

Waterfront Installations and Maritime Activities in the Mareotic Region

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Introduction

Lake Mareotis represents one of the most distinctive geomorphic features in the north-west coastal region of Egypt. In antiquity, it was fed by means of a number of canals, which bifurcated off the Nile's defunct Canopic Branch, and flowed into the southern and eastern sides of the lake (Fig. 1). Some of these canals were navigable, which enabled merchandise to be transported to and from the hinterland. By the Greco-Roman period the lake was also connected to the sea through a navigable canal that debouched at Alexandria (Strabo 17.1.7). Its connection to both the Nile and the sea resulted in Mareotis becoming a vital conduit of communication in Egypt's internal transport system. Moreover, it supported around its shores various agricultural activities and embraced major production centres for different industries, which contributed significantly to the economy of Alexandria and to Egypt as a whole. Accordingly, this paper will look at the role that Lake Mareotis played in the 'maritime'¹ transport system of Greco-Roman Egypt. It will also examine the types and nature of the maritime and waterfront installations that were recorded along the shores of the lake and the possible spatial and functional relationship between the different sites.

The Lake Mareotis Research Project

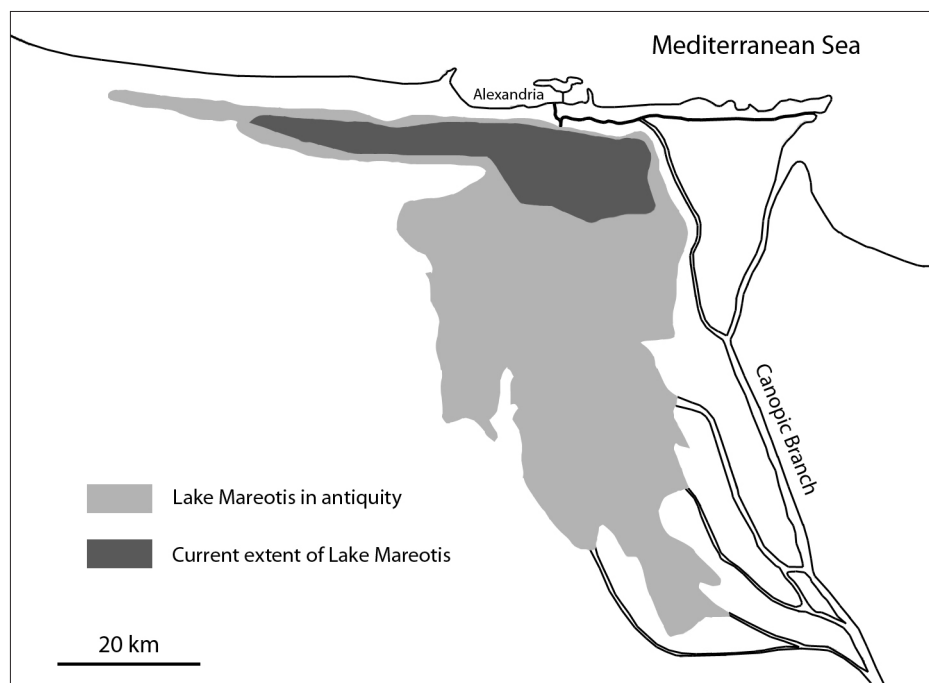
Much evidence indicates that Lake Mareotis extended in antiquity for about 50 km south and west of Alexandria (Strabo 17.1.14; Pliny 5.11.63). It comprised a main rec-

tangular body of water which merged to the east and south with the Nile Delta Plain, and a narrow arm that extended westwards parallel to the northern coast. However, during the past two millennia Lake Mareotis has undergone dramatic changes which significantly affected its size and nature. Nonetheless, the western extremities of the lake reflect the original extant remains, and form an arm, known as the Mareotic Arm, that extends some 40 km west of Alexandria and is 2-3 km wide and is separated from the lake's main body by causeways and shallows. It also contains an island, Mareotis Island, which is 3.7 km long and about 680 m at its widest point (see both Blue and Hopkinson this volume).

Archaeological investigation of the western Mareotic Arm has been ongoing for several decades; however, previous research has been largely limited to specific areas and specific issues such as work on the Byzantine port of Marea/Philoxenite (Petrucci & Gabel 1982; El-Fakharani 1983; Rodziewicz 2003), and work on amphorae and wine production (Empereur & Picon 1986, 1998) and on the wineries of the Mareotic region (Rodziewicz 1998b).

Since 2004 the Centre for Maritime Archaeology (CMA) of the University of Southampton, in collaboration with the Department of Underwater Antiquities (DUA) of the Egyptian Supreme Council of Antiquities (SCA), has conducted a comprehensive archaeological survey along the

Fig. 1: The approximate ancient and present limits of Lake Mareotis (E. Khalil).



1. The term 'maritime' is used in this sense to denote all aspects of waterborne activity and communication from the sea, across the lake, along the canals and on the Nile River.

