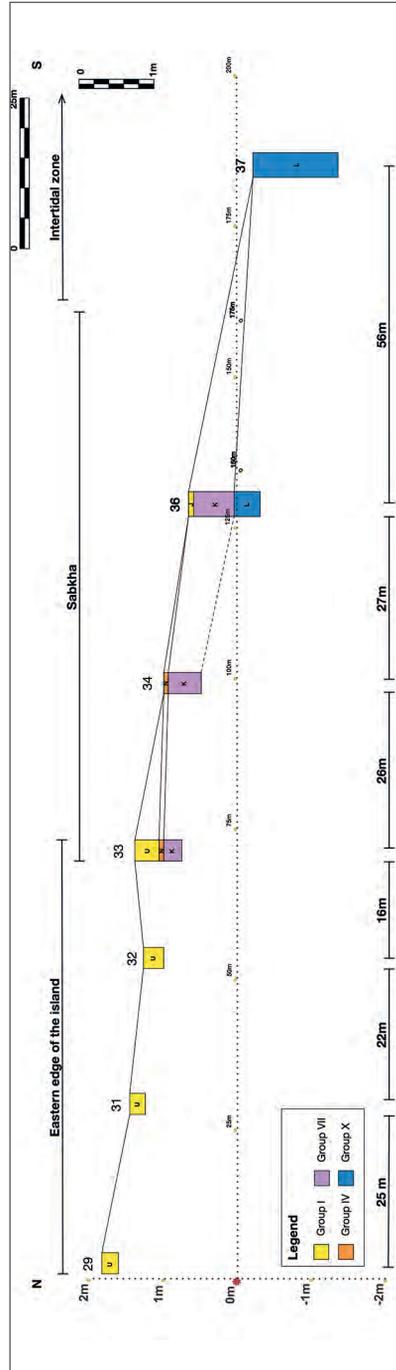


Fig. 6C. Transect BE11-T04 (for location, see Fig. 4)

Table 1. (continued from page 74)

Colour code on transect	Group Name	Description	Includes facies
X	Near shore marine (shallow)	Sedimentation in a marine environment, close to the shore, and just outside the influence of the inter-tidal zone. The depth of the water and the lack of wave action (compared to the inter-tidal zone) mean that there is a lack of free oxygen and a closer link to the marine biological ecosystem.	L: marine sand/moderate to deep water (dark greyish-brown, waterlogged, medium sands; occurs in BE11: AH36 and 37) E2: moderate depth/marine anaerobic (dark greyish-brown, waterlogged, very fine to fine sandy silt; occurs in BE12: AH1-3, 6, 7, 12-15, and 19-20) K2: anaerobic with large shells (greyish-green to blackish green, sandy silt with clay; occurs in BE12: AH16 and 17)
XI	Offshore marine (moderate)	Sediments very similar to the near-shore group, but laid down at an even greater depth of water, slightly further offshore.	F2: deeper marine/anaerobic (black, waterlogged, fine sandy silt; occurs in BE12: AH1-3, 7, 12, 13, 15, and 19-20)

(continued from page 72)

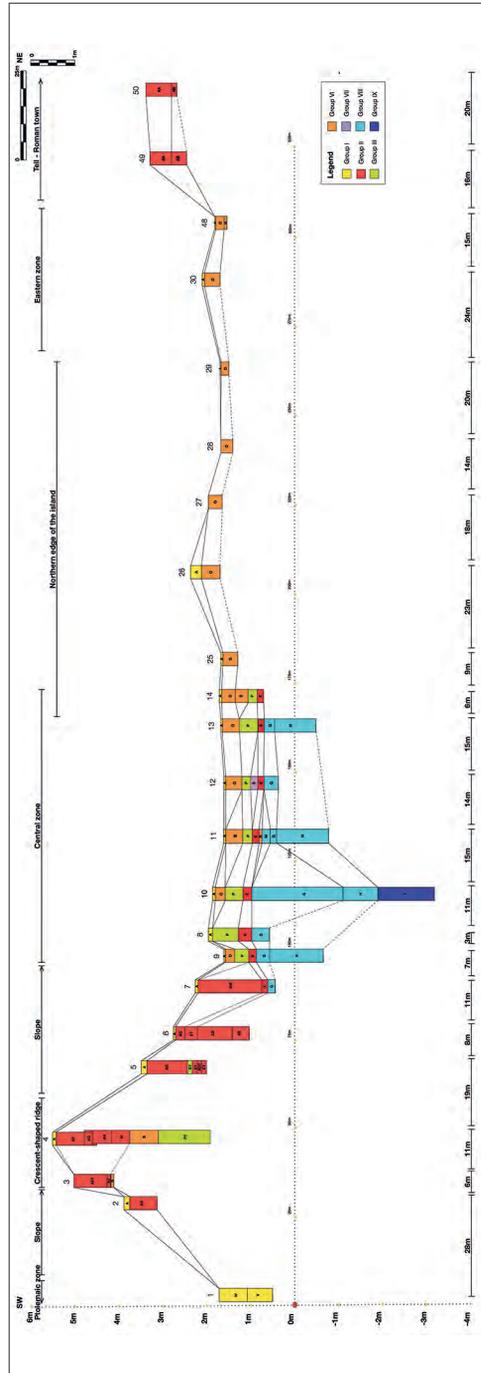


Fig. 6D. Transect BE11-T05 (for location, see Fig. 4)

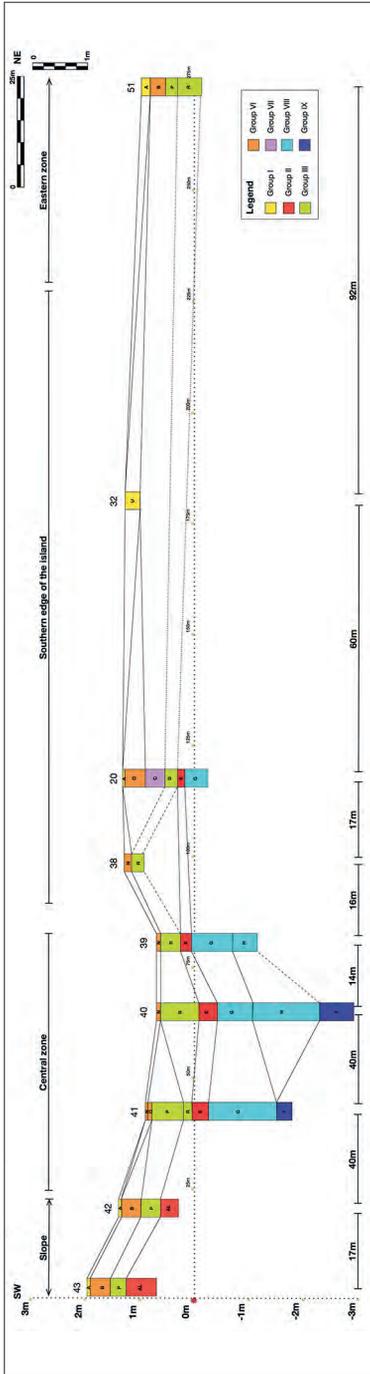


Fig. 6E. Transect BE11-T06 (for location, see Fig. 4)

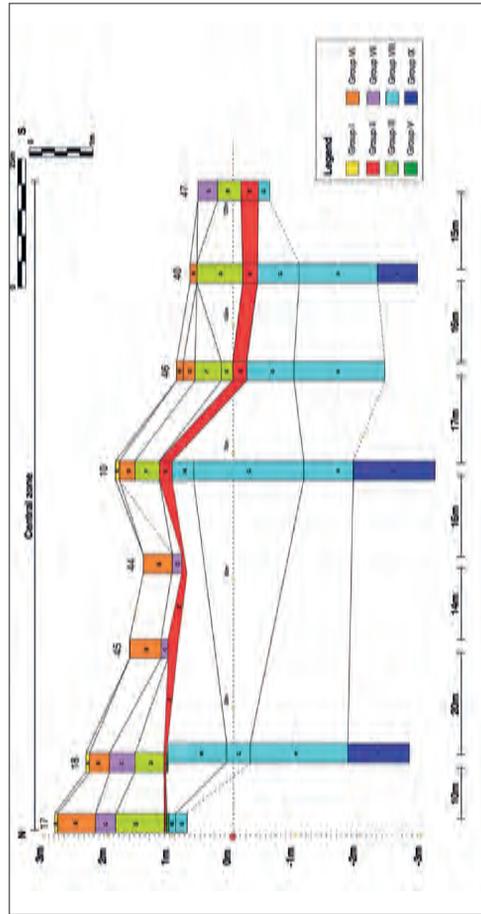


Fig. 6F. Transect BE11-T02 (for location, see Fig. 4)

Fig. 7. Transects BE12 with radiocarbon dates location. The distance between each augerhole or section is presented on the horizontal axis (and above its interpretative allocation to a particular functional zone of the site), and on the vertical axis represents the depth of the interventions. The 0 – meeting point of X- and Y-axis has been established as the current MSL. Note that the vertical scale on each transect is exaggerated to allow a more legible representation of stratigraphic logs in each augerhole and to pick up topographic changes in transects. For groups of facies, see Table I (Design, drawing and digitizing A.M. Kotarba-Morley)

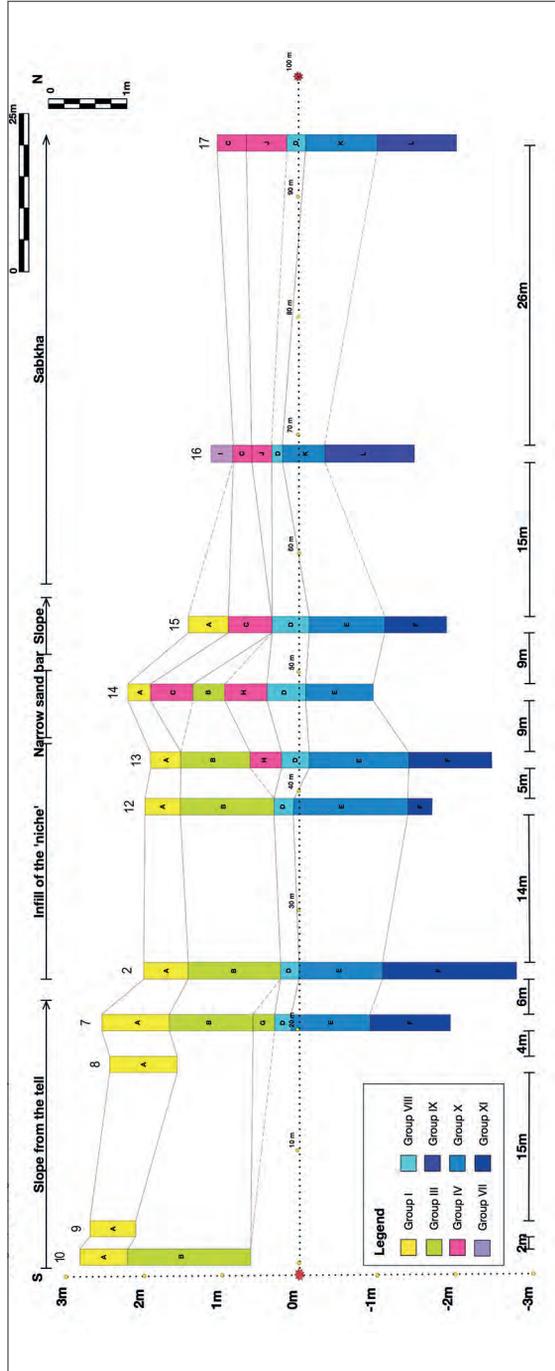


Fig. 7A. Transect BE12-T01 (for location, see Fig. 4)

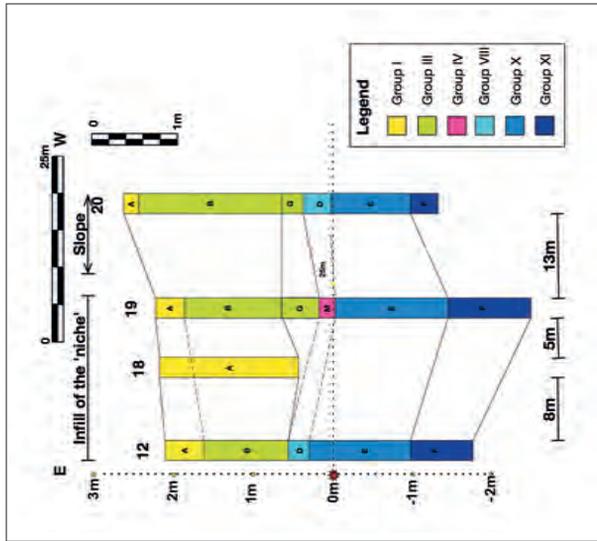


Fig. 7C. Transect BE12-T03 (for location, see Fig. 4)

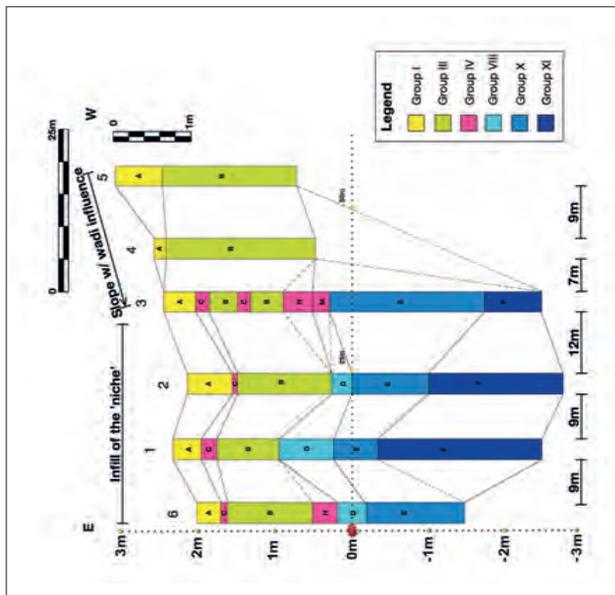


Fig. 7B. Transect BE12-T02 (for location, see Fig. 4)

## RESULTS

Results of augerhole surveys in Berenike revealed highly distinctive and environmentally diagnostic sedimentary sequences beneath the present site and its immediate environs. They also allowed observation of the changes in sedimentology that reflect marked fluctuations in landscape dynamics at the site through time.

For a better understanding of the subsurface stratigraphy across the site, and for the convenience of the reader, descriptions of the sedimentological units (Facies) recorded across all transects are grouped in tabular form and represented visually (for a detailed description and analysis, see Kotarba-Morley 2017) [*Table 1; Figs 6–7*].

### LANDSCAPE RECONSTRUCTION

Results of geoarchaeological analyses demonstrated that Berenike has a very well-preserved subsurface stratigraphy that could be used to reconstruct changing coastal environment. This stratigraphic record has been investigated not only with respect to the existing archaeological evidence, but also in relation to the present-day above-ground geomorphology [*Fig. 7B*]. Coastal geomorphological surveys around the site and its hinterland linked contemporary landscape features with the reconstructed ancient landscape, allowing for a far greater appreciation of the ‘Parameters of Attractiveness’ (Kotarba-Morley forthcoming), a theoretical framework designed by the author to statistically quantify and qualify the most important factors that ancient prospectors, settlers, and traders would have considered when founding a new port.

Using the sedimentological, geochemical and geochronological data derived from the analysis of core sediment samples, and the relative age determination of diagnostic ceramic fragments in conjunction with absolute AMS radiocarbon dates, a chronology for landscape change has been developed and is presented below.

#### Early landscape (Prehistoric and Pharaonic)

Geomorphological and sedimentological features recorded around the site indicate that the entire site of Berenike was inundated in the Pleistocene. A small and undiagnostic stone tool assemblage was found on top of the limestone buttes/terraces to the southwest of the site (see *Fig. 1* top left) during a survey conducted by the author and Piotr Osypiński, a Palaeolithic specialist. It confirms the ephemeral presence of prehistoric human groups in this landscape already in the Middle Pleistocene, when this area of the coast would have looked strikingly different.

Wave-cut notches recorded at the base of these limestone outcrops, at an elevation of ~12 m above the ground surface [see *Fig. 3* inset], indicate higher sea levels during, possibly, the Marine Isotope Stage (MIS) 11.<sup>5</sup> This is supported by the subsurface stratigraphy recorded in geoarchaeological transects indicating the base of the lagoon at a much higher elevation towards the ‘Crescent-shaped Ridge’. Following a lowering of the sea level in the terminal Pleistocene during the Last Glacial Maximum (LGM),<sup>6</sup> and what seems to be significant changes in the coastline at the

<sup>5</sup> MIS 11 that occurred 424–374 kya was the longest and warmest interglacial interval of the last 500 ky. It corresponds with the geological Hoxnian Stage.

<sup>6</sup> LGM occurred between 26.5 kya and 19–20 kya.

mid-Holocene highstand,<sup>7</sup> the land around Berenike became viable for human exploitation as a port site, opening up possibilities for a proto-Berenike to emerge and for human occupation of the site to begin.

#### **‘Proto-Berenike’/Ptolemaic settlement**

The early Ptolemaic town may have been preceded by a small fishing village or a coastal settlement (maybe seasonal), although no traces of such dwelling have been identified to date. Therefore, the Ptolemaic settlers and elephant-carriers of the 3rd century BC were probably the first to use the area of what is currently the archaeological site of Berenike. Most likely this used to be a relatively small-scale venture prior to becoming a formalised part of the maritime trade infrastructure, gaining a fort, city walls and a gate.<sup>8</sup> At this time the foreshore area would have been used for seafaring activities such as loading and unloading of boats, vessel repairs and maintenance, and temporary storage of goods. The prograding backbeach environment and the shore, from the ‘Central Zone’ of the ‘Southwestern Embayment’ (‘inner’ + ‘outer’ harbour)—in most times the city harbour—towards the narrow sandbank in the ‘Northern Anchorage’, would have been particularly responsive to the relative sea level lowering thereby conducive to such port activities (see *Fig. 3 top*).

Based on current knowledge regarding the site and its buried stratigraphy, it can now be suggested, with reasonable confidence, that the pottery layer (Facies E and E1, see *Table 1*) correlates with the bed of the Ptolemaic harbour basin and indicates a lowering of the sea level by ~0.85 m since

that time to the present. Charred pottery from Facies E1, dated to the early Ptolemaic period, formed a component of hearth structures from the time when the beach-front (observed in trench BE11-71, see *Fig. 5*) was utilised for maritime activities. However, pottery recovered from Facies E in augerholes further east is heavily water-abraded and the layer angles downwards at a gradient and in a pattern similar to that of the intertidal zone of the contemporary lagoon (see transects: BE11-T01, *Fig. 6A*; BE11-T02, *Fig. 6D*; BE11-T03, *Fig. 6B*).

#### **Roman Berenike (early)**

Following the Ptolemaic period, the harbour basin and lagoon areas began to infill with silt and other fine sediments. The exact mechanism of this process is currently unclear, but natural factors such as coastal progradation and wadi discharge would have certainly contributed, possibly also with an influx of windblown fine sands. Human modification of the landscape, with practices such as overgrazing of livestock (especially caprine, available in abundance in the archaeozoological record) causing landscape destabilisation and a marked increase in sediment availability, would have exacerbated the situation.

The siltation could well have been initiated during the main occupation phase at Berenike, with pulses of wadi sediment discharged during heavy rains and flash flood events (potentially linked with an increase in local precipitation or increased seasonal floods, for example). An instance of increase in sediment flux to the coast most likely occurred between the late Ptolemaic/early Roman and the late period

<sup>7</sup> 0.5–2 m difference noted at around 5 kya (Hein et al. 2011).

<sup>8</sup> The Ptolemaic city walls and gate were uncovered during the 2013 and 2014 field seasons (M. Woźniak, personal communication; Sidebotham and Zych forthcoming).

(late 4th–early 6th century AD), as seen through the approximate limits of coastal progradation marked by the ‘Harbor temenos’.

Sedimentology indicates that prior to this phase of siltation, in the Ptolemaic and, probably, in much of the Early Roman periods, the harbour extended right through the ‘Central Zone’ of the Southwestern Embayment to the ‘Lagoon’. It is at this time, when the ‘Lagoon’ achieved its greatest extent, that it was exploited for international maritime trade. Intensive commercial activity would have most likely necessitated regular dredging that, however, could have been performed only episodically.

Evidence of dredging is often detectable only in very subtle stratigraphic changes (e.g., Morhange and Marriner 2010), and as such was not directly identified during the augering of the Berenike’s Southwestern Embayment. This could be due to the limitations of the equipment and/or the lack of a robust geochronological framework with which to identify gaps and inverse relations in the stratigraphic record associated with dredging events, or the relocation of the harbour further into the ‘Lagoon’, where augerhole coring was impossible. Alternatively, it might be related to the lateral shift of the functional area of the port, such as moving from the ‘Central Zone’ favoured by the Ptolemies, further into the Southwestern Embayment and the ‘Lagoon’ during Roman use, when the ‘Central Zone’ may have already partly silted up.

### **Roman Berenike**

(late 4th–6th century AD)

During the late period Berenike witnessed a slow decline. The extent of Roman con-

trol over this area of Egypt from the late 3rd century AD is unclear, but a reduced trade with the East and the overall decline of maritime trade in the Mediterranean—part of a general economic pattern (Wilson 2015)—had a severe impact on the port. A detectable gradual deterioration of living conditions in the city (e.g., architecture, richness of the diet) seems to be mirrored in the decline of the functionality of the port. This may have been influenced not only by geopolitical factors, but also by subtle changes in the geomorphology of the catchment area leading to enhanced siltation to the coast and harbour basin. Processes such as increased wadi sediment discharge and gradual lowering of the sea level would have hindered port operations and required ever-increasing costly and time-consuming maintenance, making, most likely, the areas such as the ‘Central Zone’ and ‘Northern Anchorage’ non-operational at this time.

Increasing sediment flux and subsequent silting up of the basin, caused by a combination of natural and anthropogenic factors, would have necessitated either extensive dredging at the entrance to the harbour/lagoon, or partial reconfiguration of functional areas of the port and associated infrastructure. If such were not performed, the port could soon become unusable. Additionally, even though events such as an epidemic (e.g., the Justinianic Plague of plausible Indian or Ethiopian origin; Sarris 2002: 171–172 was deemed to have prompted the final decline of the city) are undetectable in the geoarchaeological record (although, in the archaeological record, some pathological evidence for such causes of death can be identified in the human skeletal record and a large number of contemporaneous burials could

be seen in the cemeteries) they could have had an impact on the decline of the city. Minor climatic changes, contributing to the site's diminishing role in trade and eventual decline, could have also occurred at this time, although none can be unequivocally confirmed nor dated at this stage.

#### Arabic times and the East India trade

Because of a lack of historical or archaeological evidence for the continued use of Berenike during the Islamic period, when most of its trade had been moved to the port of Myos Hormos (Quseir al-Qadim, some 260 km to the north), it is important to ask why the site, after its initial decline in the 6th century AD, was not revitalised by the Arabic caliphates and, later on, by the Portuguese traders. It seems likely that extensive modification or even refurbishment of the already abandoned port of Berenike, with a partly or wholly silted up lagoon at this time, may have surpassed efforts and expenses connected with transferring its operations to another port in the region such as Quseir. This was of much greater significance at the time as it lay directly on the *hajj* (pilgrimage route) to Mecca.

The East India trade since the 16th century AD onwards, passing through this area, is known not only from the historical records but also from the engravings in the Eastern Desert (such as those of ships; Blue, Whitewright, and Thomas 2011). However, the geoarchaeological evidence from Berenike shows that the Southwestern Embayment would have been, by that time, almost totally silted up and therefore probably unsuitable for Portuguese or English ships of the 16th century AD and later.

#### Modern

Although the present-day coastal landscape of Berenike is not viable as a shipping port, a major naval and air force base—Baranis—is located some 10 km north of the site. It is equipped with a naval harbour proving that this area of the coast still possesses the 'Parameters of Attractiveness' (Kotarba-Morley forthcoming) for modern maritime activity. It is currently unknown why the original Ptolemaic and early Roman port was not situated in this location and whether the activities would have moved there in the late period and/or early Islamic period (and if not, why) as this military area is inaccessible to research.

#### INTERPRETATION

Berenike was founded in a harsh, marginal environment where relatively minor environmental changes (e.g., fluctuations in sea level, changes in coastal geomorphology, increase in seasonal floods) might have had a dramatic effect on the short- and long-term viability of the site. The results of this research show that:

- i. There has been a drop in relative sea level of ~0.85 m since the Ptolemaic period.
- ii. The role of the 'Southern Promontory' was both as an ancient viewpoint (with a potential beacon to guide vessels), and as a barrier against the waves and sheltering of the bay. It also acted as a trap for alluvial sediments resulting in the silting-up of the lagoon, most likely contributing to the decline of the harbour.
- iii. The extent of the harbour in Ptolemaic times was outlined and limited to the 'Central Zone' of the Southwestern

- Embayment, with at least one of the harbour floor levels identified.
- iv. Previous interpretations regarding the role of the Crescent-shaped Ridge as a harbour wharf with piers are suspect. Location of the 'Ship Maintenance Area' and interpretation of the function of a wooden bollard as a mooring device have also been reevaluated.
  - v. New data have been generated providing clues as to the location of the 'Temenos of Temples' and the 'Northern Anchorage' (the 'Niche').
  - vi. Attractiveness of the location of the Ptolemaic fort and the 'Ptolemaic Industrial Zone' have been reinterpreted in light of the potential environmental marginality of the location.

The coastal location of Berenike benefits from at least two basins (the 'Lagoon' and the Southwestern Embayment, including purported inner and outer harbours), both of which are highly conducive to accommodating significant mooring areas with little need for human modification of the existing natural landscape.

However, given that these basins are also very efficient sediment traps, with the potential to infill with coastal, fluvial and windblown sediments, high levels of maintenance must have been necessary to prevent them from silting up and becoming unnavigable.

Whilst the current coastal situation of the site does not seem propitious for hosting a large volume of maritime traffic, the design and construction techniques of ancient merchantmen, navigational and mooring techniques available at the time (e.g., using oars or tug boats for entering and exiting ports, unloading on the roadstead with lighters and entering the port without the cargo), location of the Red Sea at the crossroads of the Indian Ocean and Mediterranean commerce, as well as the configuration of natural features of the coastal landscape, all meant that Berenike must have possessed a sheltered harbour with water depth sufficient to accommodate high volumes of incoming and outgoing merchant vessels.

## DISCUSSION 1: SCENARIOS TO RECONSTRUCT THE PORT CITY OF BERENIKE

In order to articulate different site narratives, specifically to better understand the form, function and configuration of Berenike's harbour basins, alternative scenarios for potential reconstructions of the port city of Berenike are presented below. These scenarios are based on results of the geoarchaeological and archaeological interpretations and they emphasise different aspects of interpretation of the ancient lagoon and embayment topography [see *Fig. 3* top]. Furthermore, they allow for examining how the port might

have functioned given small changes to the environment (possibly in different periods of utilisation).

The scenarios below show that Berenike was most likely a natural haven that might have been altered over time (maybe even extensively, although this proves difficult to determine with the limited dataset available to date) to accommodate the changing volume of traffic, types of boats and the needs of the local population. Some modifications might also have been necessitated by the dynamic landscape

changes such as siltation, and local changes in the sea level.

### SCENARIO 1

**Most traffic located in the inner harbour (including smaller and large vessels); overflow in the outer harbour; potential seasonal use of the roadstead**

Scenario 1 assumes that the sea level reconstruction recorded in trench BE11-71 at  $\pm 0.85$  m means that the inner harbour was deep enough to accommodate (at least in the Ptolemaic period and the beginning of Roman occupation) large sea-going ships with a draught of up to 3 m.<sup>9</sup> This 'inner harbour' was located within the 'Central Zone' of the Southwestern Embayment, attaining a depth of around 0.85–1.4 m at the margins, and at least 3 m in its deepest part (according to the topographic reconstruction), with smaller vessels beached or moored in shallower parts of the basin.

Whilst most of the traffic is accommodated in the 'inner harbour', the overflow is directed to the 'outer harbour' or 'Lagoon'. The 'outer harbour' would have either been a single basin comprising only the southwestern part of the 'Lagoon', or, dependent upon the size of the first basin and the amount of traffic, would have comprised two outer harbours. In the second case, the northeastern sector of the 'Lagoon' would also have been adapted to accommodate vessels and would be treated as another 'overflow basin'.

Assuming all marine traffic to have been accommodated within the inner and outer harbours (west of the Southern Promontory), maximum vessel draught would be limited by the depth of the

channel leading to the 'Lagoon' through the coral reef. Additionally, the roadstead to the east of the Promontory and the entrance to the 'Lagoon' would only need to be used seasonally, if at all. The 'Northern Anchorage' would not need to be utilised in this scenario.

### SCENARIO 2

**All traffic accommodated between the inner and the outer harbours; roadstead used episodically**

Contrary to Scenario 1, in which vessels of all sizes would be accommodated in the inner harbour, Scenario 2 assumes that the inner harbour catered to the smaller coastal and ancillary vessels. Along with the outer harbour including the 'Lagoon', accommodating larger, ocean-going ships, they catered to all marine traffic. The roadstead on the northeastern side of the 'Southern Promontory' could be either episodically or permanently used for mooring long-distance merchantmen and navy vessels passing through Berenike on their way south or north. The 'Northern Anchorage' would not have been utilised in this scenario.

Furthermore, this scenario assumes that the remaining large vessels would have been moored even further east or north in Foul Bay (and loaded/unloaded via lighters), i.e., in the roadstead located in the bay, some 1.5 km north of the ancient city. Despite the sheltered, back-reef setting, the coast of Foul Bay is persistently exposed to the action of waves and storm surges posing potential risks to vessels. Therefore, the more exposed roadstead northwest of the 'Southern Promontory' might have only been used in favourable weather conditions

<sup>9</sup> Similar to that of the Madrague de Giens merchantman shipwreck (Pomey and Tchernia 1978), as well as military vessels that we know were stationed at the port.

whilst the northern extension would have been more propitious.

### SCENARIO 3

#### **All traffic accommodated in the inner and outer harbours; potential usage of the roadstead and/or Northern Anchorage**

In Scenario 3, both the ‘inner’ and ‘outer’ harbours, to their maximum possible extent, were used jointly to accommodate marine traffic, forming a single basin. The ‘Northern Anchorage’ was also connected with the single basin and used to house important and/or prestigious, smaller vessels such as those used by governmental officials or those belonging to visiting dignitaries or rich merchants from the south. The roadstead may have also been used to accommodate overflow of the traffic, but it is unlikely to have been essential.

In this scenario, taking into account the high sedimentation rates in the northern

area of the site (at least 1 m recorded in the northern part of the site), and the subsequent lowering of the relative sea level by some 0.85 m, it is possible that the depth would have been sufficient, even at a low tide, for small to medium vessels to access this part of the shoreline and take advantage of its sheltered location.

### SCENARIO 4

#### **Most traffic located within the outer harbour; probable second outer harbour**

Scenario 4 assumes that most of the maritime traffic, including small and large vessels, is accommodated only within the outer harbour (‘Lagoon’), and in the absence of any visible remains of direct port infrastructure (waterfront, jetties, etc.), that beaching on the eastern slope of the city mound would have been the most likely way of housing ancillary vessels. The roadstead would have been used only sporadically.

## DISCUSSION 2: ESTIMATING THE CAPACITY OF BERENIKE’S HARBOUR

Whilst the calculations of the capacity of ancient ports put forward by de Graauw (2014) and Boetto (2010) are useful for estimating the volume of traffic in the Mediterranean harbours (both man-made and natural), they are based on the assumption that vessels were moored stern or side on to the quay. However, as we have seen from the reconstructed topography of the ‘Lagoon’ and the lack of any port infrastructure in the archaeological record to date, the style of mooring at Berenike is likely to have been very different. Based on a new reconstruction of site conditions, types of vessels that could have moored in this port (Kotarba-Morley 2017), and

personal experience of navigating into and out of small- and medium-size harbours under sail, some new estimates have been calculated as part of this research.

Calculating ‘comfortable’ capacity of the ‘Southern Port’ of Berenike (including both the ‘inner’ and the ‘outer’ harbours) is based on a series of assumptions expanded below, and some modern analogue mooring experiments undertaken by the author in small- and medium-size harbours (chiefly Shellharbour and Wollongong, NSW, Australia) during different phases of the tidal cycle. It assumes that:

- i. Most larger merchant ships moored at Berenike were an average 25 m by

- 7 m in size (with a 250–350 tonnes deadweight tonnage; but vessels of up to 625-tonne, such as *Hermapollon*, are recorded as well, Kotarba-Morley 2015b; 2017).
- ii. The ships under investigation would have had an average draught of 3.5 m, but no less than 2 m (Kotarba-Morley 2015b; 2017), meaning that, accounting for the average tidal range of approximately 0.50 m on the Red Sea (but note: spring tides<sup>10</sup>), it would not be possible to moor them comfortably anywhere shallower than +1–1.50 m of their draught at high tide.
  - iii. A large number of ancillary and fishing vessels of various sizes and draughts could be moored at the edges of the embayment and the lagoon, in their own area of the harbour, or simply beached (these vessels are not taken into consideration in the estimate as they were most probably indirectly linked with the Indian Ocean trade, i.e., did not contribute to its overall quantity).
  - iv. Based on the results of geoarchaeological analyses, a ballpark figure was calculated for the capacity of different functional areas of the site. The ‘Southern Port’ (including ‘inner’ and ‘outer’ harbours from the scenarios mentioned above) was likely to be approximately 17.3 hectares, and the alleged ‘Northern Anchorage’ approximately 0.48 hectares.<sup>11</sup>
  - v. Our understanding of the bathymetry of the ‘Lagoon’ and the Southwestern Embayment makes it clear that the entire 17.3 hectare basin could not have been used to moor large merchant vessels. The available data show that the near-shore part of the ‘Central Zone’ would have a depth of approximately 0.85–1.40 m, whilst the Southwestern Embayment would range from 2.85 m to 3.35 m and deeper. It is assumed that little over a half of this body of water would have attained a depth of 5 m or deeper. The other half could accommodate shallower-draught fishing and ancillary crafts and mid-size merchant vessels. For the sake of this calculation and based on the above assumptions, merchant ships can be accommodated only in some 9 hectares of the harbour.
  - vi. Taking into account the tidal range, directions and strength of the offshore winds, and the experiments conducted in similar size harbours on board vessels of various sizes and capacities, the space between the boats on ‘swing’ moorings or on anchor should be at least 1.5–2 times their width side to side, and at least 1 time their length stern-to-bow to allow for safe manoeuvring and passing space for other vessels.
- With the above in mind, a medium-size merchant ship of 25 m by 7 m would take up an area of 175 m<sup>2</sup> (based on assumption i.; but using a square area rather than a circle for easy calculation<sup>12</sup>). As mentioned above, a vessel would also need sufficient

<sup>10</sup> A tide offering just after new and full moon with the greatest difference between low and high water.

<sup>11</sup> For comparison, the town on the elevated reef outcrop was approximately 6.2 hectares in size, whilst the island with the ‘Temenos of Temples’ was approximately 0.16 hectares.

<sup>12</sup> This could also be calculated by using the long axis (length of a vessel) and the length of the anchor chain (at least twice or three times the length of the vessel) as the radius of a circle that the vessel could swing around on its mooring, i.e., 25 m vessel + 50 m anchor chain = a circle with a radius of 75 m. This sort of calculation would be used in a harbour with a high tidal range and where the vessels would moor using anchors only on the bow/or stern rather than a number of anchors dropped from different points of the vessel.

space between it and any adjacent vessel, and a channel between the rows of moored ships through which to travel. This creates a requirement of 850–1,050 m<sup>2</sup> per vessel (based on assumption vi.) to accommodate a merchant ship comfortably in the harbour, meaning that an area of 90,000 m<sup>2</sup> (based on assumption v.) would accommodate 85–105 medium to large ships at maximum, although it is unlikely that such a large number of vessels would have been moored at Berenike at any one time. Additionally, Berenike would accommodate a much larger number of smaller ancillary and fishing vessels that would be

located in shallower waters and beached.

Whilst there are obvious limitations to this estimation, and there is an apparent need for much more data derived from interdisciplinary research to further enhance these calculations, the figure of 85–105 medium to large vessels has been presented to allow us to imagine how the port of Berenike might have looked and what its potential capacity and maximum occupancy might have been. Despite very general assumptions used to calculate this figure, they still reflect a fair estimate of Berenike's capacity on the basis of the current state of knowledge.

### DISCUSSION 3: THE PORT AND ITS FUNCTIONALITY

Archaeological excavations at Berenike, yielding an abundance of high-quality imported material and ancient textual evidence for trade and contacts with the outer world (Sidebotham 2011), demonstrate that the site was of great importance as a seaport during late Ptolemaic and early Roman times. During that time, environmental conditions and the size of the 'Lagoon' were optimal for the operation of this international port and harbour. Results of sedimentological analyses and the geoarchaeological component of this research have provided an understanding of the dynamics of the 'Lagoon' at Berenike and its changing viability as a harbour, as well as giving some estimates of its size, depth and capacity.

Although only limited information regarding port infrastructure is available from archaeological excavations and ancient texts recovered to date, the environ-

mental conditions during peak periods of occupation of the site were highly conducive to establishing a port. The site would have been attractive for human settlement as it was located relatively close to some fresh water sources in the foothills of the mountains (some 8 km) and to the wadi corridors, through which a 12-day caravan route to the Nile Valley<sup>13</sup> was marked out. The Roman infrastructure in the Eastern Desert seems to have developed in unison with the rise of maritime trade at the Red Sea, with state-sponsored provisions for establishing roads, wells, security posts and alike on the ground, and support for private entrepreneurship. It should also be noted that in the Roman period, it was within easy reach of a large complex of mines and quarries, and therefore represented a very good location not only for a commercial port town, but also a regional administrative centre.

<sup>13</sup> Compared to the six-day route from the more northerly port of Myos Hormos, sailing time to which may have been much longer than a week, depending on conditions.

At present, despite new data available regarding the changing landscapes and coastal seascapes of Berenike, there remains insufficient archaeological data pertaining to the definite delineation of the harbour and its functional zones, and the mechanisms of its operation. What can be said with reasonable certainty is that the harbour's heyday was in the Ptolemaic and early Roman periods, with the +0.85 m sea level providing at least 2.85 m water depth in the 'Lagoon'. High sedimentation rates (potentially connected with a slightly wetter climate, as attested by the 'flooding' layers in trench BE11-71, Facies F, see *Table 1*) could have instigated a slow decline of the harbour. The basins would have started contracting already in the early Roman period unless dredging was undertaken. If dredging had indeed been performed—and it is likely that it was, despite the lack of hard evidence to date—it probably occurred in the early Roman period when maritime trade was at its peak, and could have been repeated later on, when required.

The late port from the 4th through 6th century AD appears to have been much smaller, without the use of the 'Central Zone' or the 'Northern Anchorage'. The location of the late 'Temenos of Temples' suggests that much of the 'Central Zone'

would have already been infilled at this stage. The gradual lowering of sea level over about 500–600 years, combined with the high sedimentation rates, would have also impacted the depth of the 'Lagoon', which may have diminished even by 2 m (or more) in some places.

Considering archaeological evidence alone it appears that during the early Ptolemaic period vessels, especially the famous, flat-bottomed *elephantagoi*, could have simply been beached or anchored in the 'Central Zone'. This may also have been the case during later periods in some parts of the city and for some types of boats, as no jetties or wharf structures have been found. By the late period, as the 'Lagoon' began to choke with silts, the roadstead could have been used more commonly, with small boats loading and unloading their cargo outside the old main harbour, or anchoring and using a boarding ramp to unload directly into the shallows, the goods then being carried ashore.

The geoarchaeological survey has led to a clearer understanding of local environmental dynamics. However, what is lacking to take this research further is a high-resolution geochronological framework and robust palaeoenvironmental context on which to hang this palaeogeographical reconstruction.

## CONCLUSIONS

During its 800-year operational lifespan, the port city of Berenike was located in a somewhat inhospitable, marginal environment at the edge of an arid coastal plain adjacent to the Red Sea. Based on the results of this study, it is clear that even though the reason for Berenike's inception was partly political and strategic, the physical configuration of the coastal

landscape was also important in the choice of its location, whilst a key factor in its subsequent decline was the political shift and the changing dynamics of its environment. The presence of a natural lagoon and favourable prevailing winds constituted such an attractive location for a port that neither the proximity of four large wadi systems, prone to deliver silt to

the harbour basin, nor the scarcity of fresh water or food for humans and animals, could act as a deterrent to the city's development and continuous occupation. Clearly, political and economic requirements for a port outweighed potential disadvantages of its location.

