The British Museum

The evolving environment of the Nile Delta from 6000 BP to the present

Judith M. Bunbury, Ben Pennington and Laurence Pryer

British Museum Studies in Ancient Egypt and Sudan 24 (2019): 7–14

ISSN 2049-5021

The evolving environment of the Nile Delta from 6000 BP to the present

Judith M. Bunbury, Ben Pennington and Laurence Pryer

Introduction

In this article we explore how the Delta was inundated by sea-level rise at the end of the last Ice Age to produce a geographically rich habitat for humans.[1] When the sea level stopped rising the coast of the Delta began to move (prograde) seawards and the distributary network that had been strongly branching began to focus into a limited number of branches that radiated from the Memphis area. The changes in the distributary network led to increased importance for the Memphis area and the possibility that a single town could control traffic on each of the branches within the Delta. The development of the Delta also produced a migration of its head, first southwards and then to the north, which may have been one of the factors that influenced the changing locations of the Egyptian pyramid fields and subsequent developments. It is in this context that Naukratis was founded, during Dynasty 26 (*c.* 685–525 BC, Herodotus History, 2.178–79, Dewald 1998), at a strategic point within the Nile Delta (Fig. 1). The Canopic branch upon which Naukratis was founded is now silted up (Pennington and Thomas 2016), as are others of the former branches of the Nile (Stanley and Warne 1993). We explore the changing landscapes of Egypt and, in particular, the Nile over the past 6,000 years to provide a context for the site.

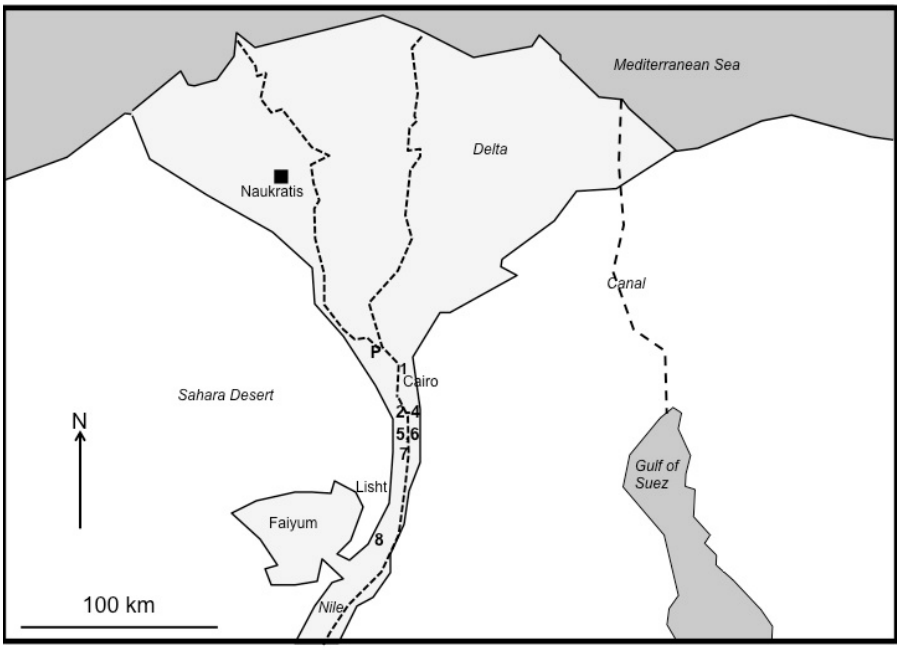

Fig. 1: Map of the Delta and the Nile valley as far south as the Faiyum showing the locations of Naukratis and the historical positions of the Delta apex from Table I (below). Dashed lines indicate modern waterways. By author

1 Front cover image: View of the Nile Delta, by Judith Bunbury.

Change in the Nile Valley

Before the last glacial maximum, around 50,000 years ago, the Nile flowed in a similar way to that of modern times towards the Mediterranean Sea (Said 1962). As global temperatures fell and the ice caps formed, sea level fell and the Nile cut down through its sediments leaving a river system with sandy islands amongst the river branches. As the Earth warmed again from 20,000 years ago, the ice sheets melted and sea level rose from 12,500 years ago, again spilling into the Mediterranean basin and drowning the Delta and the river-mouth of the Nile. By 6,000 years ago, sea-level rise had slowed and the Delta, in common with other deltas around the world (Stanley and Warne 1994), began to recover from the flooding. There are a number of processes that are attendant upon the recovery of a delta in this way and they have affected the patterns of occupation of the Egyptian Delta through the last six millennia.