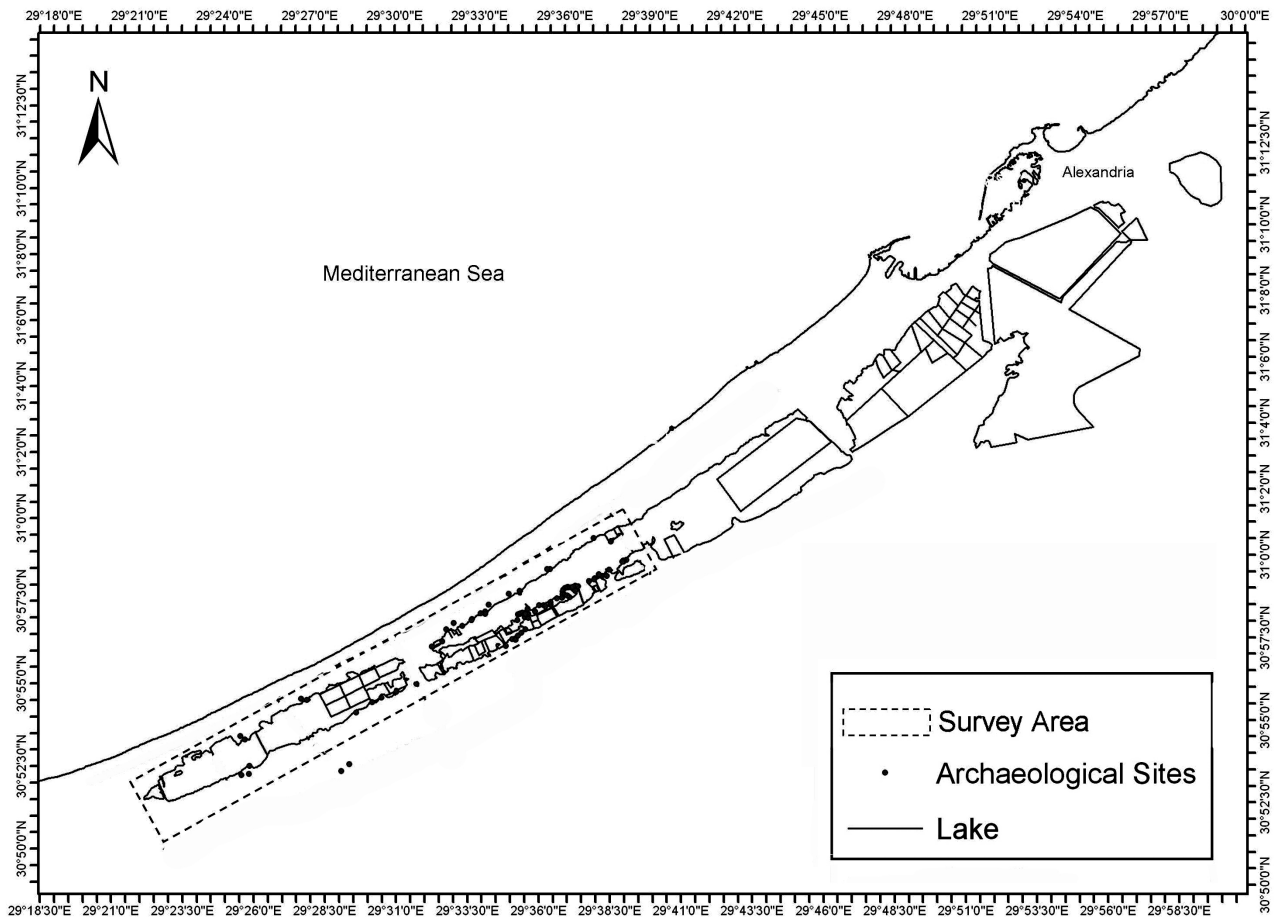


Fig. 2: The Lake Mareotis Research Project survey area along the shores of the western Mareotic arm (Lake Mareotis Research Project).

shores of western arm of Lake Mareotis (see Blue this volume). The survey revealed a wealth of archaeological sites including numerous sites of maritime and industrial nature, which reflect the economic activities that were taking place in the Mareotic region (Fig. 2). Most of the archaeological sites recorded along the shores of the Mareotic Arm are located between Marea/Philoxenite and Taposiris Magna, with a concentration on Mareotis Island. The sites identified include maritime structures, such as harbours, jetties and quays, in addition to what appear to be waterfront warehouses and storage facilities. Sites pertaining to industrial activities are also evident and include amphora kiln structures, ceramic slag and kiln wasters, as well as a number of structures relating to water management, such as cisterns, wells and water wheels (*sakkia*). This correlates with much archaeological and textual evidence for viticulture and wine production in the region.

The dating of the sites discoveries relies primarily on the ceramic assemblages collected during the survey. Accordingly it was realised that the majority of sites date from the Hellenistic period until the 7th century.

Waterfront Sites in the Mareotic Region

The waterfront sites that were recorded along the shores of the western Mareotic Arm and on Mareotis Island can be classified into four categories:

1- Harbours; in the form of harbour complexes of significant design and constitute substantial structures. However, the only two sites that fit this description are Marea/Philoxenite and Taposiris Magna. The complexity and magnitude of their structures are unrepresented elsewhere in the entire Mareotic region. The two harbours date, however, to quite different periods, Taposiris Magna is essentially Hellenistic in date, while Marea/Philoxenite mostly dates to the Late Roman period. However, the two harbours are associated with relatively large towns, and much historical and archaeological evidence indicates that these two towns were probably among the largest and most active along the shores of Lake Mareotis in antiquity.

