A Nilometer from Graeco-Roman Thmouis: Hydrographical, Historical, and Ideo-Political Significance in Hellenistic Egypt

Jay E. Silverstein[1], Robert J. Littman[2], Stacey Anne Bagdi[3], Elsayed F. Eltalhawy[4], Hamdy Ahmed Mashaly[5], Emad Hassan Mohamed[6] and Mohamed Gabr[7]†

[1] Cranfield Forensic Institute, Cranfield University, College Road, Cranfield MK43 0AL, *United Kingdom*

Email: jay.e.silverstein@cranfield.ac.uk

[2] Languages and Literatures of Europe and the Americas, University of Hawaii, 1890 East West Road, Honolulu, Hawaii 96822, *USA*

Email: littman@hawaii.edu

[3] Ludwig-Maximilians-Universität München, Katharina-von-Bora-Straße 10, 80333 München, *Germany*

Email: stacey_bagdi21@hotmail.co.uk

[4] Egyptian archaeology, Tanta University, Building 2 B—Al-Shennawy Residence, Mansoura, 31527, *Egypt*

Email: altalhawy@yahoo.com

[5] Al Mansoura Office of the Ministry of Antiquities, Al-Shennawi Residences, Al-Tawhid Mosque, Building 2, Mansoura 35511, *Egypt*

Email: hamedymashaly@gmail.com

[6] Al Mansoura Office of the Ministry of Antiquities, Al-Shennawi Residences, Al-Tawhid Mosque, Building 2, Mansoura 35511, *Egypt*

Email: emad.hassan22@yahoo.com

[7] Egyptology Department, Faculty of Arts, Tanta University, 31527, *Egypt*

Abstract

In 2010, a construction project for a new water pumping station on the west side of Tell Timai (Egyptian Delta) encountered a limestone structure. This discovery triggered a salvage excavation that exposed a rare example of a well-preserved Delta nilometer. The architectural features of the nilometer reveal some specific and even unique adaptations consonant with the hydrological situation of the Graeco-Roman city of Thmouis. Unlike other examples of nilometers, an aqueduct runs from the north, spilling into the stairwell leading down into the stilling well. A dam stone in the aqueduct appears to have regulated the release of water. The nilometer was also articulated with an adjacent hill by a staircase. Folk tradition memorialised the stair and nilometer location in local fertility and healing rituals performed during Nile flood-related festivals; this tradition preserved the sacred space long after the nilometer and its associated architecture were buried and forgotten. The multifaceted role of the Thmouis nilometer in the cultural and economic life of the city and nome carries wider implications for *the political organisation of the nome and the dynamic between syncretic forces and imperial appropriation in Graeco-Roman Egypt. Here we review the shape, function, archaeological context, ideological significance and hydrography of the nilometer and consider the implications of the nilometer for the history of the Mendesian nome and its sacred relationship with the Nile River.*

Keywords: *Delta, Isis, Mendes, Nile, Nilometer, Tell Timai, Thmouis*

Introduction

The Mendesian nome is situated between the now defunct Mendesian and Tanitic branches of the Nile Delta (Figure 1). For most of ancient Egyptian history, Mendes served as the nome capital; sometime after the arrival of Alexander the Great, however, the southern extension of the city, Thmouis (Tell Timai), usurped Mendes' position as the core city of the nomarchy. Archaeological data provide clues to the influences underlying the political and ideological transformation of the nome. The discovery of a nilometer on the west side of Thmouis is one of the most recent contributions to this discourse.

>>Insert Figure 1 about here<<

The first objective of this paper is to collocate the nilometer within the palaeogeographic and hydrological environs of ancient Thmouis. This entails comparative analysis with nilometers in other hydrographies and a look at the functions of nilometers through history, thereby placing the Thmouis nilometer in a larger Egyptian context. The second goal is to examine traditions derived from the archaeological and ideological context of the Thmouis nilometer and to consider how the nilometer articulated with the historical, sacred and urban landscape. The continuity of ritual significance at the location of the nilometer from ancient to modern times, even after all architectural elements were long buried, illustrates the persistence of cultural memory in the regional landscape (Bagnall 1993; Schama 1995; Frankfurter 1998; Assman and Livingstone 2006; Bagdi 2013). Resilience to assimilation and acculturation to imposed imperial values cannot truly be understood as falling upon a single axis of cultural continuity and change, but rather occurs in local contexts and multiple dimensions of society, and in response to deliberate and inadvertent forces of cultural imposition (Hingley 2005; Ghisleni 2018). Thus, the Thmouis nilometer provides a rare example of the resilience of sacred landscapes even in the face of episodes of iconoclasm aimed at eradicating Egyptian religious traditions.