Delta dynamics

A delta starts to form where the base of a river channel meets sea level. At this point, the river divides to form two or more shallower channels and the process continues to form a distributary system. The channels bring sediment which, when deposited, helps to build the delta seawards and, as this happens, the environments within the delta system also shift seawards as does the 'delta head' or apex, the point at which the first distributaries form. Within the whole river system channels constantly migrate laterally and meander. The process of delta development can be reset by either subsidence of the delta sediments or by sea-level rise; in either case, the sea level rises relative to the sediments. Studies of the Rhine Delta (Berendsen and Stouthamer 2001) that incorporate 180,000 boreholes give a more detailed picture of how progradation happens and we can identify features of the Rhine Delta in the Egyptian Delta, where there are many fewer cores available.

Nile Delta development

Stanley and Warne (1993), from their extensive survey including eighty-five boreholes, identified the locations of past distributaries and showed that a period of marine incursion, initiated around 11,000 years ago, was followed by a period of delta progradation and subsequently a reduction in the number of distributaries. Stanley and Warne (1994) also noted that other deltas in the world were likely to have been affected by the same processes. Pennington, Bunbury and Hovius (2016) and Pennington (2017) identified three such deltas that were associated with primary states to show that, broadly, the evolving delta environment provided a nutrient-rich habitat that was suitable for early humans. Subsequent reduction in productivity of the habitat as the delta prograded changed the transport regime of the Nile Delta and is connected to the formation of some of the early city-states.

Changing habitats

As sea level rises, the coast and the estuarine environment are pushed inland from the original coastline. Inland from this, abundant distributaries form and produce a habitat rich in marshes and channels that branch and reconnect. During periods of high river-flow (the summer flood of Egypt), the distributaries frequently break their banks (crevasse splay), refreshing the marshes and forming lobes of sediment suitable for plants. New marshes may form for 100km or more inland of the coast and provide a habitat rich in fish and fowl, as well as vegetation. Since there are many branches, occupants anywhere in the marshes can travel easily in any direction, as Strabo in *c.* AD 24 reported (Strabo, Geography 17.1.4, Strabo, c 40 BCE, Jones 1932), and food resources are rich everywhere in the distributary network. The relict mounds of Pleistocene (approx. 2.5Ma to 11,500 years ago) sand, known as gezireh in Egypt, remained proud of the floodwaters during the flood and Yann Tristant (2006) has shown that as early as the Predynastic period they were favoured as places of occupation and for burials.

With time, sediment supply from the channels began to fill the marshes, starting from the most inland point and migrating seawards, so that the rich habitat became marginalised towards the sea and eventually was consolidated such that the only nutrient-rich habitat that remained was the estuarine habitat close to the coast. The remainder of the Delta had returned to its current morphology and would require the use of irrigation and agriculture to become the food-source that it is today. As the marshes filled in, the distributary system also silted up, leaving fewer distributaries with fewer connections between them (Fig. 2). Currently the distributary network emanates from a point to the north of modern-day Cairo, a strategic point for a capital city, and consists of two main branches.