Taposiris Magna has extensive archaeological remains that date from the Hellenistic to the Late Roman period, including evidence for thriving maritime and commercial activities (El-Fakharani 1974; Empereur 1998: 225-7; Rodziewicz 1998a; Boussac & El Amouri this volume). The town which is located on the northern shore of the western sub-basin of the lake has one of the best preserved harbours in Lake Mareotis (see Boussac & El Amouri this volume). Commercial activities in Taposiris Magna were mainly focused on handling products transported across the lake as well as receiving goods arriving from the west through overland routes, and shipping them to Alexandria (Empereur 1998: 225). Under the Romans, Taposiris

Magna was a customs station where duties were levied on products coming from the Mareotic region and from Cyrenaica heading east towards Alexandria or to the Nile Delta (Empereur 1998: 225-7; Vörös 2001: 15-6). Alternatively, river vessels could have travelled on the lake through the harbour of Taposiris Magna to the west as far as the lake extended.

The harbour of Taposiris Magna was constructed to control the movement of vessels travelling through it. This was achieved by digging a channel c. 1600 m long and 50 m wide parallel to the northern shore of the lake. The spoil resulting from the digging was piled up to form an artificial ridge which delimits the channel from the south. At the western end of the channel stood a limestone structure that took the form of a double-opening gate or bridge, which all boats wishing to go through Taposiris Magna had to pass through (Empereur 1998: 225-7; Rodziewicz 1998a: 102, n. 32; Vörös 2001: 15-6) (see Figs. 5-7 in Boussac & El Amouri, this volume). The total width of the gate is about 8.3 m, however, it is divided by a 1.2 m thick wall into two openings; one is 4.10 m wide and the other one is 3 m wide, thus indicative of the maximum possible width of the vessels that passed through. The western entrance of the channel is partially obstructed by a quay which is c. 230 m long extending from north to south perpendicular to the shoreline. The distance between the southern end of the quay and the eastern end of the artificial ridge, c. 100 m, forms the eastern entrance of this semi-closed harbour basin of Taposiris Magna. The eastern quay of the harbour includes at least two de-silting openings to allow water to flush away the silt and sediments that might accumulate in the harbour basin.

This arrangement was supplemented by the construction of a 1700 m long wall that extends southwards from the artificial ridge to the southern shore of the lake. It was also supplemented by the construction of a solid limestone wall that extended from the northern shores of the lake to the seashore. This wall ensured that even caravans travelling

Fig. 3: Taposiris Magna tower (photo by: E. Khalil).



in both directions had to go through the town of Taposiris Magna (see Fig. 1 in Boussac & El Amouri, this volume) (De Cosson 1935: 111; Rodziewicz 1990: 72-4).

Another prominent structure in Taposiris Magna is a 17 m high tower that stands on the coastal ridge to the north of the harbour over looking the Mediterranean coast to the north and the lake to the south (Kadous 2001: 457-60). The function of the tower and its relation with the town and harbour of Taposiris Magna is disputed (El-Fakharani 1974; Vörös 2001: 37). Nonetheless, it is generally accepted that the tower, which represents a 1:4 or 1:5 replica of the Pharos lighthouse of Alexandria, was in fact a funerary monument for a Hellenistic necropolis that occupied the area around and below the tower (Empereur 1998: 225). The utilisation of such a structure as a landmark by navigators on both the sea and the lake is a possibility that cannot be overlooked (Fig. 3)

As a result of the recent excavation of the area, it is now believed that the digging of the channel as well as the construction this harbour system, took place during the Early Roman period rather than during the Hellenistic period, as was previously believed (El-Fakharani 1974; Boussac & El-Amouri this volume). Although the northern shoreline at Taposiris Magna was occupied during the Hellenistic period, as evidenced by houses and shops from the 2nd and 1st century BC, it seems that it was abandoned by the end of the Hellenistic period as a result of a rise in the lake level. The flooded area was then excavated in the Roman period to create the closed harbour system (Boussac & El Amouri this volume).

Marea/Philoxenité is located about 15 km east of Taposiris Magna, on the southern shore of the lake. El-Falaki (1966: 96) identified this settlement and its associated harbour as the town of Marea, the capital of the Mareotic region. According to Herodotus (2.31), Marea was a post of Egyptian soldiers guarding the Libyan border during the time of King Psammetichus of the 26th Dynasty (Rodziewicz 2003: 27). In the Ptolemaic and Roman periods, Marea functioned as a major trade centre, second only to Alexandria. In the Byzantine period, in addition to its involvement in commercial activities and internal trade, Marea flourished as a stopover for pilgrims heading to the holy Byzantine shrine of St. Minas (Abu Mina), 20 km south of the lake (Gabel & Petruso 1980; Kucharczyk 2002; Rodziewicz 2003). Until recently, most archaeological research carried out in the area has revealed no evidence earlier than the 5th century AD. However, recent archaeological investigation at Marea has revealed material from the Hellenistic and Roman periods (see Pichot and Babraj & Szymańska this volume).

