



# Paleoenvironmental surveys at Naukratis and the Canopic branch of the Nile



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## ABSTRACT

Thirty-five auger cores (covering an area of c. 1 km<sup>2</sup>) were undertaken at the ancient site of Naukratis in the Nile Delta, an important trading port from c. 620 BCE until 650 CE, supplemented by an Electrical Resistivity Tomography (ERT) profile. These data inform on the location and navigability of the Canopic branch of the Nile, a river that was a major communication, trade and transport artery between Egypt and the Mediterranean during this period; and on the evolving relationship between the river and the port of Naukratis, Egypt's primary Mediterranean trade hub during the Late Period (664–332 BCE). The Canopic branch of the river was located to the west of the settlement and was c. 5 m deep and c. 200 m wide, aggrading at 1.1–2.4 mm/yr. During the Late Period the river channel abutted the site, before migrating westwards, away from the edge of the town, during the closing centuries BCE. A swampy backwater was left directly beside the site, which silted up and was built over in Roman times. The river itself ceased to flow during the later first millennium CE, after which it was canalised.

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## 1. Introduction

The Canopic branch is the westernmost of the ancient trunk channels of the river Nile in the Nile Delta (Fig. 1), and was a major trade route into Ancient Egypt between the Late Period and Byzantine times, before silting up at the end of the first millennium CE (Cooper, 2014). Today it is all but invisible at the surface. Over the past thirty years, both geoarchaeological and text-based investigations have been undertaken to help understand the evolving relationships between the Canopic, contemporaneous settlement, transport, and navigation; an increasingly detailed picture is now emerging for different portions of the river. Unfortunately, however, the spatial dimensions of the river (and thus its capacity for carrying large seagoing vessels) are unknown; and its relationship to the major port of Naukratis c. 70 km upstream has been controversial for over a century (Thomas and Villing, 2013). In order to resolve these longstanding controversies at Naukratis, as well as shed light on the dimensions and navigability of the river, an auger survey was initiated in the context of new archaeological fieldwork at the site (Thomas, 2014, 2015; Thomas and Villing, 2013; Villing et al., 2013–2015).

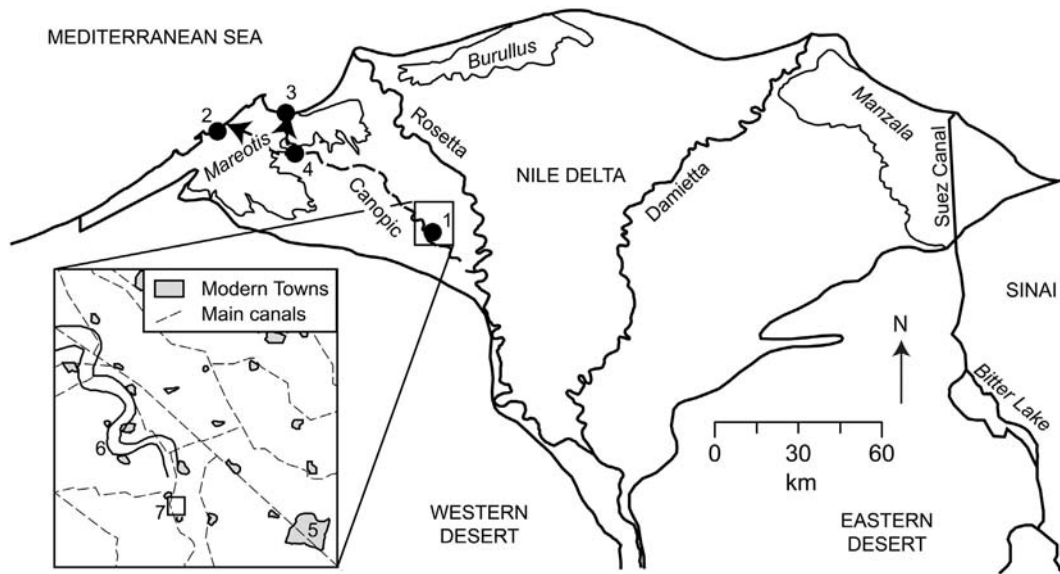
### 1.1. Previous research on the Canopic

Both textual sources and geoarchaeological evidence have been used to suggest the overall course of the Canopic, as well as shed light on its demise. Ancient sources mention the Canopic river in the context of being one of the two main trade routes (along with the eastern Pelusiac branch) into Egypt during the Late Dynastic, Hellenistic and Roman periods (Herodotus 2.179; Strabo 17.1.4; Ptolemy 100–2; see Cooper 2014, p. 30; Möller, 2000) and into the Byzantine period (Cooper 2014, p. 30; Sijpesteijn et al., 2011), between c. 664 BCE and 640 CE. At the main river mouth, the important ports of Herakleion and Canopus were located (Constanty, 2002; Goddio and Fabre, 2008; Goddio, 2007), destroyed following successive catastrophic events in the 2nd century BCE and the 8th century CE. Texts suggest that the river then appeared to have suffered a gradual demise and loss of navigational capacity during the Islamic era (Cooper 2014, pp. 58–60, 63, 122, 201, 209, 251; Bernard, 1970; Tousson, 1922, 1925, 1934), although seasonal, possibly canalised, vestiges survived into the 13th, 15th and possibly 17th centuries CE (Cooper, 2014, p. 60).