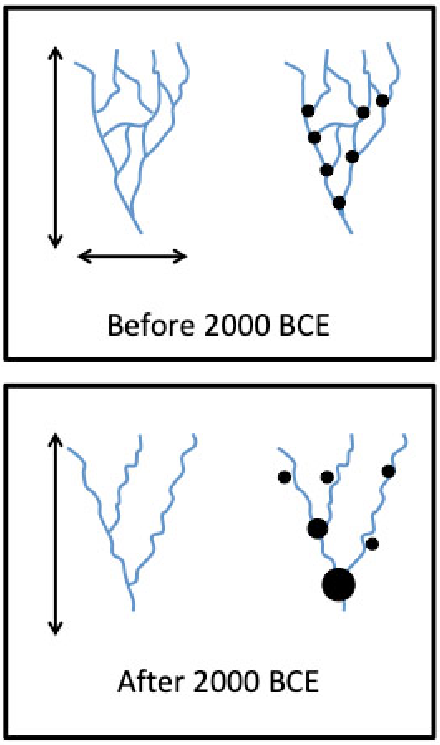

Fig. 2: Diagram to indicate the connectivity of the Delta distributary system before and after 2000 BC. Before 2000 BC there are a large number of well-connected distributaries in a nutrient-rich environment, whereas after 2000 BC the number and connectivity of the distributaries is reduced, as is the nutrient availability. By author.

Migration of the Delta head

The modern Delta head is just north of Cairo, the modern capital of Egypt, but David Jeffreys (Jeffreys and Tavares 1994) has long suspected that the Delta head may have moved within the landscape. Much debate has focused on the location of Itj-Tawi (the two lands), Middle Kingdom capital of Egypt, with candidates at Lisht and elsewhere being proposed. Bunbury and Jeffreys (2011) propose that Itj-Tawi may be a toponym that reflects the location of the Delta apex and may, therefore, have moved as the Delta apex moved.

Table 1: Delta apex positions through history taken from a literature review. Location numbers refer to the map in Fig. 1, with the distance south measured from the present day apex (P) at 30o10'45"N, 31o10'44"E.

Location	Distance South / km	Estimated date	Error in date / years	Source
Present (P)	0	2000 AD	0	GoogleEarth
1	18.4	700 AD	+/- 300	Jones 1997
2	36.3	3000 BC	+/- 200	Diodorus via Rennel 1830
3	36.3	3000 BC	+/- 500	Lutley 2007
4	36.3	3000 BC	unknown	Jeffreys 1985
5	47.3	70 AD	+/- 5	Pliny via Rennel 1830
6	49.7	25 BC	+/- 5	Strabo via Rennel 1830
7	57.2	300 BC	+/- 50	Ptolemy via Rennel 1830
8	89.3	unknown	unknown	Calculated this work

Evidence was compiled from historical texts, geological and archaeological investigations, and this enabled nine discrete points to be identified as likely Delta apex positions through history, as shown in Table 1. The points show a northward trend of the apex over the last 3,000 years, but a southward trend before that. This suggests an change in direction of Delta apex migration around 3000–4000 BP. We would, therefore, expect that the reduction in branches of the Nile started around 3,000 years ago as the apex began again to move northwards.

Observations of the topography of the Nile Valley floor (Pryer 2012) taken from the contours of the Egyptian Department of Survey and Mines in 1934 (Egyptian Survey Authority 1997) suggest that there is no second set of levees created by a second channel of the Nile any further south than Meidum (Fig. 3). From this observation we infer that the Delta apex cannot have been further south than this location.

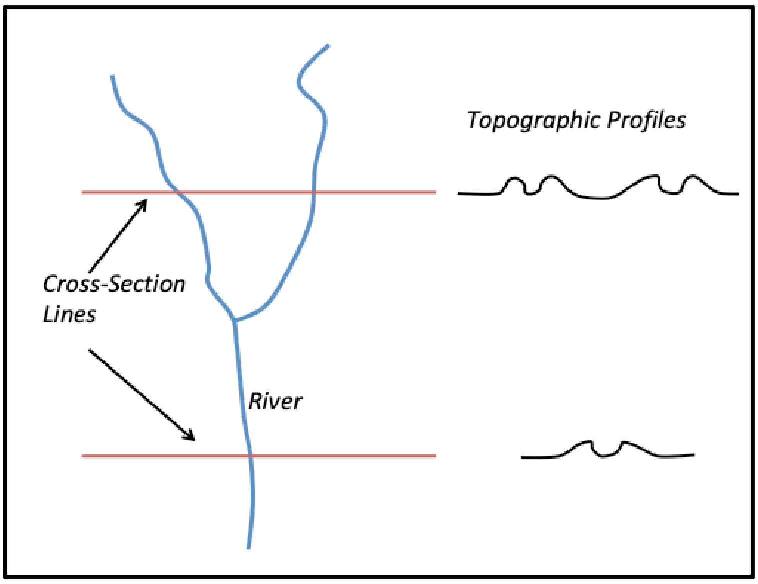

Fig. 3: Diagram to show how ancient channels can be identified from topographic maps. In this case the contours from the Egyptian Department of Survey and Mines 1934 show that there is no evidence for two channels further south than Maidum (Meidum). By author.