Amongst the most significant archaeological remains in Marea are four quays that extend into the lake and divide the 1.5 km long shoreline into eastern, central and western harbour basins (Figs. 4 & 5). The dimensions of the quays from west to east are: 41 m x 6.5 m, 111 m x 5 m, 125 m x 7 m, and 35 m x 4 m (Szymańska & Babraj 2008: 11-



Fig. 4: The middle quay of the harbour of Marea (photo by: E. Khalil).

15). Judging from the construction technique of the quays at Marea, in which large regular limestone blocks (1 m x 0.5 m x 0.03 m) were used for their construction, it seems reasonable to suggest that the four quays were constructed earlier than the Byzantine city. However, they were probably subject to several building phases in subsequent periods since evidence of Byzantine hydraulic mortar (*opus signinum*) can still be seen between many of the building blocks of the quays.

Excavations on the peninsula at the easternmost part of Marea resulted in the discovery of a large Early Roman building which consists of a courtyard surrounded by numerous rooms of relatively similar size. The building is connected to a quay to the north through stairways cut into the rock. Therefore, it has been suggested that the building

could have been used for storage and trade. The remains of 1st century BC to 1st century AD workshops for metalwork were also discovered on the peninsula (Pichot this volume). The recent archaeological discoveries at Marea, particularly of pottery and coins, would indicate that the area was thriving before the 5th century and possibly as early as the Hellenistic period

2- The second category of waterfront sites that was recorded along the shores of the western Mareotic Arm consists of different types of **anchorage facilities** such as quays and jetties, which form the majority of maritime installations in the region. More than ten different anchorage facilities were recorded on the northern and southern shores of the lake and on the northern shore of Mareotis Island. Possibly the most substantial of them is a kibotos or box-shaped

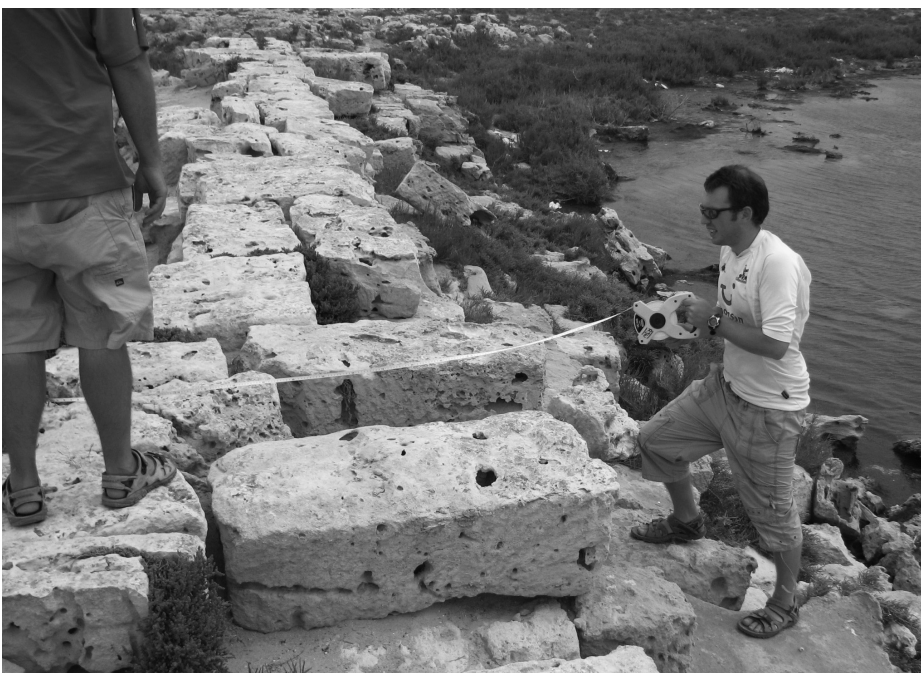


Fig. 5: The quay of Marea harbour was made of large regular limestone blocks without evidence for the use of mortar (photo by E. Khalil).



Fig. 6: The box-shaped harbour on the southern shore of Lake Mareotis. (Photo: Lake Mareotis Research Project).

harbour (Site 09) which is located at the end of a promontory on the southern shore of the lake, about 2 km to the west of the Sidi Kerir – Borg El Arab road. The harbour, which is constructed of large limestone blocks, consists of two parallel moles enclosing an area some 60 m long (N to S) and 36 m (E to W) wide (Fig. 6). The eastern mole is 60 m long and at its northern extremity it returns to the west for a distance of 12 m, while the western mole, which is less well preserved, extends for 40 m and returns to the east at the northern end for a distance of some 6 m. A gap of 18 m between the two ends of the two moles equates to the entrance of the harbour on the north side. The moles are constructed of up to three courses of single and double breadth limestone blocks. Although the dating for this harbour is still uncertain, judging from its construction technique and from the large size of blocks used (c. 1.10 x 0.7 x 0.5 m), it seems that the harbour is pre-Roman in date. However, the existence of lumps of coarse red mortar *opus signinum* with lime inclusions between some of the blocks indicate that it remained in use at least until the Byzantine period. One carved mooring ring was noted on the upper course of one of the blocks, which would have helped facilitate the mooring of vessels to the outside of the harbour (El-Fakharani 1984; Blue & Ramses 2006).