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# The harbor of early Roman “Imperial” Berenike: overview of excavations from 2009 to 2015

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**Abstract:** Excavations by the American–Polish project in Berenike on the Red Sea since 2008 have aimed at uncovering and reconstructing the ancient landscape of the southwestern embayment, tentatively identified as the harbor of the Hellenistic and early Roman city, and its immediate vicinity. A review of the evidence from the excavation of several trenches in this area paints a picture of the bay—still incomplete—and contributes to a reconstruction of the cultural and economic landscape, the “lived experience” of the town’s inhabitants and incoming merchants and sailors during the heyday of “Imperial” Berenike, that is, in the 1st and 2nd centuries AD.

**Keywords:** Berenike, Red Sea, harbor, Hellenistic, Roman, landscape archaeology, Kushan envoys, Augustus, Trajan, Domitian

Looking today at the sandy expanse of the southwestern embayment in Berenike one is hard put to imagine the bustle here at the height of a shipping season in antiquity [*Fig. 1* top]. Vessels from as far as India and from closer in, like the southern stretches of the Red Sea, South Arabia and East Africa, standing out in the outer bay, beyond the coral-reef barrier, the goods they had carried—spices, cloth, steel and precious gems, among others—being ferried on small craft plying the shallow waters of the lagoon and inner bay. Merchants celebrating a successful crossing with votive offerings in the temples of their choice, then presumably rejoicing in the taverns in town or else attending to official business in

the administrative quarter. Resident elites, including custom officials, shipping agents and military personnel, retiring to their opulent houses, possibly hosting visitors of high social standing, intermediaries acting directly for the Roman Emperor and, on occasion, foreign envoys traveling on behalf of their respective exotic kings. The industrious folk of the lower classes, the porters and animal keepers, craftsmen engaged in ship maintenance and other much needed trades, suppliers of food and water and anything and everything that may have been needed, scurrying about their business, making the best of the day with temperatures, especially in September, soaring into the 50s°C.

The ebb and flow of life in the ancient emporium would have followed closely the trading cycle, which was in turn linked integrally with the monsoons. Twice in the year the population of Berenike would have swelled significantly: in the spring when the laden ships sailed in and again in the fall when they left for the trip to India. Agents, merchants, intermediaries, caravan leaders, animal keepers, and guard details would have filled all the hostels the city had on offer, perhaps putting up tents in the nomadic style. Sailors and ship captains from the ships on the roadstead would have visited the town and gone about the business of cleaning and repairing their ships after a long journey in and fitting and supplying them for the journey out. Then there would be the various fortune seekers and entertainers, magicians and harlots that surely made their appearance in a busy harbor. And the indigenous peoples living in the mountains of the Eastern Desert, nomadic or semi-nomadic, trading with the 'city people' on the coast, much like the 'Ababda Bedouin of today.

In between these periods of activity were long months of waiting, a hot, sleepy, presumably uneventful existence in the summers and cold rainy winter months, fraught with the danger of flash floods

sweeping down from the mountains of the Eastern Desert and escaping the natural channels of the wadis that spread out their pincer-like grip around the location of the town. Being on slightly higher ground, the houses in the town to the east of the harbor bay would have been protected, but the bay itself would have been washed right out into the lagoon, the surging water carving deep gullies in the ground, carrying anything and everything in its way, leaving behind layers of sand.

Indeed, there is evidence of such a layer, almost a meter deep, recorded in a number of trenches in and outside the bay (see Kotarba-Morley 2017b; 2017c, in this volume). Judging from its position in the stratigraphic record, this steely blue sand predates the Augustan age, attesting to a calamitous event of this nature perhaps in the 1st century BC. It is not tantamount to Berenike being deserted at this time. In the last quarter of the 1st century BC, it may have been a fairly quiet fishing village, but one that offered enough amenities as a natural landing place for ships of different size, sheltered from the winds and currents, and as a source of food, water and fuel supplies for passing ships. In other words, it had the tradition behind it and the investment potential to attract Roman trading under Augustus.

## BERENIKE TROGODYTICA: FOUNDATION AND TOPOGRAPHY

Ancient Roman written sources indicate that Berenike Trogodytica was established as one of a network of similar harbor sites extending south along the western coast of the Red Sea, from the southern reaches of Egypt to East Africa (Sidebotham 2011).

This was an economic and military project envisioned by Ptolemy I and his son Ptolemy II, engineered most likely by the latter, a venture that must have been driven by knowledge of this region and its potential amassed by the Egyptians ever since they

started exploring it in the 2nd millennium BC. A distinct part of this undertaking was a daring bid to build the Ptolemies’ own “armored tank” force of elephants, replacing the Indian elephants, which they could not have because of the hostile relations with the Seleucid kingdom, with the African variety. This ingenious idea was based on the assumption that these animals could be captured and transported up the Red Sea from East Africa to Egypt, where they could be trained for the war effort.

Underlying the elephant venture, however, was an even more important and lucrative business, that is, a thriving South Arabian trade in mineral resources and human slaves, as well as spices and frankincense, which provided a strong stimulus for developing harbors and landing places along the Red Sea coast. With early Roman Imperial trade in *luxuria* from the East reaching exorbitant levels, the need for an effective working harbor to deal with the commercial aspects of the process was a simple economic necessity (Fitzpatrick 2011).

In this context, one may speculate about the incentives that led to the establishment or perhaps rather development of Berenike as a major Roman entrepôt in the 1st century AD. There is no reason to think of the site as deserted in the so-called Augustan period, that is, after the conquest of Egypt by Augustus, and every reason to assume that it had a nicely thriving, even if modest fishing harbor. Indeed, a recent find of a shattered stone stela bearing a cartouche of the Twelfth-Dynasty pharaoh Amenemhat IV (Hense, Kaper, and Geerts 2015; Hense and Sidebotham 2017) has suggested a date more than 1500 years earlier for the generally accepted origin of settlement in this location. The stele

fragments were found in a pile of fragmentary inscribed stones and architectural elements, collected in a 5th century AD context in the courtyard of the Great Temple of Berenike. Rather than being brought to the site from some as yet unidentified location, either as building material or ship ballast, a stela of this particular Egyptian pharaoh was much more likely to have been set up intentionally in commemoration of one of the southward-bound expeditions of this king passing through Berenike, in similarity to the celebrated Marsa Gawasis finds from a few hundred kilometers further up the Red Sea coast (see, e.g., Bard and Fat-tovich 2007; 2011). Should this be true, then it can also be speculated that there was already a station of some significance located at or near the future Berenike, possibly even on the site on which the Great (Sarapis) Temple was built more than a millennium and a half later.

Geological and geoarchaeological investigations conducted to date at the site (summed up in Harrell 2017 and Kotarba-Morley 2017a; 2017b) have contextualized the Berenike harbors within the landscape and discussed them in the light of the newest set of evidence (Kotarba-Morley 2017d; see also Sidebotham 2008). The location was well protected from prevailing northerly winds by Ras (Cape) Benas extending far into the sea to the north of the site. Ships were either anchored in deep water beyond the coastal coral reefs or they entered the lagoons formed at the mouths of two wadis forking just northwest of the site and surrounding it with their beds. These wadis today are silted up and an alluvial flood plain (*sabkha*) extends several dozen meters from the original shoreline into the sea. Excavations as well as coring research have demonstrated, however, that



*Fig. 1. Looking across the southwestern embayment today: top, view looking east to the lagoon beyond the nebkas lining the shore, note concentrations of larger shells and fossil coral heads in an otherwise sandy stretch of ground; inset, natural shore along the southern side of the lagoon; bottom, view south from the ridge toward the filled-in lagoon at the mouth of the wadi (Photos I. Zych)*

the sea level in historical times (in the Ptolemaic period) has changed insignificantly compared to the present (Kotarba-Morley 2017a: especially 134–135; 2017d: 216). The locality consisted of a plateau set off by the southwestern wadi, which skirted it on the western side. Rising east of the plateau, separated from it by a stretch of sand apparently filling a deep trough in the original surface, was a coral ridge forming a crescent-shaped formation that opened toward the sea to the south and southeast. This is the southwestern embayment which encompassed a natural sandy beach. On the opposite, eastern side of this bay the fossil reef created yet another low plateau already at the sea edge, covered with alluvia and sand. Here the Great Temple was raised (presumably in a sanctified location, possibly on the site of an earlier temple(s), see, e.g., Hense 2017, in this volume) and around it, the presumed fishing village and commercial town of the Ptolemaic age. It was easily defended by a fortified wall that cut across at the neck of the promontory, incorporating a large stone fort and related architecture on the western plateau at the edge of the wadi, which must have been deeper at this time, acting perhaps as

a kind of moat (Woźniak and Rądkowska 2014; Woźniak 2017, in this volume).<sup>1</sup> The plain extending north of the defensive wall would have constituted a natural stopover for caravans arriving to Berenike from the Nile Valley via the Eastern Desert trails. The area was certainly occupied by craft workshops, especially in the western part (see Sidebotham and Zych forthcoming).

There is no archaeological evidence to date for the elephant harbor of the Ptolemies, that is, the port of the mid to late 3rd century BC, although it may be speculated that the animals were unloaded directly onto the beach. All that is actually needed for the operation is a stretch of sandy beach where the wide and flat-bottomed barges (as the special *elephantegoi* ships for carrying these animals are imagined to have looked, although none has ever been found) could have landed and been secured in place with a ramp to offload the wild animals. The only viable place for this landing would have been the natural beach within the so-called southwestern embayment, in the immediate vicinity of the fort and the presumed elephant pen (Sidebotham and Wendrich 2002; 2007) [*Fig. 1* bottom].

## ARCHAEOLOGICAL EXCAVATION SEASONS 2009–2015

The southwestern embayment, which is the modern term for this apparently partly natural and partly manmade feature (see Herbich and Zych 2017; Kotarba-Morley 2017b), was the main objective of the investigations of the American–Polish project of the University of Delaware and the

Polish Centre of Mediterranean Archaeology University of Warsaw, which took over in 2008 from the American–Dutch project that had investigated the site from 1994 to 2001. In the course of eight seasons, carried out through 2015, the Project excavated some 13 trenches in different parts of

<sup>1</sup> The Hellenistic remains of the military fort are being studied by Marek Woźniak under a grant from the National Science Center of the Republic of Poland (UMO-2015/17/N/HS3/00163).



the bay (altogether approximately 260 m<sup>2</sup> of ground surface) (generally, Sidebotham et al. 2015; Sidebotham and Zych 2011; 2016; 2017; forthcoming; Zych et al. 2016). The main purpose was to recognize the stratigraphy in this feature and determine its landscape and the nature of its operation as Berenike’s chief harbor.

The Project started with exploring the lunate-shaped ridge around the embayment in three places along its perimeter [Fig. 2 bottom]. Trenches were traced following minute examination of the results of a magnetic survey of the area, carried out mainly in the 2010 season with some extra work on the fringes in later seasons (see especially Herbich and Zych 2017)

[Fig. 2 top]. Part of the reason behind the location of some of the trenches was to test the observed magnetic anomalies in an effort to contextualize the survey results within the specific conditions of the site. Trench BE09-55 was dug at the southwestern end of the ridge, where it starts to turn in to the east, at the highest point, which reaches here just over 5 m ASL; another trench, BE14/15-102, was located immediately north of it (separated only by a baulk), surprisingly finding no continuation of features from the first trench. Another section of the ridge was tested at mid-point of the crescentic arch in trench BE10-67. Trenches BE09/10-54/62/64 started with exploring the northeastern end of the ridge



Fig. 3. Trenches BE11-71 and BE11-72 in enfilade in the middle of the southwestern embayment, looking east, toward the main city mound (the highest point is the archaeological dump next to the Great Temple) (PCMA Berenike Project/photo I. Zych, 2011)



Fig. 4. Trench BE15-108: furnace in the beach area (PCMA Berenike Project/photo I. Zych)

where it appeared to join what turned out to be a natural rock path leading down into the bay. The discoveries in this trench, which included a well-preserved wooden ship-hull frame and dozens of meters of coiled mooring rope, prompted three more trenches, BE11-78, BE14-98 and BE15-109, to be dug in enfilade, extending south alongside this pathway. Within the embayment, trenches BE11-71 and BE11-72 were placed over a feature that looked on the ground (and in satellite images) like a typical entrance to a built harbor basin. Trenches BE14-100 and BE14-101 in the western part of the embayment tested for remains of a large building suggested by the layout of magnetic anomalies. The southernmost trench excavated by the Project, BE15-108, was located apparently already



Fig. 5. Trench BE11-71: Hellenistic/Roman bowl, on the ground-level of Augustan-age coral-head architecture (PCMA Berenike Project/photos S.E. Sidebotham)

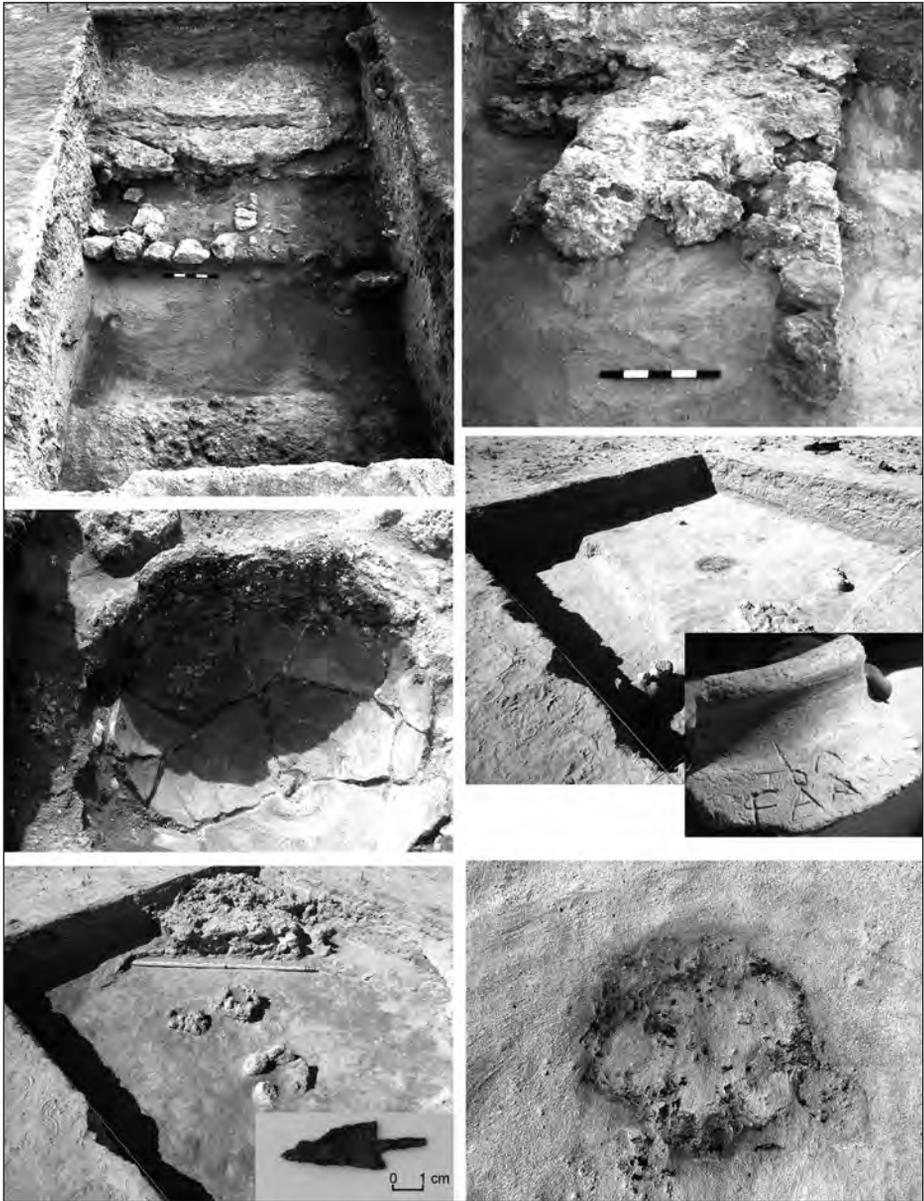


Fig. 6. Trenches inside the embayment: top and center left, BE11/72, looking east and top view of pithos (caulking pit?); top right, BE11-71, looking southwest, coral-head architecture; center right, BE14-100, stub coral-head walls and charcoal circle; inset, jar with graffito; bottom right, charcoal patch from BE14-100; bottom left, BE14-101, fragment of wall and small ovens; inset, iron arrowhead (PCMA Berenike Project/photos E. Nieto Breogan, S.E. Sidebotham, I. Zych)

on the bay shore, just beyond the end of the lunate-shaped ridge. A small probe near the top of the ridge, BE15-106, was dug for the express purpose of collecting samples for archaeobotanical analysis by flotation. Finally, one of the houses on the eastern shore of the bay was explored in BE13-91.

The two trenches, BE11-71 and BE11-72, both 2.50 m wide and 10 m long, proved beyond all doubt that the long features extending from the lunate-shaped ridge and apparently sectioning the embayment on the inside, observed clearly in satellite imagery and earlier interpreted as possible wharfs inside the harbor basin, had nothing to do with any kind of water facility. Not the least because they were from 3 to 5 m ASL. A ground survey of the area had recorded concentrations of larger broken coral heads, shells and pottery sherds covering these embankments on slightly higher ground, contrasted with the finer sand fill in the hollows between them and further south in the embayment, containing only very fragmented small pieces of corals, small shells and practically no artifacts. Moreover, based on the results of magnetic prospection in the southern part of the embayment, this area should be interpreted as shallow water at the beach edge. The excavation in BE11-71 reached the natural beach surface of early Ptolemaic times (mid-3rd century BC), thus establishing the sea level for this period. It also recorded a meter-thick layer of sand underlying the 1st century BC/1st century AD strata (conveniently dated by a whole bowl found *in situ*, see *Fig. 5*), attesting to a fairly cataclysmic flash-flood incident that took place sometime in the 1st century BC (see Kotarba-Morley 2017b). The bowl was found within architecture constructed of broken coral heads, consisting of walls of

different thickness [*Fig. 6* top row], many fairly thin, hence probably designed as a base for upper sections and roofs made of rather perishable materials, like palm matting. Floors included simple sand surfaces and cobbled pavements, apparently connected with industrial activity of some kind, as attested by the bottom parts of a large pithos or amphora containing traces of a whitish substance [*Fig. 6* center left], found in two successive phases. This installation is suggestive of ethnographically attested Omani practices of cleaning the hulls of their seafaring ships of barnacles and caulking them anew after each sea journey, even of just a few months (Zych et al. 2016: 330 note 2). For this purpose, lime was prepared from burnt sea shells mixed with animal fat. While the whitish substance could not be tested in laboratory conditions, it is possible that the area was intended for just such activities.

The magnetic survey traced a large regular building in the western part of the embayment. Testing in trenches BE14-100 and BE14-101 contributed to an improved understanding of how to interpret magnetic anomalies in the specific conditions of the Berenike site. For instance, an anomaly that looked very much like a stone building wall turned out to be the robber ditch left after the stone had been salvaged for reuse; the salt-crusted fill of the ditch gave a misleadingly clear result; several other architectural 'ghosts' of this kind have since been recorded by the Project [see below, *Fig. 22*]. The identity of this building was not established, apart from it being a structure of substance [*Fig. 6* bottom left and center and bottom right]. It yielded an arrowhead (not a frequent find from early Roman strata) and an assemblage of pottery, including a jar with a graffito on its

neck, that has been dated generally to the 1st–2nd century AD. Small furnaces in an open space suggest the presence of a courtyard where household activities took place. The apparent dismantling of its walls seems to correspond to site-wide evidence of major building activity in the early Roman period, consisting of quarrying the derelict ruins in the western part of the site for suitable stone. It is at this time that the Hellenistic city wall and large stone fort on the western plateau were apparently dismantled down to the ground (Woźniak and Rądkowska 2014; Woźniak 2017, in this volume). The charcoal patch on the level of the dismantled wall in trench BE14-100 may well be evidence of bread-baking [Fig. 6 bottom right].

The southernmost trench excavated in the area of the embayment was BE15-108. It was located already on flat ground at the very end of the lunate-shaped ridge, right by the presumed mouth of the wadi where it entered the lagoon. The trench yielded evidence of secondary metalworking, including a furnace [see Fig. 4], as well as what appears to have been a large wooden chest hammered together with long iron nails; this chest was apparently burned on the spot. Among the artifacts recovered from the trench was a bone ear- or lip-plug, the first of its kind from the site. The date of the material from the trench fell broadly in the early Roman period.

Close to the building tested in trenches BE14-100 and BE14-101 is the highest-rising part of the lunate-shaped ridge surrounding the embayment. Excavation of trench BE09-55 revealed a platform-like structure with cobbled surface [Fig. 7 top right], well-dated by a late Flavian almond-embossed glass beaker, which was found inside a pit sunk in the floor and lined with

a large amphora body (Kucharczyk 2011: 98) [Fig. 7 bottom and inset]. Stacked against the side of this platform and piled on top was rubble from an apparently domestic context, containing a pair of loaded dice among others (Zych 2011: 149 No. 87b, Fig. 12-83; for the context, Sidebotham and Zych 2011: 48). The pottery assemblage was rather more luxurious in nature, including fine wares, as well as sherds of South Arabian jars with monograms of the Hadramauti kings, dated to the 1st–2nd century AD, possibly into the early 3rd century AD (Zych et al. 2016: 331) [see Fig. 27]. Excavation of trench BE14/15-102, immediately to the north of BE09-55 and separated only by a meter-wide baulk, failed to uncover any continuation of these structures. Instead, it yielded two fine cameos from the upper layers of domestic rubble [see Fig. 25]. Both trenches revealed evidence of major water flows carving deep gullies in the softer rubble deposits. Observation of similar modern erosion of trench walls and backfilled trenches during the more violent winter rains has led the excavators to suggest the occurrence of such events sometime after the 3rd century AD, especially as other evidence from the main city mound also proves regular flash flooding during the 4th and 5th centuries AD (J. Zieliński and J. Trzeciński, personal communication, 2013).

Underlying strata in BE15-102, undisturbed by erosion, produced a series of small simple furnaces, apparently for secondary metalworking in copper. They should be dated to the turn of the 1st century BC/1st century AD, possibly earlier (Oller Guzmán forthcoming).

The two other trenches excavated on top of the lunate-shaped ridge, both 2.50 m wide and 10 m long, also revealed

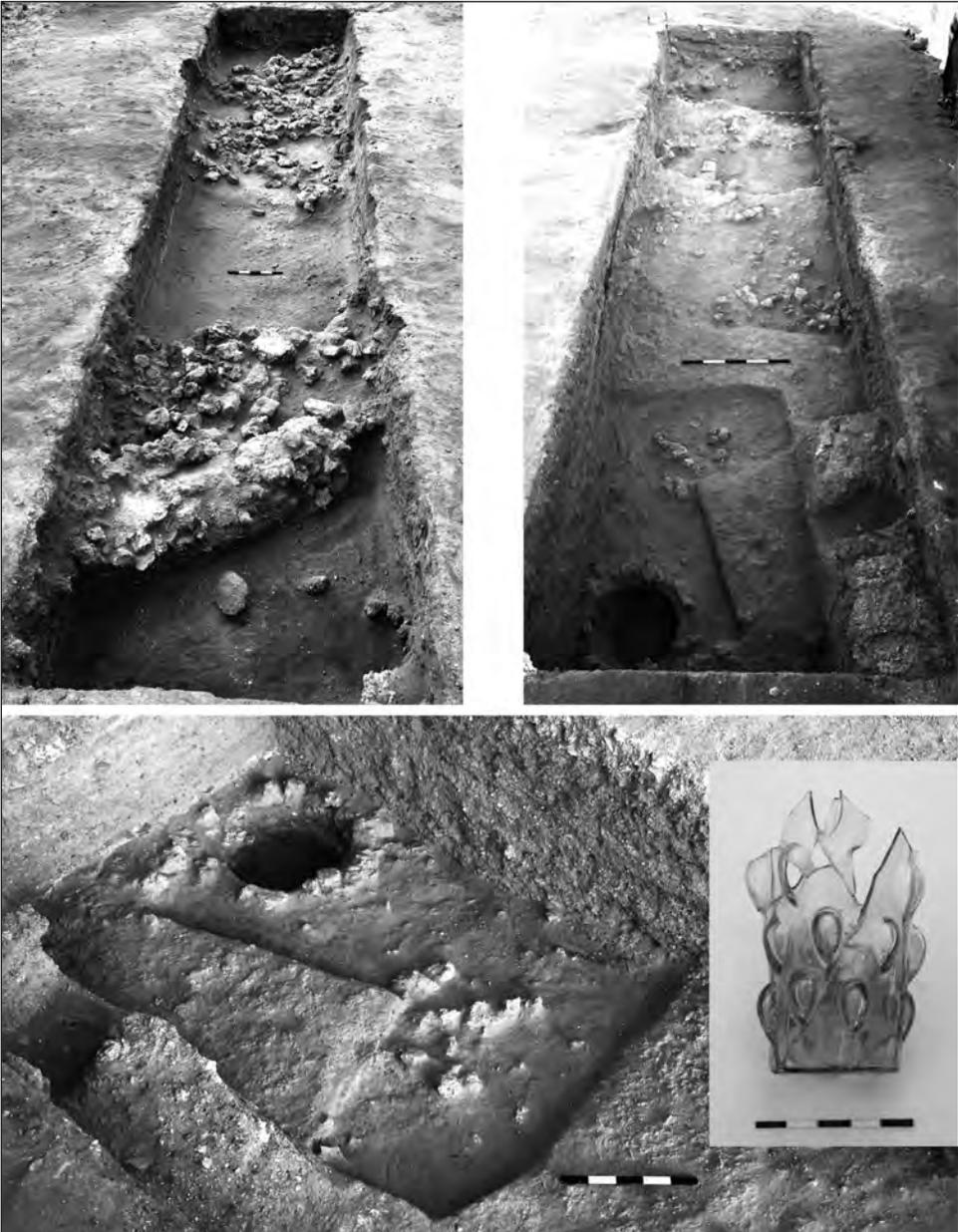


Fig. 7. Trenches excavated on the crescent-shaped ridge: top left, BE10-67, looking southeast with fossil coral-head architecture on top of the ridge; top right and bottom, BE09-55, fossil coral head architecture and pit which yielded an almond-embossed glass beaker (PCMA Berenike Project/ photos S.E. Sidebotham)



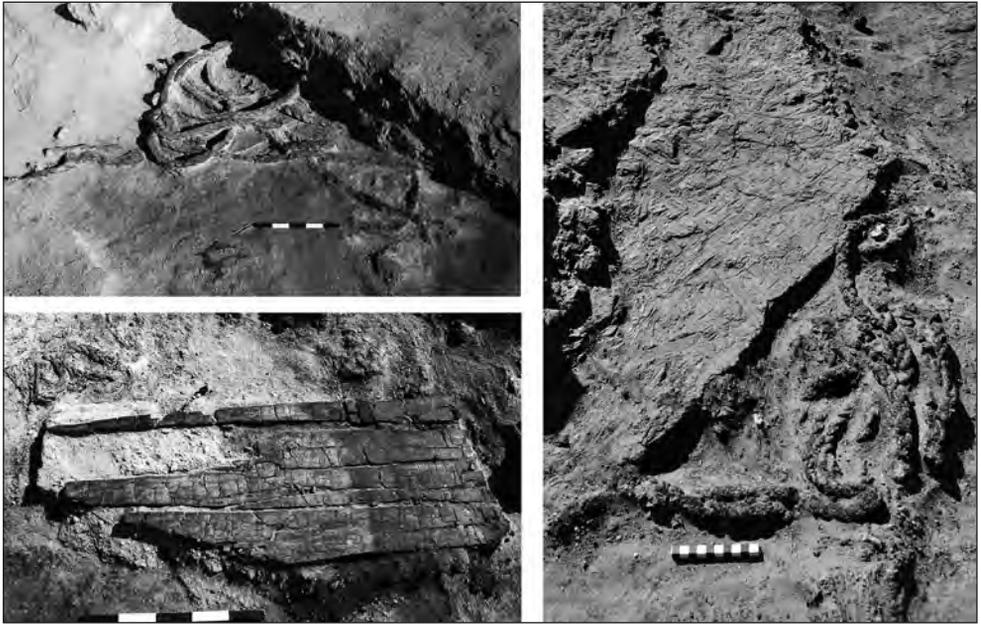
*Fig. 8. Trench BE09/10-54/62/64: looking south, light architecture with matting and cedarwood feature; further south, coral-head cells for storing shipping accessories; inset, huge burning area and ashes (PCMA Berenike Project/photos S.E. Sidebotham)*



*Fig. 9. Trench BE10-62/64: top view of the harbor stores edging onto the hollow full of burned ashes (PCMA Berenike Project/photo S.E. Sidebotham)*



*Fig. 10. Trench BE10-62/64: collapsed partition wall of matting (PCMA Berenike Project/photo S.E. Sidebotham)*



*Fig. 11. Trenches BE10-64 and BE15-109: coils of mooring rope and shipping hull planks; right, expanse of burnt matting and baskets plus fuel wood (PCMA Berenike Project/photos S.E. Sidebotham)*



*Fig. 12. Trench BE12-78: top view looking northwest; on right, path following the rocky ridge down to the beach, back of the stores; on left, meter thick accumulation of fine black ashes and burned wooden material (PCMA Berenike Project/photo S.E. Sidebotham)*

manmade structures. In BE10-67, walls of broken coral-heads were recorded, but the exact nature of the structures was not identified [Fig. 7 top left]. The pottery assemblage placed the occupation here squarely in the 1st–2nd centuries AD. Culturally sterile layers were not reached. The other trench, BE09-54, revealed a sophisticated floor surface made of resin-poured tamarisk twigs and cobbles. This section, erroneously interpreted in early reports as part of a waterfront, was associated with a solid cedar-wood post and some nondescript cedar-wood framing that could suggest a structure of some kind [Fig. 8 and inset]. Successive layers of matting, mixed with evidence of domestic occupation, including chicken and rat bones, indicates that at least food was consumed in the structure lying atop the lunate-shaped ridge in trench BE09-54.

Further south of this structure, excavations for a distance of some 40 m revealed a series of rectangular compartments divided by low walls of broken coral heads [Fig. 9], which served as bases for the upper parts of walls made of perishable material, palm-leaf matting for instance [Fig. 10]. These units appear to have been open to the west, toward the embayment, their back aligned with a rocky ridge that served as a pathway down into the harbor bay. They seem to have served as storage for ship-related accessories, among others, coils of thick mooring rope of palm-fiber, pieces of thinner rope, basketwork, pieces of fuelwood and branches, several kilograms of broken obsidian [see Fig. 24 left], but most interestingly pieces of wooden ship hulls, some planks more than 3 m long and joined with the characteristic mortise-and-tenon technique. There was also a wooden ship frame, preserved

complete (Zych et al. 2016: 329) [Figs 8, 9, 11].

The slope west of these compartments is covered with a sizable deposit of extremely fine ashes, its thickness reaching almost a meter level with trenches BE12-78 and BE14-98, thinning out toward the north and south [Fig. 12]. The fine ashes are spread in swirling tongues of black at least 20 m to the eastern end of trench BE11-72. The conflagration was very strong considering how fine the ashes are and the material that fueled it was quite homogeneous, leaving no evidence on record. It also seems to have been controlled to some extent, the wooden remains and rope in the stores frequently being burned only on one side, the one nearer the fire on the west. The reason for this conflagration and whether it was intentional or not continues to defy interpretation (one idea is that it was a rubbish dump that was set on fire, another that it was a charcoal-burning pyre, assuming that charcoal was after all among the requisite ship supplies). Dating evidence from the compartments indicates functioning in the later 1st–early 2nd century AD, no later than the end of the 2nd century AD. After that the area was evidently deserted, never to be used again.

Two probes dug below the layer with the ship-related remains, one just west of trench BE09-54 and the other in the northwestern corner of BE15-109, uncovered in the former case a coin of Ptolemy IV Philopator (221–205 BC) (Sidebotham 2017: 316, No. 19) and in the latter, a series of *Pinctada* shells, laid flat, possibly representing leftovers from a meal (Zych et al. 2016: 330–331 and Fig. 10). The latter context should be dated to the 1st century AD; in the case of the former one, it shows that the embayment must have been used

from the start of the Hellenistic occupation of the site.

There is a tendency when discussing the southwestern embayment to overlook the fact that the bay actually extended eastward, the lunate-shaped ridge meeting up with higher ground which then ran in a gentle curve to the east and southeast. The magnetic map of this quarter, which is a series of sand-covered small mounds rising in the general direction of the main city mound, showed a dense quarter of rather large houses with courtyards, separated by narrow alleys, descending straight down to the water edge. There were no waterfront facilities here, no wharves or anything except the beach stretching west. Testing in the entrance to one of the houses (trench BE13-91) revealed only late occupation, from the 5th century AD, but the date of the original development of this

quarter cannot be determined without further work. The house was built of broken coral heads [Fig. 13], but considering the mounting evidence for the use of coral heads for construction also in the early Roman period in Berenike, it cannot be used as firm proof of its dating.

Observation of the magnetic anomalies recorded within the southwestern embayment reveals a division into two parts. All along the inside of the structure that is now concealed under the lunate-shaped ridge, for approximately 100 m in the direction of the lagoon, the ground is peppered with anomalous readings [see Fig. 2 top]. One should disregard the heavy black arching anomalies to the northwest, which are believed to be natural and not anthropogenic. The black streaking lines visible at bottom right should also be interpreted as a record of the original shore with fossil



Fig. 13. Trench BE13-91: example of fossil coral-head architecture on the western shore of the main city mound, view looking north (PCMA Berenike Project/photo S.E. Sidebotham)

reefs long before the historical period. It follows, however, that the 40-m-long anomaly, heavily black with a white underpinning on the northern side, assuming that it, too, belongs to the original coastline, may have formed a wave-notch (see Kotarba-Morley 2017b: 149 and Fig. 5-3, 2017d: Fig. 6-2). The architecture on the eastern side of the embayment is easily traced on the magnetic map and there can be no doubt that the two structures observed on the map just above the said feature (and already proved in excavation) were stone buildings as well [Fig. 14 inset]. It is apparent even to an untrained eye that the zone about 50 m wide stretching in a curve on either side of the two structures

is “quieter” from a magnetic point of view. The ground survey conducted in this area also demonstrated a difference between the two zones, the “quieter” zone having very little and very fragmented pottery and only small shells and corals, none of the big broken coral heads used for building nor the big shells of consumer use for the inhabitants of Berenike. The assumption is that this zone was under water in the 1st and 2nd century AD, when the embayment was in use. Multiple arching anomalies traceable between the two zones may reflect the gradual infilling of the bay, the emerging *sabkha* flats gradually pushing back the water of the lagoon. Dating these processes is difficult apart from saying,

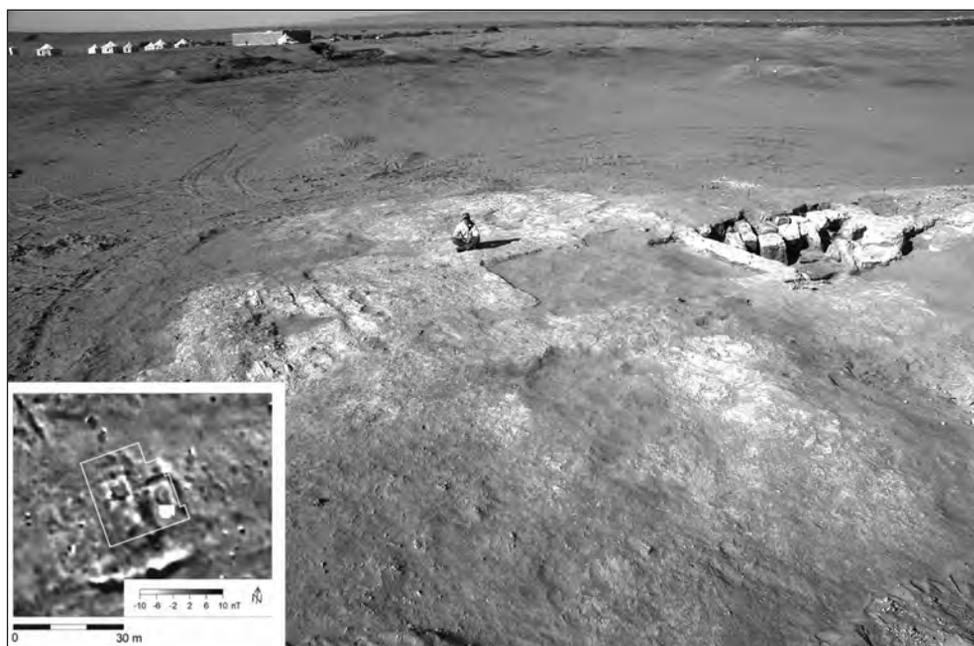


Fig. 14. Trenches BE10-61 and BE10-70: the harbor sanctuary in the first season of excavation; top, view of the late shrine looking west with the Eastern Desert mountains in the background; bottom, top view of the melted gypsum anhydrite patches around the Square Feature, looking north toward the dighouse and archaeological camp; inset, magnetic image of the harbor sanctuary (PCMA Berenike Project/photos S.E. Sidebotham, I. Zych; magnetic map processing T. Herbich)

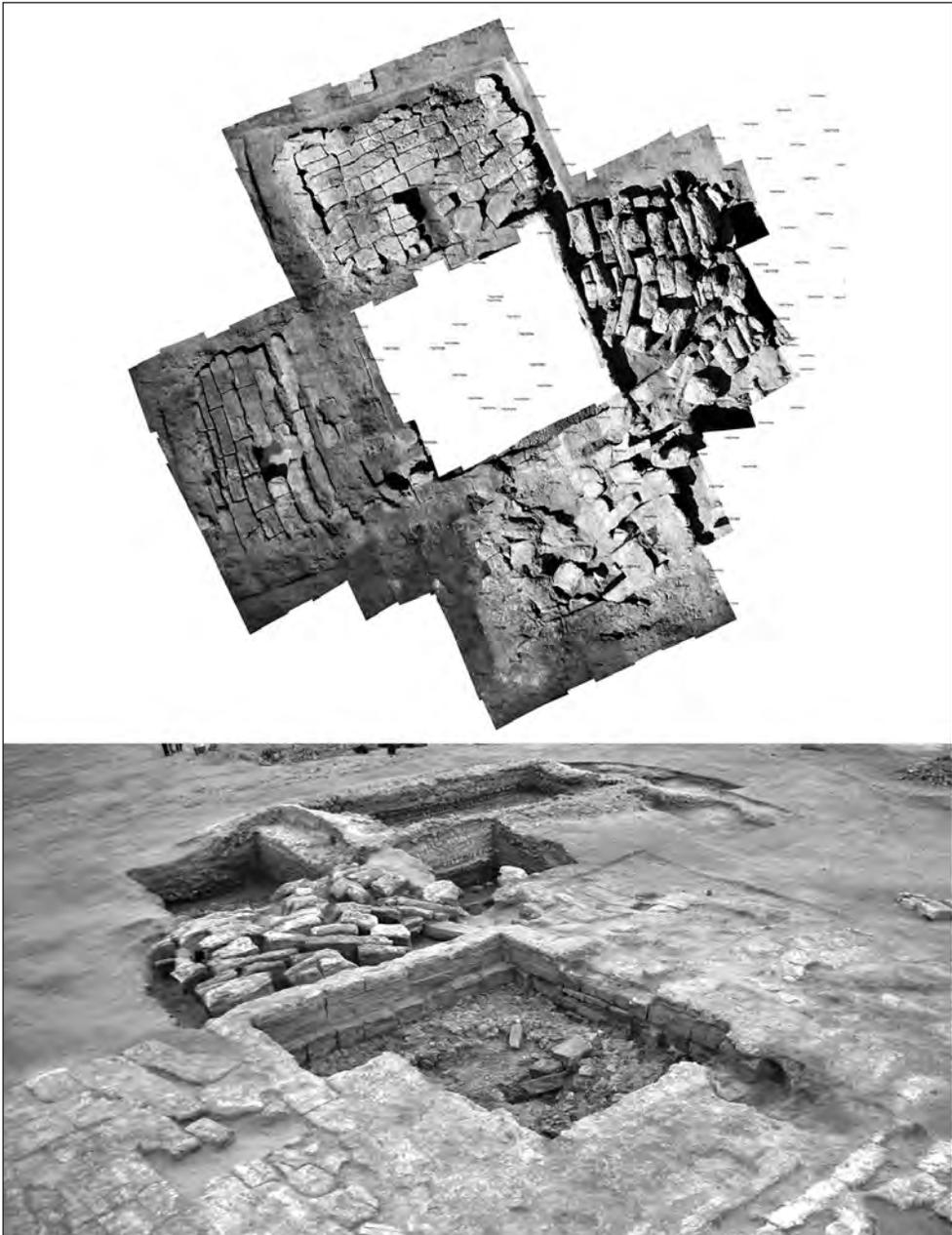
based on the archaeological evidence, that they post-date the functioning of the embayment in the early Roman period. Further study, especially integrating the results of the geoarchaeological coring and georadar survey by Kotarba-Morley, may answer many questions. Even so, at this point, it is possible to comment on the appearance of the feature noted at the southern side of the embayment, in the middle of it, that is, if we assume that the bay actually reached the main city mound on the east.