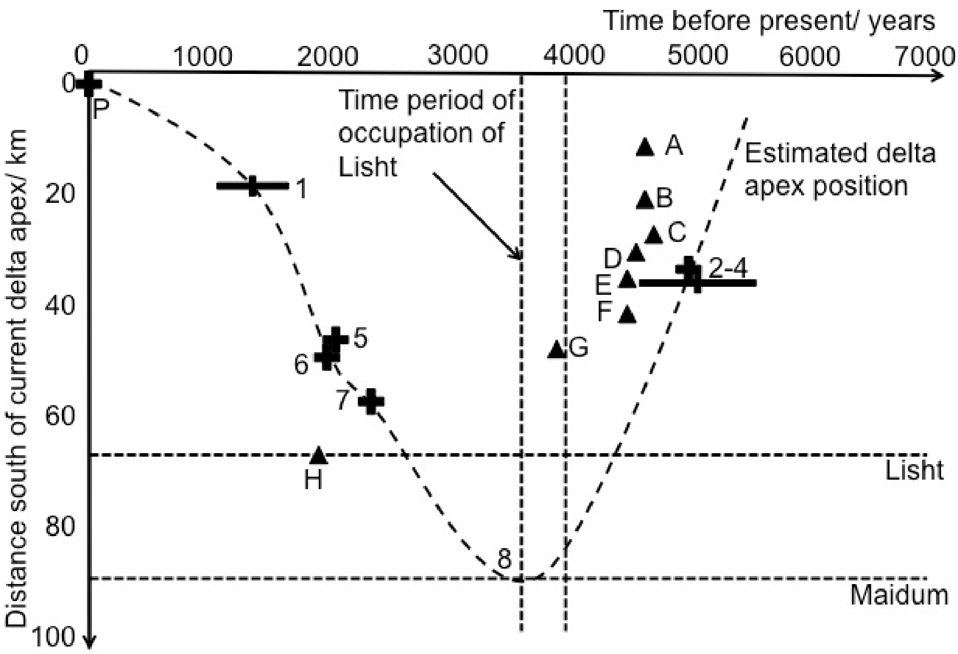

Fig. 4: A graph of distance of modelled apex south of current position against time with the apex locations from Table 1 shown with crosses (the length of whose arms indicate the range of the location and date values) and the pyramid locations from Table 2 (below) shown as triangles. The coarse dashed line shows an interpolation of the delta apex positions while the fine dotted lines show time or location constraints. By author.

Pyramid field locations in northern Egypt

It is observed that the pyramid fields in northern Egypt (summarised in Table 2) seem to change location frequently (Barta 2005) for reasons that are not entirely clear. A plot of pyramid field location (superposed on Fig. 4) with our inferred position of the Delta apex suggests that the pyramid fields broadly track the locus of the Delta apex through space and time. Since the delta apex is also a point through which river traffic frequently passes, we propose that the location of the Delta apex was one of the factors that stimulated migration of the chosen sites for pyramid fields during the period 2649–1800 BC. However, as we have seen, as the apex began again to move northwards around 3,000 years ago, there was a reduction in the number of the branches of the Nile Delta, creating a stable Delta distributary system. The new stable distributaries north of Memphis in the Delta region allowed cities such as Naukratis to flourish.

Table 2: Table showing the locations of northern Egyptian pyramid fields that are plotted in Fig. 4. Distances are shown south of the current Delta apex (P in Fig. 1) at 30o10'45"N, 31o10'44"E.