Thmouis lies 500 m south of Mendes (Tell el Rub'a) and, at times, the two have been mapped or envisioned as a single entity. The current town of Timai El-Amdid flanks Tell Timai on the east, and Kafr Al-Amir Abd Allah blends with the tell on the west (Figure 2). Over the last several decades, parcels of land on the edges of the archaeological site have been given to the towns for various construction projects, including a garbage dump, a propane storage facility, a school and apartment buildings. Pre-dating these constructions is a modern cemetery situated on a hillock on the west side of the tell, just 100 m southeast of the renowned mosque of Abdullah Ibn Salam. An allotment of land at the base of the west side of the cemetery hill was dedicated to the construction of a water pumping station. The area had been previously examined through the use of salvage test pits; these pits, however, did not penetrate to a sufficient depth to detect any significant architecture. In 2010, as the foundations for the pumping facility were dug, workmen encountered a limestone block structure. Archaeologists from the Ministry of Antiquities quickly intervened. The ensuing archaeological excavation revealed an intact nilometer.

>>Insert Figure 2 about here<<

The discovery of this nilometer enhances our understanding of the physical, spiritual, and political history of the Mendesian nome and Ptolemaic Egypt. To set the stage for interpreting the nilometer, we review the evolution of the urban centres of the nome, the cultural significance of nilometers in Egypt, and geohydrological factors influencing nilometer construction. This is followed by an assessment of the archaeology of the Thmouis nilometer, the hydrographic and political inferences, and the legacy of the nilometer as sacred space in regional traditions.

The Relationship Between Mendes and Thmouis

Mendes was a dominant town in Egypt for thousands of years, and with the consolidation of Upper and Lower Egypt it became the seat of rule for one of the initial eleven nomes of the 'Land of the Flood' (Redford 2010: 14). As the nation and empire of Egypt developed, 'Anpet, the Egyptian name for the Mendesian nome, became further integrated into the state's pan-Egyptian religious, economic and political structures (Redford 2010). According to legend, Horus, the harbinger of unification, delivered his father's spirit, Osiris, from his home in Abydos to the territories of Egypt (Redford 2010: 34). The gift of fertility and renewal enshrined 'Anpet as the 'Abiding Place' or *Djedet* (i.e., the burial locale) of the backbone and *ba* (the soul's personality aspect) of Osiris where the deity manifests as the ram god Banebdjedet.

As Egyptian political organisation evolved, the Mendesian name became better known as Kha, the 16th nome of Lower Egypt. When the superstructure of the Egyptian state broke down in the Third Intermediate Period (1069–664 BC) (see Table 1 for all chronological periods mentioned), some of the more powerful cities began to assert their position over the political chaos and Mendes, then well-established as a seat of noble, priestly and strategic power, became a major player on the political stage. The impressive temple complex of Banebdjedet was matched by powerfully placed priests, nobles and the professional military force of Kalasirians—Herodotus (*Histories* 2.166.1) references both Mendes and Thmouis among eleven settlements of this warrior caste (Thebes, Bubastis, Aphthis, Tanis, Mendes, Sebennys, Athribis, Pharbaïthis, Thmouis, Onuphis, and Anytis). The assertive nature of the rulers of Mendes led Redford (pers. comm., Sept. 2021), who directed excavations at Mendes for decades, to refer to the city from the Third Intermediate Period forward as the 'Bad Boy' of the Delta.