This feature, if one looks carefully, has the shape of an irregular 40 m by 30 m island amidst the "quieter" zone around it. There may have been a path leading down from the lunate-shaped ridge (note the darker hint of a stepped line extending northwestward from the island) and this anomaly corresponds roughly with the rock path discovered in the trenches dug along this line in this part of the embayment. The two buildings observed as squarish anomalies of the Earth's magnetic field are located on the eastern side of this island, whereas the anomalies on its western side cannot be easily interpreted. Of the two structures, the eastern building has been excavated completely (trench BE10/12/13/14/15-61) and it is a late shrine, used in the late 4th and 5th centuries AD (Rądkowska and Zych forthcoming a; forthcoming b). It is clear by now that the users of this shrine salvaged artifacts from the ruins (like inscribed stone altars and religious paraphernalia) for their purposes, but they also actually reused parts of older architecture, built of stone blocks and still standing, working them into the tissue of their new structure made of broken coral heads.

Unlike the late shrine the structure west of it was not visible on the ground when excavations started. The gypsum

anhydrite blocks, of which its wall were built, had melted as a result of the humidity, forming an unshapely white patch in the sand everywhere except for the square sand-filled interior [Fig. 14]. Tedious and patient brushing and hacking at the white surface ultimately revealed four lying walls (BE10/11-70). Two of these, the northern and the western one, appear as in a pop-up cardboard box [Fig. 15 top], the east wall is not as evenly laid out and the front wall, on the south, was also disturbed when it fell. Early references to this structure as "sunken" were misleading as it is now clear that it was not sunken in any way. However, there is every reason to consider the ground level on the Island, and consequently also the threshold level in the entrance to the "Square Feature", to have been little above the sea level at high tide. It is also evident that it was not a freestanding structure. A side door in the west wall led into a neighboring chamber, which could have contained a flight of steps leading to the roof (J. Rądkowska, personal communication). The opening in the back (north) wall should be interpreted as a niche(?). A double-wing door in the south wall opened to the inside and could be secured shut with bolts fitted into appropriate holes in the threshold.

The original chamber had a substructure of coral heads forming a U-shape around an empty rectangular space in the center which was aligned with a cubic podium raised against the back wall, directly below the niche [Fig. 16 top]. Stone slabs had once covered this foundation substructure. Whatever had once stood in the center is lost, but it may well have been a basin which filled with water through a system of pipes(?) passing through the threshold from the outside (the threshold can be



*Fig. 15. Trench BE10/11-70: Square Feature looking northeast with the lying stone walls and explored center (PCMA Berenike Project/photo S.E. Sidebotham; orthophoto processing R. Ryndziejewicz based on photos K. Braulinska)*



*Fig. 16. Trench BE10/11-70: Square Feature during excavation, top, original phase with missing floor, looking southwest; bottom, tumbled structures and inscribed altar inside the main chamber, looking north (PCMA Berenike Project/photos S.E. Sidebotham)*

seen in the top image in *Fig. 16*). No pipes have been preserved, but the threshold was raised at some point, possibly changing the original function. The compartment on the left (west) side of the podium was blocked off, the one on the other side may have also been closed off by stone slabs. These were found either lost or disturbed. Filling the inside of the chamber was a tumble of stone blocks, including pieces of a shattered water basin. One of the stones was an inscribed altar bearing an inscription dated to the reign of the Flavian emperor Domitian and evidence of the *damnatio memoriae* that this emperor suffered after death

[see *Fig. 28* left]. The fill contained material from the 1st through the 3rd century AD, including a 2nd–3rd century lamp with a representation of a Maenad with a thyrsos on the discus and the toe of a more than life-size bronze statue. A white-stone eye inlay may have also belonged to a statue of this kind as well [see *Fig. 29*]. However, the fill was also mixed with late material, dating from the late 4th to early 6th century AD. This form of mixed deposits have been encountered elsewhere on the site and have yet to be explained satisfactorily (Kucharczyk and Zych forthcoming).



*Fig. 17. Trench BE13-81: above, documenting the early architecture underlying late-period temple; right, coin of Philip Arab found under the collapsed wall of stone blocks (PCMA Berenike Project/photos S.E. Sidebotham, I. Zych)*



The Square Feature was built of blocks of gypsum anhydrite, some of monolithic size, very similar in form and wall bond to the building material found in the Great Temple in the main city. Stone blocks were the preferred building material also in other structures dated to the early Roman period, such as the building with three podia, a tentative temple-mausoleum situated on the western outskirts of the site [BE15-105, *Fig. 18*] and the northern administrative building [BE15-110, *Fig. 19*]. However, excavation around the Square Feature (BE12/13-81, BE12/13-87 and BE15-103) has demonstrated an equal preference for broken coral heads to be used in architecture of lesser importance. Fragments of walls built in this technique were discovered in trench BE12/13-81,

underlying the collapsed east wall of the Square Feature, very conveniently dated by a coin of Philip Arab (AD 244–249) found on the surface covering the earlier architecture, on which the stone wall had tumbled (see Zych et al. 2014) [*Fig. 17*].

The northern and western quarters around the southwestern embayment constituted the burial grounds of early Roman Berenike. A formal cemetery was discovered in trench BE01-44, on one of the mounds on either side of the road leading to the site. Recent investigations in the ruins of the Hellenistic fort, defensive wall and gate west and northwest of the embayment also uncovered several human burials, although most of these skeletons seem to have been buried without any grave goods, in simple pits excavated quite



*Fig. 18. Building with three podia on the western fringes of the site; bottom (trench BE15-105) (PCMA Berenike Project/photo S.E. Sidebotham)*

shallowly among the ruins. However, three burials in trench BE15-104—two men and a female—were buried with the requisite care [Fig. 20]. The men had rings fitted with small keys of the kind used to lock small caskets, perhaps ones holding trade documents. The older of the two men was buried wrapped in a colored shroud and furnished with two strings of beads, many of which were of semi-precious stones. These individuals were not Roman and neither were they Egyptian; they presumably represented one of the exotic nationalities that passed through the emporium. The female burial was even more outlandish. She was very tall, laid on her back, her head and face covered with a halved amphora. A biconical stone weighing down her pelvis reflects a custom that is again suggestive of a certain exotism.

Last but not least, tombs were discovered on a butte west of the site; a survey in the area yielded a gemstone depicting an Eros milking a goat [Fig. 25 bottom left].

Of even greater interest is the formal animal cemetery that was discovered in the northern quarter of the site, within the early Roman trash dump that the Project has been excavating on and off since 1994. Cats and dogs were buried there starting from the mid 1st century AD and all through the 2nd century, the later phases characterized by a greater diversity of buried species, for instance, grey grivets, gazelles, wild birds. The dog buried in BE11-76 was exceptional, being wrapped in a mat and covered with the two halves of a cut Dressel 1 amphora [Fig. 21 bottom]. However, dog burials have been found also in the western quarter, also in context



Fig. 19. Trench BE15-110: looking west, example of stone-block architecture in the northern complex of the main city mound; note rectangular niche in west wall, once lined with marble and in a wooden frame (PCMA Berenike Project/photo S.E. Sidebotham)



Fig. 20. *Human burials: trench BE15-104, formal cemetery from the early Roman period in the ruins of the Hellenistic gate and well installation (PCMA Berenike Project/photo S.E. Sidebotham)*



Fig. 21. *Animal burials: top, trench BE10-65, three dog skeletons buried intentionally in an early Roman midden; bottom, trench BE11-76: dog burial under an imported Dressel amphora and next to it, a cat burial (PCMA Berenike Project/photos S.E. Sidebotham)*

with an early Roman midden [Fig. 21 top]. It remains to be seen whether there is more to these burials than just an illustration of a human–pet relation, which should probably be seen as a foreign custom in Berenike (for the finds and a discussion, see Osypińska and Osypiński 2017, in this volume).

In closing, one should comment on the finds from the trenches excavated in the southwestern embayment. Of greatest importance are the wooden parts of ships discovered in the series of compartments. A study of these remains has shown that the ships that sailed the Red Sea in the 1st and 2nd century—at least those that were dismantled and discarded in Berenike—were of Mediterranean design. The area of the stores was also a source of several kilograms of obsidian chunks as well as sizable quantities of pepper, as well as three varieties of frankincense: boswellia, mastic and camphora [Figs 24, 26]. Excavations in the trenches along the western side of the lunate-shaped ridge yielded a set of finds exemplifying a taste for a luxurious life—fine pottery wares, fine glasses (see Kucharczyk 2017, in this volume), gemstones [Fig. 25] and terracotta oil lamps. One lamp, which must have come from Italy, perhaps in the baggage of a Roman intermediary, also shows an inclination to have a good time: the fragmentary discus scene showed an erotic scene. Equally fine pottery, glass and lamps came from the structure around the cedar-wood post in the northernmost part of trench BE09-54, e.g., a large volute lamp with a wreath represented on the discus.

Much more representative of the early Roman period in Berenike is the assemblage coming from the trash dumps in the northern quarter of the site. The trenches

excavated in this area yielded a plethora of artifacts, including pottery: fine wares, cooking pots, storage and transport containers, illustrating the extent and directions of the trade that passed through the emporium in the 1st and 2nd centuries AD. The following is a characteristic of the pottery assemblage from two of the trash trenches, BE14-96 and BE15-107, which in the opinion of Agnieszka Dzwonek, one of the Project's pottery specialists, was the most representative of various kinds of vessels used in the port. Most of the assemblage consists of Egyptian amphorae and locally produced table and cooking ware, with a substantial representation of imported wares from different parts of the Roman Empire and, specifically for this site, from lands beyond the imperial borders.

According to Dzwonek, who is the author of the remarks below, most of the ceramic material from trench BE14-96 was made up of Egyptian amphorae made of Nile silt (around 60–65%). Two types were the most common: Egyptienne 3 (a broad long form with almond-shaped or triangular rim and two small looped handles, produced in three different clays: calcareous light orange-brown, dark brown and dark reddish-brown with grey core) and Dressel 2–4 Egyptian (copying Koan Hellenistic amphorae with double handles) produced in the Mareotis region from the mid 1st century AD.

The most common imported amphorae were: a) Dressel 2–4 Italian, produced in the Campania region, distinguished by its characteristic volcanic fabric; dated from the late 1st century BC to the early 3rd century AD; and b) Dressel 2–4 Cilician, produced in both western and eastern Cilicia, from the early 1st into the 2nd century AD; a relatively coarse fabric, light

beige to greyish-orange with many well-sorted inclusions; vessels were painted occasionally with red bands on the neck and shoulders.

Other kinds of amphorae were sporadic: Dressel 20 Baetica, Dressel 24 Asia Minor, Dressel 6A Italy-Adriatic Coast, Dressel 43 Crete and unidentified types of Aegean amphorae.

There was also an abundance of table and cooking wares produced locally in silt, marl or silt/marl mixed clay. The most popular forms were bowls, especially small thin-walled bowls with slightly inturned rim (Mons Claudianus type 15), dishes, small carinated cups, jugs with plain or three-foil rim, small cylindrical vessels, marl spouted vessels, jars and basins, lids, cooking pots (especially Mons Claudianus type 40-41) and casseroles.

Fine wares were represented only by a few small, often very abraded sherds, making the dating of the contexts much more difficult. These were mainly vessels made of fine pink Aswan fabric (not many diagnostics), also sometimes with pale reddish coating. Sigillatas are much less represented: Eastern Sigillata A (forms 13, 29, 35-37, 45), Eastern Sigillata B (forms 29, 32, 70), Italian Sigillata (forms 21, 26-27, 34). A few fragments of thin-walled vessels with barbotine decoration were also registered.

A substantial amount of vessels imported from lands outside the Roman Empire is significant and typical of the Berenike assemblage. Storage jars from South Arabia predominate in this group. These large coarse containers occur in three different organic fabrics: marl, buff and oxidized. The second big group of non-Roman imports is constituted by pottery from India. These pots are generally

distinguished by a specific red pellet fabric, black or reddish-black in color, with burnished surfaces. These are mainly cooking wares (like forms Wheeler 6, 8 or 24-25) and coarse wares. Finally, one should mention handmade pottery, of which only a few tiny pieces were found. This pottery was produced locally in the Eastern Desert, but identification and analysis are still hindered by the absence of extended studies.

The other trench in question, BE15-107, located a dozen or so meters from trench BE14-96 right in the center of the animal cemetery, produced a lesser pottery assemblage. In structure, however, the collection consisted mostly of the same kind of ceramic material, that is, amphorae produced locally: Egyptian Amphora 3 (mainly in dark brown fabric) and Amphora Dressel 2-4 produced in the Lake Mareotis region. Among the imported vessels, the most common was also Amphora Dressel 2-4, but produced in Campania foremost and much less abundantly in Cilicia and the Tyrranean and Aegean regions. Single fragments of other types of amphorae were present as well, e.g., Forlimpopoli (Italy), Late Rhodian Amphorae or unidentified types of Spanish clay.

The other kind of container, which appeared regularly almost in every context, is the keg, a big rounded vessel with a side spout, produced of Nile silt. Table and cooking wares in this trench did not come in any significant number. Bowls (Mons Claudianus types 15 and 8) were recorded, along with jugs, marl strainers (MC type 66), cylindrical vessels, coarse storage jars, cooking pots (MC types 31, 40), casseroles (MC types 62, 105), lids and one unguentarium.

As for fine wares, the record holds 1-2% of this category of ceramics. Most

were thin-walled vessels made of Aswan pink clay. Single fragments of Sigillata (ESA and ESB) were found, as was also an exceptional little glazed bowl (in pieces) produced in Tarsus. Likewise, the quantity of non-Roman pottery was much smaller compared to the other trench. Thick sherds of organic storage jars from South Arabia were present, along with Indian coarse and rice-tempered vessels, Indian cooking pots and even a single sherd identified as coming from Axum.

Excavation in trench BE14-100 provided evidence of a process that seems to have been fairly common in the early Roman period, namely, salvage of building stone. The stone blocks from the structure in the western part of the embayment were removed [Fig. 22]. Blocks were removed from the Hellenistic fort in the western quarter (trenches BE12-83/85/86) and the already derelict defensive wall (BE13-90/93), in some trenches (like BE01-42), blocks had been prepared but abandoned before they could be moved. Even without



Fig. 22 Trench BE14-100: looking northwest, robber trench documented in the negative by salt cementing of the fill after the stone blocks of the wall were removed (PCMA Berenike Project/photo I. Zych)

calculating the volume of the stone that was thus moved from its location (regardless of where it was quarried originally, see Harrell 2017: 245–247), it takes some imagination to see all this stone being used elsewhere on the site. It must reflect major building investment on a scale that can only be described as "Imperial" — projects of construction like the Great Temple in the main city, the Shrine of the Palmyrenians. It should be noted that as far as domestic architecture is concerned, the Project has excavated mostly late structures built in the characteristic coral-head technique and some modest sand-brick walls of Ptolemaic date under the Roman trash dumps in the northern quarter; the early Roman architecture of the town is practically unknown and has only started to be explored. Even so, recent excavations in trench BE15-110 [see Fig. 19] have shown that the major buildings of the early town were constructed of large stone blocks. We may be dealing thus with a situation, in which the building material from the Hellenistic ruins was



Fig. 23. Patch of broken basalt chunks - ship ballast in the upper parts of the embayment (PCMA Berenike Project/photo S.E. Sidebotham)

salvaged and reused in constructing the Imperial city of the Julio-Claudian, Flavian and Antonine age. Indeed, the quest for stone building material in this era must have been overwhelming: another building that was apparently dismantled down to the ground is the so-called building with three podia [see *Fig. 18*]. The structure is generally of Augustan date. Considering the range of the dating evidence for dismantled buildings, the building industry in Berenike in the 1st and 2nd century AD must have been thriving.

The latest activity in the southwestern embayment is represented by a series

of circular patches made of broken basalt [*Fig. 23*]. The basalt, identified as coming most likely from Sanaa (Sidebotham 2008: 313 and note 30; Harrell 2017: 240–245), was probably ship ballast, carried presumably in canvas bags (the circular shape would suggest some kind of container of this kind) and jettisoned here when the ships loaded up with whatever goods they were commissioned to transport. The remains cannot be dated, however, the sole suggestion being that the action post-dated the functioning of the southwestern embayment, possibly in the 3rd century AD or later.

## DISCUSSION

“It would have been logical to place the harbor facility and workshops making items used in ship repair/refurbishment in close proximity to each other” (Sidebotham 2008: 313). This was the view held by the excavators prior to the start of the American–Polish project in 2008. The topography of the southwestern embayment, especially when viewed in Google Earth imagery, nicely mimicked a regular built port. At the present stage of the project, after several seasons of exploration and study, and pending a more extensive publication, it may be said that the preliminary evidence is sufficient to form an idea of when the southern harbor of Berenike was in use and what it may have looked like.

The documentary and artifactual evidence from excavations of the early Roman trash dump in the northern part of the city has also provided a trove of information on the goods that passed through the port, whether as trade commodities or crew rations or ship supplies, and the Roman customs house and shipping

procedures from the early centuries of the Empire in Egypt. There is even a papyrus from Berenike listing items related to sailing: bundles of rope, a mast belt, block and tackle equipment, branding irons and a type of gum (Bagnall, Helms, and Verhoogt 2005: 45–47 No. 131; for the documentary evidence, see Bagnall, Helms, and Verhoogt 2000: 21–24; 2005; for a summing up of the Red Sea trade, especially Sidebotham 1986; Seland 2016; Sidebotham 2008; De Romanis and Tchernia 1997). It is a pity though that apart from the name of one ship, the *Gymnasiarchis* (Bagnall, Helms, and Verhoogt 2000: 61 No. 86), and the pictorial graffito of a ship with sails furled on a potsherd (Sidebotham 2008: 309–310, Figs 7–8), the epigraphic and pictorial sources have not yielded anything specifically related to the port(s) in Berenike.

Previous fieldwork, notably a magnetic mapping of the northern part of the site, had given an idea of a northern inlet, which could have been used for smaller craft (see



Fig. 24. *Examples of minerals discovered in Berenike: left, obsidian, and right, agate nodule (PCMA Berenike Project/photos I. Zych, E. Nieto Breogan)*

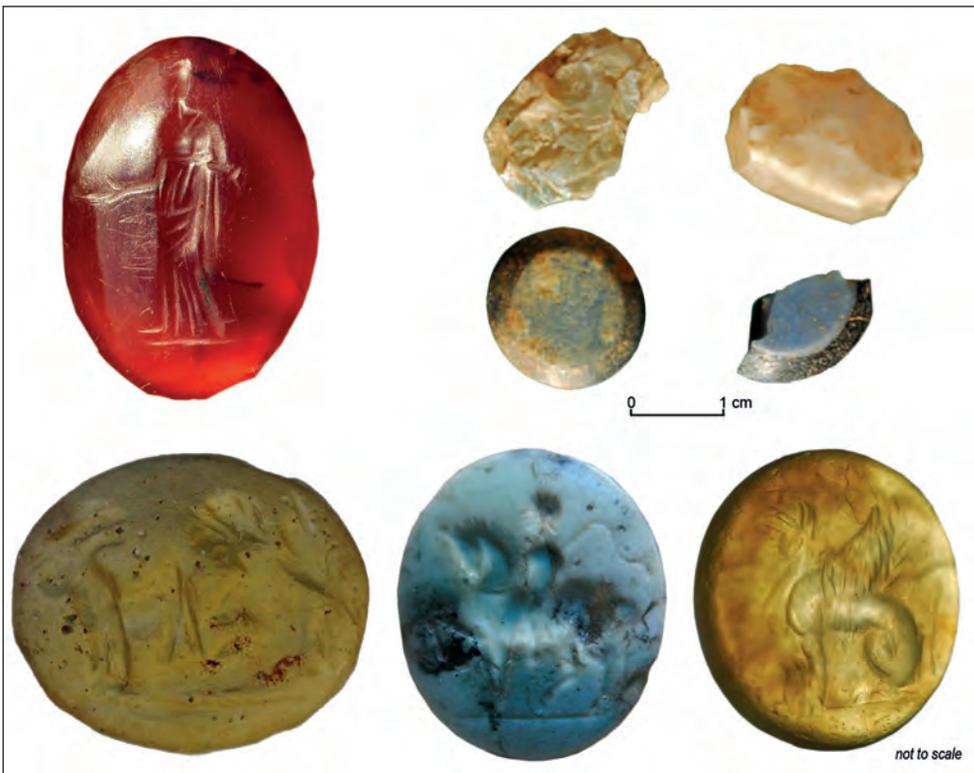


Fig. 25. *Cameo blanks and carved cameos from Berenike (PCMA Berenike Project/photos S.E. Sidebotham, K. Braulińska)*

Herbich 2007). It was also clear from the excavation that a sea wall built sometime in the 1st century AD ran along at least parts of the eastern extent of the site, meaning that boats, if not regular ships, could have been moored there; this gives a limited idea of the configuration of maritime facilities in Berenike in the Imperial period (see Sidebotham 1996: 25; 2000: 74–75). A paired set of potential lighthouse and an edifice (a small temple or large altar, for example) was also part of the early Roman harbor landscape (Sidebotham 2008: 317–318 with references; most recently Kotarba-Morley 2017d: 216–217).

Combining the evidence of the recent excavations in the southwestern embayment and the geomorphological survey has revealed how misleading the satellite image is. Strabo it seems had it right when he reported (17.1.45) that Berenike was a convenient landing place, an anchorage or roadstead, and not a proper manmade harbor of the kind that the Roman Mediterranean harbors of Caesarea Maritima, Alexandria, or even Carthage or Ostia near Rome, to name just a few of the well-known ports that have been reconstructed based on the archaeological record. Writing less than a century later, Pliny the Elder (*Nat.* 6.26.103) glossed over the issue. The archaeological record remains mute and the geophysical prospection, which has covered all the significant parts of the site, does not leave any real hope for the discovery of anything like the Roman pier at Myos Hormos/Quseir al-Qadim, which dates from the early 1st century AD (e.g., Blue 2002). The finds from Myos Hormos are an indication that the technology and know-how were there, the architecture of the monumental Great Temple in Berenike (as well as some other early Roman

buildings) demonstrate a capability for major building undertakings, and the volume of the Red Sea trade—as reasonably reconstructed based on historical and epigraphical evidence, demonstrating the importance of this trade for the early Roman Empire—suggests that there were both economic and political reasons for the investment. Moreover, considering the degree of military security and management (network of *praesidia* and working lines of communication) in the Eastern Desert hinterland throughout the early Roman period, one cannot see any significant obstacle in the form of, for instance, brigandry that could have restrained such



Fig. 26. Three different kinds of frankincense found in the harbor: from left, boswellia, mastic and camphora (PCMA Berenike Project/photos K. Braulińska)

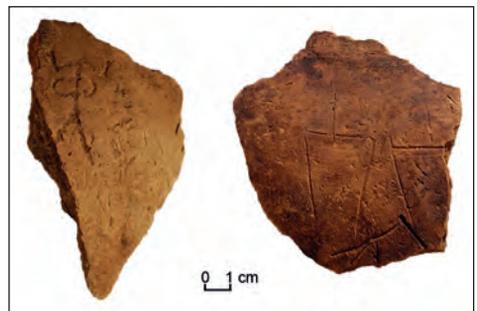


Fig. 27. Sherds with graffiti interpreted as Hadramauti (PCMA Berenike Project/photos S.E. Sidebotham)

a project. One is led to conclude that the reasons for there not being a proper man-made harbor in Berenike was that it was simply not needed there in such form. This is meaningful only in the sense that it did not compromise the functionality of Berenike as a commercial entrepôt, that is, a transshipment port where merchandise may be imported, stored or traded, and in most cases sent on. It also assumes that all the required functions related to ship maintenance and provisioning, as well as the transfer of goods to and from ships was handled without hitch.

Berenike was undoubtedly a hub of the Roman Red Sea trade, but it was by no means “created” by the Romans. It was a functioning center that was stitched into the Roman trade system, tapping into the extensive and prospering Indian Ocean trade network of the late 1st century BC (Tomber 2008; Fitzpatrick 2011: especially 29–30 and notes 10 and 11). Its role grew as the Roman trade with the East accelerated, an economic process that led Pliny to lament on the professed trade deficit incurred by Rome (Fitzpatrick 2011: 31). However, while silk and gemstones can be considered as *luxuria*, other commodities, admittedly expensive, like spices and frankincense, were already fairly mundane. Their acquisition in a controlled way, bringing a sizable return to the Roman financiers who could loan the requisite capital for organizing the shipping, determined the extent of the investment in infrastructure that took place in Berenike. As Fitzpatrick points out, voyages to India were hugely expensive and could not be organized without the participation of financial intermediaries, such as the Sulpicii of Puteoli, who acted as a bank underwriting the risk of loans to Roman traders (Fitzpatrick

2011: 40–41). Roman efforts to control the major trade networks of the East culminated under Trajan and Hadrian, and, again citing Fitzpatrick (2011: 43 with reference to Fergus Millar’s research, see note 73), “the largest amount of East–West exchange flowed not via the difficult and often dangerous trans-Eurasian overland route, but rather via the comparatively fast and safe oceanic trade route”. While this concerns the Arabian Gulf route to Mesopotamia, it also reflects the route taken by Chinese and Far Eastern goods, which were sailed down India’s rivers to the Indian entrepôts servicing Arab and Roman trading vessels (Fitzpatrick 2011: 44). Fitzpatrick also sums up the evidence for Indian traders in Egypt (2011: 48 and notes 101 and 102) and states, citing among others the archaeological evidence from Berenike (Sidebotham, Hense, and Nouwens 2008: 189–192), that the Roman Indian trade in the 1st century AD was handled by a “cosmopolitan assortment of polyglot intermediaries from the southeast of the Roman Empire who used Greek as a common *lingua franca*” (Fitzpatrick 2011: 49).

Wealth to be acquired by tapping into this lucrative trade (including the much underestimated role of the Arabian peninsula and the incense market supplying the demand of Roman religious observance in this period, see again Fitzpatrick 2011: 51) was of such unimaginable proportions that it fired Roman imperial policy from the time of Augustus well into the 2nd century AD. Berenike, or rather the Red Sea coast of Egypt in general, thus became a player in Roman dreams of Eastern expansion (see Sidebotham 1986: 139ff.), the first step to which, in Augustus’s view, was to control not only the African, but also the Arabian shore of this, as

Fitzpatrick puts it so figuratively, “Red Sea commercial bottleneck”. On the other side of the Indian Ocean, however, there were the complicated politics of India in this period, especially the rise of the Kushan Empire and its reaching out toward Rome (Fitzpatrick 2011: 44 and note 78, citing J. Thorley). Roman sources mention at least two instances of diplomatic envoys being sent to the Roman Emperor: by the first Kushan king Kanishka the Great (the king’s missionary zeal in spreading Buddhism should also be taken into account) to Augustus and later again in the times of Hadrian. The possibility that these envoys would have traveled by the sea route and through Berenike can only be suggested and not proven, but, as mentioned above, there is enough sound archaeological evidence from the harbor to support the idea of Indians perhaps even residing in Berenike (see Tomber 2000). In turn, the South Arabian presence in Berenike is manifested especially in pottery, sherds bearing graffiti of the Hadramauti kings (Sidebotham and Zych 2011: 176) [*Fig. 27*] and some of the bronze statuary and stone altars reused in the late Harbor Temple (Radkowska and Zych forthcoming a; b). The graffiti are proof of trading, the religious articles of cultural influence and possibly even residence.

The documentary evidence from Berenike gives insight into two other categories of the population in Berenike in the first centuries AD: soldiers and cameldrivers (for extensive discussion, see Bagnall, Helms, and Verhoogt 2000; 2005; Ast and Bagnall 2016). These men drew water rations in Berenike and would have presumably made use of at least provisional housing as well as using other amenities, including food preparation (the water in

two instances was intended for a garden and for a barber shop). To judge by a few of the surviving papyri, like the verses related to the goddess Kybele (e.g., Ast and Lougovaya 2015; Ast and Bagnall 2016: No. 262), some of these people had a taste for the better life in terms of literary interests, hence would have presumably opted for a comfortable style of living. This the town of Berenike should have been able to provide.

The archaeological evidence from the Polish–American excavation of trenches within the southwestern embayment paints a picture of what Berenike’s harbor would have looked like in these early centuries. The ridge surrounding the embayment is still the most convenient walkway from the area of the city around the Great Temple, which must have been a landmark from both the sea and land sides, to the southwestern part of the site. The ridge appears to have at its core a natural fossil reef, encased in a kind of substructure, which, if continuous, would have formed an enclosure around the bay. A dip in its northwestern part (used today by the expedition’s jeep) may have been the official gateway in and out of the embayment. The bay served as a natural landing place for the small tender that plied the waters of the lagoon between the ships standing out at the roadstead and the natural landing places on the beach. Assuming any kind of customs process taking place at Berenike, even if the actual taxes and the imported goods were paid at Koptos in the Nile Valley, as the Tariff of Koptos would suggest, the embayment would have been a secure and convenient place for unloading and checking before goods were moved to safe storage and subsequently packed on a caravan of camels or donkeys. No

warehouses have been discovered so far in this area, although the existence of buildings resembling warehouses was recorded in the southeastern part of the wall, near the presumed seawall.

The results of excavations within the embayment area have revealed the presence of a large building, constructed of dressed stone blocks, with courtyard and evidence of ovens and fires. Finds included an iron arrowhead as well as a gamut of early Roman storage containers. The building was dismantled down to the foundations (although it should be emphasized that little in the way of sturdy foundations was needed in Berenike), at least in the two trenches in which it was traced. The rubble found in a nearby trench (BE09-55) could have come from this structure, although one is left wondering why it would have been carried away to be dumped in such meticulous fashion from a ruin. In any case, this trench and the neighboring BE14/15-102 trench yielded artifacts like exquisite carved gemstones, a pair of loaded dice and a almond-embossed glass beaker, attesting to the “luxurious” furnishings of this structure if nothing else.

The finds from the opposite end of the embayment, where it meets up with the houses of the town, also suggested a more affluent lifestyle, not the least the fairly unusual terrace of resin-hardened tamarisk twigs and pebbles, connected with a cedar post and wooden framework around a space laid with successive layers of matting. The space was not identified functionally at the time of excavation, but considering the evidence: two halves of a pearl-oyster shell and a camel rib shell in a pit by the cedar post, two large chunks of Syrian fir tree resin also in an apparent pit and a plaque of *Boswellia* wood, as well

as a faunal assemblage indicative of food remains (including a rodent) (Sidebotham and Zych 2011: 37–38 and Fig. 4-17), we may be dealing here with a small shrine.

The remaining architecture that has been explored within the embayment, which is tentatively also the reason for the rising embankments that stretch from the ridge down into the bay, was of a different nature. It consisted of low walls of broken coral heads, just two or three courses high, anchoring partition walls of nothing more than palm-leaf or tamarisk-branch mats and thatched with similar mats. These walls formed at least eight small units aligned side by side along a ridge descending into the bay. They would have been arranged around open spaces where industrial and domestic activities took place. This is especially evident in the line of excavations in the eastern (but actually central) part of the embayment, where large pieces of planking from ships and coils of thick mooring rope were discovered, partly destroyed by a huge fire that seems to have burned in a single spot, raging so fiercely that it left a very fine black ash deposit more than a meter thick at its center, spreading out for the better part of 20 m. In the southern end of this section there were more baskets and acacia wood, suggesting a more domestic character of this area.

The eastern end of the embayment, which escapes notice owing to the central ridge with the architecture and remains described above, has not been explored to any extent. However, the magnetic map of the area suggests that it also formed a natural cove with the city architecture coming down densely to the shore, practically to the water edge. Buildings here were fairly large, separated by narrow winding alleyways, including one compound with a large

hall ending in broad apses at either end of the transverse axis. North of this area stands the so-called West Shrine or Temple of the Palmyrenians, which the Dutch–American project excavated in the mid 1990s, which must have been an important landmark in the late 2nd and early 3rd century AD. This western quarter of the city (which so far has not yielded any finds earlier than the 4th to 6th centuries AD) shows a definitely different orientation than the houses on the city mound east of the Great Temple. A study of the magnetic map of the site shows the different orientation of the urban architecture on the main mound and the quarter of buildings behind the Great Temple, which appears to act as a hub for the two quarters. The temple seems to be fitted into the grid of the western district despite having its back to it. Its position in the city is aligned more or less with the path passing along the lunate-shaped embayment ridge and crossing the main mound in a fairly straight line all the way to the sea in the outer bay. This is actually the *decumanus* of the Roman town, the main street that also featured a tetrapylon-like structure at the crossing with the main *cardo*. Moreover, one should note that the apparently early Roman temenos in the northeastern part of the main mound seems to follow the orientation of the western district, as if the more strictly regular architecture from the center of the town did not exist.

Objectively speaking, the Great Temple is the central point of the town and it is the oldest standing building excavated to date on the site. In its currently known form, it falls in well with the late Ptolemaic/early Roman Egyptian temple-building tradition exemplified by the score of sacral buildings that were constructed in this period in the Nile Valley in Upper

Egypt (e.g., Elephantine). The orientation of the town architecture around it must have respected it to some extent regardless of how isolated it was from the urban fabric as a whole. The main east–west thoroughfare started from in front of its facade and the western of two *cardines* heading off to the north and south of this *decumanus*, ran in front of it. The streets in the town proper, located on the promontory to the east and northeast of the Great Temple, followed a more or less regular grid despite never being apparently given pavements or porticoes. Three round dots at the intersection of two main streets, observed on the magnetic map of the site, might even suggest the presence of a tetrapylon. Taken together with a broad range of archaeological and architectural evidence suggesting the prosperity of the town in the early Roman period, one can easily imagine a major urban refurbishment, if not building from scratch, aided by an Imperial endowment perhaps, in this part of the town at the heyday of the Roman imperial trade, that is in the late 1st through mid 2nd century AD. Inscriptions on stone, on altars as well as from the walls of the Great Temple, suggest heightened activity in the time of Claudius, the Flavians, Trajan and Hadrian (Ast and Bagnall 2015; 2016: 12–15; 2017).

Last but not least, those approaching the natural landing place within the embayment would have observed immediately a semi-insular sanctuary composed of a tower-like structure at least 6 m high, or rather a group of structures including this shrine. It may have been dedicated to the cult of Isis-Tyche and the Roman emperors. The evidence is circumstantial, but if it is accepted, then the shrine certainly existed in the reign of Domitian (reigned

AD 81–96; an inscribed altar mentioning this emperor was found inside the so-called Square Feature in this sanctuary) and was still in place in the first year of Trajan's reign (AD 98), when another small altar was inscribed with a dedication to Isis-Tyche by a freedman from the emperor's court (see Ast and Bagnall 2017) [see Fig. 28]. A coin of Philip Arab (about 240) indicates when this temple was already in ruins.

Interestingly, the sanctuary was the only part of the southwestern bay to continue in use in the later Roman period, that is, in the late 4th through mid 6th centuries AD, after which Berenike appears to have been peaceably deserted. A new temple

was built on hallowed ground, partly reusing for structural purposes one of the old standing walls. For all practical purposes, however, it was located on the far western outskirts of the port, which must have had much of the desolate wasteland look that it has today. In this context, keeping in mind that the piles of unworked vesicular basalt were recorded mostly along the top of the ridge, and hence clearly post-date at least the 3rd century AD, they likely represent shipping events from the late period of Berenike.

To sum up, there seems to be abundant evidence at this point of major building works taking place in the city, the Great



Fig. 28. Inscribed stone altars from the harbor sanctuary: left, dedication dated to the reign of Domitian, and right, from the reign of Trajan (PCMA Berenike Project/photos S.E. Sidebotham)

Temple and the Square Feature in the semi-insular sanctuary in the port being only two examples. The archaeological record has shown large squared blocks of stone being salvaged from the Hellenistic ruins for use presumably elsewhere at the site. Some are still in place, prepared for moving but abandoned. It seems clear, however, that these works did not include building a “proper harbor” and that the southwestern embayment was used in lieu of such a harbor.

The archaeological evidence from the area of the harbor bay paints a picture of everyday activities involving ship maintenance and repairs, mundane everyday jobs, perhaps burning lime, copper-working and less easily identifiable activities. A group of *Pinctada* shells laid flat on the ground suggested cooking and consumption activities, perhaps in open-air taverns. Yet the tamarisk/cobble resin floor as well as the platform-like substructure at the other end of the ridge represent Roman(?) engineering at its best, connected with a building of substantial size and possibly also splendor. Considered in context with the Roman sanctuary at the entrance to the bay and in light of the evident disuse of the landing place after the 2nd century AD, one

is entitled to wonder whether this area was not used also for the special occasions when a large cortege, for instance accompanying a foreign ambassador from far-off India, would set down, resting after the sea journey before the next leg of its trip by caravan across the Eastern Desert.

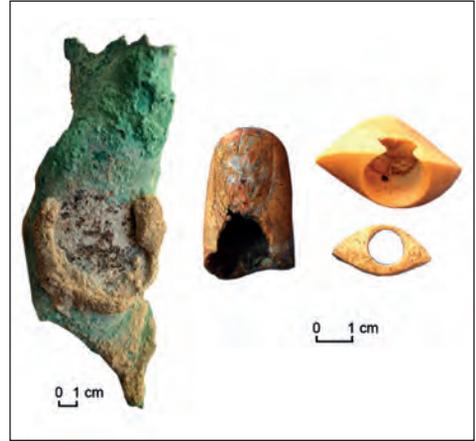


Fig. 29. Parts of bronze statuette from the harbor sanctuary: from left, fragment of the leg of a nude male figure; larger than life toe and stone eye inlays (the bottom one resembles cat mummy inlays from the Nile Valley) (PCMA Berenike Project/ photos S.E. Sidebotham)

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# The Great Temple in Berenike: new findings of the Berenike Temple Project

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**Abstract:** A reinvestigation of the so-called Serapis Temple of Berenike produced proof for the existence of undisturbed archaeology around and even inside the building. Until recently it was assumed that this temple was completely excavated during the several, poorly documented, excavations of the 19th century. A small test trench against the back wall of the temple uncovered the remains of a secondary stone wall and parts of a small statue. The excavation of the northwest room resulted in the find of architectural details never published by the early excavators.

**Keywords:** Berenike, Great Temple, Belzoni, Serapis, Horus/Sobek

The so-called Serapis Temple in the Red Sea port of Berenike was the first building investigated on the site by the 19th century European and American explorers, who failed however to publish much from their endeavors. Recently, in 2011, the Berenike Project mounted the first substantial excavation since the 19th century, speeded up by a deplorable act of vandalism, which tore down part

of the northern side wall of the temple. Test trenches indicated the presence of undisturbed archaeological layers inside the sanctuary. The Project now aims at a thorough investigation of the temple complex to document its architecture and history, its links with the town and its inhabitants, and the influence the international character of the town exerted on its functioning.<sup>1</sup>

## EARLY RESEARCH

When Giovanni Belzoni discovered Berenike in 1818, he gave special attention to a stone temple in the center of the site,

the most visible remnants of the town (Belzoni 1821: 330). Pressed by a shortage of drinking water, he managed only a hasty

<sup>1</sup> The excavations of the temple are part of the Berenike Project, directed by Steven E. Sidebotham (University of Delaware) and Willeke Z. Wendrich (University of Leiden) and since 2008 by Steven E. Sidebotham and Iwona Zych (Polish Centre of Mediterranean Archaeology, University of Warsaw). For more on the excavation, see Sidebotham and Zych 2017.

excavation. Still, parts of reliefs on the walls and a fragment of a stela were found at the time. The first plan of the temple was also produced then.

