# Water History

## Water, Water Everywhere: Riverine, Lagoonal and Marine Influences in Northern Egypt

--Manuscript Draft--

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| Manuscript Number: | |
| Full Title: | Water, Water Everywhere: Riverine, Lagoonal and Marine Influences in Northern Egypt |
| Article Type: | SI: Roman and Late Antique period |
| Keywords: | Delta; lagoons; sustainability; Egypt; Alexandria; Canopus. |
| Corresponding Author: | Penelope Wilson<br>Durham University<br>Durham, UNITED KINGDOM |
| Corresponding Author Secondary Information: | |
| Corresponding Author's Institution: | Durham University |
| Corresponding Author's Secondary Institution: | |
| First Author: | Penelope Wilson |
| First Author Secondary Information: | |
| All Authors: | Penelope Wilson |
| All Authors Secondary Information: | |
| Abstract: | Abstract<br>The reconstructed landscape of the north-west Nile Delta in Egypt suggests that in antiquity (ca. 300 BC to 9th century AD), the lagoons, marshes and river channels provided a watery environment that was exploited to the maximum to support the major political power centres of the time. Archaeological evidence from the lagoonal areas of Mareotis, Abuqir, Edku and Burullus as well as the main river branches of Canopus and Bolbitine-Rosetta suggests that the location of settlements may have been a key factor in the network of monitoring and control of goods and raw materials travelling from place of production to urban centres. In addition, the creation of 'new' administrative units, including Alexandria, confirms the significance of the control of water systems and the sustainability of the areas in which they were located with abundant agricultural and fishing resources. Only modern developments in road and rail transport have changed this ancient system. The paper looks at these developments from an archaeological perspective. |
| Suggested Reviewers: | Graham Philip, BA, PhD<br>Lecturer, Durham University<br>Graham.Philip@durham.ac.uk<br>He has done some landscape reconstruction and has an interest in economic developments within the Middle East. |
| | Andrew Wilson, BA, PhD<br>Professor, Oxford University<br>andrew.wilson@arch.ox.ac.uk<br>Interests in archaeology of the Roman Empire, water and acquaintance with Egypt. |
| Opposed Reviewers: | |

Penelope Wilson studied Ptolemaic Egyptian hieroglyphs for her doctoral research, now published as 'A Ptolemaic Lexikon'. She worked in the Fitzwilliam Museum, Cambridge and has also carried out fieldwork in Egypt since 1983. She has worked on sites throughout the country and is currently Field Director of the Durham University/Egypt Exploration Society/Supreme Council of Antiquites Sais project in northern Egypt, as well as carrying out extensive survey work for the Egypt Exploration Society. She is currently lecturer in the Department of Archaeology, Durham University and her interests include settlement archaeology in Egypt from Prehistoric times to the Islamic Period, especially in the Delta and religious life in temple and domestic contexts.

Penelope Wilson

Department of Archaeology, Durham University, South Road, Durham, DH1 3LE

Penelope.Wilson@durham.ac.uk

+44 191 334 1159

Fax: +44 191 334 1101

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Penelope Wilson

Department of Archaeology, Durham University, South Road, Durham, DH1 3LE

Penelope.Wilson@durham.ac.uk

+44 191 334 1159

Fax: +44 191 334 1101

Abstract

The reconstructed landscape of the north-west Nile Delta in Egypt suggests that in antiquity (ca. 300 BC to 9$^{th}$ century AD), the lagoons, marshes and river channels provided a watery environment that was exploited to the maximum to support the major political power centres of the time. Archaeological evidence from the lagoonal areas of Mareotis, Abuqir, Edku and Burullus as well as the main river branches of Canopus and Bolbitine-Rosetta suggests that the location of settlements may have been a key factor in the network of monitoring and control of goods and raw materials travelling from place of production to urban centres. In addition, the creation of 'new' administrative units, including Alexandria, confirms the significance of the control of water systems and the sustainability of the areas in which they were located with abundant agricultural and fishing resources. Only modern developments in road and rail transport have changed this ancient system. The paper looks at these developments from an archaeological perspective.

Index words: Delta, lagoons, sustainability, Egypt, Alexandria, Canopus

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## Introduction

The foundation of Alexandria as the new capital and main port of Egypt at the beginning of the Ptolemaic period between 331-312 BC was a sound strategic and political decision. The location of the city on a narrow limestone ridge at the western extreme of Egypt's Nile Delta, cut off from the main landmass of the Delta and the Nile by lagoons, however, must have given the city planners some pause for thought. In the event, the disadvantages of the location were overcome to such a extent that, not only was Alexandria to become a commercial hub of the Mediterranean for a thousand years, but a wholly new productive area of Egypt was created and settlement patterns were profoundly altered in the north of Egypt. The focus of power switched from the southern centres at Thebes and the ancient capital at Memphis, to the north of the Delta where new administrative power nodes were created or reinvigorated. Each of these nodes required an efficient production hinterland or terrain, with access to water transport. The key to this shift was mastery of the watery northern environment and the arteries by which it was linked to the agricultural heartlands of the rest of Egypt. This paper aims to provide a reconstruction of the ways in which settlements, water systems and food production centres were managed successfully from the beginning of the Ptolemaic period in 323 BC through to the Arab invasion in AD 641.

**Modern and Ancient Perspectives** (Map 1)

A modern atlas view of the Nile Delta and the north of Egypt shows a green tract of land with some bodies of water at the fringes, bordered by desert. The cuspate subdeltas of the coast are prominent at Rosetta and Damietta, while the brackish lagoons of Lakes Mareotis, Edku, Burullus and Menzala are cut off from the sea and are relatively small in size (Butzer 1976: 22). The images and ideas presented in Roman mosaics about Egypt suggest a colonial perspective, where Egypt was a swampy wilderness, inhabited by merry-making pygmies who travelled on papyrus skiffs and lived in reed huts. It was exotic, far away and ancient, the opposite of Rome in its habits and people (Versluys 2002: 436-43). Boating parties were beset by crocodiles and hippopotami (Whitehouse 1985), but ancient temples and cities stood high above the general wateriness of the landscape, lending an exotic and dreamy quality to the landscape, as, for example in the paintings and mosaics from Pompeii (Versluys 2002: 39-236). Ancient writers also provide an external perspective, recognizing the different Egyptian landscapes and the different economic development of each of them at different times (Butzer 1976: 99). Such a time-specific scenario leaves a general problem in the assimilation of evidence from three temporal positions: written and inscriptional evidence is often precisely dated; archaeological evidence can be widely dated within hundreds of years or more closely dated and geological evidence, which is usually widely dated. In addition, the Delta landscape is a palimpsest, where two main factors have changed the appearance of the northern delta, creating problems in integrating geological, historical and archaeological evidence for water-power.

Firstly, the river Nile and the pattern of its distributaries have changed. In antiquity, there were between five and seven main branches of the Nile reaching the Mediterranean sea, each creating a small promontory or headland along the northern coast, where the mouth debouched, depositing its load of sediment (Said 1973: 68-73). Over the course of time, not only did the main branches of the river move east and west, bifurcate and dry up, but they developed myriad distributaries and small channels. Between accounts of classical writers from Herodotus around 450 BC to the Coptic bishopric and *kurah* lists of 10th century AD branches came and went, so the historical accounts may be ‘accurate’ only for a specific time frame (Ball 1942). The areas at the coast through which the river branches ran also changed. To the east of the delta, the area around the Pelusiac, Tanite and Mendesian Branches was a large swamp with lagoons (now the area of Lake Menzala) and small islands of higher ground, including sand hills, emerging to form the basis for settlements (Bietak 1975: Abb. 10). In the north, the area between Buto and the modern shore of Lake Burullus was also marshy, with town sites (now abandoned mounds called *tells* or *koms*) dotted along the levees of river distributaries, while the Sebennytic branch created a central delta promontory. In the north-west, the Canopic Branch ran from its point of bifurcation on the Bolbitine/Rosetta branch through the internal port of Naukratis north to debouch at Canopus-Herakleion. Here, recent research (Goddio 2007; Stanley 2007) has demonstrated how dramatically the environment in the north has changed. Following high floods in AD 741-2, massive land subsidence was triggered in the area of the Canopic mouth, causing the low-lying substrata to collapse. The cities of East Canopus and Herakleion-Thonis disappeared under 5 metres of water in some places, perhaps one by one in a combination of sudden, localised and more gradual events (Stanley 2007: 54-7). Further floods and vertical land displacement caused the shoreline to recede to its present position 5 km to the south and 2 km west (Stanley, Warne and Schnepp, 2004: 928). In addition to the changing main branches, there were also distributaries and smaller channels affected by avulsion and sedimentation.