>>Insert Table 1 about here<<

The city frequently appears as a major player both in internecine struggles and as a centre of resistance against outsiders, most notably the Persians. The constellation of important temple cities in the central-eastern Delta, including Mendes, Busiris, Sebennytos, Sma-Behdet, and Behbeit el-Hagar, appear united in the Osirian-Isis cultic tradition, and their lineages of nobility dominated the region and much of Egypt during the last Egyptian dynasties (e.g., Gallo 1987; Elbayoumi Mohamed 2018). Supporting these major centres was a network of subject towns that formed the economic infrastructure harvesting the wealth of human and natural resources of the Delta. Mendes rose to become the capital of Egypt in Dynasty XXIX, and a crown then passed to Sebennytos for the 30th Dynasty before Egypt was reconquered by Artaxerxes III in 343 BC. Mendes, as an epicentre of resistance in the renegade satrapy, felt the heavy hand of Persian retribution (Redford and Redford 2004: 34; Littman and Silverstein 2020).

Mendes held the status of the primate city of the region from the Old Kingdom to the Ptolemaic period, a status visible in the remains of impressive walls, tombs and temples that includes the largest standing temple. Alexander the Great liberated Egypt in 332 BC and by 305 BC, Ptolemy I Soter had solidified his role as Pharaoh, initiating the Ptolemaic dynasty. The Ptolemaic pharaohs depended on the support of priests and nobles of the Egyptian power networks, and Mendes was a key node within this structure. Ptolemy II Philadelphus visited Mendes to participate in the annual festival and processional ritual, as recorded in the Great Mendes Stele. Its inscription reveals a mix of demands and concessions which illustrate the negotiated relationship between Alexandria and the power centres of old Egypt. It was a time of great change, as migrants flowed in from the Hellenistic world (Knight 2019; Lewis 2001), and every aspect of Egyptian culture faced reforms. Syncretic religions emerged, a monetary economy was introduced and new systems of taxation and bureaucracy blended into the traditional temple-based organisation (Crawford *et al.* 1980; Bagnall 1984; Johnson 1986; Brunsch 1987; Frankfurter 1998; Lewis 2001; Fischer-Bovet 2007; Reden 2010; Adler 2012). These transformations seem to herald a more ominous future for Mendes; during the later Hellenistic or early Roman period, Thmouis took over the position of nome capital.

The two cities were thereafter entwined in a dynamic relationship related to religion, Hellenistic imperialism, economics, the hydrologic evolution of the Nile and Hellenistic geopolitics. The decline of Mendes and the rise of Thmouis has been attributed to the possible movement of the Nile away from Mendes. This hypothesis assumes that the riverscape changed, favouring the harbour of Thmouis as the Mendes harbour filled with silt; this idea, however, has not gone unchallenged. Another factor may have been that, as a consequence of the Great Rebellion (207–185 BC), the Ptolemaic dynasty invested in developing a Greek colony at

Thmouis to strengthen its control of the region (Littman and Silverstein 2017). In this hypothesis, the silting of the Mendes harbour may have been due to the cessation of maintenance, reflecting a deliberate Ptolemaic imperial strategy. The discovery of a nilometer at Thmouis adds a new piece to this puzzle by confirming the location of the western arm of the Mendesian branch of the Nile and the possible location of the river harbour at Thmouis. The harbour and the sacred precinct around the nilometer would have been key elements of urban infrastructure necessary for Thmouis' rise in power.

Nilometers: Form and Function

A review of the form and function of nilometers in Egypt provides a baseline for evaluating the hydrological situation and sacred significance of the one found at Thmouis. Nilometers include some variation on the following architectural elements: a vertical column that reaches below the surface of the river that can serve as a stilling well (a room connected to a main body of water) or water crypt (a pool designed to hold water for purification rituals associated with the worship of Isis); an open articulation with the living waters of the Nile; and a staircase that can provide both ritual access and a graded measure of water levels (Kleibl 2007; Wild 1981). Given these parameters, the specific form of nilometers conforms to stylistic norms, specific engineering constraints related to the regional hydrography and geology, and the articulation of the nilometer within the larger religious precinct. The majority of surviving nilometers date from the Late (664–332 BC) and Graeco-Roman periods (332 BC–642 AD).