Eight years later, John Gardner Wilkinson visited the site and made the first detailed plan of the town. The temple, about 23 m long, is seen on it. Wilkinson excavated room 1 and a small section of room 2. He probably also unearthed a small part of the large front hall, which he called a portico. His notes contain drawings of inscriptions with cartouches, on both sides of the entrance to room 1; he thought them to be of the emperor Marcus Aurelius (AD 161–180) (Wilkinson MS. XXXVIII, 92, Bodleian Library, Oxford; Meredith 1957: 61–62). In *Topography of Thebes* he described his finds in the temple: “In excavating these chambers (for I did not attempt the portico), I found a Greek dedication to Serapis, the head of a Roman emperor, either Trajan or Adrian, a small fountain, and some rude figures, probably *ex votis*” (Wilkinson 1835: note on pages 418–419).

In 1836, James Wellsted visited Berenike and excavated a small part of the temple. The plan he made at the time of discovery suggests that less than half of the building was visible above the ground at the time. Wellsted mirrored the southern part of the plan, creating a non-existent, symmetric temple with two staircases. Clearly, he must have been unaware of the plans made by Belzoni and Wilkinson.

Despite time constraints Wellsted managed to excavate a large part of the sanctuary (room 2), which appeared to have already been partly excavated, probably by Wilkinson. At the depth of

about 1.50 m, he first came across several figures on the walls which, upon further investigation, turned out to be “the figures of deities and the king... arranged in groups along the walls”. He found two fragments of a stela with a Greek inscription, containing a dedicatory text of a Ptolemaic king. To access the room Wellsted dislodged several massive roofing stones (Wellsted 1836: 98).

Arriving in Berenike in 1846, Heinrich Barth was disappointed to find the town “barely more than a trash heap”, amidst which even the temple was not clearly visible. His observation that the temple, although covered with hieroglyphic texts and reliefs, had no inscription dated before the reign of Tiberius (Barth 1858: 16), is probably based on the reports of Wilkinson. After having measured the visible remains of the temple, he left for the nearby mountain site of Shenshef.

When Theodor von Heuglin arrived in Berenike in July 1857 by means of a small local freight ship hired at Quseir, he saw “a temple of large limestone blocks ... probably originating from stone quarries I discovered about 2 miles north west of the ruins...”.<sup>2</sup> He found the temple inaccessible as it was buried in sand up to the roof slabs. The stone surface which could have been observed at that time had eroded so much that no inscriptions or reliefs were visible, except for an upturned roof block with stars carved in relief. Although most of the temple was covered by sand, traces of recent excavations were still visible (von Heuglin 1860: 333).

The next to excavate the temple was Erastus Sparrow Purdy, a Union Army major who was also an experienced

<sup>2</sup> These quarries seem to have been lost to 20th century building activities.

surveyor. He was one of the 50 veterans of the American Civil War that the Egyptian ruler Ismail Pasha hired in 1870 as part of an attempt to modernize his army. Purdy was sent on several expeditions to the south of Egypt and Sudan. In 1870 and 1873, he surveyed the Berenike region. During his second stay there he also visited Berenike itself and with a group of Egyptian soldiers excavated parts of the temple (Purdy 1886, but without mention of the actual work in Berenike). Although it is claimed that Purdy excavated the temple in its entirety, precisely how much was unearthed during the 1873 expedition was not clear until the clearing in 2011 by the Berenike Temple Project, which has shed light on this issue. After Purdy's sudden death in 1881, his expedition notes were deemed to have been lost forever, although in 1922 Daressy

discovered a copy of the plan of the temple made by Purdy in the archives of the Institute d'Égypte (Daressy 1922: 170). The plan shows the north and south walls of the so-called forecourt and a huge fallen roof slab in the forecourt, as well as a crypt under room 8, with a narrow entrance in the "forecourt".

Russian egyptologist Vladimir Golénisheff visited Berenike and published in 1890 a version of the temple plan to which he also added a cross-section of the then still exposed corridor 6 (Golénisheff 1890: Pl. V). In 1994, Hans Barnard and Fred Aldsworth also drew a plan of the temple as part of the survey of Berenike (Aldsworth 1995). The plan presented here is based on those made by Purdy, Golénisheff and by Barnard and Aldsworth, updated to include the results of the 2011 test trenches.

## BERENIKE TEMPLE PROJECT RESEARCH IN 2011

The repeated clearing of parts of the temple in the 19th century led to rapid deterioration of the reliefs exposed to the air, a state noted by Wellsted already in 1836. One of the objectives of the current project was to assess the state of preservation or rather decay of the walls, especially the exposed parts of the monument during the previous 100 years. The project will also record the architecture accurately and any surviving stratigraphy, reliefs and inscriptions. In 2011, room 3 was cleared and a test trench, BE11-79, was dug against the outside of the back wall of the temple, the purpose being to locate an area with intact stratigraphy, undisturbed by the 19th century excavations [*Fig. 1* bottom].

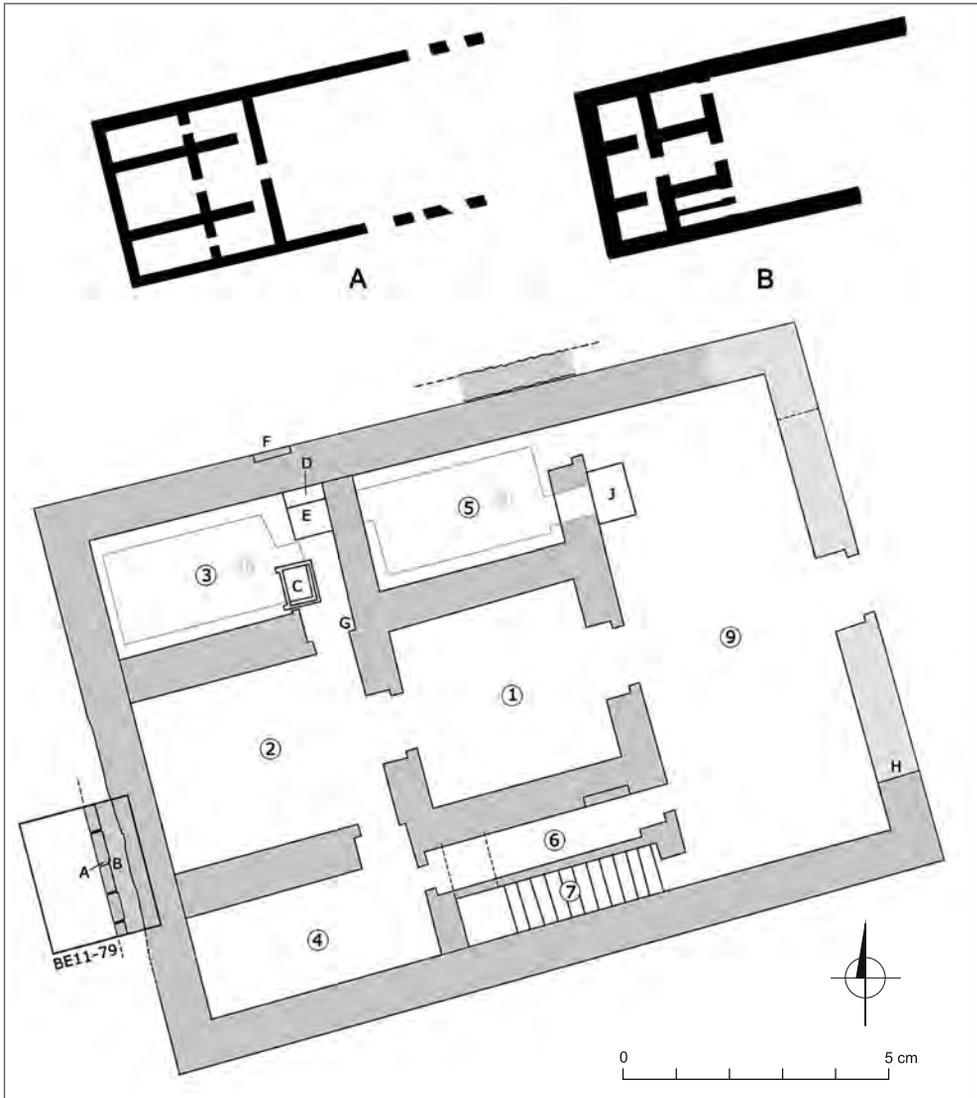
### ROOM 3

Room 3 is a narrow room in the north-western corner of the temple. It was cleared repeatedly and stood open for longer periods of time as indicated by the different lines of salt on the walls. Upon closer inspection, it turned out that the 19th century excavations were not thorough. Vandals digging for treasure prior to the 2009 season of the Berenike Project re-excavated the room, uncovering a trapdoor in the stone floor and clearing a crypt underneath [C in *Fig. 1* bottom]. In 2009, the Project protected the uncovered architecture and backfilled the room. In 2011, the floor and the trapdoor were uncovered again and documented [*Fig. 2*]. It should be noted that Purdy's drawing did not record the crypt (Daressy

1922: 172, Figs 3 and 4), which is additional evidence that he never fully excavated this room.

The trapdoor gave access to a crypt between the heavy foundation walls of

room 3. This crypt is not shown in Purdy's plan, although he noted another crypt, underneath room 5, accessed through a small entrance [J in *Fig. 1* bottom] in the 'courtyard' and through a narrow door in



*Fig. 1. Revised plan of the temple: new data combined with the Purdy/Golénisheff (1A) and Barnard/Aldsworth plans (1B) (PCMA–University of Delaware Berenike Project/plan M. Hense after Purdy/Golénisheff and Barnard/Aldsworth)*

the floor of room 3 [E in *Fig. 1* bottom]. The impression is that Purdy never fully excavated the crypt underneath room 5, because his plan recorded a solid west wall. The foundation walls observed in the crypt underneath room 3 were much wider than the walls they supported. Such a construction technique was typical of many temples built after the Twenty-fifth Dynasty (e.g., Arnold 1999: 172, Fig. 120). The north foundation wall appears to be built on top of an older structure, which can be seen as a row of stones in the floor of the crypt. The temple may have been constructed on a stone platform, in which case, the original ground level around the

temple could be placed well into Ptolemaic period levels reached in the excavation of nearby trench BE-10 in 1999 (Sidebotham and Wendrich 2007).

The trapdoor is carefully cut in the stone floor [*Fig. 2*]. Two recesses on the western edge of the opening probably accommodated metal hinges. It was cut far too close to the south wall, the foundation wall of which partly blocks the opening. Those planning the trapdoor obviously were unaware of the foundation walls being much wider than the temple walls, which would point to the secondary character of this feature (probably cut into the stone slabs of the floor years after the



*Fig. 2. Trapdoor in room 3*  
(PCMA–University of Delaware Berenike Project/photo M. Hense)

construction of the temple). The secondary character of the crypt is also confirmed by the absence of any indication of a stone floor in it and the rough stone surface of the foundation walls on either side.

The floor of room 3 was made of a series of large stone slabs, resting on the foundation walls [Fig. 3]. The rather rough surface of the large slabs indicates that they were once covered with thin, flat paving stones. The presence of a paving is further confirmed by a small ledge at the base of the walls. A grey-brown sand fill in the interstices between the floor slabs yielded a cowry shell of the same kind as excavated in other late Roman period sanctuaries, suggesting a date for the original fill of the room in the 4th century AD or later. The missing presumed flooring, probably made of a quality stone, may have been removed after the temple fell into disuse in the 4th century AD. Finds in the courtyard of

a nearby house in trench BE00-37, some meters east of the temple, seem to indicate that it was quarried for building material in the 5th century AD, possibly in the same action.

A connecting doorway opened between room 3 and the sanctuary (room 2) [see Fig. 1]. It was once closed with a wooden door, as attested by two recesses for a pivot block, the pivot probably made of bronze, remaining in the eastern corner of the lintel [Fig. 4; G in Fig. 1 bottom]. The pivot block would have been locked in place with an L-shaped something fitted there. It is likely that this construction consisted of two parts, the smaller part being used to secure the pivot block in its place.

At least in room 3, an examination of the inner walls revealed that they were not interconnected with the outer wall of the temple [Fig. 5 left]. The outer walls in the northwestern corner featured some

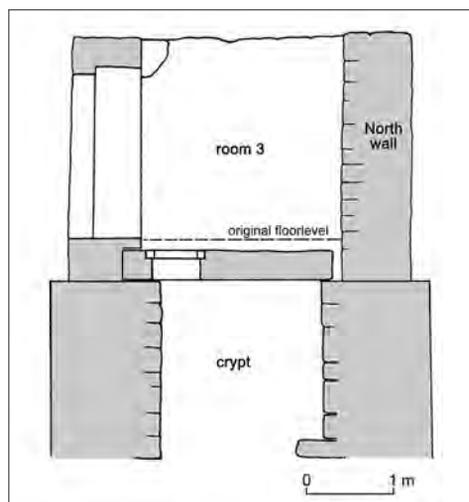


Fig. 3. E–W section through room 3 and the crypt below it (PCMA–University of Delaware Berenike Project/drawing M. Hense)



Fig. 4. Recesses for a pivot block in the connecting door to the sanctuary, seen from inside room 3 (PCMA–University of Delaware Berenike Project/photo M. Hense)

L-shaped corner blocks, which are not unusual in Ptolemaic–Roman Egyptian architecture [Fig. 5 right]. The procedure was to mount in place roughly cut blocks transported from the quarries and then cut back the inner surface, creating the unusual L-shaped form that is found in this corner. After building the outer wall of the temple, the rough and uneven surface was cut back to form a smoother surface, resulting in an outer wall that was 0.80–0.84 m thick. The south wall of room 3 is not connected to the outer wall but abuts the cut back wall surface. It means that these inner walls, with a thickness of 0.74 m, were built after the eastern face of the west outer wall and the southern face of the north outer wall of the temple had been finished.

There is a considerable disparity in the quality of the anhydrite and gypsum

ashlars of the walls, ranging from dense crystalline anhydrite to soft and easily weathered blocks. It is an indication of logistical problems and the costs involved in building a large stone temple on an isolated site like Berenike. Another remarkable imperfection can be observed in the masonry of room 3. The south and east walls consist of several layers of smaller blocks topped by layers of larger blocks. Layers with smaller stones were used also in the north and west walls, the outer temple walls, but these layers are slightly higher in the wall. This may be an indication of restoration or resuming building work during the revival of Berenike in the early Roman period. A very unusual niche was located in the outer wall at the eastern end of room 3. Its height above the original floor level of the temple indicates that this

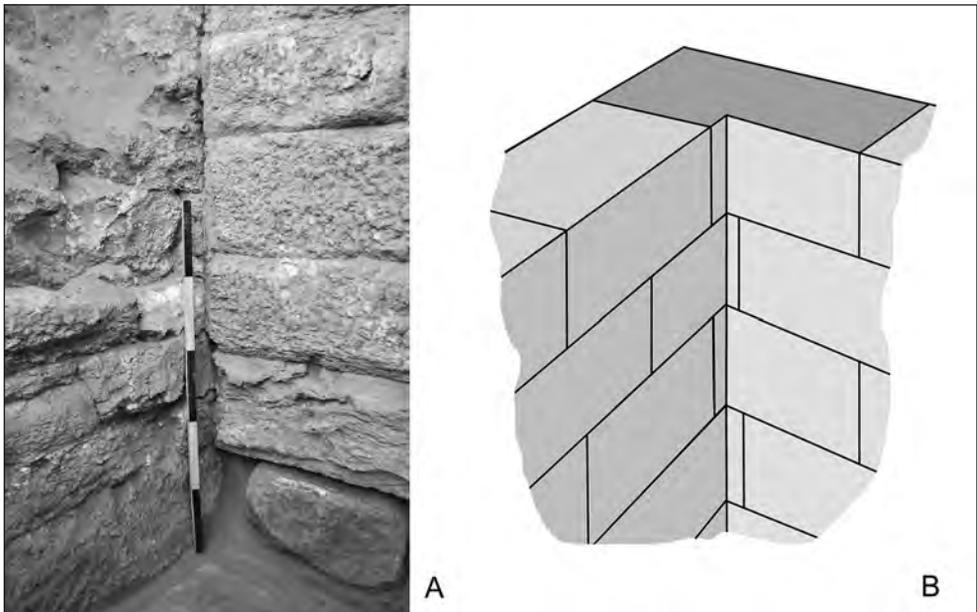


Fig. 5. The inner faces of walls in room 3: left, the northeastern corner; right, L-shaped blocks in the northwestern corner (PCMA–University of Delaware Berenike Project/photo S.E. Sidebotham; drawing M. Hense)

niche was probably secondary and may have even been carved in the stone after the 4th century.

Excavations documented a large block set on the floor of room 3 and leaning against its north wall [Fig. 6]. It is far too big to be a part of any of the walls. With a thickness of 0.45 m, it is most likely a fragment of a large roof slab. The top of this block bears on one side traces of a later stone and coral edifice, which constitutes the remains of a structure built on top of the temple during the late 4th through early 6th century. This evidence confirms

Wilkinson's observations from 1826 that a coral head wall had been built on top of one of the roof beams prior to its collapse. A similar situation can be found at other temple sites, where during the 19th century houses and other structures were reported on temple roofs. The underside of the stone slab with remnants of the aforementioned coral head wall seems to have once had a decorated surface, most likely the remains of a star pattern.

Decorated ceiling blocks were seen by Wilkinson in 1826, one in room 1 and another one in room 2. He produced

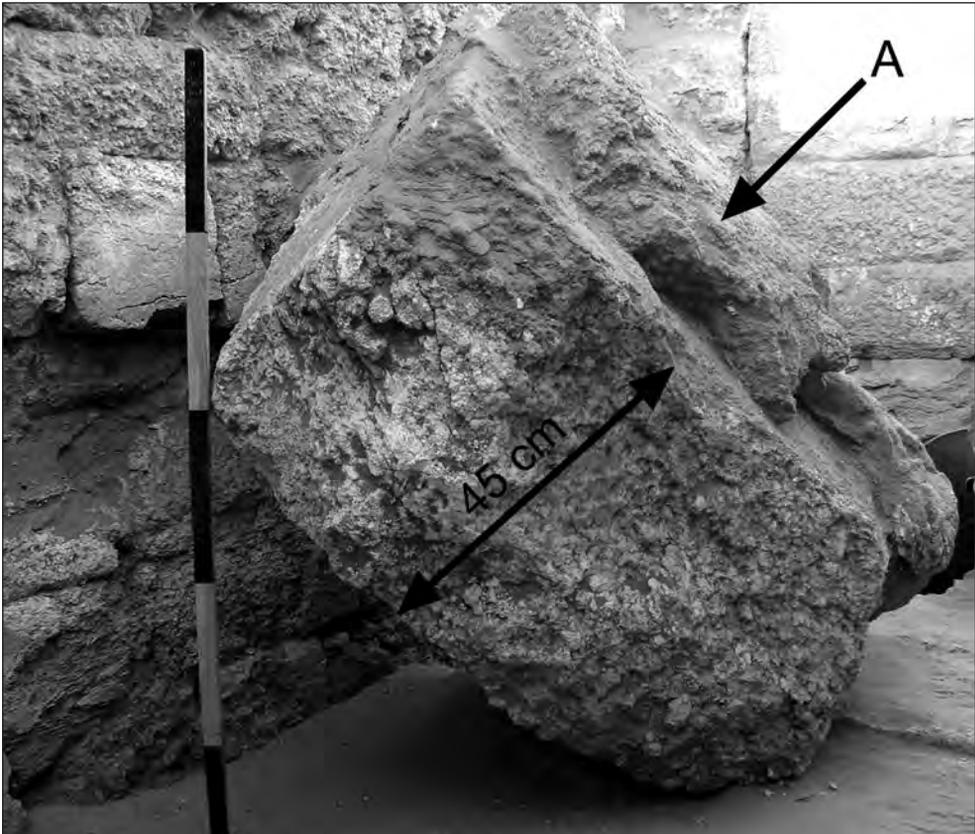


Fig. 6. Fragment of a roof block leaning against the wall in room 3  
(PCMA–University of Delaware Berenike Project/photo M. Hense)

a sketch of the second fragment, which shows the name and titles of a Roman emperor and a part of a vulture. This decoration is typical of the central axis of a temple ceiling (Wilkinson MS. XXXVIII, 93 and MS. V, 50, Bodleian Library, Oxford). Wellsted dislodged several roof blocks in room 2, uncovering some ceiling blocks with hieroglyphic inscriptions “in a beautiful state of preservation” (Wellsted 1838: 336–337). Heuglin saw another block with stars during his visit to Berenike in 1857. This fragment of the ceiling might be one of the blocks removed from its original location by Wellsted, some twenty years before (von Heuglin 1860: 333).

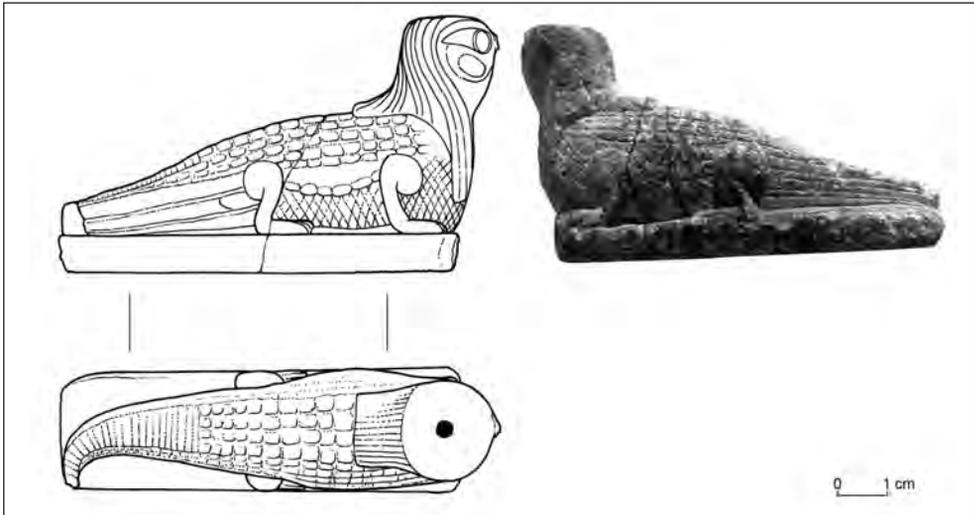
#### TRENCH BE11-79

Searching for undisturbed late period stratigraphy the Project opened trench BE11-79 against the back wall of the temple. Directly below the surface were the remains of a collapsed wall, comprising rubble from a wall face added to the back wall of the temple. The wall face consisted of stones only 24–26 cm thick, the remaining space between the original temple wall and the new stone wall, about 25 cm, being filled with coral blocks. The gypsum/anhydrite wall was probably an inner wall face of a later building, with a much higher floor level. However, all the houses excavated thus far in Berenike are predominantly built of fossil coral

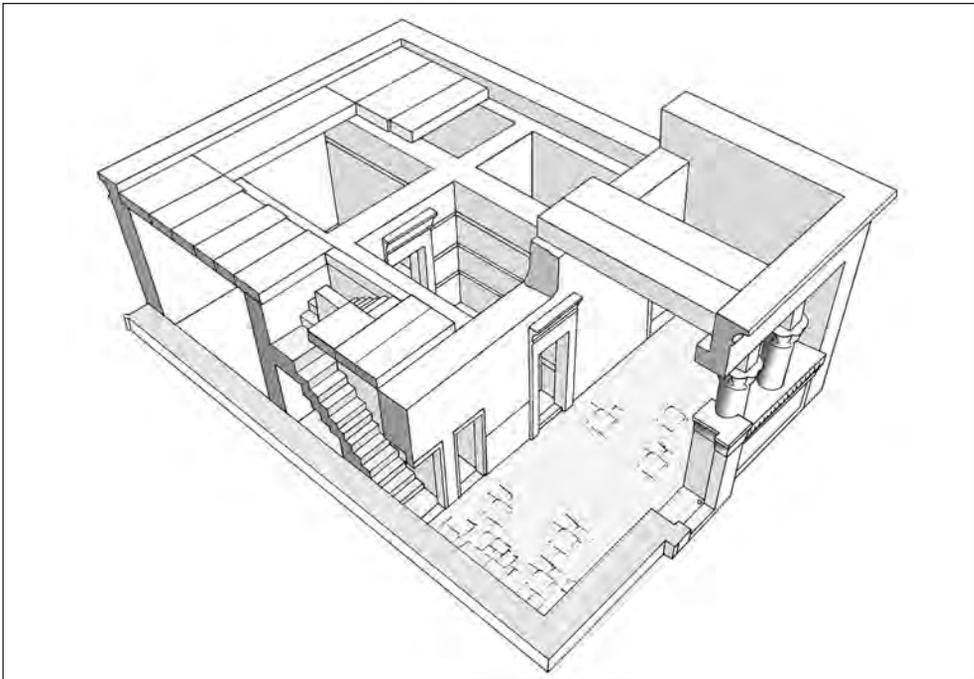
heads with only a few gypsum/anhydrite ashlar used for thresholds, doorposts, cupboards, steps and reinforcement of wall corners. Only one structure in Berenike other than the Great Temple is built entirely of stone ashlar. It is the so-called Square Feature on a small island in the harbor, situated next to the late Harbor Temple, apparently contemporary with the Great Temple period, viz. Ptolemaic/early Roman. It is unlikely therefore that the thin stone wall at the back of the Great Temple was part of a later domestic structure. Considering the very limited use of stone in Berenike, and mainly in the Ptolemaic and early Roman period, this wall was probably a new temple wall face or part of an added sanctuary. The wall face of the original back wall of the temple is extremely irregular, and must have suffered extensive damage, probably during the phase of abandonment of the site in the late Ptolemaic period or after the mid 3rd century AD. Cutting back the wall face was apparently not considered, as it would have made the wall very fragile. All the effort of adding a new wall face may be justified by the presumed significance of this part of the temple, necessitating buttressing.

The wall rubble in the trench yielded a stone statuette of a crocodile with falcon head (Zych and Sidebotham 2011; Sidebotham and Zych 2017) [Fig. 7]. The upper part of the headdress of the statue,

<sup>3</sup> Parallels for the Horus/Sobek statuette: 1) Egyptian Museum, Cairo (floor 2, Hall 19), limestone, H. 9 cm, L. 36 cm, provenance: Mansurah, Daqahliya; 2) Metropolitan Museum of Art, New York, Ptolemaic; 3) Staatlichen Museen, Berlin, Late Period–Ptolemaic; 4) Walters Art Museum, Baltimore, steatite, 40–250 BC, L. 26.8 cm, crown missing; 5) University College London, Petrie Museum, Late Period, steatite, UC60054, L. 7.3 cm, W. 2.0 cm, crown missing; 6) University College London, Petrie Museum, Late Period, copper alloy, UC8149, L. 3.8 cm, overall H. 6.2 cm, winged crocodile with falcon head and crown; 7) British Museum, London, Late Period, 600 BC, lapis lazuli, 1993.0629.2/EA74189, L. 3.45 cm, W. 1.15 cm, H. 1.7 cm; 8) British Museum, London, Twenty-sixth Dynasty, blue-glazed, 1925.0511.66/BM 57914, L. 1.73 cm, W. 1.39 cm, H. 3.72 cm; 9) British Museum, London, Twenty-sixth Dynasty, red-brown glazed, 1925.0511.66/EA57914.



*Fig. 7. Horus/Sobek statuette found in BE11-79  
(PCMA–University of Delaware Berenike Project/drawing M. Hense; photo B. Wójcik)*



*Fig. 8. Reconstruction of the temple  
(PCMA–University of Delaware Berenike Project/drawing and interpretation M. Hense)*

probably made of metal or a different type of stone, is missing. About a dozen parallels of this type of statuette are known in collections worldwide. All date to the Late Period–Ptolemaic era, with one exception dating to the Eighteenth Dynasty. However, the find context of these figurines is unclear.<sup>3</sup>

#### COURTYARD

Purdy's plan shows an enormous stone slab, probably a roof stone, blocking the entrance to the staircase (7). Meredith doubted this "as a single slab over 12 ft. [about 4 m] long and 3–4 ft. [about 1–1.30 m] wide is hardly possible" (Meredith 1957: 59). The 'courtyard' is, in fact, less than 0.25 m wider than room 2, which was definitely roofed. Invariably described as a courtyard, room 9 was probably, a small roofed hall as no temple of this type is known to have

a courtyard so narrow and surrounded by a stone wall. The width of the hall, merely 3.75 m, is small enough to be bridged by a single slab of sandstone, although a row of two or four columns supporting the roof is also feasible. The top of the south wall can be traced on the surface of the site up to the southeastern corner, but the east wall seems to end abruptly at only 1.70 m from that corner (H). This suggests a half open front, making the hall a pronaos [Fig. 8].

Based on Belzoni's and Wilkinson's observations, it seems that a courtyard existed in front of the stone temple. Belzoni noted the east–west length of the temple to be 2.37 times the width (Belzoni 1821: 335), which corresponds with the depiction of the temple in the plan Wilkinson made (Wilkinson MS. XLV D.11, Bodleian Library, Oxford).



Fig. 9. Magnetic map of the Great Temple and its immediate vicinity showing anomalies representing the architecture in front of the temple (PCMA–University of Delaware Berenike Project/processing T. Herbich)

Based on these numbers, the temple they observed was over 55% longer, in its east–west orientation, compared to the excavated stone temple. According to Belzoni’s observation, the temple is 26 m long [Fig. 1:A], while the Wilkinson plan shows walls extending to the east for at least 24 m [Fig. 1:B]. The stone building is, in fact, 14.90 m long, which leaves a space in front of the temple at least 11 m by 11 m in size. Barth, in 1846, did not see the extension (Barth 1858: 16), nor did

Wellsted or any of the later visitors. This can be explained by assuming the existence of a courtyard consisting of coral walls. The top of any remains of connecting walls must have collapsed between 1826 and 1836 (the year of Wellsted’s visit), the remains being subsequently covered by sand. Any remains of the courtyard found at some distance from the stone temple must have been dismissed as its possible parts based on the fragility of the coral blocks of which they were built.

## CONCLUSION

The long walls Belzoni and Wilkinson saw stretching far beyond the facade of the building are probably courtyard walls, seemingly confirmed by an analysis of anomalies recorded by a magnetic survey of the site showing most of the temple area in some detail. Walls of a series of at least two courtyards are visible directly east of the temple. The easternmost courtyard is wider, and may have been added some time after the first one had been constructed. The courtyards gave access to the main east–west street of Berenike, probably through a monumental gate of gypsum or

anhydrite blocks, built in a temenos wall of coral blocks. Remains of what seems to be this gate structure are visible on the magnetic map as well [Fig. 9]. Not visible on this map, as late buildings cover the area around the temple and its courtyards, are the workshops and storage rooms that must have been present in the temple complex. Although during the 19th century there were several excavations in the Great Temple of Berenike, recent research has proven that the temple and its immediate surroundings can still yield a considerable amount of archaeological information.

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# Come and dine with me... Early Roman luxury glass tableware from Berenike — new evidence from the harbor area and trash dumps

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**Abstract:** The harbor of Berenike on the Red Sea coast of Egypt was a major transit point in the long-distance trade of luxury commodities between the Roman Empire and the Indian Ocean basin. The heyday of the commerce and the prosperity of the port lasted from the 1st to the mid-2nd century AD. A huge quantity of commodities passed through the port, imported not only for the purpose of exchange, but also for self-consumption. Glassware was among them. The high proportion of wares of high quality and exceptional esthetic value is quite extraordinary, even by modern standards. These wares highlight the position of Berenike in the trade, but they also showcase the city's wealth and the great demand for luxury glass that existed there in the first centuries of the Roman Empire.

**Keywords:** Berenike, Indo-Roman trade, *Periplus Maris Erythraei*, early Roman glass, polychrome cast glass, colorless glass

Following the annexation of Egypt by Augustus in 30 BC Rome gained not only access, but also control over the enormously profitable trade routes, connecting the Mediterranean world with the Red Sea and the Indian Ocean regions. A great deal of information about the organization and management of overseas trade and ports comes from papyrological, epigraphic and a few classical literary sources, which also and perhaps foremost, showcase the impressive array of precious luxury commodities, brought to and sold at these harbors.

According to Strabo (Strab. 2.5.12), Pliny the Elder (Plin. *Nat.* 6.101–106) and the *Periplus Maris Erythraei* (hereafter *PME*, 1–4), the anonymous mid-1st century AD coastal navigation manual and merchant's compendium, there were two ports on the Egyptian Red Sea that played a key role in the long-distance maritime trade between the Roman Empire and the Indian Ocean basin: Berenike and its sister port of Myos Hormos (modern Qusair al-Qadim). The trade passing through Berenike moved in two directions.

The long journey for a wide variety of merchandise from all the Mediterranean started from Alexandria, which was “not only the receptacle of goods, but also the main source of supply to the Roman world” (Strab. 17.1.13). Valuable cargo, together with supplies for ship crews and the local population of harbor towns, was loaded on river barges and shipped along the Nile up to Coptos, just north of modern Quft. At that time it was an important base for commercial business and the starting point of two well-established trade routes, leading from the Nile Valley across the Eastern Desert, either to Myos Hormos or Berenike. When caravans of donkeys and camels reached the ports, the goods would be off-loaded and stored in warehouses, or else directed immediately onto the ships to await favorable winds, from October to April, which would bring the vessels to India taking advantage of the monsoon winds that facilitated sailing to and from India (Strab. 2.118 and 17.798; Plin. *Nat.* 6.101; *PME* 57). On the return journey, in May and June (*PME* 14, 39, 49, 56), a wide range of precious products from India, Arabia and Africa were unloaded at the harbor. Commodities brought for local consumption were stored for the most part in warehouses in the port. The traded goods were sent to Coptos and transferred via the Nile to Alexandria, and

subsequently to Rome and other centers of consumption (for exports of ordinary and more costly items from the Roman provinces around the Mediterranean, and an impressive range of consumable imports from the Red Sea–Indian Ocean littoral into the Mediterranean world via the Red Sea ports, see *PME* 3, 4, 6–13, 17, 27, 29, 32, 36, 39, 48, 49; Plin. *Nat.* 5.11, 12.14, 37.78; Casson 1989: 39–43; Seland 2010; Sidebotham 2011: 223–245 and further references). The role of Berenike as an important administrative headquarter for the Roman authorities, as well as a consumer and distributor of a wide variety of goods, is reflected in the rich archaeological material (for information on the site and results of earlier and ongoing excavations, see Sidebotham and Wendrich 1995; 1996; 1998; 1999; 2000; 2007; Sidebotham, Hense, and Nouwens 2008: 177–185; Sidebotham and Zych 2010; 2011a; 2011b; 2017; forthcoming). It shows that the heyday of the international commerce, by the same token also the prosperity of Berenike, lasted from the 1st century AD to the mid-2nd century AD. At that time Berenike became an extremely cosmopolitan place, an international marketplace, targeted by merchants of all ranks trading in a wide variety of prestigious and exotic goods (Strab. 17.1.45; Plin. *Nat.* 6.26.103; Sidebotham 2011: 68–86).

## GLASS AND THE *PERIPLUS*

Glass was one of the regularly traded goods between the Mediterranean and the East [Fig. 1]. In contrast to many commodities mentioned in textual sources, which are often not present in archaeological remains, glass has survived alongside pottery, in varying quantities, on many sites along the

East African, Arabian and Indian coasts. For glass, which is referred to in the *PME* by three different phrases: “several sorts of colored glass” (6, 7, 10, 11, 17), “glass vessels” (39), and “unworked glass” (48, 49, 53, 56; see also Casson 1989: 20–23, 40–41, 111–112, 126–127; Stern 1992: 113),

the archaeological evidence is the most closely compatible to the written sources.

In Egypt, quantities of early Roman glassware have turned up not only at Berenike (Hayes 1995; Nicholson 1998; 1999; 2000; Nicholson and Price 2003; 2007; Kucharczyk 2011), but also at Quseir al-Qadim (Meyer 1992: 15–42; Peacock 2011: 57–72; for information about the site and results of recent excavations, see Peacock and Blue 2006; 2011). Extensive evidence of glass material of a similar kind has been forthcoming from stations and small fortlets in the Eastern Desert: Maximianon (modern Wakalat al-Zarqâ), Krokodilô (modern al-Muwayh), Kainé Latomia (modern Umm Balad), as well as Didymoi (modern Khashm el-Minayh, see Brun 2003; 2011) and the sites at Gebel Abu Dokhan (ancient Mons Porphyrites, see Bailey 2007).

Beyond the Roman imperial frontier, findspots of glass in East Africa include Axum (Morrison 1989: 194–197, 206) and Adulis (Zazzaro 2013: 82–87). A remarkable assemblage of early Roman mosaic glass was excavated at Heis (ancient Moundou) in the Horn of Africa (*PME* 6,9; Casson 1989: 126–127; Stern 1993). Many of the glass types mentioned in the *PME* have been reported from excavations in the Arabian Peninsula (De Maigret and Antonini 2005: 71, Fig. 51:11–12; Nehmé, al-Talhi, and Villeneuve 2010: 215–216; Al-Ansary 1981: 80–81), including the extensively excavated Qané (Qani'), an important Indian Ocean emporium on the southern coast of Arabia (modern Yemen, see Salles and Sedov 2010: 305, Pl. 124:730) and the Omani port of Khor Rori (*PME* describes it as the ancient Moscha Limên, see Lombardi 2008: 404–406).

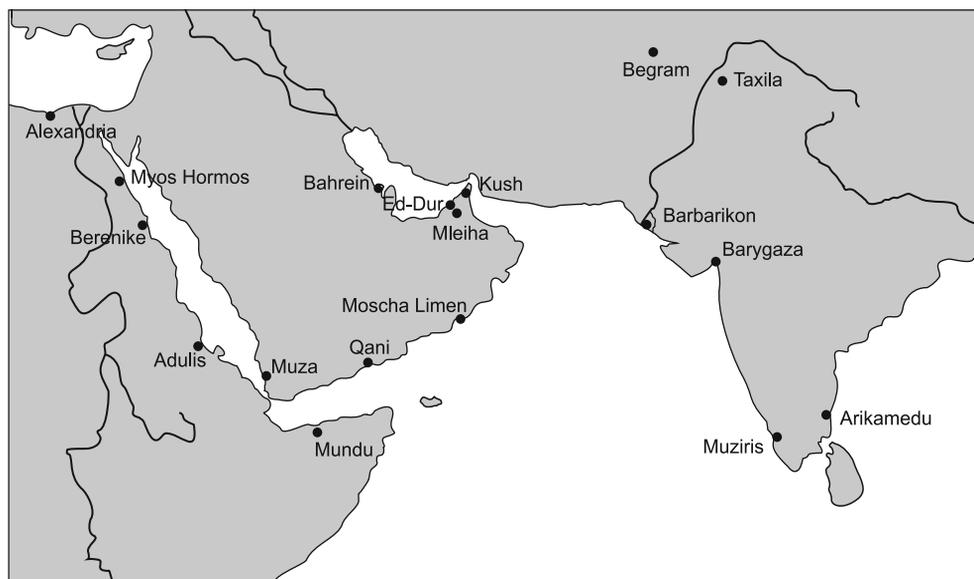


Fig. 1. Map of the Indian Ocean in Roman times showing major sites which have yielded early Roman glass (Drawing and digitizing G. Majcherek)

A wealth of early Roman glass comes from important findspots bordering the Gulf: el-Dûr (Emirate of Umm al-Qaiwain, UAE, frequently, but not securely identified with the Parthian Gulf emporium of Omana, mentioned in *PME* [36], see Whitehouse 1998; 2000), Kush (modern Ras al-Khaimah, UAE, see Price and Worrell 2003: 153–154, Fig. 2:1–6), Bidya (Al Tikriti 1989: 108, Pl. 82) and the inland sites of Mleiha (Emirate of Sharjah, UAE, see Potts 1990: 264–271; Jasim 1999: 79–80, 83, Fig. 20), and a tomb at Dibba al-Hisn (Jasim 2006: 221–223). First-century Roman glass was found also on the island of Bahrain (Boucharlat and Salles 1989: 110–122; Nenna 1999b; Andersen 2007: 22–84).