A second problem of visibility is produced by the annual inundation of the Nile. It created a hydraulic régime the exploitation of which was one of the key factors in the success of Egyptian civilization, although perhaps without much additional human effort in the Dynastic period (3100-323 BCE) (Kemp 2006: 10-11). Technological improvements in water-lifting led to advances in land cultivation in the Ptolemaic period (323-30 BCE), causing the centres of the administrative units (nomes) to be reorganized so that they were each situated on the Nile or linked to it by a designated harbour (Butzer 1976: 105). A basin irrigation system was developed, involving building levees, dredging and blocking channels, subdividing flood basins into smaller manageable units and controlling water access and retention by temporary openings in dykes (Butzer 1976: 47). Such a system continued throughout the medieval period until the nineteenth century, when true canal irrigation was implemented (Bowman and Rogan 1999). The flood brought water and sediments, which were deposited upon the land mass at a variable rate of between 1.1 to 3 mm a year (Arbouille and Stanley 1991: 56 in the northern delta). Allowing for some erosion, since Year 0 at least 2 metres of alluvium has accumulated on top of the ancient levels and perhaps as much as 10 metres in the last 6,000 years (Butzer 1976: 25). This means that some ancient sites are buried from view and so diachronic surveys of settlements can only be partial at best. In addition, the sediment caused the delta front to prograde and extend further into the Mediterranean. The inundation, however, was variable in its intensity and periods of drought or famine, causing economic and political instability throughout Egypt's history (Hassan and Stucki 1987; Hassan 1994). The annual flood has now stopped due to the building of barrages in the nineteenth century and then the Sudd Ali (dam) at Aswan, which was operational by 1971, and so the delta is now in a phase of destruction as the shorelines are eroded by water action and rising sea levels (Stanley and Warne 1993). Such a dynamic geological system means that assessing the relationship between people and water in archaeological and historical terms is a challenge. As a starting point, Alexandria must be the focus of attention and, in particular, the stomachs of its inhabitants.

**Feeding Alexandria … and Rome?**

Population estimates of ancient Egypt are, in general, fraught with difficulty, but for the Ptolemaic period there exist census data, as well as contemporary accounts. As a general parameter, the population of Alexandria could have numbered as many as 1 million people, both free and otherwise in the Ptolemaic period (Fraser 1972: I 91; II 171-2) or perhaps, more realistically, around 500,000 in the early Roman period (Manning 2010: 139). In addition, there were other smaller cities and urban centres, especially in the Delta. Sustaining the population of Alexandria alone, even if only at the lower estimate above, would necessarily have required a regular supply of grain. On the basis of a *per capita* consumption of 200 kg a year, the city would therefore need approximately 100,000 tonnes of grain every year. Given that an average *kerkouros*-grain boat could carry 306.5 tonnes in one load, there would need to be approximately 326 boat loads a year arriving at the city (Thompson 1983: 72), with less frequent sailings during the inundation season from July to September. The grain would have been a surplus produced from the rest of Egypt and with subsistence, seed-corn and animal feed set aside for the next year. If the carrying capacity of the delta was 59% of the land (Butzer 1976: 83; Hassan 1994: 166 using a proportion of 1.4:1), a maximum estimate of 14.75 million *modii* (3,245,000 or 99,460 tonnes) of tax-grain was grown in the delta each year.

Furthermore, estimates of tax-grain gathered in Egypt in the Roman Empire have been put at not less than 25-30 million *modii* in most years (1 *modius* = 6.743 kg, from Thompson 1983: 72 and n.38). After payments to soldiers, quarry workers and boat crews and in good years, some surplus was offered to Eastern cities, while the bulk was shipped to Rome (Erdkamp 2005: 227-236). Erdkamp estimates that about third of Rome’s grain, 10-15 million *modii* (67,430-101,145 tonnes) annually may have come from Egypt (Erdkamp 2005: 227), for a population of up to a million people there (Hopkins 1978: 96-8). In total, 2000-3000 shiploads (average 70,000 kg load), of which approximately 1500 came from Egypt, would cross the Mediterranean each year to arrive at Ostia and Portus and then the grain was trans-shipped to Rome (Kessler and Temin 2007: 315-6). The Ptolemaic and Roman reliance upon grain demonstrates the potential catastrophe, for both Alexandria and Rome, if the grain supply failed. The economic and political power of two main centres, therefore, depended upon the productivity of Egypt and the efficiency of the Nile-Mediterranean-Tiber network.

Grain was not the only requirement of Alexandria. It was also supplied with other produce, including vegetables, fruit, wine, vegetable oils (including sesame and olive oils), linen cloth, fish and fish products, fowl, meat and milk from cattle and sheep/goats, matting, pottery and papyrus. There were three main sources: the immediate zone of sustainability around Alexandria; the Delta agricultural heartland, including the immediate *chora* or *regio* of Alexandria from the eastern shore of lake Mareotis to the Nile (Haas 2001: 48), and the Nile Valley, including the Fayum area, which had been reinvigorated in the Ptolemaic period (Manning 2010: 139-140).

All of this produce had to be moved from the point of production to Alexandria and other cities and the interactive riverine-lacustrine-marine system seems to have been particularly suited for the purpose, lending new power to certain settlements *en route*. The areas closest to Alexandria were almost ideal, offering waterways for a multitude of different kinds of boat and linking with smaller canals and land transport (Figure 1).

### *The River-Lagoon-Sea Systems*

**Lake Mareotis and the organisation of its carrying capacity** (Map 2)

Lake Mareotis consisted of two distinct parts: a freshwater-brackish lagoon extending 40 kilometres to the south-east of Alexandria and a narrower lagoonal body stretching 70 kilometres to the south and west, with a total area of 700 $km^2$ (Warne and Stanley, 1993: 35-6). Distributaries or canals brought water directly from the Nile and there was an artificial outlet near modern El-Mex, which could empty the lake it if it was too full, keeping the water level at sea level. Marine incursions were possible from the north-east, technically making the body of water a 'fluvially influenced lagoon' (Warne and Stanley 1993: 53-58).

In the mid-5th century AD, it took a day and a half for Palladius to cross from Alexandria to Nitria (Barnugi) on the southernmost shore (*Lausiac History* 7.1, Meyer 1964: 40) and in the 14th century, Ibn Batuta records travelling from Alexandria to Torouga, a distance of 35 km, in half a day. It is likely that the prevailing wind was behind him (Shafei 1952: 75). This part of Lake Mareotis was known for its papyrus marshes, abundant fish and waterfowl (Pliny cited by Haas 2001, 59 n.8).

The western branch of Mareotis was a narrow lake, with islands and several significant towns, such as Marea and Taposiris. The area of Marea was famous for its white wine and also produced some grain, olive oil, pigs, sheep/goats, fish, duck and gazelle (Haas 2001: 50-51). Archaeological work has shown that in this region that there were many quays and harbour facilities (Blue and Khalil 2011), as well as villas and country house estates (Haas 2001: 53-4). It is clear that the whole area was brought into production by the presence of Alexandria and continued to be important into the Late Roman era when the pilgrimage centre of the Apa Menas monastery was a focus for visitors, entering through the transit harbour at Philoxenite (Haas 2001: 56). According to Longinus Celer, in the 2nd century AD, it took a day to sail from Alexandria to Taposiris (P. Michigan 338, APIS database).

Around Lake Mareotis the settlement pattern of sites recorded by archaeological survey suggests some of the possible systems of control in place throughout the Ptolemaic and Roman periods. If the lake level is restored to sea level, the archaeological sites at the edge of the lake and those inside the lake are clear and may suggest the various primary functions of those sites (Wilson 2010a). In addition, Trampier has established from SRTM data and pools observed on *Survey of Egypt* maps that two distributaries of the Rosetta/Bolbitine branch flowed through the south-western delta and entered Mareotis at points perhaps corresponding to the Kom el-Gel area on the southern part of the lake (‘Khenes’, or El-Hagar channel) and in the Kom el-Nasr area (Masraf el-Amum) (Trampier 2010: 340 Figure 5.6; also Toussoun 1922: Pl. XII; Warne and Stanley 1993: 54). Two such channels are also shown on Jacotin’s map published in 1826 (after Sestini 1989: 104 fig.3). This is a warning that the visible geological data relate to recent events, which suit best investigations from the Ptolemaic period onward.