Much of the river's course has been reconstructed along the Islamic-era Abu Diyab canal (Cooper, 2014), although sources record an additional channel having been constructed in the late 4th century BCE when the waters of the Canopic branch were split at Schedia (Bergmann and Heinzelmann, 2004; Blue and Khalil, 2011, pp. 9–11, see Fig. 1), to provide a navigable link to the new city of Alexandria. This channel also suffered a gradual demise during the Islamic period,

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**Fig. 1.** Map of the Nile Delta showing positions of river channels, lagoonal areas and localities mentioned in the text: 1) Naukratis; 2) Alexandria; 3) Herakleion/Canopus; 4) Schedia; 5) Itay el-Barud; 6) course of the Canopic as traced by Wilson (2007); and 7) location of Fig. 2.

and it was only through regular canal-building schemes and channel maintenance that navigable routes to Alexandria were maintained (Cooper 2014, pp. 63–65).

The research that has thus far been carried out on the Canopic river within a scientific framework has generally served to back up the textual evidence. At the mouth of the Canopic in Abu Qir bay, core-drilling and analysis of SRTM imagery (Chen et al., 1992; Stanley and Jorstad, 2006; Stanley et al., 1996, 2004) were used to suggest that the river ceased to flow at the end of the first or the beginning of the second millennium CE, in broad agreement with the textual evidence which notes a demise through the Islamic era. These studies also further showed that the Canopic was in existence since c. 4000 BCE (Stanley et al., 2004). The splitting of the waters at Schedia is also confirmed by auger and magnetometry surveys (Ghazala and El Shahat, 2005; Strutt, 2005), while its course upstream along the Abu Diyab canal has been broadly confirmed by analysis of satellite images, Survey of Egypt 1:50,000 maps and Edelman-style hand auger surveys as part of the Western Nile Delta Regional Survey (El-Awady, 2009; Wilson and Grigoropoulos, 2009, pp. 68–69; Wilson, 2007, 2010), as well as by electrical resistivity analysis (el-Gamili et al., 1994).

### 1.2. Previous research at Naukratis

From the late 7th century BCE onwards, Naukratis – situated c. 70 km upstream of the sea on the Canopic river – was one of the most important ports in Egypt, where trade between Egypt and the Greek Mediterranean was concentrated and regulated (Arnauld, 2012; Herodotus 2.179; Möller, 2000). Unfortunately, while the course of the Canopic has been mapped directly north of Naukratis (el-Gamili et al., 1994; Wilson, 2007, 2010; see Fig. 1) the relationship of the Canopic branch in its middle section to this major port town has never been well-understood, despite over a century of archaeological research at the site (Thomas and Villing, 2013).

Naukratis was originally excavated by Flinders Petrie and Ernest Gardner between 1884 and 1886 (Gardner, 1888; Petrie, 1886), then by David Hogarth in 1899 and 1903 (Hogarth et al., 1899, 1905). Since that time the site has constantly been under threat from the actions of *sebbakhin* (local farmers who dig out the mudbrick for use as fertilizer on their fields), and during the early 20th Century this quarrying continued such that by the time the next archaeologists to work at the site arrived in the 1970s and 1980s (Coulson and

Leonard, 1979; Coulson, 1996; Coulson et al., 1982; Leonard, 1997, 2001), the area where previous excavations had been was by then an enormous man-made lake some 3 or 4 m deep (Fig. 2). Recently the lake has been drained, access to the site of the original excavations is now possible, and new archaeological and geoarchaeological fieldwork has been undertaken at the site since 2012 (Thomas, 2014, 2015; Thomas and Villing, 2013) as part of an on-going reassessment of Naukratis by the British Museum (Villing et al., 2013–2015).

The location of the Canopic relative to the settlement has been controversial since excavations began. Ancient textual sources confirm that the Canopic existed near the site in antiquity (Herodotus 2.97, 2.179; Strabo 17.1.4; Ptolemy 100–2), but these texts are contradictory on where the river was located, with Herodotus possibly placing it to the west, and Strabo and Ptolemy to the east (Bernard, 1970, pp. 618–623; Möller, 2000, pp. 115–116; Petrie, 1886, pp. 2–4). Geoarchaeological evidence to locate the position of the river relative to the site is also both ambiguous and limited (Thomas and Villing, 2013, pp. 91–94). Petrie initially suggested the river abutted the western edge of the site on the basis of a “thick bed of black mud” at the western limit of the town (the western margin of the modern-day lake) which he thought was “some old dock or pond” for sea-going vessels (Petrie, 1886, p. 10). Hogarth instead placed the river to the east, based upon finding “clean wet black river sand” at the base of his pits at Rashwan, just north of Abu Mishfa (Hogarth et al., 1905, pp. 122–123).

Sedimentary information from a borehole survey of fourteen cores carried out as part of the fieldwork in the 1970s and 1980s (Coulson, 1996, p. 9; Leonard, 1997, p. 28; Villas, 1996) (Fig. 2, Table 1) was then used initially to suggest the river flowed southeast-northwest, through the town (Coulson et al., 1982, p. 75; Möller, 2000, p. 116), and in a future publication southwest-northeast, also directly through the centre of the settlement (Villas, 1996). Neither of these scenarios acceptably meshes with the archaeological evidence (Thomas and Villing, 2013), and the placement of the majority of the boreholes of this survey within the confines of the ancient town makes it difficult to believe the conclusions about the regional geology. Finally, the results of regional electric resistivity analysis (el-Gamili et al., 1994) suggested the river flowed in two channels, one either side of the settlement. Clearly, a new programme of geoarchaeological fieldwork was required in order to resolve the controversy surrounding the position of the Canopic relative to the site.

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