Archaeological evidence from India, substantiating the *PME* statement, comes mostly from Arikamedu (ancient Podoukê; *PME* 60), which has yielded abundant glass remains, including finished glass objects, but first of all the raw glass ingots,

beads and waste from bead-making (Sen and Chaudhuri 1985: 151–164; Stern 1991; Francis 2004: 448–530). The second most important Indian site to evidence early Roman glass material in the material, including mosaic glass, is Pattanam (generally identified with the ancient port of Muziris; *PME* 49, 54, 56; Cherian and Menon 2014: 66–71, 82–84). The *PME* lists raw materials and glass vessels among the Roman goods imported to Barygaza (modern Broach, *PME* 49, 56.19) and Barbarikon (*PME* 39.9) in the Indus delta. It is not possible to omit the evidence from Taxila (Marshall 1951/II: 683–690; 1951/III: Pl. 209:i,j,k,l,n and Pl. 210; Sen and Chaudhuri 1985: 156, 162–163, 183–184, Fig. 19), as well as the spectacular glass vessels discovered in a cache at Begram (Cambon 2010; Whitehouse 2012: 54–55). Early Roman luxury glassware even ended up in China (Taniichi 1983: 83–85, 102–105; Laing 1991: 109–112; Borell 2010: 127–129).

## EARLY ROMAN LUXURY GLASS TABLEWARE FROM BERENIKE

The exceptionally large glass assemblage of early Roman date from Berenike, representing a wide variety of vessel types, shapes, manufacture and decorative techniques and colors, not only provides the most vivid picture of glass exported from the Roman world, but above all testifies to the emporium's wealth and highlights its position in the "global" trade of its day. Its volume reflects a huge demand for luxurious and highly decorated wares, not only by the elite consumers — a small segment of the port's affluent residents, but also by a much wider clientele, certainly constituting the largest market for these goods. Buyers

obviously appreciated the spectacular quality and esthetic value of glass vessels, their sophisticated decoration and resemblance to precious and semiprecious colored and naturally veined stones, such as banded agates (onyx and sardonyx), and crystal, rare and valuable materials coming chiefly from India, from which expensive and ostentatious vessels were carved in the Imperial period (*PME* 49, 56; Stern 1997; Sidebotham, Hense, and Nouwens 2008: 181; Sidebotham 2011: 238).

The collected archaeological evidence offers a glimpse into the dinnerware sets in use in the houses of the well-to-do

residents of Berenike, who even though living on the fringes of the Empire, craved for a substitute of the luxury enjoyed by the Roman aristocracy. However, not all the high-status glass vessels that reached the site were used routinely for everyday dining. They could have acted as showpieces, a symbol of political prestige to be displayed on official occasions and during informal dinners, the objective being to show off the host's wealth and to impress guests.

Glass excavated at Berenike was manufactured in the glasshouses of Italy and the Eastern Mediterranean. In the case of mosaic and colorless glass, Alexandria famous for its glasshouses is a prime candidate, although surprisingly small numbers of luxury glass of

late Hellenistic and early Roman date have been reported from regular excavations in the city. The evidence for this production in Alexandria is still vague (for a list of finds, see Kucharczyk 2014: 29, Note 2). It is related in particular to the colorless tableware, characteristic of the Flavian–Trajanic period. The common opinion among researchers that they were produced in Alexandrian workshops does not find confirmation in already published material from the city. This category of glass is still a “big absentee” in assemblages, at least from Kom el-Dikka, the biggest archaeological site in Alexandria (for the most recent discovery of the first fragment of rim with an overhang at the edge, coming from a bowl, see Kucharczyk 2016: 96, Fig. 6:2).

## NEW EVIDENCE OF LUXURY GLASS TABLEWARE FROM THE HARBOR AREA OF BERENIKE

Recent archaeological investigations in the southwestern bay of Berenike recorded essential, if somewhat sketchy, evidence of the early Roman harbor and docking facilities, where the actual customs house and warehouses for incoming and outgoing goods may well have been located (BE09-54 and BE09-55) [Fig. 2] (Sidebotham and Zych 2011b; see also Zych 2017, in this volume). Public buildings and offices of high-ranking officials: the military commander, harbor stewards etc. may have been situated on the high ridge surrounding the bay, even more likely the premises of Roman *naukleroi* and *emporoi*.

They were poorly constructed of local materials, like almost everything in Berenike, mainly of fossil coral heads, cut blocks of rock gypsum and sun-dried mud bricks. A sizeable quantity of *lapis specularis* (a kind of transparent gypsum that forms

crystal sheets, which split appropriately can be fitted as window panes) and some flat panes, apparently produced in the cast or roller-molded technique characteristic of the early Roman period, excavated in this area, will argue in favor of the existence of this architecture. Windowpanes were likely to have been set in wooden frames, which are now lost, and mounted in small openings. In the dry desert conditions at Berenike, window glass would have been used generally to let in light and to provide essential protection against strong winds, prevent draft and keep out the rain (Kucharczyk 2011: 88–89, Fig. 9-1). In Egypt, evidence of the use of *lapis specularis* in an early Roman context came from a funerary hypogeum in Marina el-Alamein, where a glass panel of considerable size may have closed off one of the main burial niches (Zych 2010: 335, Note 3, Fig. 4).

In view of the early Imperial activity known to have taken place in the harbor, the presence of glass in this area is of particular interest, demonstrating as it does that luxury vessels, alongside a lesser grade of undecorated dining wares made of cheap green glass, were not something unusual in Berenike already in the Augustan period. It is then that the town catapulted to a position of great affluence and prosperity, and this process undoubtedly found expression in the glassware.

The glimpse that we get of the tableware of this period, as far as the glass is concerned, begins with polychrome cast vessels, the most attractive and finest luxury wares of this time. Apart from fragments with yellow spirals, embedded in a variegated matrix of light and dark blue, and a flower-like motif, consisting of irregular circles, filled with opaque yellow,

light green and red dots (Kucharczyk 2011: 84, 94–95, Cat. Nos 2–3, Figs 9-4, 9-5, 9-6:2,3), there is also a monochrome laced bowl [Fig. 3:1–3; Fig. 8 top row]. This product, one of the most characteristic ones of the Italian glass workshops of the Augustan period, is very seldom reported from the Eastern Mediterranean. In Egypt, save for Berenike (Kucharczyk 2011: 84, 94–95, Cat. No. 1, Figs 9-3 and 9-6:1), similar examples have been reported only from Quseir al-Qadim (Meyer 1992: 35, Pl. 12:300–301) and Tebtynis (unpublished). Such vessels are also present in the Graeco-Roman Museum in Alexandria (Nenna 1999a: 53, Note 2).

The content of this assemblage shows that the dining tables of Berenike in the Flavian period were replete with colorless tableware, both cast and blown. It was

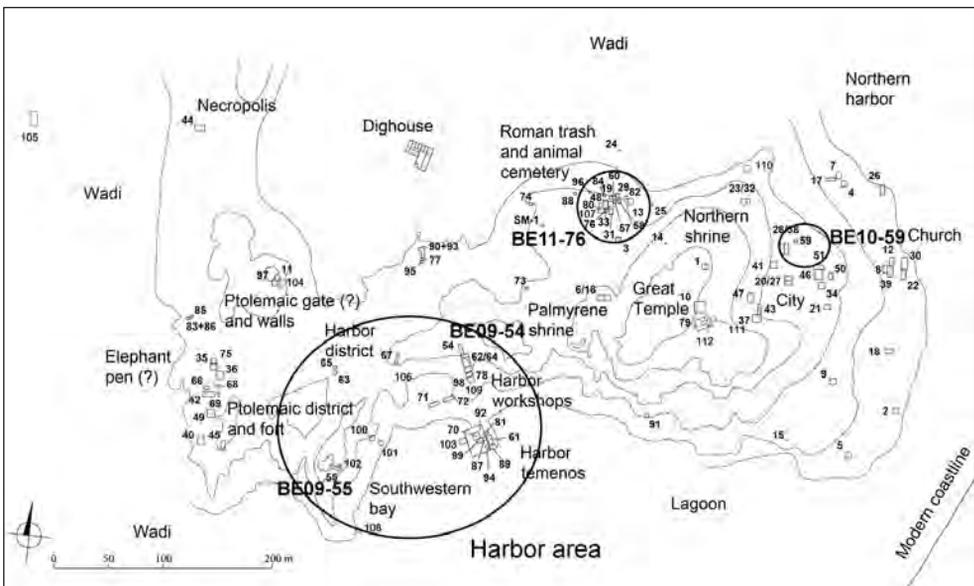


Fig. 2. Find locations of early and late Roman glass artifacts discussed in the paper (PCMA Berenike Project/map B. Wojciechowski, J. Rądkowska)

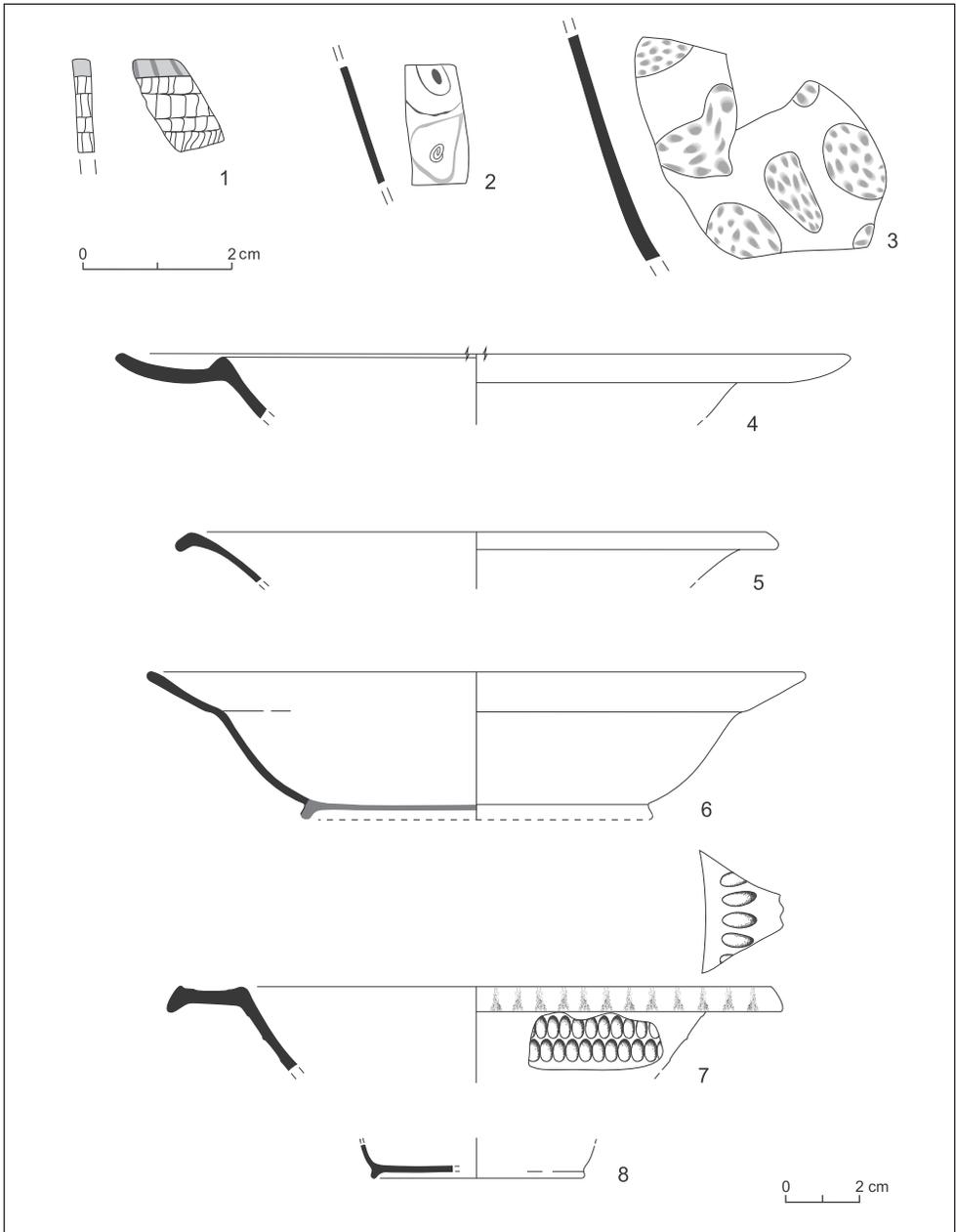


Fig. 3. Selection of early Roman glass from the harbor area: 1–3 – mosaic glass; 4–8 – cast colorless vessels (PCMA Berenike Project/drawing R. Kucharczyk; digitizing E. Czyżewska-Zalewska, M. Momot)

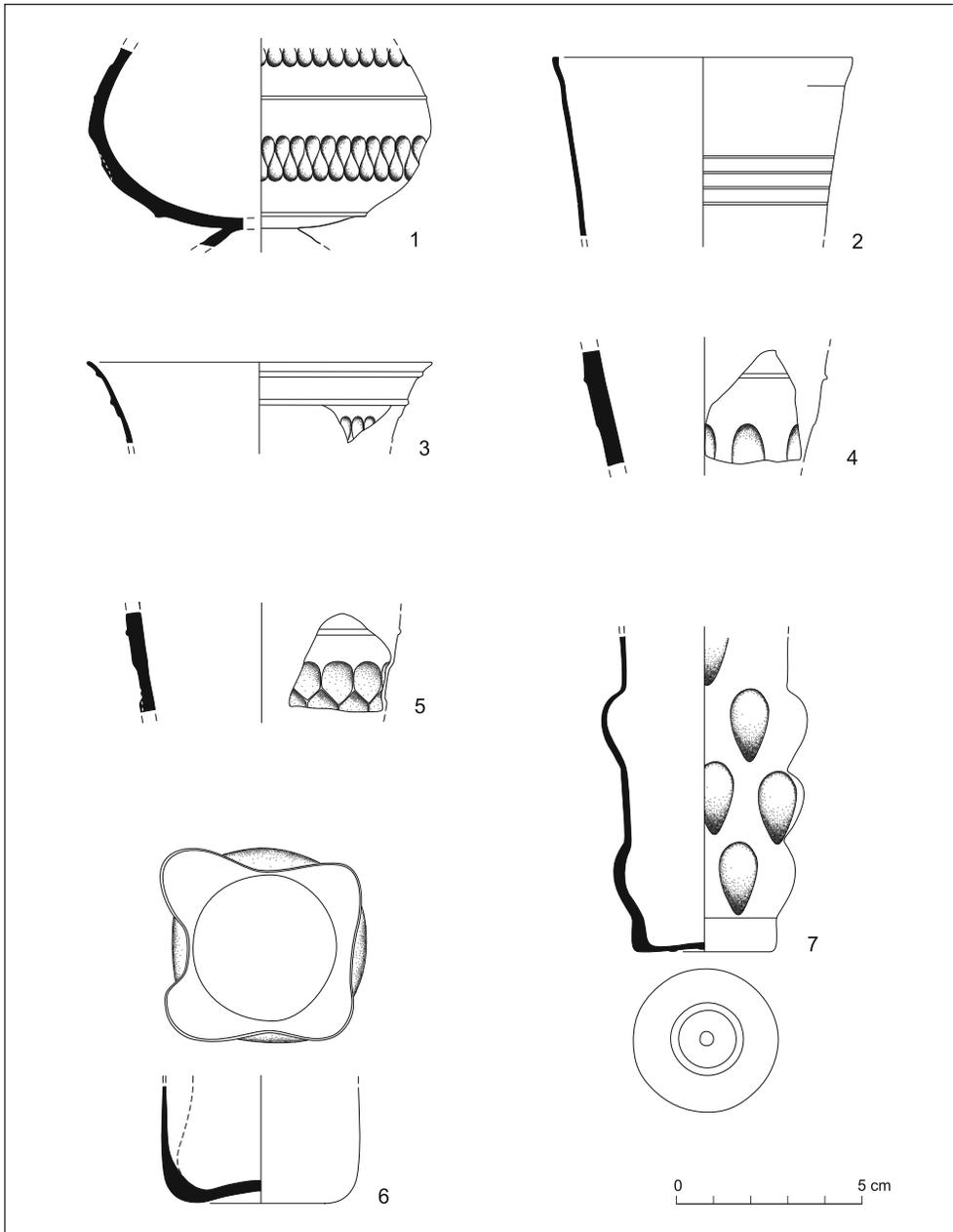


Fig. 4. Selection of early Roman glass from the harbor area: 1 – footed bowl; 2–7 – variously shaped and decorated beakers (PCMA Berenike Project/drawing R. Kucharczyk; digitizing E. Czyżewska-Zalewska)

considered as a substitute for vessels made of rock crystal, which became the most fashionable of hardstones among Rome's wealthy at that time. Pliny was thinking of these glasses when he wrote that "the most highly valued glass is colorless and transparent, as closely as possible resembling rock-crystal" (Plin. *Nat.* 36.199, 200 and 37.9; see Strab. 16.2.25, where he describes such vessels as: "crystal look-alikes"). The high proportion of such glass at Berenike is quite extraordinary (Hayes 1995: 37–38; Nicholson 1998: 282–285; 1999: 238; 2000: 151–152; Kucharczyk 2011: 85–87, 90–91). It is embodied principally by drinking vessels, and vessels for serving and consuming food and liquids. Next to polychrome glass, they are emblematic of Berenike.

Plentiful in this collection are deep and shallow dishes and bowls of varying sizes, on a high or low base ring, made both with and without an overhanging edge [Fig. 3:4–6]. They often received a high-quality, elaborate facet-cutting, either covering the entire exterior or confined to the edge of the rim and base (Kucharczyk 2011: 86–87, 96–97, Cat. Nos 15–17, Fig. 9-9:15–17) [Fig. 3:7]. Of particular interest is a hemispherical footed bowl, decorated with fine cut decoration, a shape with no parallels in the published glass material from Egypt [Fig. 4:1].

Included in this category are also truncated conical beakers and cups, either tall and narrow, or short and wide, with several schemes of facet-cut decoration above and below the zone of faceting [Fig. 4:3–5].

Other types of drinking vessels encompass, apart from numerous conical and cylindrical beakers with cut-off rims and indents, simple horizontal lines or grooves [Fig. 4:2,6], also a mold-blown truncated conical specimen with almond-shaped bosses. Such vessels rose to popularity during the Flavian period (Kucharczyk 2011: 87, 98–99, Cat. Nos 20, 24, 25, Fig. 9-12:20, 24, 25; Cat. No. 20: Isings 1957: Form 31) [Fig. 4:7]. It is significant that this type of decorated tableware, attested in many parts of the Roman world, is almost non-existent in Egypt. Similar fragments have been published only from Medinet Madi (Silvano 2012: 63, Pl. XLI:849–850; for a detailed discussion of this type and its distribution, see Stern 1995: 103–108; Whitehouse 2001: 13–14).

Colorless drinking vessels are supplemented by bottles and flasks for holding and serving beverages, often graced with cut decoration [Fig. 5:1–2]. The red wine and transparent colorless glass created a particularly elegant effect (Kucharczyk 2011: 87, 98–97, Cat. Nos 18, 19, Fig. 9-12:18,19).

## LUXURY GLASS TABLEWARE FROM THE EARLY ROMAN AND LATE TRASH DUMPS

The early Roman luxury glass excavated in the harbor area is but a minute fraction of the glass excavated in various parts of the site. Their significant presence has been observed in the early and late Roman trash

dumps located in the northwestern part of the residential quarter of the late period.

In the early Roman trash dump (BE11-76) one cannot disregard the existence of a considerable quantity of both

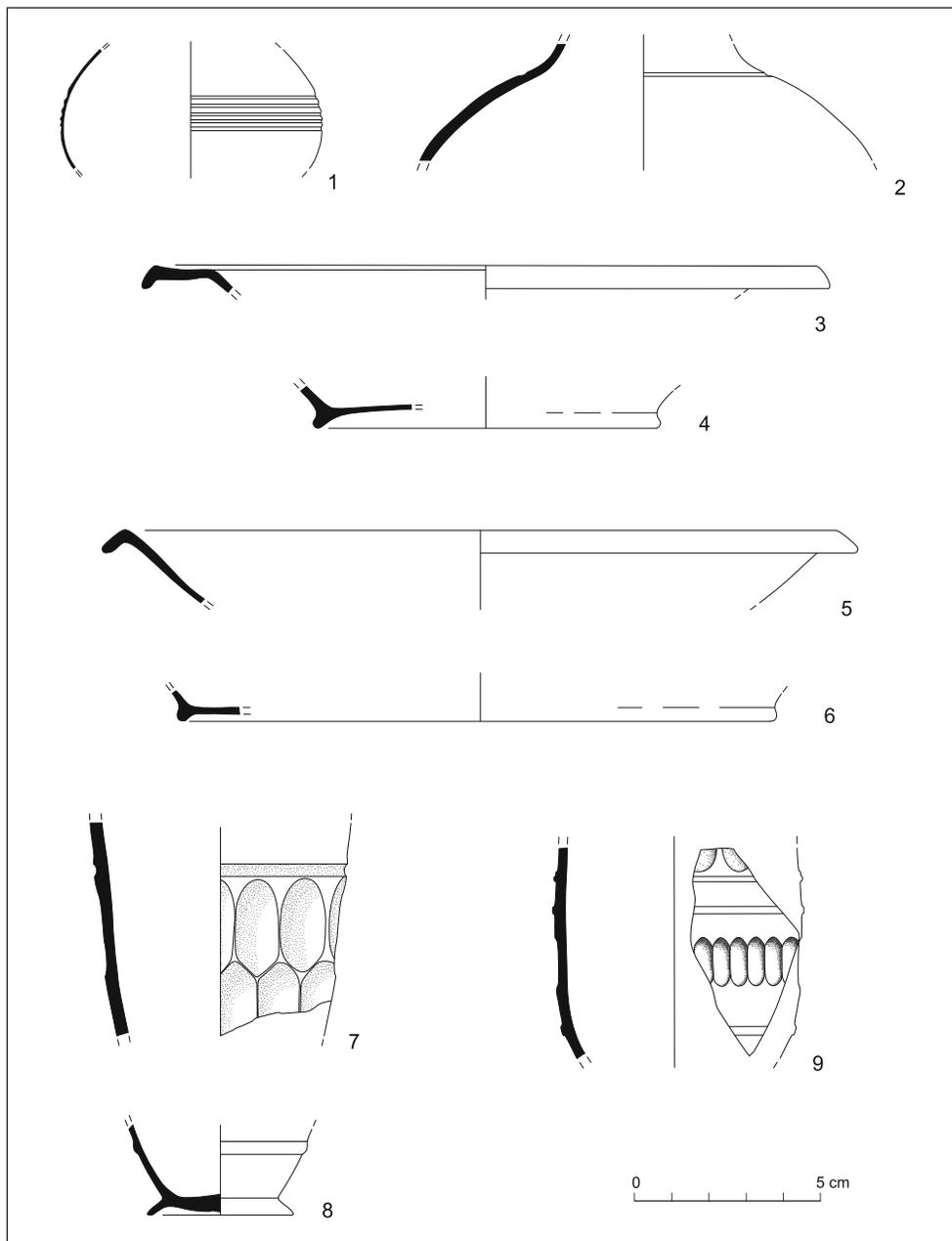


Fig. 5. Selection of early Roman glass: 1–2 – bottles, finds from the harbor area; 3–6 – cast colorless bowls; 7–9 – beakers with cut decoration, the bowls and beakers from the early Roman trash dump (PCMA Berenike Project/drawing R. Kucharczyk; digitizing E. Czyżewska-Zalewska)

cast and blown colorless glass. This group contains a wide range of bowls and plates with an overhung edge [Fig. 5:3–6], conical beakers [Fig. 5:7–9] and bottles [Fig. 6:1–4], either plain or with a wide variety of cut decoration, ranging from simple grooves and finely abraded lines to a complex and elaborate network of facets (Kucharczyk 2011: 104–105, Cat. Nos 47–50, Fig. 9-22:47–50).

Beside the colorless specimens there are some brilliantly colored vessels. Among them is a small fragment of a ribbed bowl made of amber glass (not illustrated). Its occurrence is particularly striking, as such vessels, thought of as a typical Italian product of the Augustan period, are very rare in the eastern Mediterranean. The number of this type of bowls, made of strongly colored and polychrome glass,

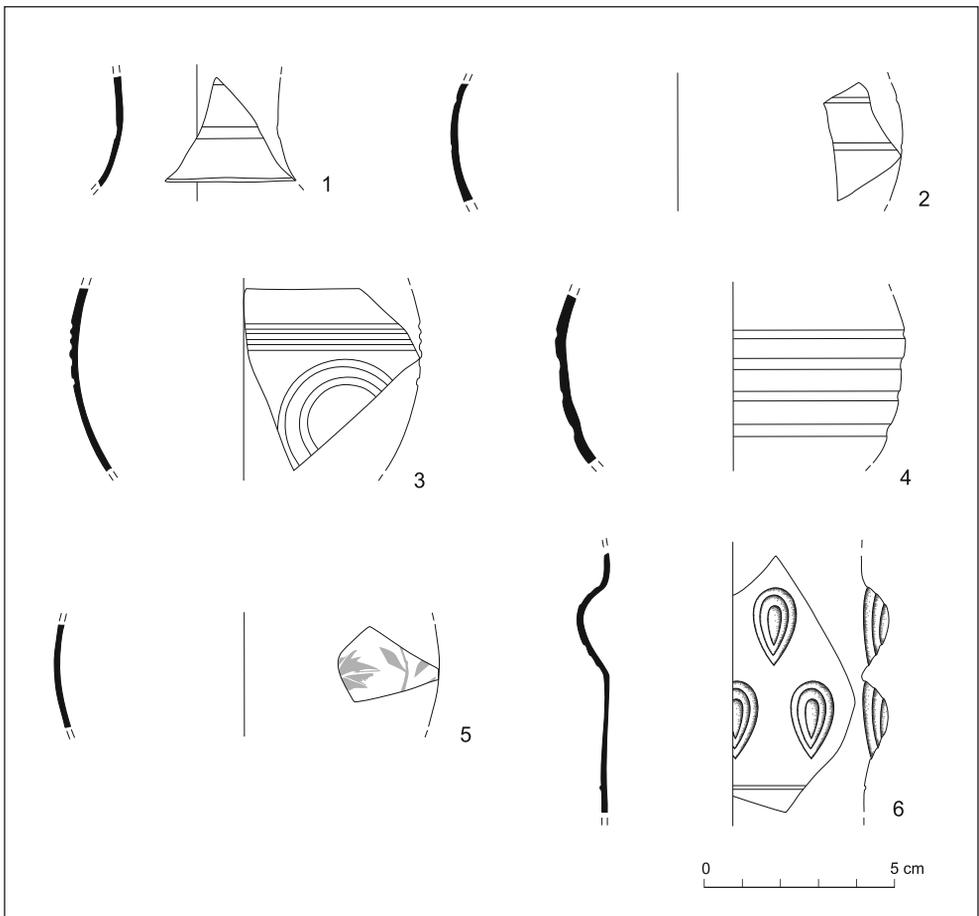


Fig. 6. Selection of early Roman glass from the early Roman trash dump: 1–5 – bottles with cut and gilded (5) decoration; 6 – almond-shaped beaker (PCMA Berenike Project/drawing R. Kucharczyk; digitizing E. Czyżewska-Zalewska)

remains in stark contrast to the naturally colored monochrome examples, representing one of the commonest glass vessel finds on the site. Further pieces in this collection belong to a cobalt blue bottle, remarkable for its floral gilded decoration, which is not sandwiched between two

fused layers of glass. It features a large multi-pointed (vine?) leaf and a stem, with opposed pairs of lozenge-shaped leaves [Fig. 6:5]. The brilliance of the gold leaf, contrasting boldly with the dark color of the vessel, produces an eye-catching effect (Kucharczyk 2011: 89–90, 102–103,

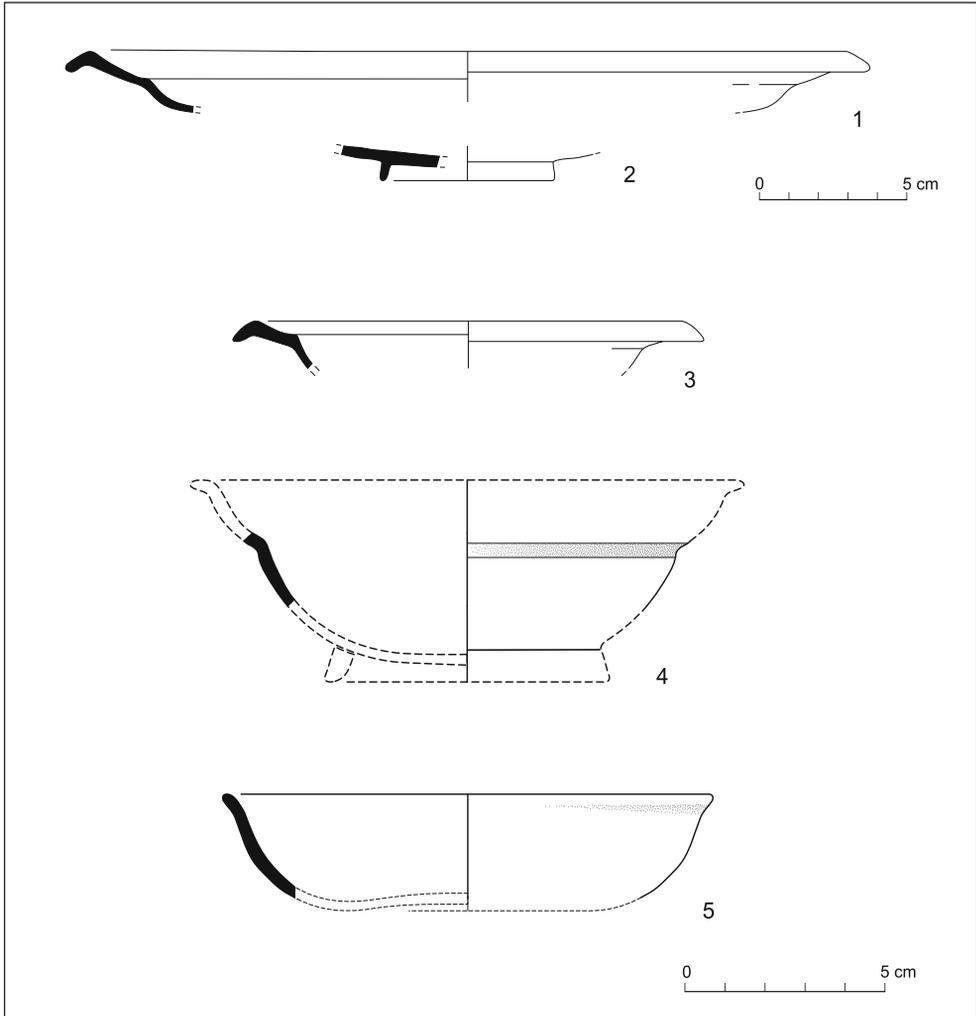


Fig. 7. Selection of early Roman glass from the late period trash dump: 1–2 – mosaic glass bowl and patella cup (reconstructed shapes); 3–5 – colorless cast bowls (PCMA Berenike Project/drawing R. Kucharczyk; digitizing E. Czyżewska-Zalewska, M. Momot)

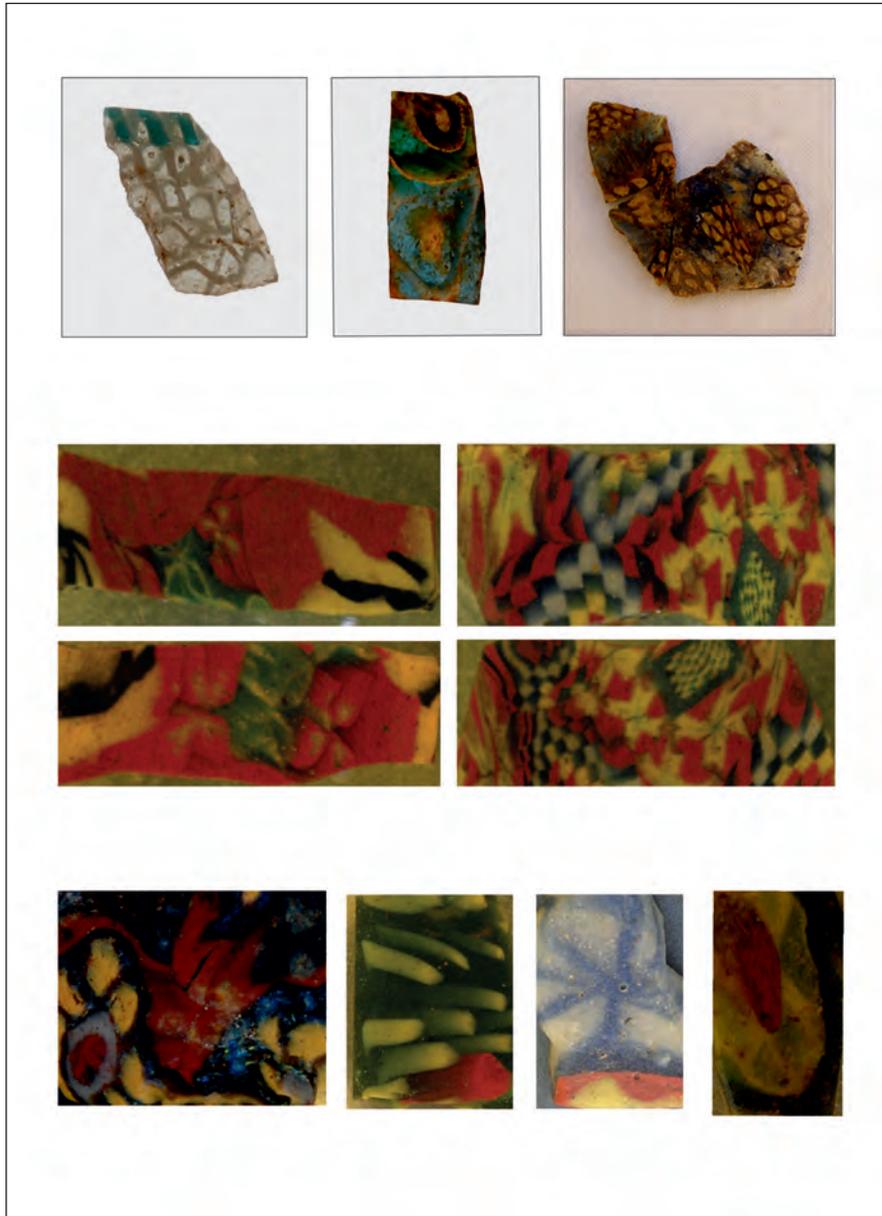


Fig. 8. Selection of early Roman mosaic glass fragments: top row, glass from the harbor area; middle and bottom rows, glass from the late 4th–6th century trash dump (PCMA Berenike Project/photos R. Kucharczyk, digitizing E. Czyżewska-Zalewska, M. Puszkarski)

Cat. No. 39, Fig. 9-18:39). Luxury gold-leaf glass is nothing unusual at Berenike. The list also includes “roundels” (medallions?), gold-glass tiles, but foremost drawn beads (Nicholson 2000: 153; Then-Obluska 2015: 753–755, Fig. 4:23–29). An important component of this set is yet another molded-blown beaker with large, three-stepped almond-shaped bosses in high relief [Fig. 6:6]. One should also add a few very small fragments with enamel painting, a category of glass already attested at the site. The most spectacular examples that ever reached Berenike include cups decorated with vine-ivy-bird motifs, garlands and stars/rosettes, and a unique bowl adorned with very vivid marine life, interspersed with vegetation and shells (Nicholson and Price 2007).

The late trash dump (BE10-59), dated to the late 4th through 6th century AD, encompassed a great variety of finds. One of the most surprising aspects of this material is the presence of a significant number of mosaic and colorless glass fragments (for the occurrence of the early and late Roman glass in a late trash

dump, see Kucharczyk and Zych in press). Polychrome finds, undoubtedly especially treasured and long cherished as heirlooms, include either inlays/plaques or small hemispherical bowls and a *patella* cup [Fig. 7:1–2] (for mosaic glass excavated at Berenike in the 2009–2011 seasons, see Kucharczyk 2017; also Nicholson 1998: 285–286, Fig. 14-6). Fragments exhibit a noticeable variety of decorative patterns, either simple or more complex with various color schemes, in many cases highly skilled and elaborate. They include: a network of quatrefoils, minute tiny heart-shaped quatrefoils and flowers composed of eight triangular petals, simple spirals, vibrant polychrome checkerboards comprised of very tiny squares, heart-shaped quatrefoils, wheel-like and flower rosettes, and imitation of *serpentino verde* [Fig. 8 middle and bottom rows]. In this set of finds, the most common, however, is colorless cast tableware. The predominant vessel types are deep bowls and large shallow dishes with broad outspayed rim, often with an overhanging edge, on low ring-bases [Fig. 7:3–5].

## CONCLUDING REMARKS

The glass discussed in this paper, representing only a very small fraction of all the early Roman glass already found at Berenike, contributes to the study of already existing material from the site. It confirms, not unexpectedly, that the emporium was a substantial consumer of glass, of which a large amount can be described as luxury tableware. It was the most fashionable glass of its time, encompassing principally drinking vessels and vessels for serving foods and liquids.

The brilliantly colored specimens, either monochrome or polychrome, as well as the colorless ones, often with elaborate facet-cut decoration, taken together with mold-blown vessels, combined with fine-quality pottery and copper-alloy tableware (fragments of handles and rims suggest the existence of these; M. Hense, personal communication), made up a quality dinnerware set for both formal and more private dinners and gatherings, which were the ideal occasion to show

off wealth and the owner's tastes. So far, none of this evidence can be tied in with specific, individual users, but it will not be a great leap of imagination to think that the members of the Roman imperial court known to have resided in Berenike, as well as representatives of Roman governance in Egypt, responsible for the smooth operation of this major harbor of the early

Imperial period, would have not only expected, but also taken the necessary steps to furnish their table with the kind of dinnerware that they were used to at home. And they would have enjoyed just as much showing off the centerpieces of their table, to be viewed and admired by guests, friends and business associates, while highlighting their affluence and social standing.

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# New evidence for the emergence of a human–pet relation in early Roman Berenike (1st–2nd century AD)

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**Abstract:** Animals were as inextricable a part of the system of common ancient Egyptian beliefs as they were indicative of it. Their special role was manifested in a rich iconography and in multitudes of animal mummies deposited in the major religious complexes. Seen in this light, the cemetery of small animals of 1st–2nd century AD date, excavated since 2011 in the Red Sea port town of Berenike, comes across as entirely unique, notwithstanding the spiritual aspects of cats, dogs and monkeys. Contrary to Egyptian animal burials of all periods associated with human ones, the Berenike inhumations were not intended as afterlife companions of their last owners; neither were they ever mummified. Recent results of research present the variety of species kept in the households and provide insight into their behaviour. Pathological changes on one of the dog skeletons suggest a mortal condition, that is, osteosarcoma. The Berenike data also shed new light on the distribution of the cat beyond Egypt and a rising preference for keeping the animal as a pet in Europe and the Middle East.

**Keywords:** Roman Egypt, animal/pet cemetery, ancient cats/dogs/pets, animals in ancient Egypt

In Egypt, burials of animals described as pets are a well recognized phenomenon from predynastic times through the Roman period (Hornung 1967; Boessneck 1988; Feder 2003; Flores 2003; Kessler 1986; Ikram 2003; 2005; Linseele and Van Neer 2009; Yamaguchi et al. 2004). It is observed across animal species and funerary practices, with mummification being the most significant form (Visser 1938).

For the people of ancient Greece and later of ancient Rome, the significance of animals for Egyptian beliefs was one of the

most characteristic features (see Herod. 2.65–67 as one example). Indeed, millions of animal mummies are known from special depositories beside temples and necropolises, with the greatest ones located in Tuna el-Gebel and Saqqara (Armitage and Clutton-Brock 1981; Ikram 2003; 2005). Animal mummies of specific species were deposited in Bubastis (cats), Elephantine (rams), Kom Ombo and Fayum (crocodiles), and Abydos (falcons). Typically, however, animals were viewed only as a manifestation of some of the

gods' domains or features (Feder 2003; Ikram 2007). Cats were, to some extent, an exception (particularly during the Ptolemaic and Roman periods) with so many meanings and taboos surrounding them that foreign authors described Egyptians as worshipping cats (Diod. 1.83 after Malek 1993).