The geological evidence seems to confirm Strabo's observation that many canals connected Hermopolis (Damanhur), Gynaecopolis (Kom Firin) and Momemphis (Kom el-Hisn) to Lake Mareotis (*Geography* XVII. 22).

At Kom el-Gel, in the area to the south where the 'Khenes' canal links with Mareotis, there is evidence for structures and wine and olive oil production, while at Kom el-Farag, originally known as Kom el-Hanache (Wilson and Grigoropoulos 2009: 51-2), local authorities conducted rescue excavations there, uncovering vats from wineries (Kenawi forthcoming: tav. II). Further *koms* are noted in the area, but one of the most prominent requires some further explanation, that at Kom Mahar, lying apparently inside the lake as an island. The impression given by material found there and by the size of the site and evidence for structures is that this was a wealthy settlement, perhaps a lakeside country villa or a harbour in the lake, active from the Late Ptolemaic to Late Roman period (Wilson and Grigoropoulos 2009: 297-301).

Further to the north-west, Kom el-Hagg and Kom Ishu also seem to be isolated within the body of the lake. The two places share similar geological structures in that both are outcrops from the eastern edge of the fingers of a limestone ridge formation. Pottery on Kom el-Hagg dates from the Early Ptolemaic to the Early Roman period, while that from Kom Ishu is Late Roman or later in date (Wilson and Grigoropoulos 2009: 45-8 and 289-94). This difference in dates may well be due to the mode of survey and happenstance of the finds, but it could also represent a different trajectory in crossing the lake. Earlier shipping may have been directed via Kom Hagg to Alexandria, while later shipping was directed via

Kom Ishu to Marea or Abu Mena to the west. Both sites may be the upper part of larger mounds and may have been strategic beacons or watch posts checking on shipping across the lake, perhaps like Kom Mahar. Further upstream, the Khenes canal links Dynastic sites at Abu Guduur and Tell Abqain before joining the Canopic branch of the Nile. The canal-lake system would have provided a direct Delta edge connection between the southern Delta and Alexandria.

The area where Masraf el-Amum joins the lake at Kom Nasr is archaeologically badly preserved and Sidi Ghazi is built over by a modern town (Wilson and Grigoropoulos 2009: 58-9). The *tells* form lines across the lake which may have functioned as stopping off points or monitoring stations. The Baslaqoun area on the north-east side of the lake similarly seems to consist of remnants of what may have once been extensive facilities for river-lake traffic at a complex of sites. A series of *koms,* including Kom el-Qadi, Tell el-Ghasuleh (at Baslaqoun), Tell el-Khanfes and Tell Luqin, may be the last remnants of areas of settlements, warehouses and harbour facilities, somewhat reminiscent of the archaeological remains at Schedia, not far to the north. The modern Masraf Shirayshra runs in a channel through the area which was once identified as the location of the 'lost' region of Menelais (Daressy 1929: 22-25). Kom el-Qadi contains a Roman cemetery and evidence for wine production, as well as other structures and pottery dating to the Roman period (Wilson and Grigoropoulos 2009: 82-4, 320-2; Kenawi forthcoming). The other *tells* have not been investigated thoroughly. The whole area lies between the Canopic Branch and Lake Mareotis and so may have provided a series of rural, water communities, which could direct their produce easily from fertile fields to Alexandria and perhaps provided a collection point for produce from this special region. The wealth of such a place could have resulted in the foundation of an important focal city, such as Menelais, but Daressy's reasoning on etymological grounds seems weak (Bernand 1970: 397-406) and the Canopus area would seem to be a better choice for the location of the regional capital.

One of the other main towns in the Mareotis area was at the site of Tell Trugi or Torouga at the south-east side of the lagoon, believed to be the town of Psenemphaia on the basis of inscriptional evidence from 5 BC (SB 8267, Guéraud 1930: 21-40; Bernand 1970: 899-913). The modern form of the name of the town is derived from the Coptic Theroge and, therefore, does not bear any relationship to the name of the town in Greek. It is possible that there were two main parts to the town and that Theroge was the 'Egyptian' quarter of the port, while the name of the Greek quarter, Psenemphaia, did not survive (Timm 1984-1992: 2545-6). Pottery and a bath-house with Ptolemaic coins suggest that the town was extant in the Ptolemaic period and its importance may be gauged by the deployment here of a cavalry unit, perhaps in the first century BC (Fraser 1959-60: 145-6, no. 10, pl. 31). The town seems to have continued to function as one of the main entries into Alexandria as late as 1290 (Bernand 1970: 883). The site was at least 800 metres in diameter at the beginning of the twentieth century (Botti 1902: 58), but is now reduced to 350 by 300 metres (Wilson and Grigoropoulos 2009: 85-7). Photographs of the removal of parts of the ancient site show high red and mud-brick buildings (Adriani 1934: 44, Fig.12). It was suggested by Botti that the ‘Naukratis’ canal connected the inland port Torouga with Naukratis on the Canopic branch of the Nile and continued past the sites at Kom Razimat, Kom el-Akhdar, Barnugi, Kom el-Lin, Kom Hammad and thence to Naukratis (Botti 1902: 58 and 64; de Cosson 1935: 79). Daressy hinted that the modern Abu Diab canal from north of Naukratis went via Nedeibeh to the area of Kom Torouga, but he did not explicitly show a linking artificial waterway (Daressy 1929: Pl. I). Joining sites in such a way makes some sense of the line of *koms*, but does not really answer the question of why such a canal was necessary when the Canopic branch was fully functioning. The sources that mention the site are Coptic and suggest that Torouga or Theroge was part of the route from Alexandria to the Wadi Natrun and its monasteries to the west. It is possible that, given the evidence for wineries and the Ptolemaic interest in the site, it was a collection point for goods coming from the Alexandrian *chora* at the lake edge and thence they were shipped directly to the city. In addition, the salts and natron from Mount Barnugi to the south-west may well have been taken by land for lading at Torouga and shipped to Alexandria for use in the salting and preserving of foodstuffs as well as human corpses, because natron was a key element in the mummification process. The course of Botti’s canal, therefore, is not yet certain and further local investigations are required to show whether there was a linking waterway here or a starting point for a land route.

A memory of the importance of places such as the Luqin-Baslaqoun area, Kom Torouga and southward may be preserved in the thirteenth century ‘Itinerary of routes to Babylon’, a list of places from Alexandria to Cairo. One journey stops first at Camloquin (Luqin), then Tharhet Therange (Torouga), Damanhur and proceeds southward, while another goes from Blouc (Balaqtar) to Tharange, to el Zahfarani, Hau-ramsis, Terrana and then Cairo (12th to 13th century, Michelant and Raynaud 1966: 250-1). Clearly the first journey was to be taken by water through Mareotis, then south along its edge to Torouga and onward by two routes, but they could have been by waterways (as in the case of the second) or by land (perhaps to Damanhur). Combining travel by river branch, perhaps canal and lake, seems to have been the method of choice and perhaps by the same boat to minimise unloading and potential security issues. Stopping at set points seems to have been a necessary control mechanism of the system, as shown in the Canopic-Abuqir approach.