With the exception of this square harbour on the southern shore of the lake, all the other anchorage facilities along the shores of the lake take the form of jetties and quays that extend into the water perpendicular to the shore (Fig. 7). The technique used for the construction of most of the quays was building two parallel single or double breadth piers of limestone and filling the distance between them with rubble. With the exception of the substantial structures already noted at Marea/Philoxenite and Taposiris Magna the two most substantial anchorages are located on the northern shore of the lake opposite Mareotis Island. They are Sites 204 (Gamal) and 208 (Quseir). The jetties at each of these sites, which are located approximately 2 km apart, are about 50 m long and 8 m wide. Evidence of

red mortar *opus signinum* is noted between some of the blocks. Also the jetty at Site 208 (Quseir) had mooring stones extending from the upper course of blocks at the eastern side (the lee side) of the quay.

A number of other jetty-like features, although not as substantial, are located along the southern shore of the lake and the northern shore of the Mareotis Island. However, it was realised during the survey that the anchorage facilities along the northern shore of the lake are mostly associated with civic and residential sites, while those along the southern shore of the lake, particularly on Mareotis Island, are associated with sites of a commercial nature. The dating of these sites based on ceramic collections is quite problematic since the jetties are continuously washed by water in the winter, which, in many cases, does not leave any ceramics to be dated. However, judging from the ceramics dated from the adjacent sites, it was realised that most of those sites could have been used for quite a long period of time, probably from the Hellenistic to the Late Roman or Byzantine period.

3 - The third type of maritime installation that was found in the region can be described as a **seawalls** or more accurately **lake walls**. Unlike the jetties which are perpendicular to the shore, lake walls are parallel to the shore and they were intended to define the shores and protect them from the effects of silting and sedimentation (Fig. 8). At least five lake walls were discovered in the survey region. These kinds of structures are mainly found along the southern shore of the lake and the northern shore of Mareotis Island, those shorelines most subject to silting and the deposition of sediments as a result of the prevailing northwest winds that would carry sediment from the coastal ridges and deposit it into the lake. Besides acting as a form of protection against silting, the lake walls could also have been utilised as docking facilities for merchant vessels. Another possible function for such structures was to retain rainwater for use in agricultural purposes.



Fig. 7: One of the quays extending into the lake at the northern shore of Mareotis western arm (photo: Lake Mareotis Research Project).

Fig. 8: (below) A lake wall extending parallel to the southern shore of the lake. Evidence for red mortar (opus signinum) can still be seen between the blocks (photo: Lake Mareotis Research Project).



The longest of these lake walls is located on the north shore of the western end of Mareotis Island (Site 21). It is c. 245 m long and 1 m wide and is constructed of a series of limestone blocks laid as stretchers along the lake edge. Other examples include a wall located in the middle of the Island on the north shore that extended some 70 m in length and was made of one course of large limestone blocks of 0.60 m x 0.30 m x 0.25 m dimension, that were arranged as headers facing the shoreline (Site 123). Similarly, on the southern shore of the lake further substantial walls of over 250 m in length were identified at both Sites 109 and 44.

4- The fourth and final type of waterfront structures does not necessarily have a maritime function. At number of sites in the survey region the remains of several **multi room buildings** were recorded very close to the present waterline. Some structures even extend into the water (Fig. 9). Examples of this type of structure are found in Sites 117, 118 and 119 which are located at the north-eastern shore of the Island. At Site 117, there are the remains of a multi-roomed building that measures 12 m EW x 17 m NS which is divided from the inside into at least four smaller rooms. Site 118, about 25 m west of Site 117, contains the remains of at least two multi-roomed structures which measure 18 m EW x 15 m NS and 20 m EW x 20 m NS. Each of them contains the remains of numerous walls which belonged to a number of internal rooms of different shapes and sizes.

About 40 m to the west of Site 118 a further Site 119 contains the remains of a rectangular building that extends from the shoreline southwards for about 40 m and measures about 25 m EW. Limited excavation carried out in the middle section of this building revealed the remains of two significant structures. The first structure is a rectangular