Label in Figure 4	Pyramid Field Location	Distance south / km	Dates of importance
A	Abu Rawash	12	2558 BCE
B	Giza	22	2566-2503 BCE
C	Zawyet el-Aryan	26.8	2637-2500 BCE
D	Abusir	30.8	2477-2422 BCE
E	Saqqara	35.8	2649-1800 BCE
F	Dashur	41.5	2600-1800 BCE
G	Mazghuna	47.9	1800 BCE
H	El-Lisht	67.4	1962-1800 BCE

Conclusions

The foundation of Naukratis as a Greek trading colony came at a time when the Delta distributary system had re-stabilised after a period of global sea-level rise. During sea-level rise the number and mobility of the distributaries increased. The resulting environment was rich in marshes and cross-linkage between the distributaries allowed easy access from one part of the Delta to another. Geographically, no area was privileged with greater accessibility or provision of food. However, as the sea level stabilised so did the Delta, with the number of marshes and distributaries gradually reducing until the remaining distributaries were linked principally through the Delta apex. At this time, certain geographical positions had greater accessibility and a stronger food supply; Naukratis was at one of these nodes. In addition, the reduction in rainfall at the end of the African Humid Period around 4,000 years ago (Drake and Bristow 2006) meant that the distributaries were unlikely to meander significantly. By the time that Naukratis was founded, its location commanded a relatively stable branch of the distributary system, strategically placed between the coast and the Delta apex in the Memphis area.

Bibliography

Barta, M. 2005. Location of the Old Kingdom pyramids in Egypt. *Cambridge Archaeological Journal* 15 (2): 177–91.

Berendsen, H. and Stouthamer, E. 2001. *Paleogeographic development of the Rhine-Meuse Delta, the Netherlands*. Assen.

Bunbury, J. M. and Jeffreys. D. 2011. Real and literary landscapes in ancient Egypt. *Cambridge Archaeological Journal* 21: 65–76.

Dewald, C tr Waterfield, R, 1998. Herodotus The Histories. Oxford University Press, England.

Drake, N. and Bristow, C. 2006. Shorelines in the Sahara: Geomorphological evidence for an enhanced monsoon from palaeolake Megachad. *Holocene* 16: 901–11.

Egyptian Survey Authority. 1997. 1:50,000 series map. Sheet BARNASHT NH36-E6a.

Jeffreys, D. 1985. *The survey of Memphis* I: *The archaeological report*. The Egypt Exploration Society Occasional Publications 3. London.

Jeffreys, D. and Tavares, A. 1994. The historic landscape of dynastic Memphis. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 50: 143–73.

Jones, H.L., 1932. Strabo Geography Book 17, 1:4 Loeb Classical Library, Ed Henderson, J and Goold, G.P. Harvard University Press, London.

Pennington, B. T. 2017. Environmental change in deltaic settings and the emergence of civilisation: A study in palaeolandscape reconstruction focussing on the mid-Holocene Nile Delta. Unpublished PhD thesis, Southampton University.

Pennington, B. T., Bunbury, J. M. and Hovius, N. 2016. Emergence of civilisation, changes in fluvio-deltaic styles and nutrient redistribution forced by Holocene sea-level rise. *Geoarchaeology* 31 (3): 194–210.

Pennington, B. T., Sturt, F., Wilson, P., Rowland, J. and Brown, A. G. 2017. The fluvial evolution of the Holocene Nile Delta. *Quaternary Science Reviews* 170: 212–31.

Pennington, B. T. and Thomas, R. I. 2016. Paleoenvironmental surveys at Naukratis and the Canopic branch of the Nile. *Journal of Archaeological Science: Reports* 7: 180–188.

Pryer, L. 2012. The landscape of the Egyptian Middle Kingdom capital Itj-Tawy. Unpublished MSci thesis, University of Cambridge.

Said, R. 1962. *The geology of Egypt*. New York.

Stanley, D. J. and Warne, A. G. 1993. Nile Delta: Recent geological evolution and human impact. *Science* 260: 628–34.

Stanley, D. J. and Warne, A. G. 1994. Worldwide initiation of Holocene Marine deltas by deceleration of sea-level rise. *Science* 265: 228–31.

Tristant, Y. 2006. L'occupation humaine dans le delta du Nil aux 5e et 4e millénaires. Approche géoarchéologique à partir de la région de Samara (delta oriental). Unpublished PhD thesis, École des hautes études en sciences sociales, Paris.