**Abuqir Lagoon, the Canopic Nile and Edku Lagoon: long term instability**

(Map 3)

The lagoonal system continued west of Mareotis, with each lagoon separated by the Canopic river branch or canals. Abuqir Lagoon was once 10 km wide, covered 105 $km^2$ and contained wetland as late as the early 19th Century (Warne and Stanley 1993: 36). It existed independently of Mareotis, but also received seawater. The channel for the Canopic Branch of the Nile reached the sea west of Abuqir lagoon, forming the Canopic promontory  (Chen el al. 1992). The lagoon may have continued as far south as Kafr el-Dauwar and east to Kom Terfayeh at its maximum extent, running parallel to the northern coast (Warne and Stanley, 1993: 31, Fig. 4). While Herakleion had been founded at the mouth of the Canopic Branch by the Late Period, as an access point for ships coming into and out of the North West Delta (Warne, Stanley and Schnepp 2004: 923), the main inland port for Alexandria lay at Schedia, south of Abuqir lagoon. The Canopic Branch ran alongside the edge of Edku lagoon, probably in a higher-lying channel, and turned northward at the harbour at Schedia. A canal was cut to the west and a large harbour facility was created between the river and the canal (Bergmann and Heinzelmann 2007: 67, Abb. 2-3). Archaeological remains of different parts of the site are scattered on both sides of the river and canal in a series of *koms*, such as Kom Giza, Kom Hammam, Sherif Khalaf and El-Nashwa (Bernand 1970: 329 ff.; Wilson and Grigoropoulos 2009: 94-98). Strabo reports that traffic on the river was controlled by a pontoon bridge across it, which gave its name to the town (*Geography* XVII. C. 1.16). The harbour had a customs post (Bernand 1970: 409-10) and it is not surprising that a garrison is attested at Schedia between 116 and 88 BC (Bernand 1970: 415-6). Security was obviously important at strategic location, such as the heads of canals, but also because goods were stored there for a time in warehouses and magazines. The customs dues may have been collected as they left Alexandria at Juliopolis, perhaps beyond the Canopic Gate, while the goods from the *chora* going to Alexandria were taxed at Schedia (Sijpsteijn 1987: 17).

Several important towns seem to have stood in strategic positions on the northern part of the Canopic Branch on its final stretch to the Canopic promontory. Kom Defshu lay to the south of the Canopic Branch and north of the Alexandria Canal, between Abuqir and Edku lagoons. Survey work at the site shows that the current *tell* is approximately 530 by 410 metres in area and 12 metres high. According to drill auger data, the site has a central core, of which the earliest stratum dates to the Late Period. The stratigraphy of the northern and western sections shows some large, mud-brick buildings in this settlement. To the south of the main mound was a cemetery dating to the Roman period, taking advantage of a small sand hill lying protected from flooding on the lee-side of the mound (Wilson and Grigoropoulos 2009: 60-70, 302-7). It is possible that the settlement at Kom Defshu could have supervised access from inland to both Alexandria and the Canopus area, perhaps performing more of a controlling and security role than the harbour of Schedia. The Defshu settlement could have enabled safe passage through marshy waters and shallow channels, especially at night, perhaps by means of a lighthouse network, of which the Pharos at Alexandria is the best known. The settlement may also have monitored traffic operating legally and illegally in Egyptian waters, in this case in the lagoons of Abuqir and Edku and the Canopic waterways. It is possible that a systematic and well organised bureaucratic system was already established in the Pharaonic period to monitor such river-sea routes, as is suggested by officials with titles such as 'Commander of the Gateway (or Fortress) of the Sea' for the Tanite-Menzala area (Chevereau 1985: Doc. 50, 52) or structures such as the 'Watchtower of Perseus' mentioned by both Herodotus (*Histories* II.15 at the western end of the Delta) and Strabo (*Geography* XVII.18 between the Canopus and Sebennytic river mouths). Such a system must have relied upon wellmanned outposts near the waterways and good systems of communication between them.

West of the Canopic promontory, Edku Lagoon covered a maximum extent of perhaps 30 km from west to east and 15 km from north to south, the edges of the lagoon being much less well-defined than those of Mareotis. It received tributary fresh water on the eastern side, directly from the Bolbitine-Rosetta branch and from canals to the south. Its north-eastern shore was cut off from the sea by a sandy ridge. The lagoon has been diminishing in size and now covers an area of 126 $km^2$, with a depth of up to 1.5 metres and a prevailing NW or NE wind (Ramdani et al., 2001: 8-9, Table 1). The archaeological sites around the edge of the lagoon suggest that the eastern and southern edges of the lagoon contained active settlements.

On the eastern side of Edku Lagoon lies Kom Ghuraf, a site covering around 32 hectares in area and rising to a height of 18 metres above current field level. The modern field systems to the east form a tight mosaic of land parcels between the Bolbitine-Rosetta river branch and Kom Ghuraf. On the western side of the *tell*, the land is reclaimed from Edku Lagoon. The map of Mahmoud el-Falakhi (dated 1869), shows Com el arfé (thus Ghuraf) lying in a bay of the lagoon (Toussoun 1922: Pl. II), with a smaller mound named Kom el-Medina nearby, thus forming a double mound complex. The latter site no longer exists. Around 6 km to the south of the Ghuraf-Medina pair is another double mound complex of Kom el-Waset (29.25 ha) and Kom el-Ahmar (16 ha). The former is a Ptolemaic site dated from the pottery and coins on the surface, but may date to the Dynastic period in its lower levels, while Kom el-Ahmar was perhaps also founded at least in the Ptolemaic period and continued into the Late Roman period. The settlement mound rises to a maximum height of 10 metres and now consists of flat areas with five small mounds, the result of illicit excavation, with the mound having been severely mined for *sebakh* (earth used as fertiliser and land-fill in reclamation areas). This work did, however, yield a bath-house dated to the reign of Ptolemy II or III by coins which was more scientifically cleared in 1942-3 (El-Khashab 1949; Wilson and Grigoropoulos 2009: 176-183). The configuration of the area at the south east of Edku Lagoon, suggests that the settlements on the lagoon edge may have been controlling and monitoring traffic between the Bolbitine-Rosetta branch, Edku Lagoon and the northern coast with a possible sea-harbour site at Edku town itself, as yet unexplored.

Reconstructions of the mouth of the Bolbitine-Rosetta branch suggest that distributaries connected the river and Edku Lagoon or that the branch once bifurcated around modern Mahmudiyah and debouched into Edku Lagoon (Stanley 2007: 13, Fig 2.7; 16-17 figs. 2.10 and 11). It is likely that the *tell* sites already mentioned were located at the place where at least two of these waterways entered the lagoon. The Bolbitine-Rosetta mouth may not have been so accessible, so the actual sea entry would have been through the Edku Lagoon and via one of the distributaries. Unloading cargo at Edku or another harbour in the shelter of the lagoon in order for it to be transhipped from there may have been easier, faster and safer. If the marshes and water in the area are reconstructed at the 0 metres above sea level contour line, the theory looks plausible, but the *tell* sites would not have lain at the water's edge. If the water level is reconstructed at the 1 metre above sea level contour line, however, the ancient sites lie conveniently along the lagoon fringe, acting as monitoring/customs posts or temporary storage and collection facilities for economic produce from the area and beyond. The lagoon edge settlements may have functioned as part of a hydraulic management system with a centre for the administration of the area based perhaps at Kom Ghuraf. There would have been some flexibility in travel and choice in the method of approach to Alexandria — via the lagoonal route, along the coast, or through the Canopic branch of the Nile and Alexandria canal to the south. If any one of the routes was not navigable due to storms or tides, then the canal and lakes offered a continuous chain of communications. During the inundation, the canalised system may also have offered some kind of raised waterway standing proud of the flood waters, moving between high *tell* sites and offering reliable and controlled waterways through the eddies of the flood waters. The system would have created power-points at the town centres, accounting, to some extent, for the size of Kom Ghuraf and, originally, Kom el-Ahmar. Each of them also had an agricultural hinterland and could have been relatively self-sustaining foundations during the Ptolemaic period, growing rich with the incoming and outgoing trade. In order to manage the 'new' area the city of Metelis at the centre of a new nome was created, but it is not clear where it was located. It may have been at Fuwa or Mutubis, east of the current Bolbitine-Rosetta branch, or even at Ghuraf on the west.

Along the southern edge of Edku Lagoon, a cluster of sites aligned north to south, suggests, as El-Falakhi showed (Toussoun, 1922: pl.2), that there were one or more inlets in the lagoon and a higher peninsula of land upon which was a series of settlements, including Tell Nakhla, perhaps on the shore of a gulf (Bernand 1970: 464), Tell Bisintawy and Kom Tagala — all of which have produced archaeological material (Wilson and Grigoropoulos 2009: 131-5; 117-118). The site of Kom el-Debaa is divided into a north and south mound, covering about 15 hectares in total (Figure 2). It dates from the Ptolemaic to Late Roman periods and remains at the site include building plans, beads, glass, corroded bronze coins and a Roman period cemetery on the northern mound. A series of drill augers around the *tells* suggested firstly that they were founded upon sand, and secondly that there were much older, buried settlement layers beneath the sites. The early settlement would have been on Edku Lagoon, perhaps monitoring sea traffic coming to the north-west of Egypt. At Kom Aziza, there was pottery dating from Dynasty 26 and two drill auger transects at the site confirmed that it had a long history, dating at least to the end of the Old Kingdom (Wilson and Grigoropoulos 2009: 121-126; 351-2). The southern edge of Edku Lagoon seems to have been exploited even in the Pharaonic period and became a relatively affluent area in the Ptolemaic period, judging from the dated material from there.