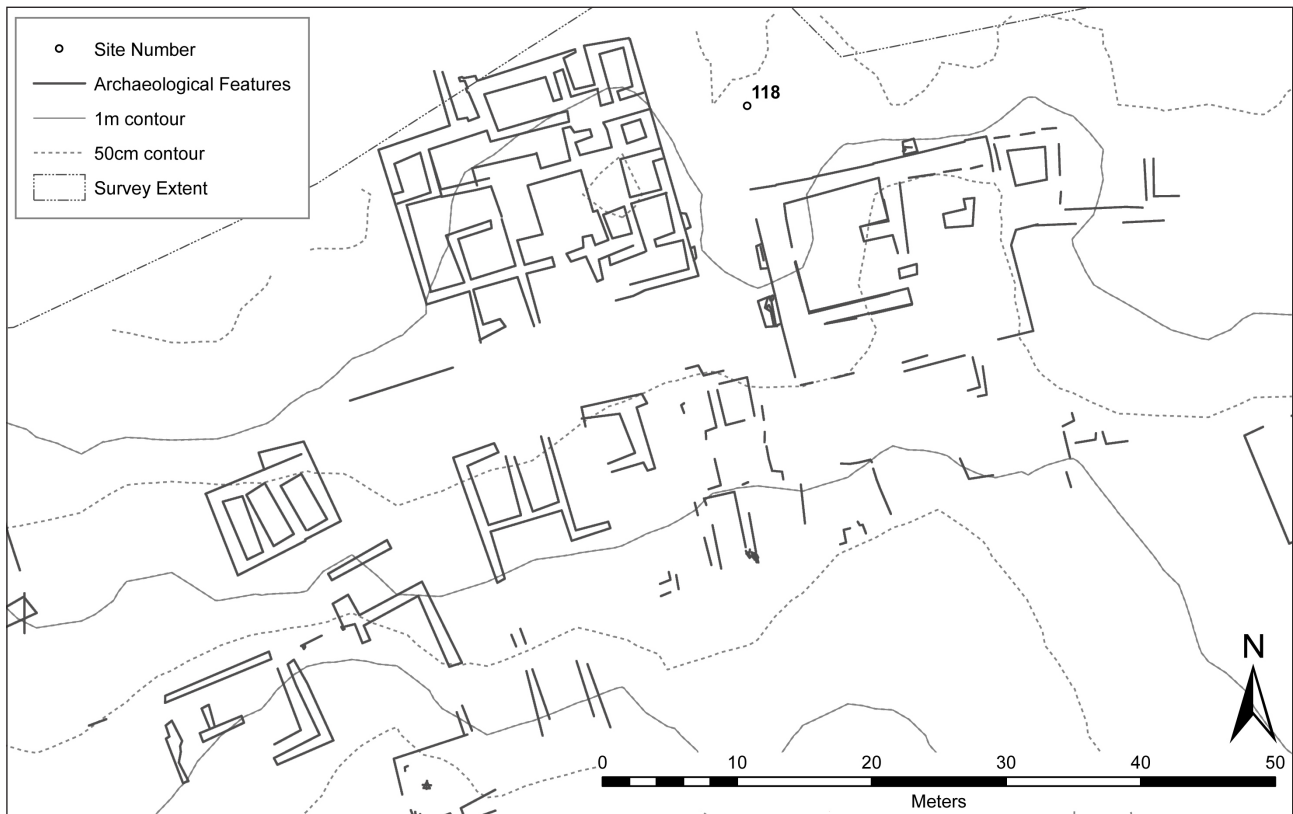


Fig. 9: Some of the multi-room square buildings located at Site 118 along the northern shore of the Mareotis Island. The buildings could have been used for storage purposes (image: Lake Mareotis Research Project).

enclosure that measures c. 9 m x 4.5 m that contained two rooms. Both rooms have almost the same dimension c. 3 m EW x 2.7 m NS. The second structure constructed on the same alignment as the first and adjacent to it to the west, is a rectangular building that measures c. 2.5 m NS and at least 5 m EW, in which remains of imported Hellenistic amphorae were discovered.

Accordingly, it seems reasonable to suggest that this type of waterfront structure were used as storage facilities for different merchandise and products that were traded along the Mareotic Arm.

By examining the remains of these structures, particularly on Maerotis Island, it becomes evident that they have undergone different phases of construction over successive periods. Moreover, it seems that the sections of the structures closest to the waterline were subject to the effect of accumulated sediments, and hence had to be rebuilt. In other words the different phases of building and modification of structures could be the result of adapting to changes in the waterline.

Relations and Significance

By looking at the distribution of archaeological sites in general and maritime sites in particular along the shores of the Mareotic Arm, it becomes evident that not only is there is an apparent concentration of sites in the area between

Marea and Taposiris Magna, only a distance of some 15 km, but out of a total of more than ninety archaeological sites recorded along the shores of the Mareotic Arm west of Alexandria, only four substantial sites were recorded to the west of Taposiris Magna. Thus, judging from the nature and extent of these sites, it is evident that the navigable limits of Lake Mareotis in antiquity extended west of Taposiris Magna for at least 12 km.

Likewise, it is noticeable that maritime installations located on the southern shore of the lake from Marea to the eastern end of Mareotis Island, are in fact located on a ridge that extends for about 800 m from the present southern shoreline to the west. It is noteworthy that no sites were recorded on the southern shore of the lake opposite this ridge. This actually raises a question about the nature of the area between the ridge and the southern shore of the lake, and whether or not it was actually land in antiquity, that has subsequently been artificially excavated or subject to inundation due to the changes in ground water level (see Flaax forthcoming). Similarly, all the archaeological sites of a maritime nature that were recorded on Mareotis Island, where located along its northern shore, with essentially no evidence for sites either on the southern shore of the island or on the northern shore of the lake opposite. This also raises a question about the nature of this island and whether or not it was actually an island in antiquity.

The different nature of maritime installations located along the northern shore of the lake and those along the southern shore and on Mareotis Island, is also noteworthy. As mentioned earlier, maritime installations such as quays and jetties located the northern shore of the lake are mostly associated with large tell sites of a civic and residential nature. These tells were up to 60,000 m² in area, and were densely occupied. They are mainly covered with building stones and the foundations of buildings, as well as the remains of several wells, cisterns and red brick basins lined with *opus signinum*, which could have been used in baths, houses or other urban structures. However, the situation on the southern shore is quite different since the southern shore is where most industrial and commercial sites were recorded, and hence maritime installations were mostly associated with those sites.