Animal mummies recorded at Egyptian sites can be divided into four main categories: a) animals accompanying their last masters in the afterlife; b) animals deposited as food stock; c) mummies of sacred specimens; and d) votive mummies (Charron 2002; Ikram 2005; Kessler and Abd el Halim Nur el-Din 2005; Aglan 2013). The last category in the Ptolemaic period demonstrates true masterpieces of decorative wrapping. However, the term 'mummification' is also used to describe the natural drying of corpses without intentional processing (embalming, wrapping etc.). Thus, some of the published animal mummies could well have been burials without intentional body processing. In most cases of spontaneous mummification, an evident connection with human inhumations exists (Ikram 2005) and, significantly, only for dogs.

## BERENIKE

Berenike or Berenike Trogodytica (Greek: Βερενίκη), was a port-town on the Red Sea. It was established as a military post protecting the landing of African elephants being carried by sea for Ptolemy II (285–246 BC), who named the place after his mother, Berenike (Sidebotham, Hense, and Nouwens 2008: 159–165; Sidebotham 2011). In the early Roman period (1st–3rd century AD), the area of the deserted Ptolemaic fort appealed again as one of the most important transshipping sites joining Upper Egypt, the Arabian Peninsula and the Indian Ocean. The latest phase of Berenike history as a local town of lesser importance dates to the 5th–6th centuries AD. Remains still visible beside the sea were recorded first by Giovanni Battista Belzoni in 1818. Systematic archaeological excavations were initiated in 1994 by Steven E. Sidebotham (University of Delaware) and have continued, except for a few years' break, until the present day. Currently, the Polish Centre of Mediterranean Archaeology, University of Warsaw, is a partner in these excavations (for reports, see, e.g., Sidebotham and Zych 2010; most recently, 2016).

## EVIDENCE

Nearly 100 complete animal skeletons have been discovered so far in a relatively small area of about 100 m<sup>2</sup>, located to the west of the so-called Great Temple [Fig. 1; Tables 1–3]. This report describes the finds excavated during seasons 2011–2015 (see also Osypińska 2017).

Based on stratigraphic relations and the identification of numerous datable materials (pottery, coins, ostraca), we can assume with certainty that the area was

used as a burial ground between the last quarter of the 1st and the first half of the 2nd century AD. This was a time of the greatest economic prosperity for Berenike, the harbor being a key link in the Roman Imperial trade via the Nile Valley to the Red Sea and beyond, to the Indian Ocean (Sidebotham 2011).

Most of the data on animal burials came from excavation trenches BE11-76, BE12-80 and BE15-107. A much

wider zone surrounding this area, known as the “Early Roman trash dump” has been explored since the beginning of archaeological fieldwork in Berenike, producing a plethora of priceless finds that have included new textual sources (ostraka, papyri). At the beginning of Berenike’s history, however, this place was an empty sandy quarter, covering the ruins of poor Ptolemaic structures, between the town and the much earlier Ptolemaic fort set to the southwest. Within this roughly flat area covered with wind-blown sand, the first intentional burials of small animals were made during the last decades of the 1st century AD. Bodies were buried in well prepared pits and protected with textiles, mats and large sherds of chrono-distinctive amphorae [Fig. 2].

The turn of the 1st and 2nd centuries saw this area organised, with a stone structure (wall?) built around a sand dune summit from the north and east (as far as the current state of research indicates), with elevated ground all around the outside of this wall paved with yellow clay [Fig. 3]. Both features sealed animal burials of an earlier age. But some of the later burials cut into this clay pavement suggested a continuity of funerary activities.

The investigation has led us to assume that inhumations were made by preference in the nearest vicinity of this stone structure [Fig. 4]. The illusory gap between burials from these loci and the next cluster in the northern part of trench BE15-107 could be explained by large intrusive pits of younger origin (the deepest part of which is marked as locus 029 in Fig. 3).

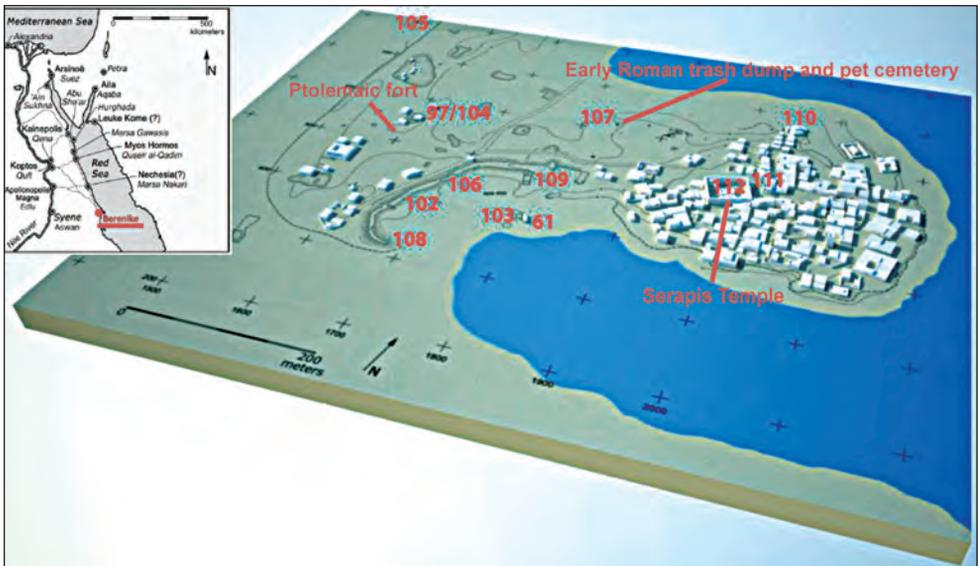


Fig. 1. Location of the animal cemetery within the early Roman port town of Berenike; inset, location of the harbor (Courtesy of PCMA–University of Delaware Berenike Project/M. Hense, 2016)

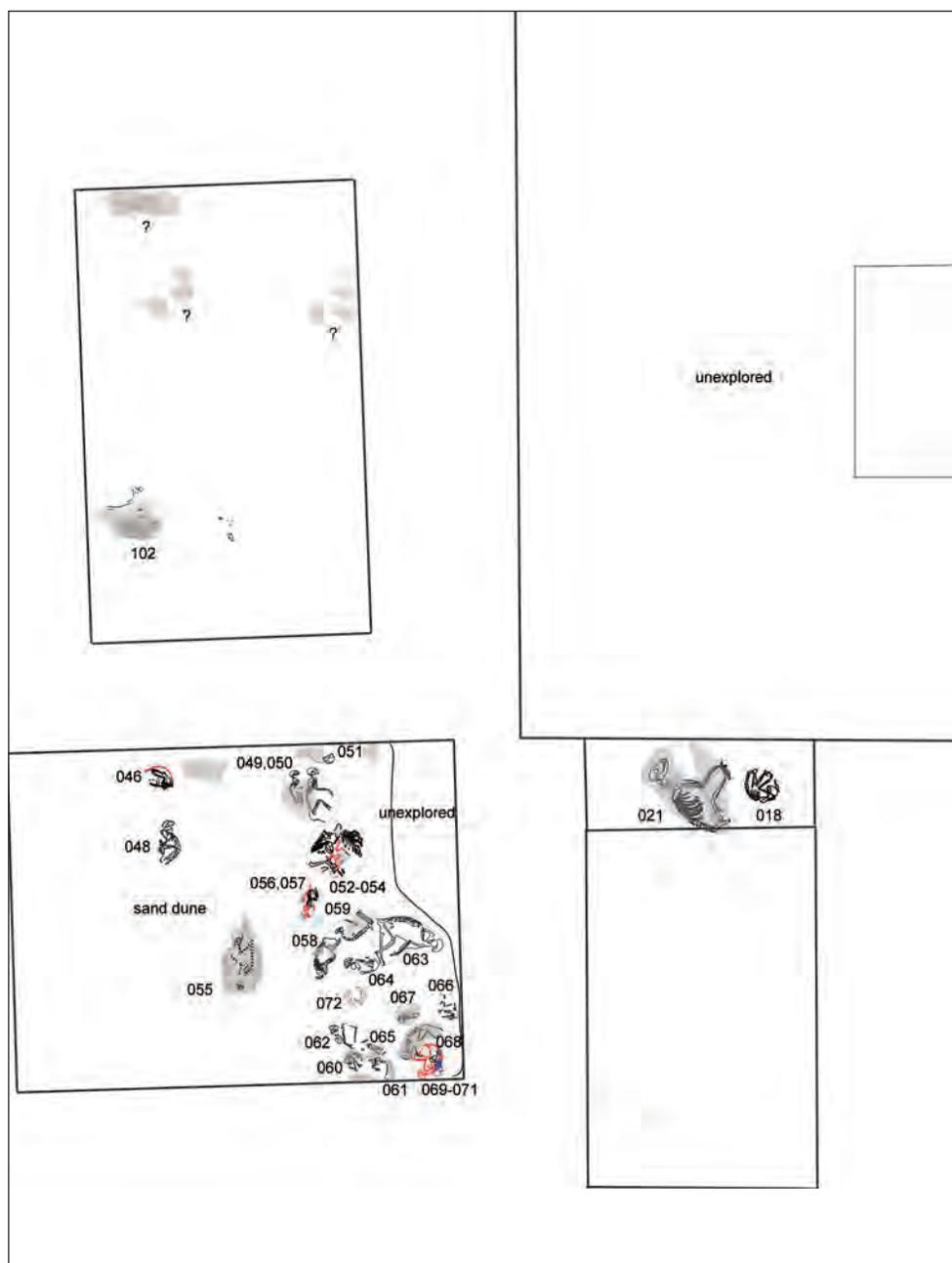


Fig. 2. Animal cemetery in Berenike: earliest phase from the second half of the 1st century AD  
(Courtesy of PCMA–University of Delaware Berenike Project/P. Osypiński)

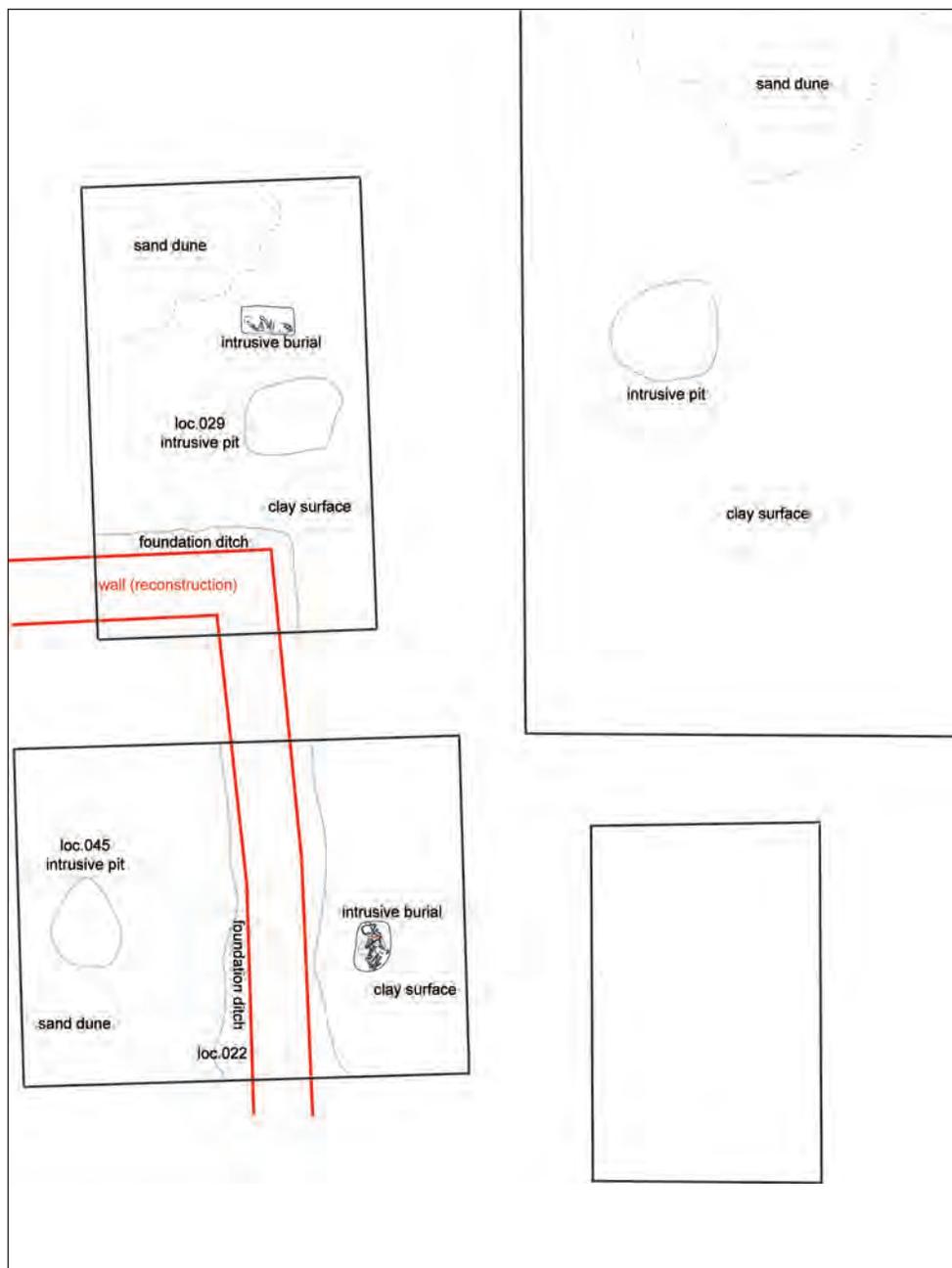


Fig. 3. *Animal cemetery in Berenike: phase dated to the turn of the 1st century AD*  
(Courtesy of PCMA–University of Delaware Berenike Project/P. Osypiński)

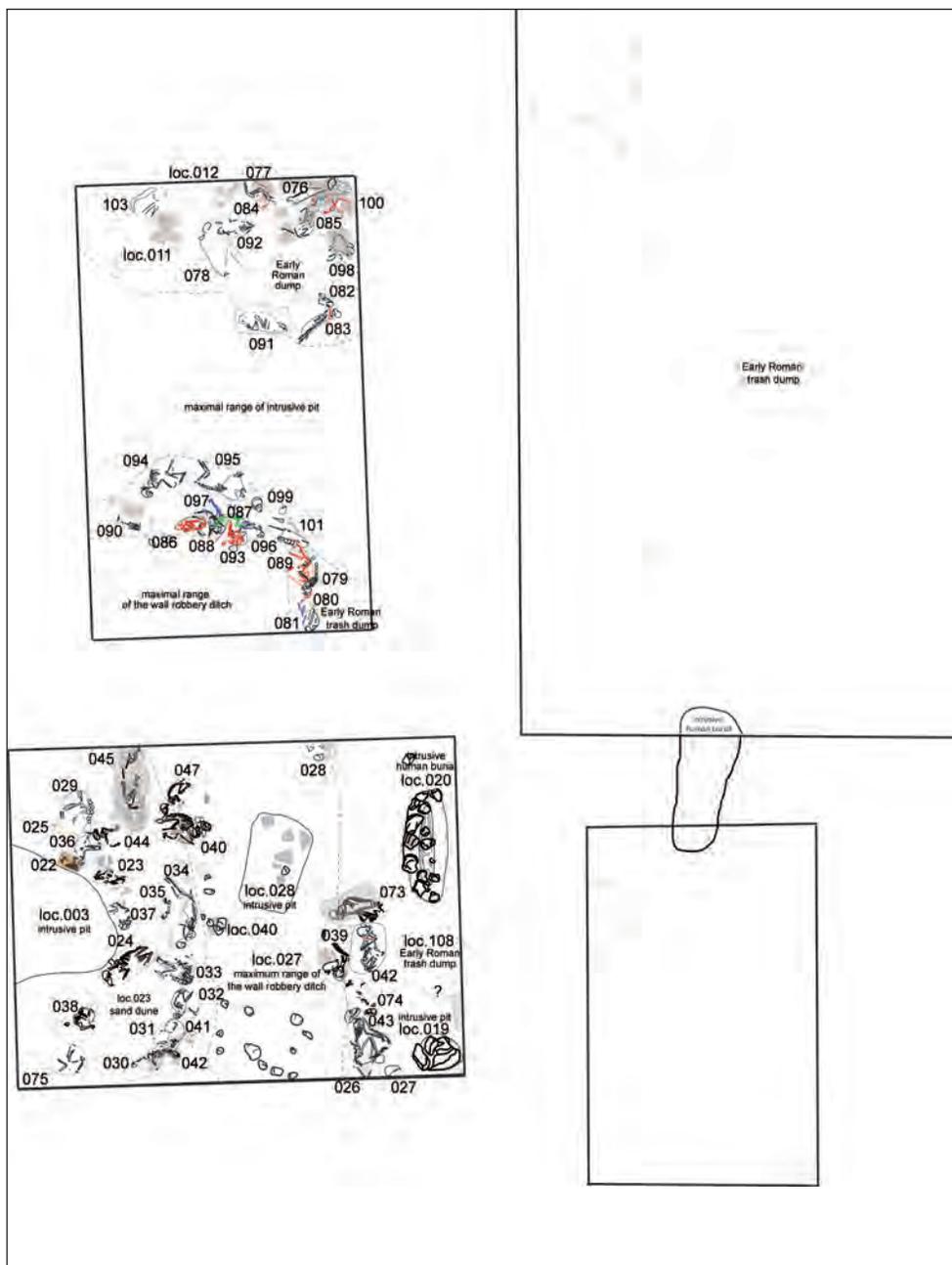


Fig. 4. Animal cemetery in Berenike: phase from the 2nd century AD  
 (Courtesy of PCMA–University of Delaware Berenike Project/P. Osypiński)

The latest animal burials dug in the trash dumped in the area can still be dated to the 2nd century AD. Layers from the 3rd century AD (and younger) were free of complete animal inhumations apart from single bones of burials disturbed during digging (focusing mostly on extraction of stone blocks). Another episode of sepulchral utilisation of the area took place probably in the 5th century AD, but it appears to have concerned only human inhumations (a two-year old child in trench BE12-80 and an adult male between trenches BE11-76 and BE01-48). In the authors' opinion, the two "cemeteries" reflected completely different funeral rites and were separated by at least two hundred years, a time of crucial cultural change in Berenike's history.

Preservation of animal burials was driven by the chemical processes taking place in the sediments in which they were deposited. Even in the small space excavated so far, the differences were clearly

noticeable. In general, burials dug deeper in a sandy sediment of relatively constant humidity were better preserved. But burials deposited within later layers, that is, mainly trash dumps full of organic waste and pottery fragments, suffered much harsher conditions: daily temperature fluctuation, humidity and salt crystallisation. Large amounts of bones from these last contexts bore traces of maceration, fragmentation or even the beginnings of dissolution. Archaeozoological identification of such remains was possible exclusively *in situ*.

All explored burials reflected funeral practices: intentional and careful placing of animal bodies in sleeping position, protected with large fragments of pottery, textiles, mats or even wooden beams. There was no evidence of the animals being killed as was the case with the Nile Valley animal mummies (Armitage and Clutton-Brock 1981; Ikram 2003; 2005). Partly preserved skeletons in all the noted cases reflected post-depositional damages.

## METHODS

Animal remains were analysed using conventional archaeozoological methods applied to funerary contexts. These involved species identification, anatomical analysis, ascertaining age (Smith 1969; Salles 1992; Amorosi 1989) and sex (Kratochvil 1976; Ruscillo 2015). All available osteometric data was collected (standards after von den Driesch 1976; Kratochvil 1977a; 1977b) and in addition pathological changes and other marks on the bones were noted. Species identification based on distinctive features of the examined

bones was supported with comparative collections, available literature (Akajewski 1979; Popesko 2008; Plug 2014) and existing metrics (von den Driesch 1976).

Archaeozoological analysis was carried out during excavation (on the spot in the trenches) and afterward in the Berenike field laboratory. The preservation of remains was recorded and described in the field. All the bones were explored and collected by hand and the surrounding sediment was sieved (2 mm mesh) without exception.

## ANIMAL CEMETERY

ARCHAEOLOGICAL  
PERSPECTIVE

No evidence has been forthcoming from Berenike on processes of animal mummification (whether intentional or natural). Dead animals were buried in pits reaching 0.40 m in depth [Fig. 5] and apparently without superstructures of any kind to mark individual graves.

Regardless of species, age or sex, animal cadavers were arranged in resting position. There was no preference for body side arrangement (either left or right). Limbs could be pulled up, as well as stretched out full length. A few cats were laid curled up. None of the identified body positions suggested chaotic dumping.

Bodies were frequently protected with large amphora sherds, which were occasionally arranged in a way that showed

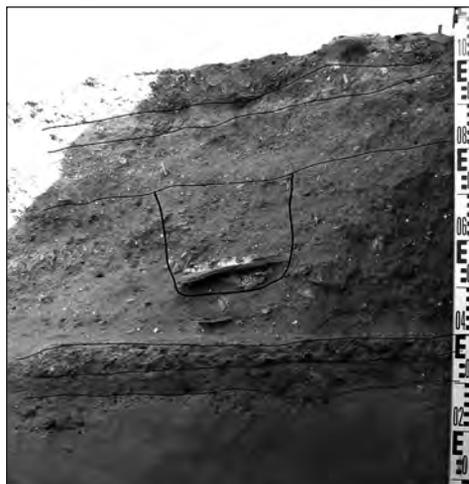


Fig. 5. Stratigraphic section through an animal burial (eastern baulk of trench BE12-80) (Courtesy PCMA–University of Delaware Berenike Project/photo P. Osypiński)

an effort toward reconstructing the original vessel shape, but using sherds from different vessels [Fig. 6 top]. Some bodies were also wrapped in textiles or covered with organic mats [Fig. 6 bottom]

Buried animals from Berenike typically had no grave goods. However, a few examples of accessories linked to animal-keeping were preserved. Two young cats were found with single ostrich eggshell beads by their necks, and another three cats and a grivet monkey had been buried with iron collars originally wrapped in



Fig. 6. Elements of burial protection: top, amphora sherds; bottom, organic mats (Courtesy PCMA–University of Delaware Berenike Project/photos P. Osypiński)



Fig. 7. Occasional accessories found with the animal burials: left, complete cattle tail; right, iron collar with glass beads (Courtesy PCMA–University of Delaware Berenike Project/photos P. Osypiński, Steven E. Sidebotham)



Fig. 8. Multiple burial of adult and juvenile cats (Courtesy PCMA–University of Delaware Berenike Project/photo P. Osypiński, Steven E. Sidebotham)

textile or hide and locked with a hook and loop system. An analogous collar with glass beads attached was found also within an intrusive pit, most likely cutting previous burials within trench BE15-107 [Fig. 7 right]. In addition, an almost complete cattle tail was found alongside a curled cat in BE12-80 [Fig. 7 left].

Beside single-animal inhumations, three burials contained two bodies [Fig. 8]. So far, the only species found in double burials were cats and, significantly, always contained an adult and a juvenile.

Burial morphology (orientation of inhumations, position, protection and accompanying elements) was not driven by chronological phases defined by the stratigraphy (before or after the space was organized with a stone structure and clay pavement). It is to be noted, however, that only cats (aside from a single dog burial) were inhumed in the older phase, whereas in the later period, cats, dogs, monkeys and one bird were buried. Of course, this summation may change as excavation in trench BE15-107 progresses to the deepest levels.

### SPECIES

The animal most frequently buried in Berenike was the domesticated cat (*Felis silvestris catus* / *Felis silvestris* f. *domestica*). Egypt was undoubtedly one of the places where cats were first domesticated and were probably the most important animal at that (Van Neer et al. 2014). The presence of cat remains, including its wild relative *Felis silvestris libyca*, is observed in archaeological contexts from the predynastic period (Van Neer, Linseele, and Friedman 2004; Linseele, Van Neer, and Hendrickx 2007; Van Neer et al. 2014). The Berenike cemetery has produced so far 86 cat skel-

etons (and a number of single bones from disturbed burials) [Table 1]. Single bones of cats were identified in other parts of the early Roman port and in trash dumps as well (Van Neer and Ervynck 1999; Osypińska 2011). Currently, the assemblage consists of 39.5% adult specimens, 23.2% sub-adult animals and 37.2% juvenile, infant or neo-natal [see Table 1].

The next most numerous species recorded in the Berenike cemetery was dog (*Canis lupus* f. *domestica* / *Canis lupus familiaris*) [see Table 1:019, 020, 021, 024, 026, 027, 035, 098, 100]. Nine burials of dogs have been recorded to date. Only two were adult animals, with the rest being immature specimens. Apart from the currently described area, complete dog skeletons have been found on the western outskirts of Berenike's Southwestern Embayment (four specimens within a 5 m by 5 m trench BE10-63) and in the ruins of the Ptolemaic fort (one specimen in trench BE15-104). Single bones of dogs have also been identified in other parts of the town (Van Neer and Ervynck 1999).

Among the animals buried in Berenike cemetery, two species of monkeys were identified as well, both belonging to the Cercopithecidae family. Two of them were remains of the grivet monkey (*Chlorocebus aetiops*), another two of the olive baboon (*Papio anubis*) [see Table 1:042, 043, 086, 099]. All monkeys died as immature animals. This is the first known evidence of these species in the Berenike bone assemblages. The two species did not occur in antiquity in the Berenike region (and are not found in the area in modern times), but the olive baboon is one of the most popular monkeys of sub-Saharan Africa, across Mali, central and southern Sudan

Table 1. List of animal burials from trenches BE11-76, BE12/14-80 and BE15-107

Burial No.	Context	Number of individuals	Species	Age	Sex
001	Organic trash dump BE11-76/locus 001/PB001	1	Cat	Adult	♂
002	Organic trash dump BE11-76/locus 001/PB999 (east baulk)	1	Cat	Subadult	?
003	Organic trash dump BE11-76/locus 003/PB005+006	1	Cat	Juvenis	–
004	Organic trash dump BE11-76/locus 006/PB014+015	1	Cat	Juvenis	–
005	Organic trash dump BE11-76/locus 006/PB017+018	1	Cat	Juvenis	–
006	Organic trash dump BE11-76/locus 006/PB019	1	Cat	Adult	♂
007	Sand dune BE11-76/locus 007/PB027	1	Cat	Juvenis	–
008	Sand dune BE11-76/locus 007/PB031+032+036	1	Cat	Subadult	?
009	Organic trash dump BE11-76/locus 999/PB025+026	1	Cat	Adult	♂
010	Organic trash dump	2	Cat	Adult	♀
011	BE11-76/locus 999/PB027			Juvenis	–
012	Organic trash dump BE11-76/locus 999/PB029	1	Cat	Subadult	?
013	Organic trash dump BE11-76/locus 999/PB030+034	1	Cat	Subadult	?
014	Organic trash dump BE11-76/locus 999/PB038	4	Cat	Juvenis	–
015				Adult	♀
016				Adult	♂
017				Subadult	?
018	Sand dune BE11-76/locus 999 (disturbed)	1	Cat	Juvenis	–
019	Sand dune BE11-76/locus 999 (disturbed)	1	Dog	Juvenis	♀
020	Sand dune BE11-76/locus 999 (disturbed)	1	Dog	Juvenis	?
021	Sand dune, wrapped in mats and covered with amphorae fragments BE11-76/locus 999 (disturbed)	1	Dog	Adult	♂
022	Sand dune, covered with a wooden beam BE12-80/locus 003/PB013	1	Cat	Juvenis	–
023	Sand dune BE12-80/locus 011/PB014	1	Wild bird	Adult	–
024	Sand dune BE14-80/locus 017/PB028	1	Dog	Subadult	?
025	Sand dune BE12-80/locus 003/PB031	1	Cat	Juvenis	–
026	Organic trash dump BE12-80/locus 999/south baulk	1	Dog	Subadult	–
027	Organic trash dump BE12-80/locus 999/south baulk	1	Dog	Subadult	–

Table 1. (continued)

Burial No.	Context	Number of individuals	Species	Age	Sex
028	Organic trash dump BE14-80/locus 024/PB033 (north baulk)	1	Cat	Subadult	–
029	Sand dune BE12-80/locus 040/BE14-80/locus 040/ PB025	1	Cat	Subadult	?
030	Sand dune BE14-80/locus 039/PB024	1	Cat	Adult	♂
031	Sand dune BE14-80/locus 038/PB023	1	Cat	Adult	♂
032	Sand dune BE14-80/locus 037/PB022	1	Cat	Adult	♂
033	Sand dune BE14-80/locus 036/PB021	1	Cat	Subadult	?
034	Sand dune BE14-80/locus 035/PB020	1	Cat	Adult	♂
035	Sand dune BE14-80/locus 034/PB019	1	Dog	Juvenis	–
036	Sand dune BE14-80/locus 033/PB018	1	Cat	Subadult	?
037	Sand dune BE14-80/locus 032/PB017	1	Cat	Adult	♀
038	Sand dune BE14-80/locus 031/PB016	1	Cat	Subadult	?
039	Over clay floor, covered with sherds BE14-80/locus 027/PB030	1	Cat	Adult	♂
040	Sand dune BE12-80/locus 027/PB030	1	Cat	Adult	♂
041	Sand dune BE14-80/locus 043/PB035	1	Cat	Juvenis	–
042	Cut in clay floor, iron collar BE14-80/locus 042/PB036	1	Grivet	Juvenis	–
043	Above clay floor, covered with textiles BE14-80/locus 044/PB045	1	Baboon	Juvenis	–
044	Sand dune BE14-80/locus 045/PB034	1	Cat	Adult	♂
045	Sand dune, covered with sherds forming an amphora shape BE14-80/locus 053/PB046	1	Cat	Subadult	?
046	Sand dune, cattle tail as grave good BE14-80/locus 054/PB047	1	Cat	Subadult	?
047	Sand dune BE14-80/locus 055/PB049	1	Cat	Subadult	?
048	Sand dune BE14-80/locus 046/PB048/052	1	Cat	Subadult	?
049	Under clay floor, covered with sherds	2	Cat	Adult	♀
050	BE14-80/locus 047a,b/PB054			Juvenis	–
051	Under clay floor, covered with sherds BE14-80/locus 047c/PB054	1	Cat	Adult	♀
052	Under clay floor	2	Cat	Adult	♀
053	BE14-80/locus 058/PB057			Subadult	?

Table 1. (continued)

Burial No.	Context	Number of individuals	Species	Age	Sex
054	Under clay floor BE14-80/locus 058a/PB057	1	?	?	–
055	Under a wall foundation ditch, covered with numerous sherds BE14-80/locus 057/PB056	1	Cat	Subadult	?
056	Under clay floor, covered with sherds BE14-80/locus 059/PB058	1	Cat	Neonatal	–
057	Under clay floor BE14-80/locus 059/PB058	1	Cat	Neonatal	–
058	Under clay floor BE14-80/locus 038a/PB023	1	Cat	Juvenis	–
059	Under clay floor, covered with sherds BE14-80/locus 060/PB060	1	Cat	Adult	♂
060	Under clay floor, covered with sherds BE14-80/locus 051/PB045	1	Cat	Adult	♀
061	Under clay floor, covered with sherds, faience bead as adornment BE14-80/locus 051/PB060	1	Cat	Juvenis	–
062	Under clay floor BE14-80/locus 061/PB061	1	Cat	Adult	♂
063	Under clay floor BE14-80/locus 062b/PB062	1	Cat	Adult	♀
064	Under clay floor BE14-80/locus 062a/PB066	1	Cat	Infans	–
065	Under clay floor, covered with sherds BE14-80/locus 063/PB064	1	Cat	Adult	♀
066	Under clay floor BE14-80/locus 064/PB068	1	Cat	Adult	♂
067	Under clay floor, covered with sherds BE14-80/locus 065/PB069	1	Cat	Juvenis	–
068	Under clay floor, covered with sherds BE14-80/locus 066/PB073	1	Cat	Juvenis	–
069	Under clay floor BE14-80/locus 068/PB071	1	Cat	Juvenis	–
070	Under clay floor BE14-80/locus 067/PB072	1	Cat	Juvenis	–
071	Under clay floor BE14-80/locus 052/PB074	1	Cat	Subadult	?
072	Under clay floor, covered with sherds BE14-80/locus 069/PB075	1	Cat	Infans	–
073	Cut in clay floor, covered with a big sherd BE14-80/locus 069/PB075	1	Cat	Infans	–
074	Cut in a clay floor BE14-80/locus 069/PB075	1	Cat	Adult	♀
075	Sand dune BE14-80/locus 070/PB076	1	Cat	Juvenis	–
076	Above clay floor BE15-107/locus 007/PB010	1	Cat	Juvenis	–
077	Above clay floor, covered with single sherds BE15-107/locus 008/PB011	1	Cat	Juvenis	–

Table 1. (continued)

Burial No.	Context	Number of individuals	Species	Age	Sex
078	Above clay floor BE15-107/locus 009/PB012	1	Cat	Juvenis	–
079	Above clay floor, iron collar BE15-107/locus 013/PB020	1	Cat	Adult	?
080	Above clay floor	2	Cat	Adult	♀
081	BE15-107/locus 014/PB021			Juvenis	
082	Above clay floor BE15-107/locus 016/PB023	1	Cat	Juvenis	–
083	Above clay floor, iron collar BE15-107/locus 015/PB022	1	Cat	Adult	?
084	Above clay floor BE15-107/locus 017/PB024	1	Cat	Subadult	?
085	Above clay floor, covered with a single sherd BE15-107/locus 019/PB026	1	Cat	Adult	♂
086	Above clay floor BE15-107/locus 022/PB032	1	Grivet	Juvenis	–
087	Above clay floor BE15-107/locus 023/PB034	1	Cat	Adult	♂
088	Above clay floor BE15-107/locus 024/PB033	1	Cat	Juvenis	–
089	Above clay floor, iron collar BE15-107/locus 025/PB035	1	Cat	Adult	♀
090	Above clay floor, covered with a single sherd BE15-107/locus 026/PB039	1	Cat	Juvenis	–
091	Above (cuts) clay floor BE15-107/locus 027/PB036	1	Cat	Subadult	♀
092	Above clay floor BE15-107/locus 034/PB043	1	Cat	Adult	♂
093	Above clay floor BE15-107/locus 035/PB055	1	Cat	Adult	♀
094	Above clay floor BE15-107/locus 040/PB052	1	Cat	Adult	♀
095	Above clay floor, wrapped in a textile BE15-107/locus 037/PB053	1	Cat	Subadult	–
096	Above clay floor BE15-107/locus 038/PB055	1	Cat	Juvenis	–
097	Above clay floor BE15-107/locus 039/PB056	1	Cat	Juvenis	–
098	Above clay floor, covered with sherds BE15-107/locus 021/PB028	1	Dog	Adult	♀
099	Above clay floor (skull only, fragment of burial 100(?)) BE15-107/locus 042/PB054	1	Mmonkey (grivet?)	Subadult	–
100	Above clay floor, covered with many sherds BE15-107/locus 020/PB042	1	Dog	Subadult	–
101	Unexplored; above clay floor, wrapped in a textile and covered with a single sherd BE15-107/locus 036/PB044	1	?	?	–
102	Unexplored; under clay floor, covered with many sherds BE15-107/locus 041/PB052	?	?	?	–

and Ethiopia and the grivet inhabit both the upper part of the Nile Valley as well as the savannah and forest outskirts of Sudan, Eritrea, Ethiopia and Djibouti (Kingdon 1977; Stuart and Stuart 2006; Kingdon et al. 2013).



Fig. 9. Burial of a wild bird (Courtesy PCMA–University of Delaware Berenike Project/ photo P. Osypiński)

One of the latest contexts of the Berenike animal cemetery contained the remains of a bird [Table 1:023; Fig. 9]. However, the identification of the species will require further study. Thus far, bird bones in the early Roman levels of Berenike were identified as representing both wild species (migrating ones, present in the region during winter season) and domesticated (mainly chicken, Van Neer and Ervynck 1999: 330).

### ANIMAL MORPHOLOGY

#### CATS

The young age of a high number of the buried cats, as well as poor preservation of some of the remains prevented osteometrical estimation and evaluation of the morphology of all 86 animals. However, a corpus of collected data [Table 2] enabled some general identification and comparative studies of the cat population

Table 2. Osteometrical data for cat bones from the animal cemetery

Scapula	Humerus			Radius	Pelvis	Femur			Tibia			Talus	Calcaneus
GLP	GL	Bp	Bd	GL	LA	GL	Bp	Bd	GL	Bp	Bd	GL	GL
14.0	077.5			84.3	10.4			19.4		21.8		16.4	22.3
14.0	077.5			93.4	10.4			19.6		23.1		17.6	22.4
14.3	094.3			96.5	10.8			19.6		21.7		17.6	26.6
14.9	096.3			96.5	10.8			19.8		20.9			26.6
14.9	099.1		17.0	103.1	11.3			15.9			11.2		28.9
15.4	099.2		16.8	103.3	11.3			19.4		20.0			29.6
	101.4		18.7	103.3				19.4		20.3			29.6
	101.5		17.9	104.3				19.8		20.3			30.6
	101.5	19	17.0					21.3		19.1			30.6
	101.7		18.1					21.4		20.0			30.8
	101.7		18.1					22.3		19.1			30.8
	102.6		17.8			99.9				21.7			30.8
	104.0		18.5			99.9				21.8			30.8
	104.9		21.1			112.2		19.2	109.7	17.2	18.6		30.8

Table 2. (continued)

Scapula	Humerus		Radius	Pelvis	Femur			Tibia			Talus	Calcaneus
	104.9		21.1			112.5		18.8	114.2			32.1
	105.0		18.6			112.5		18.8	115.7			33.0
	106.0					112.6		18.9	115.7	14.8		33.0
	107.0		20.1			112.6	18.9		115.7	14.8		33.2
	107.0		20.1			114.0			115.7	14.9		
	107.0		20.2			114.0			115.9	15.0		
	107.0		20.2			114.7		18.5	116.6	14.7		
	107.0		22.0			114.7		18.5	118.4	19.3		
	107.0	21.3				117.6		19.0	119.0			
	107.6		19.3			118.4		19.3	121.0			
	108.8		21.9			118.4		19.4	121.0			
	109.1					118.4		19.3	121.5	19.4	14.8	
	109.2		18.5			119.1			121.9	19.0	14.5	
			16.5			119.1			122.6	18.7	12.6	
			17.6			128.1			122.6	18.7	12.6	
			17.6					22.3	128.5		14.7	
			18.0						128.5		14.7	
			18.1						130.6			
			18.1						131.4			
			18.3									
			18.3									
			18.3									
			18.4									
			18.5									
			19.0									
			19.0									
			19.4									
			19.8									
			20.0									
			20.0									
			20.5									
			20.5									
			21.0									
		21.2										
		21.3										
		21.4										
		21.4										

of Berenike and specimens known from the Nile Valley as well as other regions potentially linked with Berenike (Mediterranean Europe, Near East and India). Preliminary analysis of the metrics suggests a very homogenous population. The data corresponds well with the bone values of other Northeastern African cats [Table 3]. So far, no evidence of keeping other kinds of cats has been noted in the Berenike cemetery, for example, the jungle cat *Felis chaus* known from the Nile Valley (Baldwin 1975; Linseele, Van Neer, and Hendrickx 2007; Boessneck and von den Driesch 1992). Due to the still preliminary state of research on the ancient animal populations of the Red Sea coast, we cannot say whether the Berenike cats were locally bred,

imported exclusively from the Nile Valley or from a number of different directions (as DNA analyses might suggest, Malek 1993; Mattern and McLennan 2000).

DOGS

Despite the much lower number of burials, more morphological features of dogs could be identified compared with cats. These skeletons were preserved in much better condition than the cat or monkey remains (all monkeys, due to their young age at death, were not suitable for osteometric analysis). All dogs recorded so far in Berenike early Roman contexts, beside the one specimen excavated in trench BE11-76, were of similar height, ranging between 44 and 52 cm [Table 4].