**The Rosetta Promontory: an increasing profile** (Map 4)

The importance of the waterways in establishing points of control or power can be demonstrated through the rise in power and prestige at Rosetta. The Bolbitine-Rosetta channel began to form around 1000 BC, whereas the Canopic branch had already been operating for thousands of years and by 500 BC had moved into its final channel. The flow of water in the Canopic channel had diminished by, if not before, the Arabic conquest of Egypt in AD 641 (Toussoun 1922; Warne, Stanley, Schnepp 2004: 922-3) and the Canopic river-mouth system disappeared completely between the 7$^{th}$ and 10$^{th}$ century. Water continued to exist in the relict Canopic channel until the 18$^{th}$ century AD, so that when the new irrigation system was excavated, it could incorporate the channel. At the same time, there was increased Nile discharge through the Bolbitine-Rosetta Branch (Chen, Warne, and Stanley 1992: 923) and the Bolbitine channel may have been maintained by artificial excavation from 300 BC, a suggestion which has become accepted in the literature, but appears to have no foundation (Arbouille and Stanley 1991: 59; citing du Bois-Ayme 1813; Toussoun 1992 (map); Said 1993: 70; Stanley, Warne, Schnepp 2004: 923). The 'modern' Rosetta promontory is a triangular-shaped mass of unconsolidated, fluvial-deltaic sediment protruding 14 km NNW onto the inner Egyptian shelf. The northern extension of the Rosetta promontory and subsequent Islamic period development of this area may be confirmed by the Islamic period site at Sidi Uqba, perhaps once on Edku Lagoon's shoreline and the edge of the Rosetta branch floodplain (Wilson and Grigoropoulos 2009: 171-2, 387-9), as well as Tell Dibi (perhaps

Balhib), a Late Roman settlement, but also, perhaps, an earlier lakeside stopping point, or fishing port (Wilson and Grigoropoulos 2009: 188-9, 411-4).

A similar site can also be found inland at Rosetta, showing both how much the landscape has changed since antiquity and also how access to the mouths of the Nile and thus entrance to Egypt was monitored. At Tell Abu Mandour, or Kom el-Farah as it was called, the modern promontory of the Rosetta (Rashid) Branch was not formed until after the 9th century AD. Rashid itself was, according to Islamic tradition, founded in AD 870 and at that time was at the river mouth. From the watch-tower built on Kom el-Farah by the sultan Malik el-Bunduqdari, the approach of French ships could be monitored (according to Ibn Duqmaq (d. 1406) Wilson and Grigoropulos 2009: 168-170, 382-6). While it is possible that the Ptolemaic town of Bolbitoun lies somewhere near this site (Ball 1942: 78), survey work only found pottery dating to the Late Roman period. The site seems to have lost its pre-eminence with the foundation of Rosetta, when the protective fortress was moved to Fort Qaitbey (Fort St Julien). On Forlani's map of 1566, Rosetta lay on the coast (Stanley, Warne, Schnepp 2004: 925 Fig. 4B) and after this time, the promontory at Rosetta prograded into the sea with the continued deposition of sediments. Since the construction of the Mahmoudiya canal in 1820 and then the High Dam from 1965, it has been retreating to the current position. The later development at Rosetta hints at the Islamic period expansion of administration of the northern waterways towards the system operating in the medieval and Ottoman Period. Within the subsequent modern drainage system, the Tirat Fazara, runs from the western Rosetta branch in a direct route to Edku

Lagoon, by-passing the old settlements on the lagoon edge completely and completing their isolation. The new drain shows the extent to which settlements were dependent upon the waterway system for their very survival.

**Lake Burullus and the Northern system: rural power centres** (Map 5)

In the Province of Kafr el-Sheikh on the eastern side of the Rosetta Branch, a similar relationship existed between waterways, lagoonal body and sea, except that the archaeological evidence suggests that the region was most active from the Roman through to the medieval period. Burullus was once a brackish lagoon and the levels of salinity of the water in it rose and fell according to the position within the cycle of the Nile flood, although it is now a much less saline environment (Birks 2001: 13-17). The lagoon is 55 km long by 14 km wide and covers an area of 60,000 ha. The southern shoreline has moved north since 1800 by 10-12 km due to drainage and land reclamation projects (Arbouille and Stanley 1991: 47). The northern shore consists of sand bars (Ramdani, et. al. 2001: 11-12) and the lagoon was fed from the south by tributaries of the Bolbitine-Rosetta Branch, including the old Saitic branch of the Nile. Each distributary formed a narrow peninsula of silt deposited in the lagoon, creating levees, point bars and mounds along the southern fringe (Sestini 1989: 105; map of Du Bois Aymé in Toussoun, 1922: Pl. V), not to mention as many as 50 islets inside the lagoon (Sestini 1992: 545). The major Sebennytic Branch, to the west, once debouched into the sea through this area, forming the promontory at the apex of the Delta (Bietak 1975: 149-177; Toussoun 1922: 25) and ceasing to function from the ninth to the thirteenth century (Arbouille and Stanley 1991: 60 and fig. 10; 63, fig. 11.F). It is noticeable that the main Pharaonic period sites in the north of Egypt can be found south of a line from Buto (Tell Farain) in the west to Tell el-Balamun in the east. There are, however, over 100 identified sites after that date to the north in Kafr el-Sheikh and Dumyat Provinces dating from the Ptolemaic period onwards (Ballet and von der Way 1993; Wilson and Grigoropoulos 2009). The figure amounts to almost 15% of *all* known Delta sites (http://www.ees.ac.uk/DeltaSurvey). The number of settlements suggests that something was happening to attract people to the north of Egypt in the Ptolemaic and Roman periods. There may have been something like a land-rush, as had happened in the Fayum, where the population is estimated to have risen from 72,000 to 312,000 (4.3 times) between the Ramesside period (1250 BC) and Ptolemaic period (150 BC) and from 1,170,000 to 2,160,000 in the Delta (1.8 times) (Butzer 1976: 83,Table 4).

The vast, fertile centre of the Delta may have offered an unmissable opportunity for farming and agriculture, supplying further tax-grain in the Roman period, that could not be found in the narrow Valley, where there was no real room for expansion, except on a small scale by improved drainage and irrigation technology. The development of rural towns based on agriculture, forming the collection nodes for grain-tax, supplemented by fish and animal husbandry may be a purely Roman development in the north. It seems reasonable that the increased demands of Rome were met, not just by making the existing system more efficient, but by increasing the number of food-producing areas.

The management of the area depended upon the network created by waterways and settlements, but locating their relative positions in time and place is difficult. Intensive survey using satellite images, maps and drill augers around Buto located several meandering channels buried under the modern sediments in the area, but further work is needed to date them (Andres and Wunderlich 1986: 128-9; Wunderlich 1989: 42-47). It is likely that because they were visible to satellites and on maps that they are of relatively recent date, so may relate to the sites dating from the Roman to medieval period. A further difficulty is that in the modern irrigation and drainage system, old channels were often reused for the new channels. Meandering channels may suggest the presence of an older distributary or river branch, whereas straight channels are more likely to be modern (Lyons 1906: 348).

One of the main channels in the area, according to classical sources, seems to have been the Saitic Branch. It may have bifurcated from the Bolbitine-Rosetta branch, perhaps somewhere near the site of Sais but the course of its channel from there to Burullus Lagoon is not clear (Wilson 2006: 11). The Saitic Branch may have flowed west of Buto, perhaps also ceasing at the same time as the Sebennytic channel (Arbouille and Stanley 1991: fig. 11F). Part of the ancient Saitic water course may be indicated by joining channels and ancient sites to create options for the waterway-settlement network. The modern Masraf No.9 flows on the western side of Buto in a meandering channel and then proceeds east of Kom Abu Ismail, west of Kom Sheikh Ibrahim, east of Kom Qaalieh, east of Kom el-Arab where several drain and canals meet, then continues perhaps past Kom Dahab and Tell el-Aluwe before joining the Bahr Nashart canal at Tell Foqaa, perhaps on the ancient shore of Burullus Lagoon. The Bahr Nashart itself flows through another *tell*-field and may have been in antique times located further west, linking the sites at Tell Daba, Kom Sidi Selim, Kom el-Misk and perhaps Kom Haddadi, with Kom Khawalid (Phragonis), Kom el-Khirbah and Kom el-Ahmar also part of the system.