In antiquity, almost all the amphora and wine production sites in the region, as well as *sakkia* installations (Empereur & Picon 1998; Rodziewicz 1998b; see also Blue, Hopkinson and Dzierzbicka this volume), were located at the southern shore of the lake, the focus of agricultural and industrial activities. The reason that agricultural and industrial activities were concentrated on the southern shores of the Mareotic Arm is mainly due to the difference in the topography between the northern and southern shores of the lake. The western arm of Lake Mareotis is delimited from the north and the south by two limestone carbonate ridges, of average elevation 25-35 m and average width 300 m (Said 1990: 499; Warne & Stanley 1993; El-Raey et al. 1995: 191; Frihy et al. 1996: 282). The northern ridge is known as the Abusir Ridge, and to the south a longitudinal depression 3-4 km wide known as Al-Alamein-Maryut Depression, extends roughly E-W, partly occupied by the western arm of Lake Mareotis. This depression is delimited to the south by another coastal ridge, known as Gebel Maryut Ridge, which is located 5-9 km south of the Abusir Ridge.

Accordingly, the distance between the Gebel Maryut Ridge and the southern shore of the lake is far greater than the distance between the Abusir Ridge and the northern shore of the lake. In antiquity, the area south of the lake was a fertile plain that flourished with agricultural activities and was known for the quality of its vines, olives and fruits as well as for the cultivation of flax and papyrus (Athenaeus 1.33.d-e; Pliny 13.22.71; Strabo 17.1.14; Empereur & Picon 1998; Horden & Purcell 2002: 353; McGovern 2003: 121-3). Moreover, the abundance of calcareous clay, particularly suitable for amphora production, resulted in a thriving large-scale amphora industry along the southern shore of the lake (Empereur & Picon 1986: 103-9, 1992, 1998; Rodziewicz 1998; Blue & Ramses 2007). Thus, the focus of wine and amphora production in Hellenistic and Roman times was the southern shores of the Mareotic Arm. Thus it is reasonable to suggest that those maritime installations located along the southern shore of the lake were very much involved in commercial activities including the transport of Mareotic products to Alexandria and possibly also to the southern limits of the lake.

Navigation in Lake Mareotis

In the 1st century BC, when speaking about the water supply for Lake Mareotis, Strabo (17.1.7) mentions that it is ‘...filled by many canals from the Nile, both from above and on the sides, and through these canals the imports are much larger than those from the sea, so that the harbour on the lake was in fact richer than that on the sea’. On another occasion (Strabo 17.1.22) speaks of ‘...several canals, which empty into Lake Mareotis’. As a result, it has been assumed that there was intense maritime traffic passing through the lake carrying various products and cargoes to Alexandria. Merchandise which would have been transported to Alexandria for local consumption and for transshipment to other Mediterranean harbours would have included Egyptian products such as papyrus, textile and grain (Rickman 1971: 300-6, 1980: 231-5; Lewis 1983: 165-7), as well as quarried stones from the Eastern Desert (Peacock 1992: 5-7; 2002: 426-7). It would have also included products imported via the Red Sea from India, Arabia and East Africa such as spices, tortoiseshell, frankincense, ivory, cotton, silk and gems (Strabo 2.5.12; Casson 1991: 200-212; Peacock 2002: 432-3). At the same time, Alexandria was receiving from the Mediterranean, for local consumption and for transshipment to the south, various products such as wine, oil, fine pottery, glass, timber, copper and tin. Yet, the role that Lake Mareotis played in this internal transport system is somewhat unclear.

Although it is well known that Lake Mareotis was fed by means of a number of canals, which branched off the Canopic Branch, and flowed into the southern and eastern reaches of the lake, there is a considerable degree of uncertainty about the exact number, location and the routes of these canals. However, the most important of these canals was Schedia Canal (see Bergmann, Heinzelmann and Martin this volume) It bifurcated off the Canopic Branch of the Nile at the town of Schedia, originally a Hellenistic foundation that was later known as Chaereu, currently located in the region of the villages of Kom El-Giza, Kom El-Nashw and Kom El-Hamam, some 30 km south-east of Alexandria (Bergmann & Heinzelmann 2004). While the Canopic Branch continued north to debouch into the Canopic Bay (Abukir Bay), the Schedia Canal turned north-west towards Alexandria and followed a course close to the present course of the Al-Mahmoudeyah Canal. In a statement by Strabo (17.1.16) in which he describes the town of Schedia, he mentions that it has ‘...the station for paying duty on the goods brought down from above it and brought up from below it; and for this purpose, also, a schedia (float) has been laid across the river, from which the place has its name’. Accordingly, Schedia was the main Nile emporium, customs harbour and checkpoint east of Alexandria, where custom duties were imposed on imported and exported goods (Empereur 1998: 225; Bergmann & Heinzelmann 2004). Moreover, it seems that the Canopic Branch at Schedia was obstructed by some kind of a pontoon that prevented boats from sailing past it until duties were paid on merchandise travelling both ways. Additionally, it was at Schedia where exported commodi-

ties brought from upriver were transferred from large Nile boats to smaller boats that could travel easily through the canals to Alexandria (Procopius 6.1.3; Hassan 1997: 365 n. 13).