Table 3. Osteometrical data for cat bones from Berenike (compared to the standard in parentheses) and from other sites in Northeastern Africa (After Linseele, Van Neer, and Hendrickx 2007)

	Berenike (early Roman) (mm)	Hierakonpolis (Predynastic) (mm)	Tel el-Dab'a (mm)	El Kab (mm)
Scapula				
GLP	14.0–15.4 (14.58) / Σ6			
Humerus				
GL	77.5–109.2 (102.06) / Σ27	±120; 89.5♀; 95.1♂		112.0
Bd	16.5–22.0 (18.99) / Σ40	22.0; 16.0♀; 17.4♂	20.2; 20.0	20.5; 20.4
Radius				
GL	84.3–104.3 (98.08) / Σ8	94.2♂		
Pelvis				
LA	10.4–11.3 (10.83) / Σ6	11.5♀; 12.2♂	13.5	14.0
Femur				
GL	99.9–128.1 (114.37) / Σ18	± 111		
Bd	15.9–22.3 (19.54) / Σ22	23.0; 16.1♀; 18.8♂		
Tibia				
GL	109.7–131.4 (114.51) / Σ20	± 141; 113♂		
Bp	17.2–21.8 (20.13) / Σ19	26.5; 18.0♀; 21.4♂		
Bd	11.2–19.3 (14.80) / Σ14	17.8; 13.0♀; 13.2♂		
Talus				
GL	16.4–17.6 (17.20) / Σ3	19.5; 14.9♀; 16.5♂		
Calcaneus				
GL	22.3–33.2 (29.58) / Σ18	28.3♂		

Table 4. Height at the withers (WH) of dogs from Berenike, calculated based on the length of various bones (Koudelka 1885; cited after von den Driesch and Boessneck 1974)

	Scapula	Humerus	Ulna	Radius	Femur	Tibia	WH (average)
BE-76/21	55.0 cm	55.5 cm	50.7 cm	52.4 cm	54.7 cm	52.2 cm	53.4 cm
BE-104	–	49.0 cm	46.4 cm	46.3 cm	46.8 cm	46.2 cm	47.4 cm
BE-61/A	47.7 cm	–	–	–	–	–	47.7 cm
BE-61/B	–	47.3 cm	–	–	46.7 cm	46.8 cm	46.9 cm
BE-61/C	–	–	–	–	52.1 cm	–	52.1 cm
BE-61/D	–	44.4 cm	–	–	–	–	44.4 cm

Table 5. Osteometry of dogs from Berenike and Nubian contexts (NDRS after Grant 2001: 544–555, Table 12.2)

	BE-76 Adult dog (see Table q:021)	BE-104	BE-63/65	NDRS – P37 (Middle Kerma)	Kerma (2050–1750 BC)
Humerus					
GL	164.9 164.8	145.6 148.1	140.4 131.8	144 146	144.0–178.9 (164.7)
Radius					
GLI	163.0 158.6	157.9 161.3	–	150 GL	151.0–180.3 (167.9)
Ulna					
GL	190.6 190.4	174.1 175.2	–	–	175.4–212.4 (197.4)
Femur					
GLC	181.9 181.1	–	–	–	–
GL	178.4 178.2	155.5 156.4	173.2 155.4	162	165.0–200.0 (182.9)
SD	15.1 14.5	–	–	11.2	11.0–14.0 (12.5)
Bd	32.8 32.7	–	27.7	25.8	25.4–34.0 (29.9)
Tibia					
GL	180.3 180.3	158.3 158.0	160.5	164.5	164.9–199.0 (185.0)
Bp	35.6 35.8	–	24.9	–	27.5–35.5 (32.1)
SD	13.8 13.7	–	–	11.7	9.9–13.4 (12.0)
Bd	23.4 23.3	–	–	19.6	16.5–23.3 (20.6)
Calcaneus					
GL	42.8 42.7	–	–	39	–



*Fig. 10. Bone damages: top left, femur of a cat with healed trunk break; top right, healed scapula break of a puppy; bottom, shortened canines of a cat (see arrow) (Courtesy PCMA–University of Delaware Berenike Project/photos M. Osypińska)*

Comparative studies of their metrics with the current local “baladi” dog population suggest numerous similarities. These were average-size dogs of the spitz type. Comparisons with other ancient dog populations from the Nile Valley (both cranial and postcranial metrics, *Table 5*) shows further general similarities (Boessneck 1975; 1988; Bonnet et al. 1989; Churcher 1993; Chaix 1999). Remains of a dog (male) excavated in trench BE11-76 [see *Table 1:020*] were preserved in particularly good condition, producing a complete set of data concerning its extraordinary morphology and behaviour.

#### PATHOLOGIES AND CHANGES ON THE BONES

Most of the well preserved, complete skeletons were free of life-time damages or changes. A search for potential evidence of intentional killing of animals, which is known from the Nile Valley mummies (Armitage and Clutton-Brock 1981; Ikram 2003; 2005; Flores 2004), did not bring forth any evidence.

One of the young cat skeletons [*Table 1:012*] revealed traces of a serious accident: its femur bone was broken in multiple places. Although partly healed, the bone did not knit properly, evidently handicapping the animal’s movement [*Fig. 10* top left].

Another cat skeleton, an adult specimen [*Table 1:006*], showed probable evidence of specific surgery resulting in the shortening of the canines. At first glance, such teeth could be interpreted as belonging to a senile specimen, but in this particular case all the other teeth were not worn. Such treatment is unknown from ancient evidence and current veterinary practice, but could be potentially explained as protection against biting [*Fig. 10* bottom].

Finally, one of the buried dogs [*Table 1:018*] which died at the age of 10 months, had a healed scapula fracture [*Fig. 10* top right].

Moreover, a dogskeleton [*Table 1:021*] revealed the oldest known evidence of cancer tumors found in ancient dogs.

## DISCUSSION AND CONCLUSIONS

The species list of animals buried in Berenike is similar to numerous Greco-Roman animal cemeteries of Egypt. Thus, a great number of cats, commonly linked to the cat deity Bastet, was recorded. There were also some dogs, usually related to Anubis or Hekate. Baboons were usually considered as Thoth’s embodiment (Weiss 2012). The cults of all these gods were popular in the Ptolemaic and Roman periods. Only the grivet monkey was not related directly to any beliefs; however, from predynastic (McArdle 1982; Linseele and Van Neer

2009) to medieval times (e.g., Osypińska 2014), it was a popular pet both in Nubia and Egypt. Burial morphology, no trace of embalment procedures, a diversified species list and the absence of “main” human inhumations — all these features lead to the conclusion that the Berenike cemetery reflected different aims and different cultural inspirations than the Nile Valley animal deposits. Naturally, that absence of mummies in Berenike could be assumed to reflect the deeply provincial character of the site and the absence of experts in em-

balming, so the animals were “processed” in a much less sophisticated manner. But one should not overlook the particular care given to body deposition, mostly reflecting sleeping animals. In our opinion, the described features suggest that the Berenike finds could be defined as a cemetery of house-kept pets instead of as a parallel to the known Egyptian deposits related to sacral or at least magical rites.

There is rich evidence confirming the ancient nature of the habit of keeping small pet-animals both in Egypt and Mediterranean Europe, with favored Roman dog burials commemorated with epitaphs (Lazenby 1949; Bodson 2000). Similarly informative are texts concerning diversified breeds, feeding advice and descriptions of veterinary cases (e.g., Varro 2,9:2–14). In Egypt, burials of dogs (sometimes in large numbers) have been interpreted as reflective of humanity’s emotional bond to “the best man’s companion” (Ikram 2013). Typically, however, these burials were deposited with a man, and it is difficult to suppose it suffered a natural death at the same time as its owner. In case of cats, we do not have any evidence of such kind, either from Egypt or from other regions (von den Driesch and Boessneck 1983). We see the almost mass production of cat mummies instead, with evidence of intentional animal killing (Morrison-Scott 1952; Ikram 2005), despite a commonly practiced taboo and various official bans in that matter.

One could wonder whether the burial of pets in Berenike was implemented by a foreign (Roman or Romanised) community or was merely an element of the “Imperial” cultural package adopted by a multi-ethnic and eclectic society of merchants and officials (Winnicki 2009).

In our opinion, the first proposition is more believable, due to the limited time span of the cemetery (less than a century), correlated with the greatest prosperity of the port-town and its close relations with the core of the Empire. The exceptional character of the site is also significant; so far, there is no evidence of similarly dated cemeteries either in the Nile Valley or along the Near Eastern or Red Sea coasts. Naturally, we should keep in mind the current state of research, with excavations usually avoiding more rural areas. Notwithstanding, the Berenike animal cemetery is to be perceived as an important cultural marker or even a geo-demographic correlate similar to the exclusive Italian and Greek goods consumed in Berenike in these times (glass and pottery vessels, wine, olive, gastropods and *garum*, see Sidebotham 2011).

A Roman garrison presence in Berenike in the 1st–2nd century AD is suggested by numerous texts known from Berenike itself (ostraka, papyri) and its surroundings. These people used Latin and Greek, and bore Latin and Greek names and titles. However, the sources do not show whether this important (but most probably not numerous) community included whole families or just the necessary crew members. The presence of families has been suggested so far solely by evidence of a single child burial and some female adornments (Sidebotham 2011: 77).

The next specific feature of the Berenike cemetery is the very high percentage of cats being kept as domestic animals. Cats were a respected element of ancient Egyptian civilisation throughout history, well preceding the early Roman period, but such relations were never incorporated (at least on a similar scale) by the Mediterranean

European societies. In ancient Europe ruled by Rome, the cat started to be popular in the 1st century AD, together with Roman cat breeding habits transferred by the army (repeated after Toynbee 1973). Thus, could it be suspected that the eclectic (both Egyptian and Roman) Berenike evidence reflects the adoption of the cat into a community that subsequently buried its pets? Naturally, there are plenty of reasons for keeping cats in a port-town, which almost automatically brings to mind legions of rats. But the careful segregation of kitten inhumations from adult specimens suggests a more sophisticated kind of relationship than pure pragmatic coexistence.

The harsh ecological conditions in the region of Red Sea coast (limited access to drinking water, poor quality of soil almost disabling agriculture and general

salinity) inclines one also to a reflection on the costs of keeping non-edible and non-traction animals. All species identified so far at the cemetery were undoubtedly imported (possibly excluding some dogs) and as can easily be imagined, kept in households at a moderately high cost.

The animal cemetery in Berenike is undoubtedly a unique case. Its potential is based on the possibility of evaluating the complex and important processes taking place within a multicultural town community. So far, issues concerning relations between people and pet-animals were recognised merely through a prism of archaeozoology, sociology and history. Too often, this sphere of social life is considered as modern behavior exclusively. The finds at Berenike seem to break with this stereotype.

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# Beads and pendants from the late Harbor Temple and harbor temenos in the Red Sea port of Berenike (seasons 2010–2013): materials, techniques, functions and affiliations

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**Abstract:** More than 250 beads and pendants have been registered from the Harbor Temple and its surroundings, the so-called “harbor temenos”, in the Red Sea port of Berenike. The Harbor Temple assemblage is dominated by South Asian glass beads dating from the 4th through early 6th centuries AD, but the bead finds from the presumed temenos show much greater variety in both type and date, the latter spanning the centuries from the 1st to the 5th century AD. Rather than being accidentally lost, the quantity and find context of the beads support the idea of a votive offering function. Stylistic similarities of some objects found in the Harbor Temple have led to their association with South Arabia or Axum (Rądkowska, Sidebotham, and Zych 2013); yet a much closer affiliation might also be considered. Similar ritual objects, as well as beads and pendants, have been recorded at contemporary temples and shrines in Nubia.

**Keywords:** beads, pendants, amulets, Berenike, temple, votives, Red Sea, Nubia, Egypt, Roman, Indian trade

Between 2010 and 2013 excavations at the Harbor Temple and the surrounding harbor temenos in the southwestern bay of Berenike have documented more than 250 beads and pendants, whole and fragmentary. While the Harbor Temple dates from the 4th through the early 6th centuries AD (Rądkowska, Sidebotham, and Zych 2013; Sidebotham et al. 2015), the artifacts from the temenos are of 1st to 5th century AD date (Zych et al. 2014: 260; Sidebotham et al. 2015).

The Harbor Temple (called the “Lotus Temple” in early reports) is contained in trench BE10/12/13-61. There are two main phases: an earlier one dated to the late 4th/5th century AD and a later one dated to the late 5th century AD. Several objects of cultic significance, like a horned altar, a bronze figure and bronze head of a bull, an offering table, bronze tripod bowl and other items, such as cowry shells, painted ostrich eggs, a fragment of a bone bangle, a soapstone box, a hoard of silver

lunulae in a covered pot, wooden bowls, pottery, including vessels of Eastern Desert Ware, faunal and floral offerings, a coin of Julian II with triple perforation and a faience Bes amulet, have been recorded in the Harbor Temple (Rądkowska, Sidebotham, and Zych 2013; Sidebotham et al. 2015). Additionally, excavations have documented 150 beads and pendants. Aside from some coral and stone specimens, the over-whelming majority of these objects were made of glass.

The so-called harbor temenos, which has been referred to as a “Temple Island” in view of the ground here being slightly raised above the otherwise water-filled southwestern bay of Berenike, encompasses at least one other building. It is the Square Feature (trench BE10/11-70), fronting which to the south there is an apparent open courtyard. Trenches have been dug around the Harbor Temple, in front of the entrance (trench BE13-89), behind the back wall of the structure (trench BE12/13-81), outside the northwestern corner (trench BE12/13-87) and outside the southwestern corner (trench BE13-94). Moreover, the ground surface of the central and eastern part of the temenos was cleared (trench BE13-92). Artifacts excavated primarily from the Square Feature include a stone altar with an inscribed dedication to Domitian, a bronze toe from a large bronze figure, eye inlays, a cameo blank, a bone needle, a clay oil lamp, wooden bowls, and a few red-painted ostrich eggshell fragments, as well as various ornaments that had been burned (Zych et al. 2014; Sidebotham et al. 2015). Beads and pendants, whole and fragmentary, 105 in all, were recorded from the trenches here. Most of them were severely eroded; many were simply burnt.

This overview of the bead and pendant collection from the said trenches lets comparisons to be made with contemporary finds from Egypt, as well as from Meroitic and post-Meroitic Nubia. The Meroitic period in Lower Nubian history lasted until the 4th century AD. Upon the withdrawal of the Romans around AD 298, the Nobadians encroached into Lower Nubia, possibly from the Western Desert, while the Blemmyes did the same from the Eastern Desert (Fisher 2012: 39). The Blemmyes appear regularly in historical sources (e.g., Dijkstra 2012; 2014; Obluski 2014). While the ethnic term ‘Blemmyes’ should be used with care, it probably included a wide variety of different groups of people living between the Red Sea and the Nile Valley (Dijkstra 2012). The Eastern Desert dwellers are well recognized through the Eastern Desert Ware remains at sites between the Nile Valley and the Egyptian Red Sea ports of Berenike, Quseir al-Qadim and Marsa Nakari (e.g., Barnard 2005–2006, and references therein). In the Lower Nubian Nile Valley this culture has been dated by associated objects and coins to the middle of the 4th century AD (Ricke 1967; Strouhal 1984; Williams 1991).

The stylistic features of some of the objects suggest South Arabian and Axumite affiliations for the Harbor Temple (Rądkowska, Sidebotham, and Zych 2013; Sidebotham et al. 2015). Taking into consideration the association of offering tables known from Berenike with the cultic activities of indigenous desert dwellers (Sidebotham et al. 2015), combined with other objects from the Harbor Temple and the votive function of bead adornments, this discussion will focus on a much closer connection, namely with the shrines and temples of the Lower Nubian Nile Valley.

## OVERVIEW OF BEADS AND PENDANTS

### MOLLUSK SHELLS

A few perforated mollusk shells came from trench BE12/13-81, the area north and behind the back wall of the Temple (BE12-81/011/PB017, BE12-81/013/PB019, not seen by the author). A mollusk shell worked into a bead was found as well [Fig. 2:24]. There are many Red Sea mollusk shell species recorded at Berenike and only one species from the Mediterranean (Then-Obłuska 2015b). Perforated Red Sea shells are also recorded from post-Meroitic sites in Nubia (e.g., Then-Obłuska in press; Fig. 2).

### CORAL

Coral beads are made of the *Corallium rubrum* species of Mediterranean origin. A fragment of coral bead was recorded in the temenos (BE13-87/013/PB003). Two beads were found inside the Harbor Temple. One bead is a simple short cylinder and the other is a collared one [Fig. 2:65,71].

Coral beads have been recorded in a contemporary trash pit of late 5th century date (Then-Obłuska 2015b). Alongside the drawn and rounded glass beads of Indo-Pacific provenance (compare below), coral beads appeared in large quantities at the contemporary royal cemeteries of Qustul and Ballaṅa (Emery and Kirwan 1938: Pls 43–44) and other Nubian burial sites (Kirwan 1939: 3, 6; Then-Obłuska 2016d and references).

### FOSSILIZED CORAL

Fossilized coral is a common building material at Berenike, especially in the late period in the 4th through 5th century AD (e.g., Rądkowska, Sidebotham,

and Zych 2013). Small perforated objects made of this material were found in the late Berenike trash deposits dated to this period (Then-Obłuska 2015b), and one bead has been recorded from the harbor temenos [Fig. 1:3].

### STONE

White/cream and brown banded-agate beads [Fig. 1:22, 32] represent Ptolemaic and early Roman stone bead types (Then-Obłuska 2015b) and two specimens have been recorded from the temenos. A cream hexagonal bicone has also been documented from the Harbor Temple [Fig. 2:35].

A small cornerless cuboid, 3 mm in width, found in the temenos, was made of garnet. It was perforated from both ends [Fig. 1:45]. Other faceted beads are larger in size and made of carnelian. They were found in the Harbor Temple: a standard hexagonal bicone [Fig. 2:70] and long rectangular bicones [Fig. 2:68]. The latter shape is recognized in post-Meroitic Nubian assemblages (Then-Obłuska 2014b; 2016d). One of the long bicones from the Fourth Cataract region was decorated with an “etched” pattern, allowing it to be considered as an Asian import (Then-Obłuska 2013).

### FAIENCE

Simple disc and short cylinder beads of blue and green faience are of Egyptian production. Such beads dominate the Ptolemaic and early Roman contexts in Egypt and Meroitic ones in Nubia (Then-Obłuska 2015a; 2015b). A few eroded examples have been recorded from the late Harbor Temple [Fig. 2:28].

Fig. 1. Sample of beads and pendants from the harbor temenos (not to scale), recorded by trench, locus and PB number; all measurements in mm, in the following order: diameter/thickness/length/hole opening (PCMA Berenike Project/photos and recording J. Then-Obłuska; No. 45 A. Dzwonek)

1 – BE10-70/010/PB017	Glass 17.7/14.6/5.3
2 – BE10-70/011/PB026	Glass 4.6/4.2/2.1
3 – BE10-70/013/PB022	Fossilized coral
4–10 – BE10-70/013/PB022	Metal-in-glass approx.7.0/5.0–24.0/2.3–2.9
11 – BE10-70/013/PB022	Glass 3.9/3.4/1.4
12 – BE10-70/013/PB022	Glass 10.6/6.0/6.0/5.5
13–14 – BE10-70/015/PB 023	Glass 16.2/15.0/5.0 hole opening
15–16 – BE11-70/028/PB 028	Metal-in-glass 6.3/4.1–5.6/1.6
17 – BE11-70/029/PB029	Gold-in-glass 10.4/4.35/min. 10.84/2.3
18–19 – BE11-70/029/PB029	Glass 2.9/0.8/0.9
20 – BE11-70/029/PB031	Metal-in-glass 2.6/2.1/0.9
21 – BE11-70/030/PB032	Metal-in-glass 7.0/5.3/2.1
22 – BE11-70/030/PB037	Banded-agate 5.0/6.9/1.2
23 – BE11-70/030/PB044	Glass 17.9x18.4/24.3/3.5x3.6; 11.5x8.3 loop
24 – BE11-70/030/PB044	Metal-in-glass? 7.4/5.9/1.5
25 – BE11-70/030/PB045	Metal 21.8x19.4/min. 17.05
26 – BE11-70/030/PB046	Glass 18.65/min. 15.2
27–28 – BE11-70/030/PB046	Glass 19.9x17.0/15.1, 17.0/15.0
29 – BE11-70/030/PB046	Metal-in-glass? 7.7/5.7/2.4
30 – BE11-70/030/PB046	Metal-in-glass? 7.7/6.3/1.8
31 – BE11-70/030/PB052	Glass approx.19.0/15.7
32 – BE11-70/030/PB052	Banded-agate 6.6x6.1/4.3/1.4; 1.2
33 – BE11-70/035/PB043	Metal-in-glass 8.54/5.6/2.7; 2.3
34 – BE11-70/035/PB043	Glass 2.6/2.16/1.2
35 – BE11-70/040/PB047	Glass 10.8/5.9/3.6
36 – BE11-70/044/PB058	Glass 7.2/7.3
37 – BE12-81/002/PB004	Faience 4.5/2.0/2.5
38 – BE12-81/003/PB003	Glass 3.7/2.1/1.2
39 – BE12-81/008/PB009	Faience 4.1/1.6/2.0
40 – BE12-87/006/PB004	Metal-in-glass 5.8/4.0/2.3; 2.0
41 – BE12-87/006/PB004	Glass 5.0/4.5/1.6; 2.0
42 – BE12-87/006/PB008	Glass 6.6/6.7/2.6
43 – BE12-87/006/PB009	Metal-in-glass 10.6x approx.5.5/13.0/2.0
44 – BE13-89/003/PB011	Glass data not recorded
45 – BE13-89/010/PB013	Garnet 3.1/4.1/0.7



Fig. 1. Sample of beads and pendants from the harbor temenos (not to scale)

Fig. 2. Sample of beads and pendants from the Harbor Temple (trench BE10-61) (not to scale), recorded by locus and PB number; all measurements in mm, in the following order: diameter/thickness/hole opening (PCMA Berenike Project/photos and recording J. Then-Obtuska)

1	– BE10-61/001/PB001	Glass 4.6/2.8/1.2
2	– BE10-61/001/PB016	Glass 3.4/2.7/1.4
3	– BE10-61/002/PB003	Glass 3.6/2.6/1.2
4	– BE10-61/003/PB031	Glass 5.8/3.3/1.8
5	– BE10-61/003/PB035	Glass 3.5/4.2/1.6
6	– BE10-61/003/PB035	Glass 7.8/3.8/1.1; 2.1
7	– BE10-61/005/PB037	Glass 5.3/2.8/1.5
8	– BE10-61/005/PB037	Glass 5.0/3.0/1.4–1.6
9	– BE10-61/013/PB041	Glass 6.7/8.0/1.8
10	– BE10-61/013/PB043	Glass 4.1/2.4/1.1
11	– BE10-61/013/PB042	Glass 4.0/2.9/1.2
12	– BE10-61/019/PB047	Glass 6.1/7.3/1.6
13	– BE10-61/021/PB046	Glass 4.1/2.6/1.1
14	– BE10-61/021/PB046	Glass 17.1/12.4
15	– BE12-61/019/PB001	Glass 4.8x4.1/3.3/1.7
16	– BE12-61/019/PB003	Agate 4.1/3.4/0.8; 0.7
17–19	– BE12-61/019/PB003	Glass 3.6–4.6/1.7–2.8/1.2, 1.1
20	– BE12-61/032/PB006	Glass 3.0/1.8/0.7
21	– BE12-61/032/PB006	Glass 4.1/3.0/1.1
22	– BE12-61/032/PB006	Glass 2.4/1.5/0.6
23	– BE10-61/032/PB011	Glass 4.6/2.4/1.3
24	– BE12-61/032/PB012	Mollusk shell 9.5/7.6/1.1
25	– BE10-61/032/PB012	Glass 3.4/2.2/1.3
26	– BE12-61/033/PB007	Glass 3.2/2.8/1.3
27	– BE12-61/033/PB007	Glass 4.9/2.9/1.1
28	– BE12-61/033/PB009	Faience 4.6/1.9/1.9
29	– BE12-61/033/PB010	Glass? 7.1x6.5/8.7/0.8
30	– BE12-61/033/PB010	Glass 4.2/2.5/1.7
31	– BE12-61/033/PB010	Glass 4.3/3.2/0.9
32	– BE12-61/033/PB010	Glass 6.3/4.3/1.2; 1.8
33	– BE12-61/033/PB010	Glass 1.7/1.4/0.8
34	– BE12-61/033/PB010	Glass 1.7/1.7/0.6
35	– BE12-61/033/PB021	Agate 4.3/3.6/1.4; 1.2
36–40	– BE12-61/033/PB021	Glass 2.6–5.5/1.7–4.6/0.8–2.3
41	– BE10-61/033/PB025	Glass 3.8/3.4/1.1
42	– BE12-61/038/PB008	Glass 6.0/4.5/0.9
43–46	– BE12-61/038/PB008	Glass 4.5–4.8/2.0–2.7/1.5
47	– BE12-61/038/PB014	Glass data not recorded
48–51	– BE12-61/038/PB014	Glass 2.2–4.3/1.5–2.8/0.6–1.0
52–53	– BE12-61/045/PB016	Glass data not recorded
54	– BE12-61/048/PB019	Glass 4.1/1.3/1.2
55–56	– BE10-61/048/PB024	Glass 3.0, 3.9/2.1, 2.8/1.2, 0.6
57–58	– BE12-61/050/PB022	Glass 4.1/1.7–2.8/0.6–1.2
59–63	– BE12-61/056/PB033	Glass 2.7–4.5/1.9–2.7/0.7–1.3
64	– BE12-61/056/PB037	Glass 3.0/1.8/0.9
65	– BE12-61/059/PB038	Coral 4.3/7.3/1.1
66	– BE12-61/059/PB038	Glass 6.4/6.7/2.9; 2.6
67	– BE12-61/059/PB038	Glass 3.8/2.8/1.2
68	– BE12-61/064/PB047	Carnelian 5.4x5.4/12.7/1.4
69	– BE12-61/065/PB072	Glass 4.5/1.9/1.4
70	– BE12-61/071/PB076	Carnelian data not recorded
71	– BE12-61/082/PB060	Coral 2.7/1.9/0.8

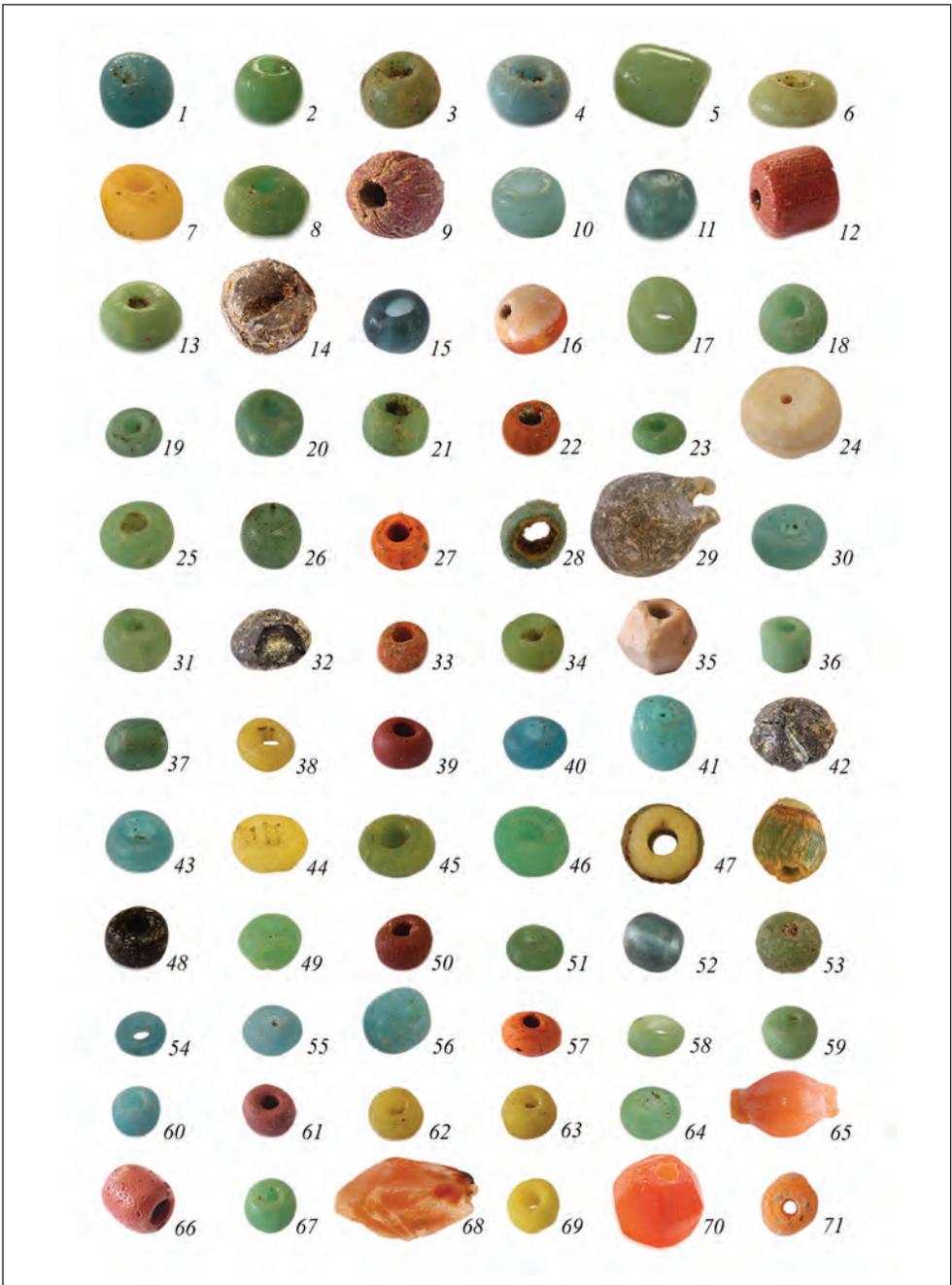


Fig. 2. Sample of beads and pendants from the Harbor Temple (trench BE10-61) (not to scale)

A fragment of a faience biconical bead was also registered from the harbor temenos [Fig. 1:39]. Similar beads have been recorded from other contexts in early Roman Berenike and Quseir al-Qadim/Myos Hormos (Then-Obluska 2015b; personal observation of Quseir material at Oriental Institute Museum, Chicago).



Fig. 3. *Faience Bes amulet (BE13-61/125/006) from the Harbor Temple (PCMA Berenike Project/photo K. Braulińska)*

A blue-glaze faience Bes amulet was found in the Harbor Temple (BE13-61/125/006) [Fig. 3]. It is double-sided, formed almost identically on the front and on the back, perforated laterally through the neck for suspension. The figure has bandy legs and hands resting on his hips. Four holes separate his arms and legs from the body. He wears a quadruple-feather headdress. The eyes, nose, cheeks, tongue and beard details are schematically underlined as projecting elements. A raised wavy line along the eyebrows with rolled up terminals, each end forming the earlobes, is a characteristic feature of the type. Some traces of yellow glaze can be discerned on part of the right hand.

Bes amulets of similar style are known as Roman-dated objects (Petrie 1914: 40, Pl. XXXIII, 188 l, =UC52806, Pl. 188 w 2, =UC52817 back plain; Whitehouse 2009: 104, The Ashmolean Museum, Queen's College loan 327).<sup>1</sup> The Bes amulet from Berenike also has a parallel in a fragment found and reused at the Christian site of Bab Kalabsha in Lower Nubia (Habachi 1967: 68, Oriental Institute Museum University of Chicago [=OIM] E42044A, personal observation, width 17.7 mm, thickness 8.5 mm, height preserved 18.0 mm, HD 2.6). The Bab Kalabsha specimen was blue-glazed with some details decorated in green, which is a characteristic feature of early Roman and Meroitic faience (e.g., Meyer 1992: Pl. 14 No. 366; Whitcomb and Johnson 1982: Pl. 59g, OIM E45910, personal observation; Then-Obluska 2015a: Fig. 14; Silverman 1997: 302–303 and Penn Museum, Inv. E7925).

<sup>1</sup> See similarly executed, but not affiliated, Bes figure amulets and Bes head amulets: MFA [=Museum of Fine Arts, Boston] 02.557; MFA 02.560; MFA 72.2096; MFA 72.2100.

## GLASS AND METAL-IN-GLASS

*Rod-formed and wound glass*

Three bichrome beads belong to the so-called “date” bead type. They are made of a green or striped yellow and green body, and an attached yellow collar. It is rather reminiscent of a lotus bud and is one of the most recognizable Egyptian beads from the 2nd through 5th centuries AD (e.g., Then-Obluska 2015b). Two specimens have been recorded from the temenos (BE13-94/011/PB014, BE12-87/004/PB006), one of which is very eroded [Fig. 1:41]. Another bead comes from the Harbor Temple [Fig. 2:47].

A fragment of elongated bead from the temenos was made of a striped yellow and green section and a red one at one end [Fig. 1:44]. The fragment bears traces of drawing, but it was most probably rod-pierced. Similar mosaic glass, yellow and green with red centers, was found shaped into tabular beads. It came from late Meroitic Karanog in Nubia (Woolley and Randall-MacIver 1910: Pl. 40:7906).

One large bead was made by winding glass around a metal mandrel [Fig. 2:66]. It is of a long oblate shape, made of glass of an opaque red color.

Large pendants and their remains [Fig. 1:1, 12–14, 23, 25–28, 31, 35–36] are the most outstanding features found in the temenos, specifically in the fill of the Square Feature. They consist of a large slightly conical base and an attached loop. A complete example measures 17.9–18.4 mm in thickness, 24.3 mm in length and its loop measures 11.5 mm by 8.3 mm [Fig. 1:23]. Like the metal-in-glass beads found in the same context (compare below), all were discovered heavily burnt. Objects similar in shape have been recorded in Spain, Syria, Jordan

and Nubia, and date between the 3rd and 5th centuries AD (Then-Obluska 2015b and references therein). Moreover, a similar pendant was documented recently from trench BE15-103 to the west of the Harbor Temple (locus 030), which is generally dated mid-4th to mid-5th century AD; however, it is more likely to be in the 4th century AD range (Roberta Tomber, personal communication). Additionally, such a pendant is recorded from the post-Meroitic Isis shrine at Qasr Ibrim in Nubia (Adams 2013: Pl. 29c).

*Drawn glass and metal-in-glass*

Some beads were made by drawing glass tubes. Next, the tubes were rolled over ribbed molds as found in the early and late Roman/early Byzantine workshops in Alexandria (Rodziewicz 1984; Kucharczyk 2011). Such molded tubes could be either broken or cut into single- or multiple-segment beads. Drawn segmented beads are one of the most recognizable Eastern Mediterranean bead types, especially in Egypt and Nubia (e.g., Then-Obluska 2015a; 2015b). Two beads of opaque red from the Harbor Temple are of a larger size [Fig. 2:9, 12].

Three glass specimens from the harbor temenos are the inner layers of metal-in-glass beads [Fig. 1:2, 20, 40]. Metal-in-glass beads comprise two layers of transparent glass and metal (gold or silver) foil in-between. Two of the beads are collared and have flattened, tabular bodies [Fig. 1:17, 43] (e.g., Alekseeva 1978: Pl. 26:70, Type 25, 1st to 3rd century AD). Similarly as in the case of other drawn and segmented beads, molds for producing collared beads have been found in Alexandrian workshops (compare above). Almost all the metal-in-glass beads came

from trenches in the harbor temenos. Like the remains of the large pendants, they were badly preserved bearing traces of burning [Fig. 1:4–10, 15–17, 21, 33, 43].

Other glass beads were drawn tubes cut into shorter pieces and then heat-rounded in some container (Francis 2002). Most of them are monochrome semi-translucent blue and green beads; there are some that are opaque yellow and orange, and a few are red and black in color. Almost all the glass beads recorded from the Harbor Temple in seasons 2010 and 2012 were drawn and rounded [Fig. 2:1–5, 7–8, 10–11, 13, 15, 17–23, 25–27, 30–31, 33–34, 36–41, 43–46, 48?, 49–64, 67, 69]. A few specimens came from the temenos trenches [Fig. 1:18, 19, 34, 38]. Those from trench BE13-87 are red in color (BE13-87/013/PB003).

The manufacturing technique for drawn and heat-rounded beads has been associated with the South Asian tradition, and the beads have been called Indo-Pacific (Francis 2002). While only a few have been recorded from the early Roman layers at Berenike and Quseir al-Qadim, a specimen from the latter site brought laboratory confirmation of its Sri Lankan/

South Indian origin (Then-Obluska and Dussubieux 2016). The presence of Indo-Pacific glass beads at post-Meroitic sites in Lower Nubia has recently been confirmed by the results of laboratory analysis (Then-Obluska and Wagner 2017). They were also macroscopically recognized at the Blemmyan Wadi Qitna cemetery (Then-Obluska 2016a) as well as at the tumulus cemeteries of el-Zuma and el-Detti in the Fourth Cataract region, where they have been dated to the second half of the 5th and first half of the 6th centuries AD (Then-Obluska 2016b; 2016d). Their export to East Africa continued over the following centuries (Wood et al. 2016). Interestingly, they have just been identified at Merovingian sites in Europe (Pion and Gratuze 2016).

#### *Other glass*

A few badly burnt biconical glass beads were found in the late Harbor Temple [Fig. 2:32, 42]. They can be compared to the destroyed glass pendants and metal-in-glass specimens from the Square Feature in the temenos. Also badly burnt was what looks like a fragment of a large pendant [Fig. 2:14].

## DISCUSSION

### BEADS AND PENDANTS AS VOTIVE OFFERINGS IN EGYPT AND NUBIA

The term ‘votive offering’ is usually used to mean ‘a gift to a deity’ (Pinch 1993). Votive offerings brought to ancient shrines are commonly known. Generally, ancient textual sources mention thank-offerings

to deities as resulting from specific pilgrimages. The offerings varied from a funded library, through a silver pig, to golden statues, and they would be placed in the northern area of a sanctuary (Petsalis-Diomidis 2005).<sup>2</sup> There is a dearth of evidence for offerings made by poor pilgrims, no doubt due to their perishable

<sup>2</sup> One of the two principal Christian pilgrimage centers, the healing shrines of martyrs SS Cyrus and John at Menouthis, were adorned with votive objects donated by pilgrims (Montserrat 1998: 272).

nature (Petsalis-Diomidis 2005: 210, Ref. 54). The votive objects might be presented to the image of a god or else pierced and hung on cords. They were also sometimes buried in pits within Egyptian temples (Pinch and Waraksa 2009: 7). Items of personal adornment, such as beads, pendants and amulets, formed a substantial proportion of the votive offerings in Hathor temples and shrines in pharaonic Egypt (Pinch 1993: 265–300, Fig. 16). The Graeco-Roman temples of Edfu and Dendera record ritual presentations of bracelets to Hathor. They are said to ‘rejoice the heart of the goddess’ (Pinch 1993: 277). According to Pinch, it seems that, in religious contexts, the intrinsic value of these objects was of little importance. The nature of the gifts, faience bracelets and necklaces, substitutes for metal jewelry, was more significant than the quality of the material from which they were made.

Rich bead and pendant adornments are characteristic features of ancient Nubian cultures, especially of the Meroitic and post-Meroitic periods. Irrespective of their sex and age, Nubian and Blemmyan individuals have been found buried with bead adornments (Then-Obłuska 2014b; Strouhal 1984; Habachi 1967). Moreover, beads also adorned many objects as well as animals (Then-Obłuska 2016d). As one aspect of rituals, beads were recorded with human figures in subsidiary graves (Then-Obłuska 2014c). A string of large globular beads belongs to the most characteristic royal and divine adornments in the Meroitic period as evidenced in Nubian iconography (e.g., Török 2011: Pls 81, 82, 87, 155, 156, 159). Napatan and Meroitic scenes from the royal stelae show kings offering necklaces to gods

(e.g., Wildung 1997: Cat. 265; Baud 2010: Pl. 223). Additionally, beads found in Nubian temples could be part of foundation deposits (e.g., Then-Obłuska 2014a), as well as being votive ornaments (see below).