Masraf no. 8 may also have been the channel of an ancient water course, except that it seems too straight and narrow, although this does not preclude part of it having been a old channel or canal. It reaches Lake Burullus east of Tell Foqaa by-passing the ancient sites of Tell Haddadi, Kom Bunduq, Kom el-Misk, Kom el-Khawalid and Kom Sidi Selim. It may have originated near Sakha, south of and now a suburb of modern Kafr el-Sheikh, the site of the administrative capital Xois. With the nome capital on the channel, this makes the Masraf No. 8 channel seem more likely as a candidate for one of the ancient Nile branches.

In order to manage the 'new' northern area effectively, the Cabasites nome was established with its capital at Cabasa. It may be significant that it was listed first by the Alexandrian geographer Ptolemy, who lived between AD 90 and 168 (*Geography* 4.5.48, Ball 1942: 85). The exact location of Cabasa is not known, but several towns with the element 'Shabas' can be found in this area (Timm 1984-1995, 5: 2218-2222). It may or may not be significant that there is a linking area of drain systems, perhaps the bifurcation of the Saitic branch between Shabas Shuhada and Shabas Umayir, and the village of Nashart, at the beginning of the Nashart drain is just to the east of Shabas Umayir.

The end points of the channels along the shores of Burullus Lagoon may have been at inland ports such as Tell Foqaa, which has extensive material dating from the Late Roman to the Arab period. Some areas of the 21.6 hectares site were evidently involved in glass production (Wilson and Grigoropoulos 2009: 233-6; 437-41). The seaward port of Parallos (Baltim) on the northern side of Burullus lagoon may have been the main transhipping port and the network may have been regulated by customs stations on some of the islands. The surface of Geziret Kom el-Akhdar, for example, is covered in Late Roman domestic pottery and structures have been noted which suggest that a settlement of some kind existed there from the 5th century (Wilson and Grigoropoulos 2009: 237-8). Navigating through the lake may have been facilitated by such sites, as much directional markers as monitoring posts. It is likely that a local guide would have been needed through the swamps to prevent boats losing their way, losing time or losing precious cargoes. Small, flat-bottomed boats may even have been taken in convoy through the marshes.

The later date of the sites in the north of Egypt may reflect the changed political and economic dynamic in Egypt between the reforms of Diocletian in AD 284 and the Early Arab periods. Produce from the north may well have been heading north to Constantinople rather than Alexandria, or east to the Levant and then, south to Babylon/Fustat at Cairo. Reaching Alexandria from Parallos would have meant sailing against the prevailing sea currents and so Alexandria may no longer have been the prime destination for ships from Burullus from the Late Roman period. After AD 750, the Pelusiac Branch to the east and Lake Menzala became the focus for routes eastward to the Levant (Cooper 2008: figs. 15-16) 750 and the Burullus system lost its short-lived prosperity.

## Summary

The power of the water network in the northern delta seems to have ensured that ‘new’ lands could be fully exploited for the benefit of Alexandria, then Rome and later Constantinople and Babylon (Cairo). Grain-tax collected from the Nile valley Fayum and Delta need hardly have touched land before it was delivered to warehouses in the cities. On the other hand, numerous collection points along the waterways, monitoring stations, customs posts and stopping places could have given rise to many opportunities for trade and exchange throughout the network, from Nubia to Alexandria. There was also a trickle-down effect in the power achieved by the ‘new’ lands. The areas between Lake Mareotis and Schedia, east of Mareotis, Lake Edku and the Rosetta Branch and south of Burullus all needed new administrative centres — Hermopolis, Menelais, Metelis and Cabasites — changing the old Pharaonic balances of power. The palimpsest of the Delta requires more work in order to unravel and match the different types of evidence from texts, geomorphological and archaeological surveys.

It may be significant that in the modern era it is Kafr Dawwar and Abu Hoummus which have become the industrial-factory cities for Alexandria, Damanhour developed as the agricultural centre for Beheira, and Rashid and Tanta grew up to serve the centre of the Delta in response to a new communication network based around the railways (Wiener 1932: 101, fig. 28) and an agricultural system based on cotton and rice. The railway and road system made water transport into an option, where it had been the communication network of choice. The old and antique centres of administration and communication were effectively displaced and their sites abandoned. In seeking the sources of power in ancient, antique and modern Egypt the answer seems to lie in the configuration of land and the water that makes it productive. It may be a balance of power that is about to change for the first time in millennia, as land and water availability comes increasingly under threat.

## Acknowledgements

I thank the Arts and Humanities Research Council for a grant towards fieldwork and research leave. I am grateful to the Supreme Council of Antiquities in Egypt for their assistance and collaboration, the Egypt Exploration Society, Roger Dickinson and the organisers of the 'Water and Power' workshop.

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Map data

All maps are compiled from *Survey of Egypt* map sheets, 1: 50,000 (1997) (digitisation by Roger Dickinson and visualisation by Penelope Wilson).

Key for Places Shown on Maps

1 Kom Ishu
2 Kom el-Hagg
3 Kom Lemsan
4 Kom el-Gel
5 Kom Mahar
6 Kom el Farag, with cluster of 4 small sites
7 Kom el-Adda
8 Sidi Ghazi
9 Kom Nagi
10 Kom el-Birka
11 Abu Guduur
12 Kom el-Saqyah
13 Kom Torouga
14 Kom Qinis
15 Kom Hassan
16 Kom Khaleesh
17 Buturis
18 Kom el Khirbah
19 Kom el-Boos
20 Kom el-Nigili
21 Kom Abu Ismail
22 Kom el Qanatir
23 Kom el-Nasr
24 Kom el-Qadi
25 Baslaqoun
26 Luqin
27 Kom Hammam
28 Tell Sherif Khalaf
29 Kom el-Giza
30 Defshu
31 Kom Baharig
32 Tell Abqa'in
33 Kom el-Khatimi
34 Kom el-Ahmar
35 Kom el Barud Kafri
36 Kom el-Dahab
37 Barnugi
38 Kom Umm el-Laban
39 Kom el-Shoqa

40 Tell Abu Humar el-Kebir
41 Kom el-Ghuzz
42 Kom Firin
43 Kom Mazen
44 Kom Terfaya
45 Kom Dahab iii
46 Tell el-Kanaies
47 Sidi Yussef
48 Kom el-Nuss
49 Kom el-Debaa
50 Kom Hashiem
51 Kom Aziza
52 Kom el-Nakhlah
53 Abwereh
54 Kom Tagala
55 Tell Bisintawy
56 Ganadi
57 Kom Barsiq
58 Kom Sebah
59 Kom Saieda
60 Kom el-Qarawi
61 Tell Abu Mandour/Tell Farah
62 Sidi Uqba
63 Kom Ghuraf
64 Kom el-Waset
65 Kom el-Ahmar
66 Tell Dibi
67 Tell Mutubis
68 Tell Qabrit
69 Tell Amya
70 Tell Matiur
71 Kom Abu Ismail
72 Kom Qaalieh
73 Kom el-Arab
74 Kom el-Dahab
75 Tell Aluwe
76 Kom Sheikh Ibrahim
77 Tell Foqaa
78 Kom el-Ahmar
79 El-Haddadi
80 Dimru
81 Kom el-Misk
82 Kom Sidi Selim
83 Tell el-Daba
84 Kom el-Khawalid
85 Geziret Kom el-Akhdar

Captions

Map 1
Map showing the modeern Nile Delta, Egypt with lake and lagoon environments, topographic features and locations of detailed maps. After Sestini 1992: Fig. 14.1.

Map 2
Reconstructed Lake Mareotis area, with area inside the 0m asl. contour line shown as water or marsh. The now defunct Canopic Branch of the Nile is reconstructed after Gamili et al. 1994; Stanley el al., 2004 and the distributaries are based on modern drains and canals and after Trampier 2010.