As it approached Alexandria, the Schedia Canal bifurcated into two branches in the Alexandrian suburb of *Eleusis* (El-Nozha). The first branch turned towards the north-east leading to Canopus, east of Alexandria, while the other branch continued south of Alexandria and parallel to the lake's northern shore, until it debouched into Lake Mareotis south-east of Alexandria. According to Strabo (17.1.7), boats also sailed from the Nile to the Canopic Branch and through the network of canals that fed the lake from the south and east, then across the lake northwards to Alexandria. This indicates that navigation on Lake Mareotis was intense and operated in many directions. It also raises a point about the practicalities of sailing in Lake Mareotis from south to north against the prevailing north-westerly wind. The predominant winds along the north coast of Egypt are north-westerly and they prevail more than 40% of the time throughout the year and more than 70% of the time during the summer sailing season (El-Zouka 1979: 125-7; El-Gindy 1999: 17). Accordingly, merchant vessels sailing in Lake Mareotis from south to north would have faced a direct headwind, which meant that the boats had to tack in order to reach Alexandria. Tacking in Lake Mareotis was possible considering the large area of the water body; however, tacking from the southern limits of the lake to Alexandria would have meant that boats would have to travel several times the direct distance across a water body full of shallows and marshlands and against prevailing winds. In the 5th century St. Palladius (7.1) mentioned that he sailed across Lake Mareotis from north to south, from Alexandria to the monastic settlement of Mount Nitria, a distance of about 50 km, in a day and half. Accordingly, sailing in the lake in the opposite direction would have taken much longer, possibly as long as four to five days.

Furthermore, the extended period of travel across the lake would have laid boats vulnerable to another challenge that prevailed on Lake Mareotis in antiquity. Achilles Tatius (4.12) in the 2nd century and Heliodorus (1:14) in the 3rd century, spoke of piracy and bandits on Lake Mareotis. The marshes and islands of the lake provided excellent hideouts for groups of bandits and their vessels. Also, the large size of the lake made it quite difficult to guard and control, therefore, it is possible that sailing across the lake with valuable commodities was quite risky.

Moreover, settlements located on the southern and eastern shores of Lake Mareotis were far more susceptible to sedimentation from silts deposited via the nearby Canopic Branch of the Nile, particularly during flood seasons, as well as sediment which had been carried by the prevailing winds across the lake from the north-west to the south-east. All this would have contributed to the build up of sediments against the southern and eastern shores of the lake, thus preventing settlements in this region from being as actively involved in across lake transportation. Con-

sequently, the lake's southern and eastern shoreline was unstable and subject to constant change, and was therefore unsuitable for the establishment of substantial harbours and waterfront installations. A recent survey conducted along the ancient southern and eastern limits of the lake (Wilson 2007; see Wilson this volume) revealed that most settlements established in this area during the Ptolemaic and Roman periods, were located on high ground around the lake's edge. Also it revealed that many settlements were involved in agriculture and industrial activities mainly in the service of Alexandria. However, as yet there is no evidence for substantial maritime structures or significant waterfront installations.

Conclusion

There were two ways for river vessels to travel to and from Alexandria, either across the lake, or along the Schedia Canal. Considering the arguments outlined above, particularly in relation to the prevailing winds, it seems reasonable to suggest that the main northbound traffic probably went via the Canopic Branch and the Schedia Canal, rather than across the lake. However, sailing south across the lake would have been conducted with considerable ease. Along those stretches of the canal where boats had to maneuver against wind, they could have been towed along from the shore, a standard procedure for moving river boats in rivers and canals around the world.

In that respect, Strabo's statement (17.1.7) about the lake harbour south of Alexandria being richer than the seaport of Alexandria, would still be valid. At the time of Strabo, the Schedia Canal debouched into Lake Mareotis, so all the canal traffic had to pass through the lake. Moreover, boats coming from the western arm of the lake also arrived at the lake harbour. Therefore, it is possible that the lake harbour was in fact quite busy receiving river vessels from the south as well as from the west. At the same time, it is not unreasonable to suggest that east-west commercial traffic along the western Mareotic Arm was probably more intense and more regular than the north-south traffic that passed through the main body of the lake. Recent archaeological investigation in the Mareotic region have revealed that the number, nature and extent of archaeological sites along the shores of the Mareotic Arm, is unparalleled anywhere else in the Western Deltaic Region (see Blue this volume). Settlements in this region were located far from the silting effects of the Nile sediments, the coastline was more stable, prevailing winds were more favourable for east-west movement, and settlements were in close proximity to Alexandria. Therefore, it is understandable why so many shoreline settlements and associated maritime installations were established along its shores. Thus, the contribution of the western Mareotic Arm to the economy of ancient Alexandria and hence of Egypt as a whole, was probably far more significant than any other area along the shores of Lake Mareotis. Thus, the shores of the western arm of Lake Mareotis appear to have been one of the most active areas of economic activity in the Western Deltaic region during the Hellenistic, Roman and Byzantine periods.

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