Interestingly, as far as faience objects are concerned, a Bes figure was found in the Isis Temple at Qasr Ibrim (Adams 2013: 131, Pl. 60c) as well as in the Harbor Temple at Berenike. The latter finds a parallel at Bab Kalabsha. There was no temple for Bes in Egypt or Nubia, but he was a deity that appeared in many temples as he was believed to have apotropaic powers during childbirth (Andrews 1994: 40; Frankfurter 2000: 124–131). In the Graeco-Roman world, he was a symbol of the more basic ritual needs of domestic life, like protection of women and children, maternity and healing. Additionally, Bes was associated with the Abydos oracle. His apotropaic function continued there until late into the 5th century AD (Frankfurter 2000: 124–131). In Nubia, ceramic statues of the god Bes and his consort Beset were found associated with the shrine in Kawa (Welsby 1998: 19, Color plate IX; 2000: 7–8, Color plate VII–VIII). The presence of Bes in the Napatan period is attested by sculptured jars as well as amulets, also of indigenous Nubian shape (Petacchi 2014; Then-Obłuska 2016b). Bes in monumental architecture is also attested in Upper Nubia (Amara West and Gebel Barkal) and in the Butana region (Meroe, Naga, Musawwarat es-Sufra), particularly during the Meroitic period when Bes, under the influence of the Graeco-Roman *mammisi*, was engraved on temple columns and pillars (Petacchi 2014: 205). Bes was displayed on the altar stone in the post-Meroitic Sayala complex mentioned above (Kromer 1967: Pl. 25,

Object XII). Bes was also recognized as a decorative motif in the crafts of Meroitic and post-Meroitic Nubia (e.g., Williams 1991: 40–41, pottery; Emery and Kirwan 1938: Plate 84A, =JE70647, ivory handle; Emery and Kirwan 1938: 383–384, Plate 109, object Q.14-77).

Small faience and metal Bes amulets have often been recorded at Meroitic cemeteries (e.g., Then-Obluska 2015b; 2016c), but they were also found as reused Napatan/Late Period and Meroitic/early Roman items at later dated sites in Nubia and in the Eastern Desert (e.g., Habachi 1963: 68, OIM E42044A, personal observation of early Roman/Meroitic faience amulet found at the Christian site of Bab Kalabsha; Then-Obluska 2016b: object D4/27, Napatan amulet from a post-Meroitic tomb at el-Detti; Kirwan 1939: Pl. XVIII:A.11/63, four faience amulets in a late post-Meroitic tomb at Firka; Meyer 2014: Pl. 34a, metal Bes amulet found at the early Byzantine mining site of Bir Umm Fawakhir, and similar to Meroitic ones in Then-Obluska 2016c; Francis 2000: 223 and Then-Obluska 2017: Fig. 10.6, faience Bes amulet from one of the late settlement trash dumps at Shenshef). It is probable then that the early Roman faience Bes amulet found in the late Harbor Temple at Berenike was a reused item like the ones found in the Eastern Desert and Nubia. It might have been left as an offering in the Harbor Temple.

#### LATE ANTIQUE TEMPLES AND SHRINES IN NUBIA, THEIR AFFILIATION AND EQUIPMENT

Some common features, including beads and pendants, can be recognized in the Berenike Harbor Temple and at some

contemporary Nubian sites in Kalabsha, Qasr Ibrim, Sayala, and on Philae.

Drawn and rounded glass beads of South Asian origin and specimens of Eastern Desert Ware were found in the Blemmyan tombs at Kalabsha (Ricke 1967; OIM, personal observation). Kalabsha with its temple dedicated to Mandulis, Osiris and Isis was also occupied at that time by the Blemmyes and visited by pilgrims as the inscriptions on the temple walls reveal (Rutherford 1998: 254). Moreover, many table offerings, similar to the ones in the Berenike Harbor Temple, and remains of an Isis statue were recorded at the neighboring mountain sanctuary (Ricke 1967: Figs 31–32, Pl. 7D,10: e.g., BK/2, BK/4, BK/5, BK/6, BK/14). Additionally, an offering table and a horned altar, both objects similar to those documented at Berenike, were recorded from the neighboring shrine situated about one kilometer away (Ricke 1967: Figs 43, 45).

As in the Harbor Temple, many bead adornments came from the contemporary Nubian Isis shrine at Qasr Ibrim, where they were left probably as votive offerings (Adams 2013). The Qasr Ibrim Isis shrine is dated to the post-Meroitic (“Ballaña”) period, although some earlier, Meroitic objects have been recorded. Apart from objects associated with farming, food and other secular activities, many cult objects, such as a small bronze figure of a soldier(?) and a deity with one arm raised and one extended (Adams 2013: Pl. 53c), offering tables (Adams 2013: Pl. 54), a simple horned altar as one of the recognized features of the Isis cult (Adams 2013: 129, Pl. 51; Witt 1971: Pl. 27), and floral remains (Adams 2013: Pl. 69c) as well as the Bes amulet (see above) can be

compared with the repertoire of objects from the Harbor Temple. Moreover, many beads were found in the Qasr Ibrim Isis shrine as well (Adams 2013: 116, 135, Pl. 67). The numerous bead finds from the shrine stand out distinctly from beads found elsewhere at the site, for the overwhelming majority is of glass (Adams 2013: 135). As in the Berenike temple, the Qasr Ibrim shrine glass specimens occur in a wide variety of colors, with blue-green or blue predominant. The large glass pendant type found in the temenos in Berenike, paralleled by objects from Jordan, Syria and Nubia (Then-Obluska 2015b), surprisingly finds much closer parallels in post-Meroitic Qasr Ibrim (Adams 2013: Pl. 29c). Some sherds of Eastern Desert Ware have been found in different contexts in Qasr Ibrim (Barnard 2013: 103). Interestingly, a find of an Indian peppercorn has been confirmed from Qasr Ibrim (Cappers 2006: 117).

Enigmatic remains from the post-Meroitic site of Sayala, described as a 'wine tavern' (Kromer 1967), have been recently reinterpreted and associated with Isis cult societies. We know the names of a number of Blemmyan officers of these societies (Edwards 2004: 209–210). The complex comprised a series of open rooms with stone benches around the walls, and sometimes stone tables. Interestingly, many vessels, including Eastern Desert Ware (Barnard, Dooley, and Faull 2005), wine amphorae, a stone offering table in the shape of a temple pool or sacred lake with steps on four sides of its interior (Kromer 1967: 29–30, Pl. 29, Fig. 2), match those found in the Harbor Temple. Also, a bronze fragment in the form of an

extended human arm, perforated mollusk shells (*Marginella Gibberula monilis* sp.), as well as green, blue and orange glass beads were found at the site (Kromer 1967: 30, Pl. 30, Fig. 1, Pl. 36, Fig. 2, length 6.7 cm for the bronze fragment). Both perforated *Marginella* sp. mollusk shells of Red Sea origin and monochrome glass beads have been found at late Berenike (Then-Obluska 2015b: Fig. 1:3). Thus, many objects found at Sayala can be compared with those from Berenike.

The Blemmyes benefitted from a special permission given by the emperor Diocletian allowing them to worship Isis at Philae. After Egypt became officially Christianized, the Isis Temple on Philae Island remained a pagan center visited by the Dodekaschoinos population until its closure by Justinian in AD 537 (Obluski 2014). By the mid-5th century AD, the Dodekaschoinos was controlled by the Blemmyes and they constituted most of the visitors to the Isis Temple. However, it probably served the whole population of the Dodekaschoinos. According to votive inscriptions from the early 5th century AD found in the temple, the names represent one family whose members were officials of the cult of Isis, and the priests of Isis may have been Blemmyes as well (Takács 2005: 361–362). According to David N. Edwards (2004: 210), the officials mentioned in the inscriptions were of 'sacred dining associations,' relating to the cultic meals that were part of the rituals taking place when the Nobadians and the Blemmyes visited Philae. Similar associations may have also organized rites at Qasr Ibrim, Sayala and Berenike, at which sites discarded vessels and amphorae have been found.

## CONCLUSIONS

More than 250 beads and pendants were recorded at the Harbor Temple (4th to the beginning of the 6th century AD) and the surrounding temenos (1st to 5th centuries AD) in the southwestern harbor of Berenike, which was in all likelihood the early Roman harbor, operating most probably until the late 2nd century AD.

Finds from the temenos comprised two main types of adornments, i.e., large glass pendants and metal-in-glass beads. Both groups found in Berenike were burnt. The drawn and rounded glass beads of South Asian provenance represented 4th to early 6th century AD types. Coral beads of Mediterranean origin also seemed to be late Berenike in date.

South Indian/Sri Lankan glass beads dominated the Harbor Temple assemblage, which also contained some coral beads and faceted carnelians. Beads of this sort have been recognized as adornments in all the 4th to early 6th century AD Red Sea ports and at contemporary Blemmyan and/or Nubian sites (e.g., Then-Obluska 2013; 2014b; 2016a; 2016d; Then-Obluska and Wagner 2017). Moreover, the early Roman faience Bes pendant was most probably a reused item. In the same way Napatan and Meroitic Bes amulets were found reused at later sites in Nubia and the Eastern Desert.

As said above, some beads found in the Harbor Temple and in the Square Feature were burnt. This suggests that they may have originally belonged to one archaeological context. They may constitute the remains of votive offerings made in the Harbor Temple, burned there and then discarded with the ashes which were dropped in the Square Feature and elsewhere. The

common presence of painted ostrich eggshell fragments and large cowries in the Harbor Temple (Rądkowska, Sidebotham, and Zych 2013: 218–221, Figs 10 and 13) as well as in the Square Feature (Zych et al. 2014: 258, Fig. 7) would also support such an assumption.

Stylistic features of the objects found in the Harbor Temple have been tentatively associated with South Arabia or Axum (Sidebotham et al. 2015). However, the Berenike temple finds have much in common with pagan Nubian traditions, as can be observed from post-Meroitic shrines and temples. Votive offerings, comprising beads and pendants, can be traced in Nubian iconography and archaeology. Bead finds in the Harbor Temple and its surroundings probably played the same role. The Harbor Temple is contemporary with post-Meroitic cultures in the Nubian Nile Valley. The Eastern Desert people, well documented by their pottery in the Nile Valley, the Eastern Desert and the Red Sea port sites, might have been middlemen between the coast and the valley, spreading Nubian traditions in Berenike and overseas imports in Nubia.

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# Conservation interventions at the site of Berenike (Egypt): challenges and solutions in an ancient city of the Eastern Desert

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**Abstract:** The desert climate of the Berenike site in the Eastern Desert of Egypt are conducive to the preservation of substantial quantities of both organic and inorganic archaeological remains. Field conservation is thus fundamental and indispensable to each archaeological campaign. All interventions have as the main objective stabilizing the material, facilitating the identification of finds and ensuring artifact conservation as much as possible. The paper focuses on the specific conditions making this site unique and an ideal place for the preservation of all materials, paying special attention to the ancient harbor area with its significant number of remains of carbonized wood belonging on the whole to several ancient Roman ships. Interventions on these materials are discussed with the goal of determining the basic problems faced by conservators working at this site, the extent to which these interventions should be carried and the scientific dialogue with archaeologists and field specialists.

**Keywords:** desert conditions of preservation, conservation interventions, carbonized wood, organic and inorganic artifacts, stabilizing

The Berenike site is a harbor town founded in the Ptolemaic period (3rd century BC) on the Red Sea coast, today 260 km east of Aswan and 825 km south of the Suez Canal. It is located in a bay strategically conducive to the development of maritime commerce, experiencing its heyday in Roman times but deserted in the 6th century AD. Flourishing during the first centuries of our era, Berenike became a leading commercial emporium thanks to trade with the Horn of Africa, the Arabian Peninsula and India.

Despite this richness, its development was marked regularly and permanently

by the environmental characteristics of its location, that is, the Eastern Desert. These characteristics made it more difficult to ensure the vital logistics involved in day-to-day functioning at the site and they have also affected adversely work conditions for the archaeological team at the site today. Nevertheless, these same conditions have permitted the conservation *in situ* of a tremendous amount of materials, which after their documentation and study have provided a great deal of data informing us of the social, economic and cultural aspects of the society that used to reside in Berenike.

Thus, getting to know the environmental and geological context in which the Berenike site is set is essential in order to understand the state of conservation of the archaeological materials that are extracted year by year. Without any doubt, the desert climate is one of the fundamental factors that ensured the preservation of these artifacts (made of such diverse materials) in such good condition after more than two millennia.

#### WEATHER CONDITIONS AT THE BERENIKE SITE

The climate of the Eastern Desert is known for a lack of rain (about 3 mm per year, according to the Global Precipitation Climatology Centre [GPCC]), an everyday thermal amplitude, humidity in the 50–60% range, and as a result of that, a high level of evapotranspiration.

In addition, the fact that the site is so close to the Red Sea coast [Fig. 1] triggers a remarkable salinization of the ground. The extreme evaporation of seawater found in the soil brings a precipitation of salts (especially sodium chloride) and gypsum that accumulates both under and over the ground. This salinization precludes any kind of vegetal growth (Sánchez Vizcaino and Cañabate Guerrero 1998: 99).

This soil is formed basically by sandy areas, limestone, calcareous cements, lime, gypsum and fossilized corals, which causes its alkalinity to be 8–8.5pH (Cronyn 1990). The basicity of these soils creates a serious conservation issue for many materials, such as glass. However, it will also be one of the agents that allows many other materials (like organic objects) to be preserved today.



Fig. 1. *The site of Berenike in the Eastern Desert of Egypt on the Red Sea coast*  
(Photo D. Eguiluz Maestro)

## ALTERATION FACTORS INFLUENCING ARCHAEOLOGICAL MATERIAL

Whenever speaking of the alteration or degradation of archaeological materials one must take into account the factors and agents taking part in this process, both intrinsic to the physical and chemical characteristics of every material and extrinsic, that is, referring to the environmental, terrestrial, historic and human buried context. Here the focus will be primarily on the entire external context of the Berenike site due to its singularity and the specificity of its characteristics.

The extreme environment of the Eastern Desert makes the alteration suffered by archaeological materials minimal and ensures that artifacts found there stay intact. This is mainly due to soil alkalinity, low humidity and the absence of vegetal and animal organic matter, and it is also the result of decomposition agents. Even so, decay is inevitable. The most important of the decay factors are as follows.

### TEMPERATURE

The temperature variation in this desert is quite notable, with a range of up to 20°C between day and night. During winter, for example, it may vary between 12 and 30°C. These great thermal fluctuations provoke some tension both in the soil and in the buried objects, which triggers sudden expansion and contraction of the material. As time goes by, these changes translate into cracks, fissures and even fragmentation.

### SALTS

The high levels of salt in the soil of this site are the main degradation agent of

archaeological artifacts. As said above, these salts, dissolved in seawater, enter the soil through humidity, the soil's capillarity and seasonal rains. The high temperatures that are characteristic of the desert climate make the water found in the soil evaporate quickly, which results in the solidification of the dissolved salts within and over the archaeological objects. This results in extensive saline concretions or even fissures in materials such as ceramic and bone, especially when the salts solidify within the pores of archaeological artifacts.

### OXYGEN AND HUMIDITY

In this case, the two factors are linked, as the presence of oxygen in alkaline soil and the humidity introduced by the sea activates the physical and chemical reactions that trigger the alteration of materials as delicate as metals, among others. Thus, when metal comes into contact with oxygen or water, the corrosion process of this material begins a process that cannot be reversed.

The depth at which an object is found can influence its state of conservation as well. Artifacts located in more superficial layers will be in a drier environment, but more exposed to oxygen, whereas objects lying deeper will be affected by the presence of water and humidity.<sup>1</sup>

It is important to note that despite the fact that the action of these agents is not very high and that materials remain in very stable conditions while buried, all mechanisms of alteration are speeded up dramatically once these objects are

<sup>1</sup> Soil begins to be humid at 20 cm of depth due to phreatic zones that are found deeper (approximately at 3.50 m).

extracted from the soil and come in contact with the atmosphere. Degradation increases consequently. Because of this, the conservator must be aware of all the diffe-

rent materials present in these objects, as well as their main physical and chemical characteristics and their intrinsic alteration processes in order to stop this activation.

## MATERIALS PRESERVED AT THE BERENIKE SITE

Berenike has yielded a varied set of objects made of materials of different inorganic (ceramics, metal, stone, etc.) and organic origin (bone, wood or vegetal fabric).

### METAL ARTIFACTS

Metal artifacts are among the most frequent finds at the site, next to ceramics and malacofauna. Bronze objects such as nails, small plaques, etc. of everyday use are excavated on a regular basis. It is quite common to find coins and, in very specific contexts as in a temple for instance, small votive sculptures [*Fig. 2* top left].

Metal is a highly unstable material that, from the moment it is created, starts a natural process of degradation. The metal objects at Berenike are usually in an advanced state of corrosion<sup>2</sup> and these are the principal agents of alteration: the presence of humidity, oxygen and salts—even though their presence is not very high, it is certainly active—and the alkalinity of the soil, because alkaline ground is known to have a high electric conductivity, thus favoring chemical reactions that produce metal corrosion (Gómez Moral 2004: 43).

However, objects made of copper and bronze, a copper alloy, usually have a large quantity of metal in their composition; up to a point where coins can be found in a perfect state of conservation, within

an intense and compact accumulation of corrosion [*Fig. 2* top right].

### POTTERY

The amount of pottery found at the site in comparison to objects made of other materials is quite large. The state of preservation is generally good, except for the fact that they have large quantities of salt accumulation both within the paste and on the surface, which creates big saline concretions. Nevertheless, amphorae and other vessels need to be lifted and transported to storage; if fragmented, pieces have to be mended [*Fig. 3*]; and when ostraka are found, it is essential to bring out the ink in order to facilitate the reading. Moreover, small objects of faience are also found, being usually in very fragile condition.

### STONE

This is the least common group, as not many objects made of stone are found in the current excavation. There are rare exceptions, like the remains of a pillar and stela fragments with relief decoration and inscriptions [e.g., *Fig. 2* center]. However, the field conservation laboratory has never been required to intervene with specific preservation procedures apart from guaranteeing environmental stability in order to avoid potential alteration of the

<sup>2</sup> Corrosion leads not only to changes in the material, but also to severe and permanent plastic deformations, cracks and even breaks (Meyer-Roudet 1999).

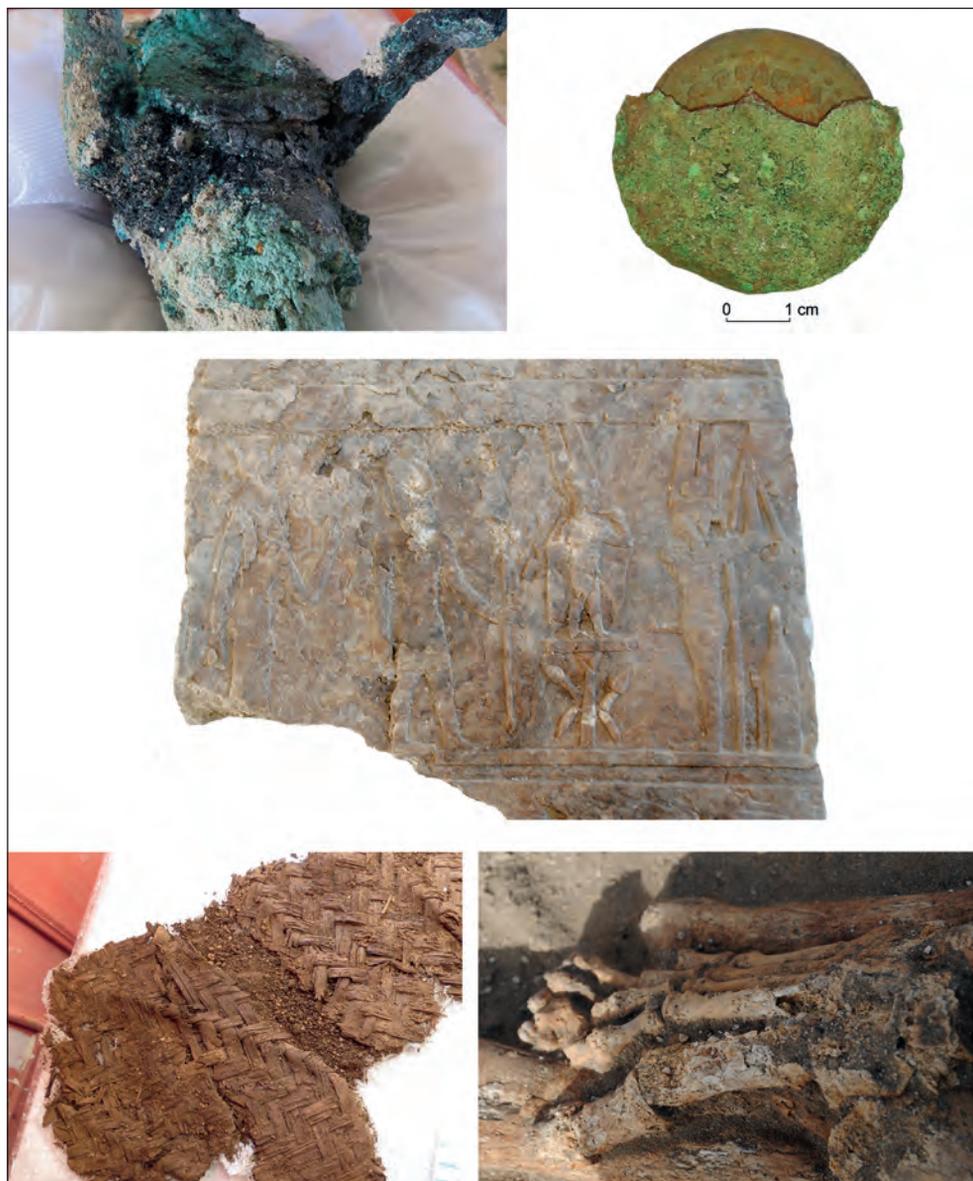


Fig. 2. *Artifacts found at Berenike representing different kinds of materials: top left, small bronze figure (BE13/61/126) from the late Harbor Temple found in 2013, showing advanced corrosion; top right, corrosion formed on a bronze coin; center, detail of a limestone stela (BE15-111/011/002) found in the Berenike Isis Temple in 2015; bottom left, basketry fragment in situ (BE15-109/017/054); bottom right, saline concretions covering the preserved osseous tissue of human bones (Courtesy PCMA–University of Delaware Berenike Project/photos D. Eguiluz Maestro)*

stone support (for earlier field conservation work at Berenike, see Lach 2017).

### VEGETAL

In relation to organic materials, one of the most common objects found in Berenike are those made of vegetal tissue, such as rope, baskets and mats. Once again, the deposition of these objects in an arid soil has favored their sometimes excellent conservation. Nevertheless, this material is found in extremely altered state. The fabric is very dry and surrounded by precipitated salts [Fig. 2 bottom left].<sup>3</sup> This forces loss of flexibility, making the artifacts extremely rigid and fragile.

### BONES

Bones are similar to vegetal material: bone is easily preserved at the Berenike site due to the alkaline pH level of the

soil and to the absence of organic matter and superior plants. Therefore, it is quite common to find large quantities of animal remains: cats, dogs, turtles, monkeys, and even human bones in some instances. Nevertheless, this material is extremely friable, mainly due to salts [Fig. 2 bottom right]. Its crystallization within the osseous tissue triggers massive alterations such as fractures, erosion and decohesion, which in most cases causes the pulverization of the osseous tissue when excavated. This bad preservation makes it impossible to run any kind of conservation treatment after lifting from the trench.

### WOOD

One of the characteristics that make Berenike such an important site is the preservation of numerous wooden elements coming from naval structures

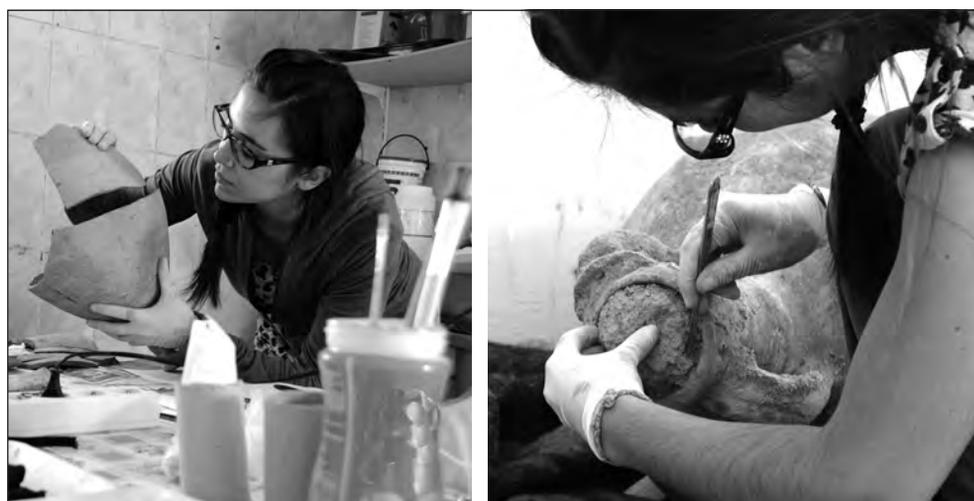


Fig. 3. Pottery interventions: left, field conservator Delia Eguiluz Maestro recomposing joining pieces for documentation purposes; right, opening of a sealed amphora under controlled conditions (courtesy PCMA–University of Delaware Berenike Project)

<sup>3</sup> This precipitation of salts is mainly due to the hygroscopicity that is characteristic of vegetal matter and every organic matter in general.

that date from the Roman period. Several fragments of Roman vessels have been recovered over the years. They are usually found completely carbonized [see *Fig. 6*], which makes it possible for these fragments to preserve their original morphology. Hence, the volume of information gathered from these objects is quite remarkable.

Nevertheless, this situation raises several problems for conservation with regards to its preservation, extraction and manipulation, due to the fragility of the wood that has gone through a carbonization process.

Regarding the combustion process wood goes through, the following should be emphasized: dehydration (as it loses water, carbonic anhydrides and organic gases), torrefaction (which occurs at 170°C), pyrolysis (where the complete chemical

decomposition of the organic matter takes place and thus turns into charcoal, a process occurring at 270°C) and the final stage (this process can reach 700°C and turn wood into ashes). Therefore, the fact that this wood has been preserved is due to the combustion process that never reached the final phase. Thus, the wood became charcoal, but it was never completely consumed (Diloli Fons et al. 2014: 60).

The physical and chemical changes that this carbonized material suffers are fundamentally the conversion into charcoal, its dehydration and the loss of volume. However, its microstructure is preserved almost intact and the fact that its chemical composition changes makes it more resistant and stable when exposed to degradation agents such as humidity and oxygen (Diloli Fons et al. 2014: 61).

## CONSERVATION CRITERIA AND OBJECTIVES

The conservator's main duty is to guarantee the conservation of the objects that are excavated at the site, trying to secure the highest physical and chemical stability. In order to meet this objective, it is essential to apply the minimum intervention criteria, to always use reversible materials and to carry out a methodical written and photographic register of the state of conservation of the objects and of every and each of the treatments applied. These tenets were established in the 1987 Charter for the Conservation and Restoration of Cultural and Art Objects.

At the Berenike site, the conservation of archaeological objects is essentially the result of a joint interdisciplinary approach of the whole excavation team. For this reason, on many occasions, stabilization and conservation interventions are linked

to other interventions, such as lifting from the archaeological context, which helps the field archaeologists to continue their work, or the recovery of the writing on some altered objects, which the specialists need to obtain as much information as possible. Needless to say, most of the information about this site comes from data collected in the course of several campaigns of excavations.

Regarding lifting of artifacts from their archaeological context, field intervention will be effective, if it is fast and efficient (Masetti Bitelli 2002: 27–62). It should permit gathering as much information as possible about the context of the find without compromising the material's future once it has been extracted.

At the Berenike site, lifting artifacts from their position in the field is a very

important part of the conservator's task and ensuring that these three premises are met becomes essential. On the one hand, because the adverse weather conditions in which the excavation is carried out imply that the job needs to be done as fast as possible in order to avoid unba-

lancing the stability of the pieces. On the other hand, the fact that these extractions are carried out by conservators guarantees minimum loss of information and maximum chances for long-term conservation (Burgaya Martínez 2012: 85).

## EXAMPLES OF CONSERVATION INTERVENTIONS AT THE SITE

Berenike field conservators need to focus in their job on recovering as much information as possible about the objects that are being excavated campaign after campaign. They need also to guarantee the integrity and stability of the material that artifacts are made of. In order to make this happen, the conservator must know the material that is being recovered, its forms of alterations—suffered while buried and appearing after extraction—and the atmosphere surrounding it (Burgaya Martínez 2012: 17). It must be kept in mind that extraction from conditions of deposition breaks the stability of the environmental conditions in which an object was found (Marichal and Rebé 1992: 280). Changes of temperature and humidity, increased exposure to oxygen, exposure to the sun and potential problems during manipulation can trigger severe degradation of the materials.<sup>4</sup> It is essential to avoid an abruptness of this change and tasks in the laboratory concerned with stabilization and consolidation must be prioritized.

Under normal conditions, a laboratory may have the necessary resources to perform certain physico-chemical tests to help determine more accurately the state of an object's degradation and the machinery needed to ensure more efficient and effective treatment. The difficulty in the case of Berenike is a lack of rudimentary basics: electricity, running water, etc. Therefore, the laboratory is a place adapted to these deficiencies and, in spite of them, there is never any risk to the life of an object at any moment.

### METAL ARTIFACTS

Metal objects require faster procedure during this type of intervention. The treatment fundamentally is to get rid of corrosion in order to make these objects as legible as possible, and to put an end to processes of active corrosion.

Cleaning is mixed, combining always the mechanic, which involves using a micro motor, and the chemical,<sup>5</sup> which consists, when it comes to copper and bronze, of a bath in a 3% EDTA solution in deionized

<sup>4</sup> Due to the action of new agents or the reactivation of a passive degradation process during burial (Cantos Martínez 1993: 21).

<sup>5</sup> It is true that chemical cleaning is a very aggressive intervention for metals (as water oxidizes metal). That is why mechanic cleaning is frequently prioritized, and if chemical cleaning needs to be used, concentrations are made as low as possible and always under a conservator's control, especially when it comes to the drying of the metal after its neutralization (Meyer-Roudet 1999: 98–99).

water. The objective of both procedures is to eliminate as much rust, copper carbonate and chloride as possible. Once neutralized, metal objects made of copper and bronze are stored in small chambers of progressive drying, and in some occasions they are even covered in alcohol and acetone in order to accelerate the drying.

In order to inhibit corrosion of bronze and copper, artifacts are placed in a 3% benzotriazole solution in alcohol for 24 hours. A layer of protection is thus created around the object in order to protect it from corrosion due to oxygen and humidity, as benzotriazole acts as a physical barrier. Finally, a thin layer of 5% solution of PARALOID B-72® in acetone is applied, the main objective in this case being to create a lasting protective layer that will slow down the corrosion processes even more.

### POTTERY

It is very uncommon for the Berenike conservator to carry out many interventions in ceramics, as the state of conservation of the pottery is generally good. Nevertheless, some procedures are required on occasion.

A commonality is the recomposition of ceramic objects, if found somewhat fragmented. In the laboratory, fragments are pasted with a nitrocellulose adhesive, UHU®, always from the base towards the edge (Burgaya Martínez 2012: 49). The purpose as a rule is to facilitate the documentation process; once the drawing and photography have been completed, the pieces are detached again and the adhesive completely removed, as there is no reason to store it reconstructed. In addition, the use of chemical products that are alien to ceramic is avoided, as

this may cause long-term damage to the material structure.

A frequent task for the conservator is the cleaning and consolidation of ostraka. These interventions are generally mild. They involve removing the superficial salts by applying deionized water with dressings, and providing the written pieces with



*Fig. 4. Ostrakon (BE15-105/008/006) in the process of surface cleaning and consolidation, before (top) and after treatment (Courtesy PCMA–University of Delaware Berenike Project/photo D. Eguiluz Maestro)*

a layer of protection by applying a thin layer of 3% to 5% solution of PARALOID B-72® in acetone with a paintbrush. This way, reading the text becomes possible again and the conservation of both text and ceramics is guaranteed [Fig. 4].

### VEGETAL MATTER

Intervention in vegetal matter is one of the most complex and delicate tasks faced by the conservator at the site of Berenike. Dehydration suffered by these materials is absolute. This allows their conservation for more than 2,000 years, but it also turns them into fragile, barely flexible and



Fig. 5. *Process of covering with gauze before lifting and cleaning artifacts made of vegetal fiber, Berenike 2015 (Courtesy PCMA–University of Delaware Berenike Project/ photo D. Eguiluz Maestro)*

easily broken tissues. For these reasons, conservation work is based on mechanic, mild and dry cleaning, using an air blower pump in order to remove any sand from the surface.

For lifting in the field, gauze is usually applied over the object using as adhesive a 10% solution of PARALOID B-72 in acetone [Fig. 5]. This acrylic resin is undeniably not very flexible, but as it is soluble in acetone, hence avoiding any adding of non-controlled humidity to the fabrics that could destabilize their physical and chemical properties.

Due to the lack of specific resources at the field laboratory for the recovery of this type of fabrics, the conservation team always chooses to guarantee the conservation of these vegetal fabrics by keeping them in conditions that are as stable and as similar to the ones they had underground. Thus, if in the future they can be treated in order to give them back the flexibility and hydration they need, there will always be a chance to resort to it.

### BONES

Treatment of osseous material is invariably based on their consolidation during excavation, the main intention being to avoid pulverization and to permit the bones to be lifted from the archaeological context. As specialists usually require no more than to be able to measure the bones and to examine them for marks, no further treatment is undertaken. PARALOID B-72® diluted in acetone with diverse concentrations (3%, 5%, 10%) is used to consolidate the bones.

Worked bone artifacts in the form of small figures or tools have been found occasionally. They are generally dirty and fragmented. Each fragment needs to be

cleaned with water and a paintbrush in order to remove the superficial dirt, and it is then consolidated. Finally, pieces are pasted, if possible, with a nitrocellulose adhesive.

### CARBONIZED WOOD

As said above, wooden remains found at the Berenike site are one of the most important elements for treatment by the conservation team.

As the wood is carbonized, conservators face an utterly dehydrated, fragile and decohesioned material. That is why the most important intervention to be

carried out is *in situ* consolidation [Fig. 7 left], as these pieces, whose size is about 150 cm long, could not be extracted or manipulated without a proper consolidation that completely reinforces them.

In this example, the conservator had to take into account the material that was being treated, the environmental conditions in which the intervention was taking place and the need of finding a consolidate with low molecular weight (Masschelein-Kleiner 2004: 78) that guaranteed great penetration and adhesion. An acrylic resin was chosen, PARALOID B-72, diluted in acetone with diverse

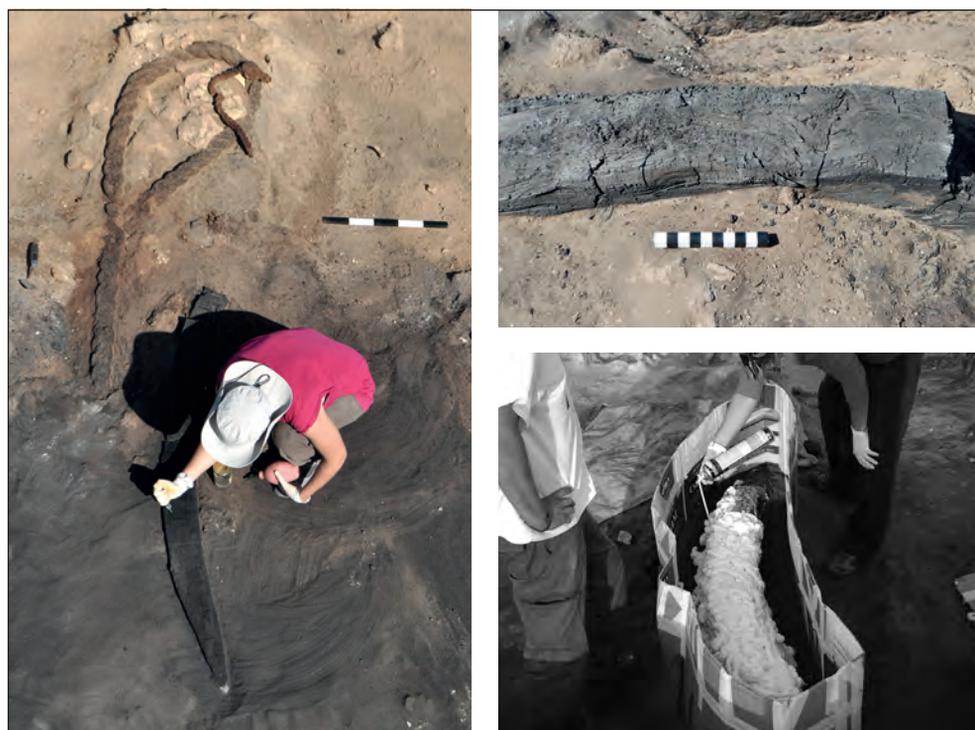


Fig. 7. Wooden intervention on site: top right, a Roman ship timber (BE14-98/013/001) found in completely carbonized state in 2014; left, conservator applying an acrylic resin in the field; bottom right, preparing the protected timber for lifting and transport to storage (Courtesy PCMA–University of Delaware Berenike Project/photo D. Eguiluz Maestro)

concentrations (3%, 5%, 10%), depending on the moment of application and the desired depth. A syringe was used for these applications, as the charcoal on the wood is very friable and does not allow the use of paintbrushes or brushes; instead a small air blower pump was used for the removal of superficial sand (Marichal 1992: 287).

Once consolidated, the best way of extracting the timber was to build a polyurethane mummy [Fig. 7 right]. These types of mummies are commonly used in paleontology for the extraction of big, heavy bones, as this structure is very compact, light, resistant to knocking and thermic changes, cheap and easy to make (Marichal and Rebé 1992: 282). Once the piece was extracted, it was taken to the laboratory where the face that was

hidden in the field was cleaned, drawn and photographed.

#### PREPARATION AND STORAGE

Following treatment, the conservator's duty is to pack all the artifacts properly for transport to a distant store. In terms of storage, in Egypt the responsibility rests with the host country's institutions, technicians, etc. (Burgaya Martínez 2012: 21). The Project conservator's duty is to ensure that the finds that are transported are protected against vibration, knocking or abrupt changes of temperature and humidity. Nevertheless, in places like Berenike, access to suitable packing materials is limited, constituting a challenge whenever needs exceed the conservator's imagination when organizing supplies before the season.

## DISCUSSION AND CONCLUSIONS

The special conservation conditions characteristic of Berenike allow the conservation of a large quantity of different materials; hence, the necessity of having a conservator in the field. This involves a constant scientific dialogue with archaeologists and specialists, and thus creates an interdisciplinary approach during every campaign.

Nevertheless, the logistics in an excavation of this kind make it more difficult and exceedingly restricts the kind of conservation interventions both in the field and in the laboratory. The field lab needs to be equipped in an ingenious manner with the basic materials that

are indispensable and that allow for the consolidation, stabilization, reinforcement and, essentially, preservation of every archaeological object excavated campaign after campaign.

In this regard, remarkable instances such as the ones involving wood imply strong challenges during the intervention process, both during the *in situ* consolidation and the preparation for their lifting. After all, resolving the existing difficulties is clearly compensated when obtaining a large amount of data thanks to the recuperation and study of pieces that would be almost impossible to document in other contexts.

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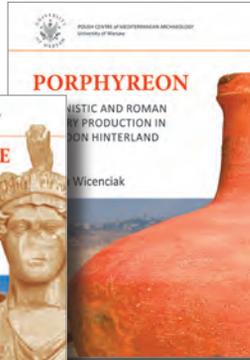
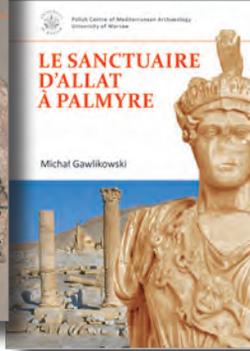
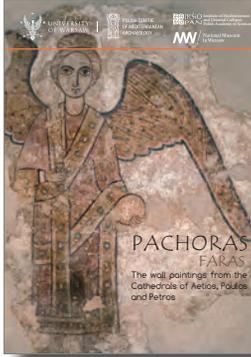
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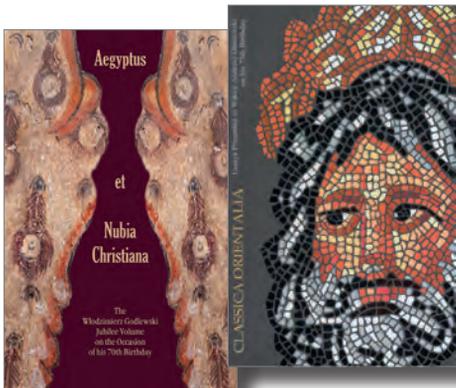
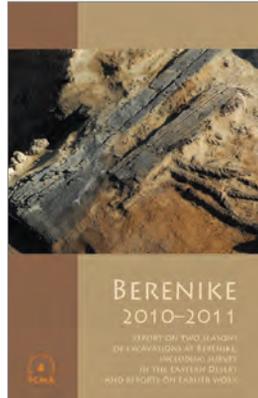
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