Map 3
Reconstruction of Lake Mareotis, Abuqir and Edku Lagoons, with area inside the 1 m asl contour line shown as water or marsh. Reconstructions of the Canopic Channel, promontory and Alexandria canal from: Stanley 2007 and of Edku Lagoon after El-Falaki in Toussoun 1922.

Map 4
Reconstruction of Edku and Burullus Lagoons, with area inside the 1 m asl contour line shown as water or marsh. Reconstructions of the Rosetta promontory after Stanley 2007 and of Edku Lagoon after El-Falaki in Toussoun 1922.

Map 5
Reconstruction of Burullus Lagoon and palaeochannels based on main modern drains and canals and after Andres and Wunderlich 1986.

Figure 1
Fishing boats on Burullus Lagoon, giving an impression of the traffic in modern times (Photograph by Penelope Wilson).

Figure 2
A view from Kom Debaa south, looking towards the northern mound at the site and with Edku Lagoon in the distance, to give an impression of the visibility from *tell* sites towards the water bodies.

**Figure**

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**Figure**
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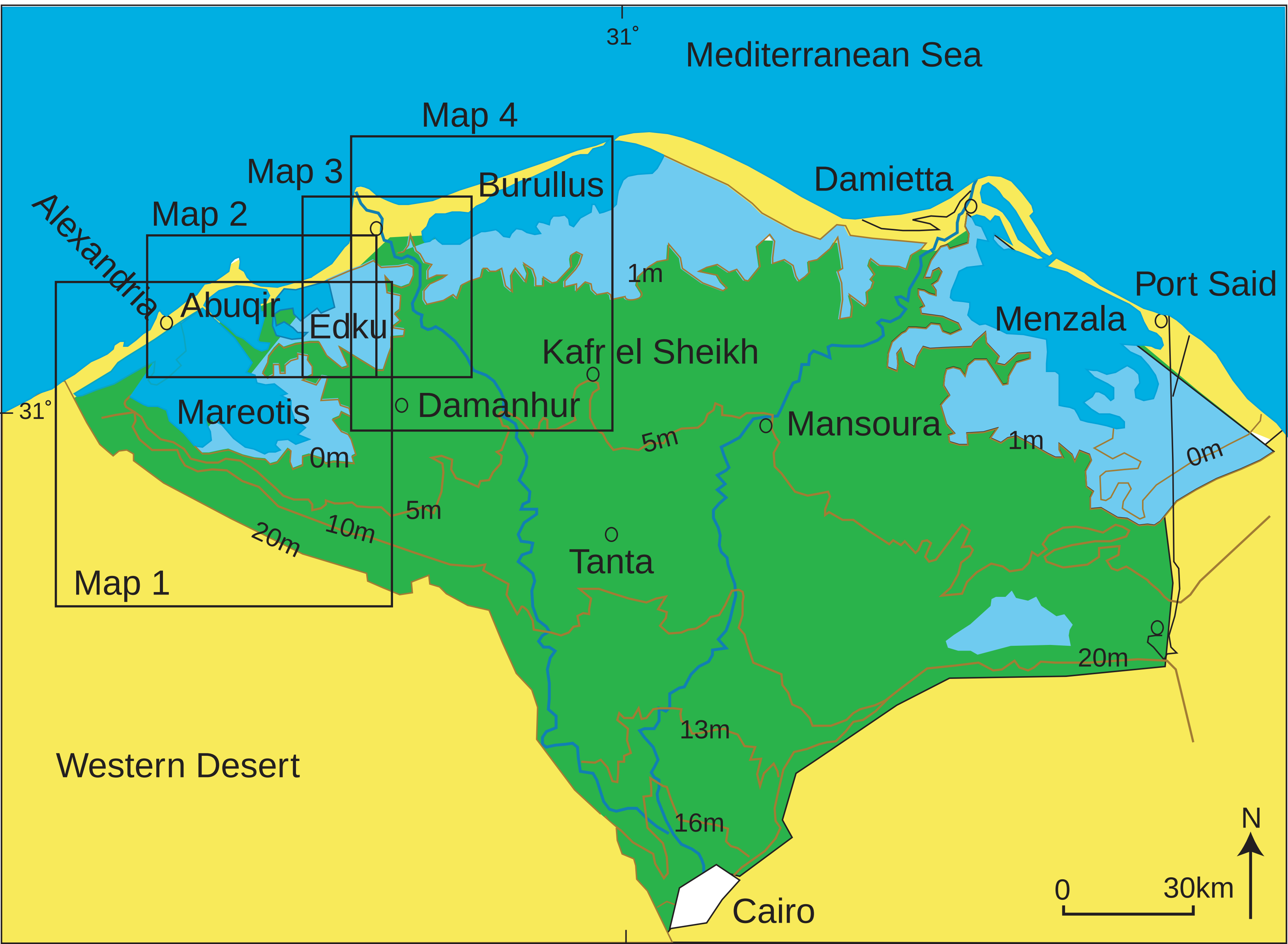

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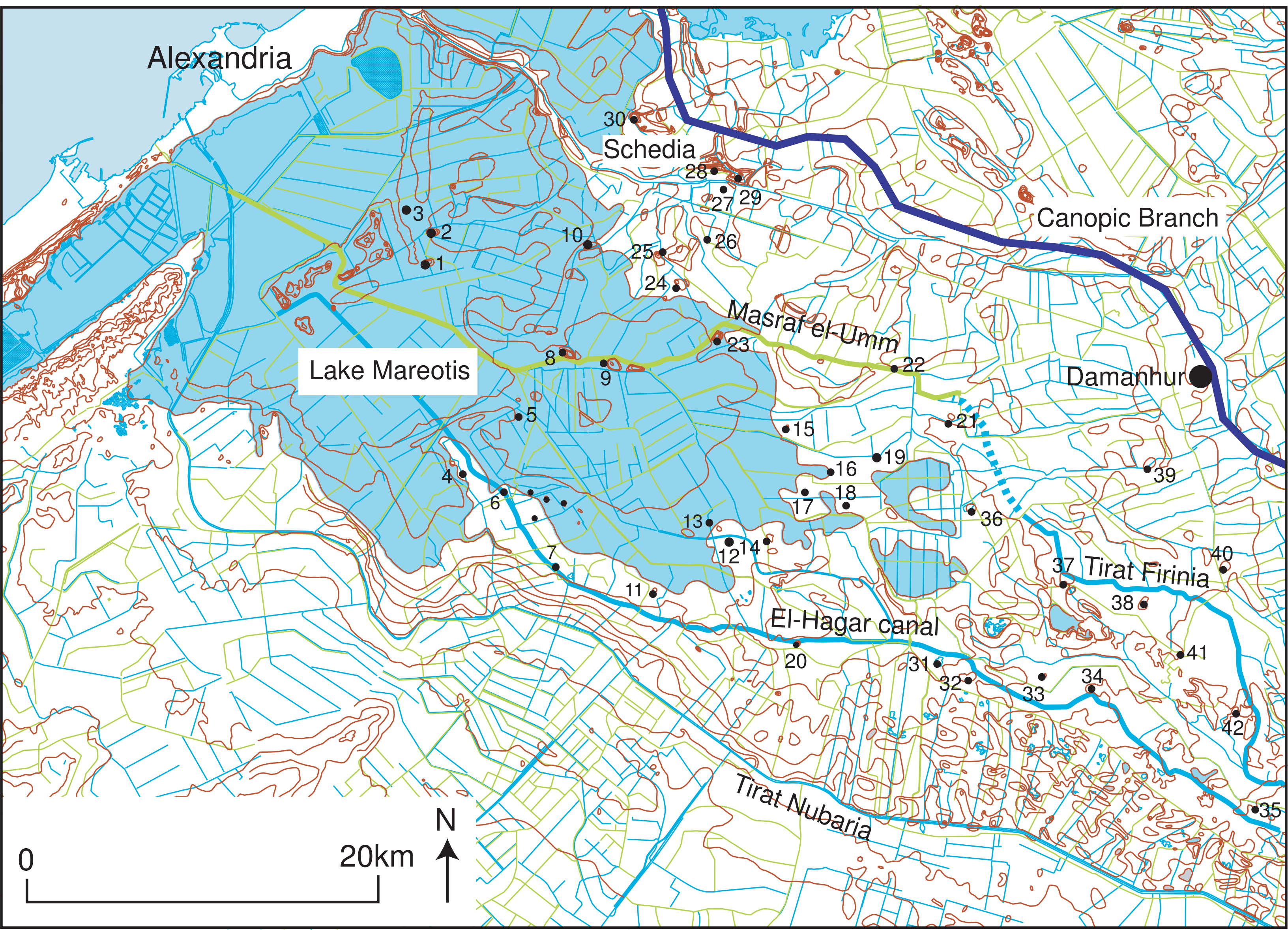

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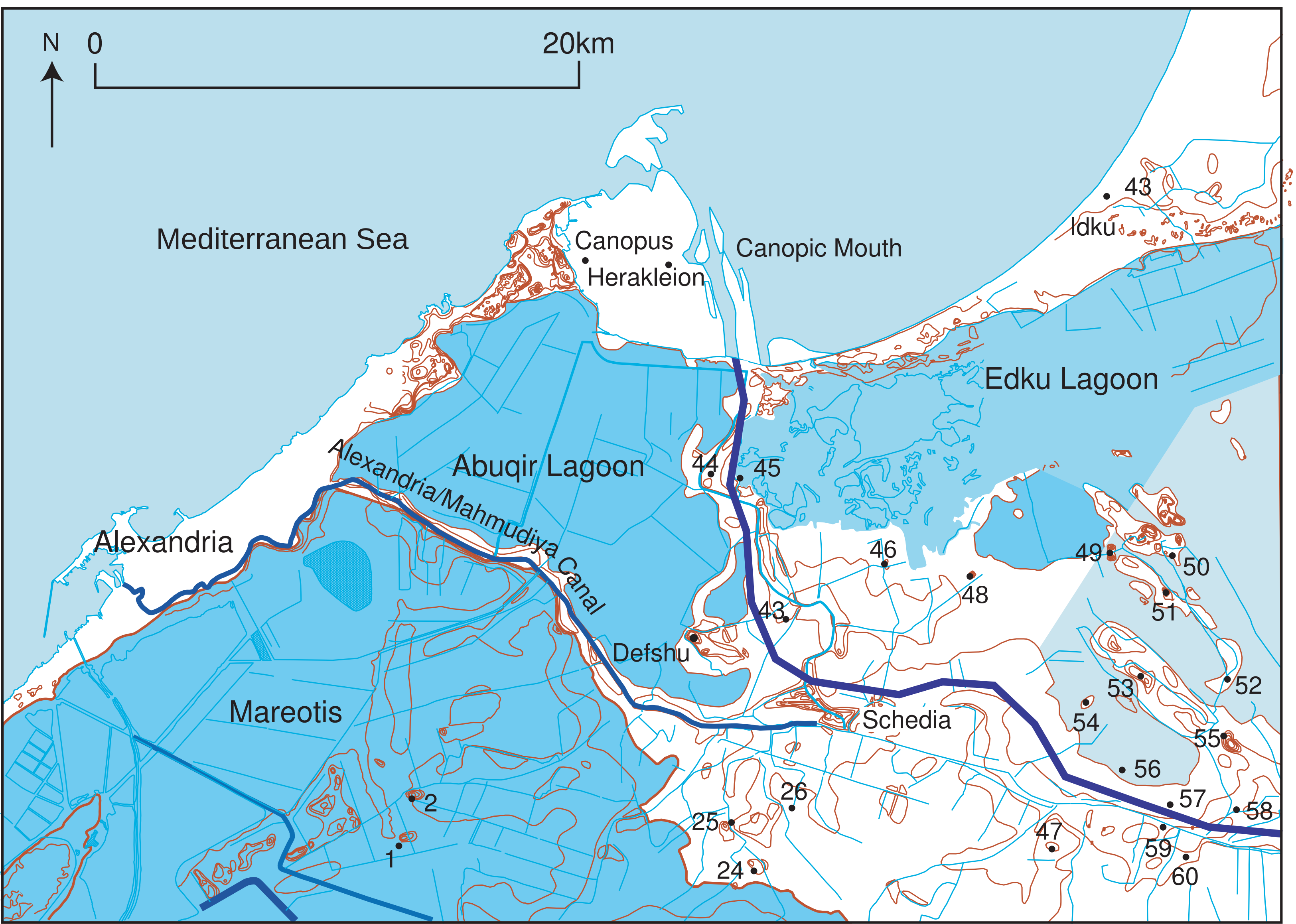

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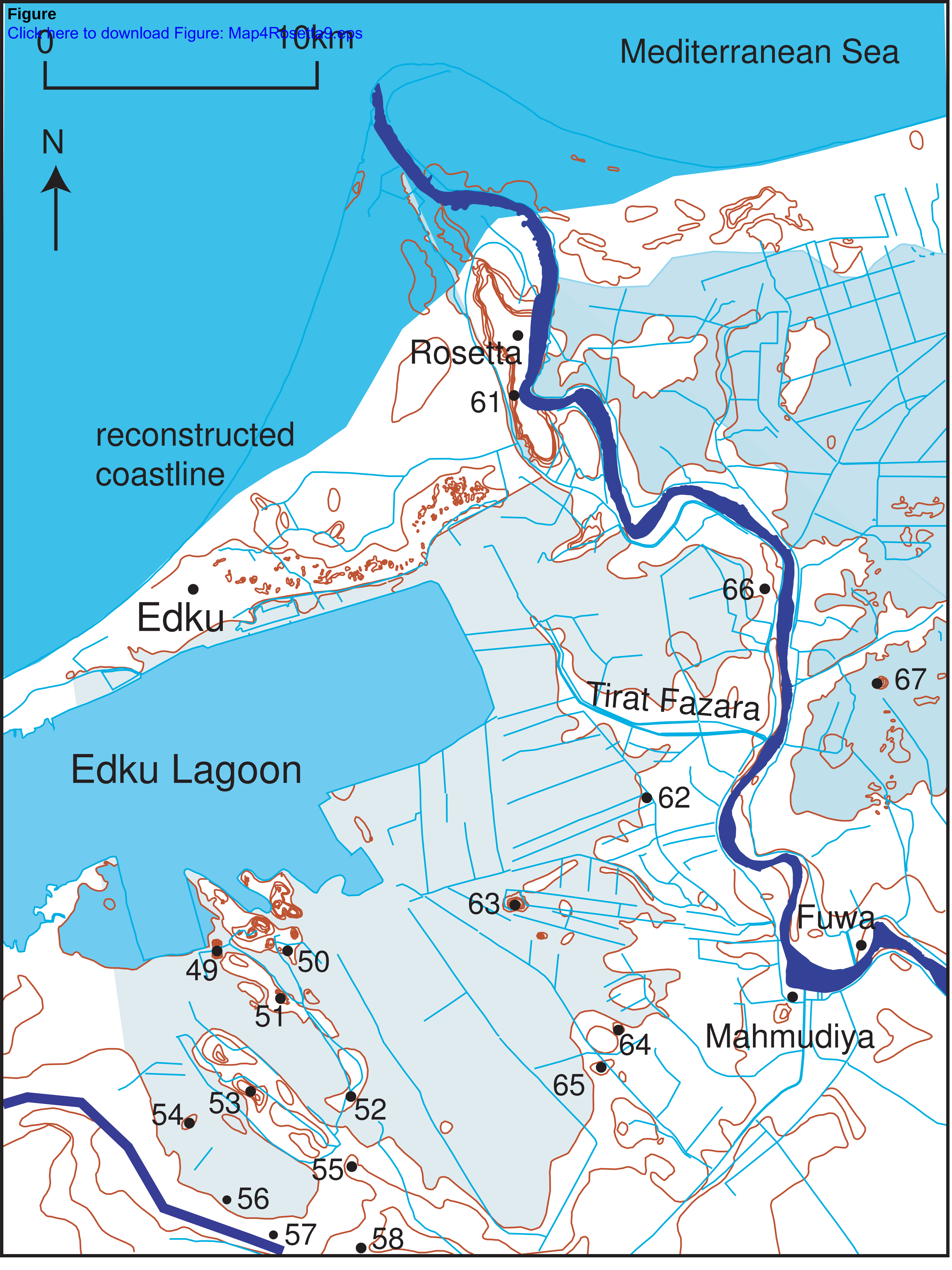

**Figure**

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