Although classification characteristics may vary slightly depending on the perspective and purpose of the authors (e.g., Wild 1981 Friedman 2014; Osama *et al.* 2016), here we consider four types of nilometer posited by Osama *et al.* (2016) for comparative purposes: (1) a walled stairwell descending to a pool that opens to the Nile, as seen at the temple of Amon-Re at Karnak; (2) those with a square or circular well with a spiralled staircase, exemplified by the nilometers of Horus Behdet at Edfu, Horus the Elder and Sobek at Kom Ombo, and of Mandulis at Kalabsha; (3) rectangular basins or water crypts with steps, as seen at the Serapeum of Alexandria or the Temple of Khnum at Elephantine; and (4) columnar examples, in which a central graduated stone column was placed within a stilling well, thus overlapping with other forms of nilometer. Columnar nilometers appear in the Ptolemaic period (332–330 BC) and continued in use throughout the Islamic period (AD 642–present) as exemplified with the still functional example at Rhoda in Cairo or in Roman documents referring to the nilometer at the Serapeum in Alexandria (Osama *et al.* 2016: 28-29). The hybrid and modified styles demonstrate stylistic seriation over time associated with cultic changes (Vidman 1970; Wild 1981; 1984), while also indicating that specific design features aligned with the particular hydrologic situation of temple locations and specific ritual needs. Changes in style over time, however, are not well understood, because of the paucity of data on earlier Pharaonic nilometers.

In all cases, nilometers served as a source of sacred Nile water necessary for purification rituals, libations and communication with the deified Nile. Nile waters played a pre-eminent role in the cults of Osiris and Isis, who were associated with fertility, renewal and the annual inundation (Wild 1981; Jaritz 1986; Witt 1997; Liptay 2019; Vasilyeva and Malykh 2020 Meister *et al.* 2021). The holy Nile waters in Egypt, and possibly imported regional substitutes, were used in a dedicated water jar (*hydria)* (Delia 1992) and with sacred ritual paraphernalia (*instrumenta sacra*) for ablutions and offerings such as libation saucers (*paterae*), stirrup-handled offering jugs (*situlae*) and libation tablets (Rüpke 2018). The role of temples in regional economies also meant that nilometers served a practical purpose as a means for measuring the height of the Nile during the annual flood (Borchardt 1906; Jaritz 1986).

From the origins of Egyptian civilisation until the construction of the Aswan High Dam in 1970, the annual inundation determined the agricultural and ritual cycle and defined the seasons. The Egyptian year was divided into three seasons. The first was *Akhet*, from mid-July to mid-November. During this period, the Nile would burst its banks and flood the adjacent plain. The waters receded in September and October, leaving behind rich alluvial deposits of fertile black silt. During the following season, *Peret*, which extended from mid-November until the middle of March, the crops were planted and grown. The last period, *Shemu*, ran from mid-March to July and marked the harvest period (Parker 1950).

If the inundation was too low, the flood would not cover sufficient area, nor would the alluvial deposits be as rich. The result was often famine. If the inundation was too high, the water destroyed the infrastructure built on the flood plain. During the pharaonic period, the inundation was inadequate or over-abundant in about one year in five. Monitoring the river using a nilometer thus had political and administrative aspects, and data from nilometers allowed priests to use flood measurements to adjust taxes (Bonneau 1986; Sandri 2017). During the onset of the inundation season, the level of the river was monitored daily by the Egyptian priesthood to predict the flood volume, which drove the development of nilometers. The first possible mention of measurements of the Nile date to the 1st and 2nd Dynasties (*ca.* 3000 BC), as recorded on the Palermo Stone in the 5th Dynasty (2494–2345 BC) (Wilkinson 2000). However, we do not know how the river's depth was measured before the Ptolemaic period. As the nexus of the divine aspect of the Nile and the seasonal periodicity of the inundation, nilometers played a key role in the Egyptian ritual calendar.

Festivals and Inundation Levels

The most famous extant nilometer is in Cairo, on the island of Rhoda (Cresswell 1979; Popper 1951). It was built by the Abbasid caliph Al-Mutawakkil ala Allah in AD 861 on the site of a previous nilometer that dated to the Umayyads, in AD 715. It was designed by the Muslim astronomer Alfraganus and is original except for the wooden conical roof and the dome, which were rebuilt in the eighteenth century. From the structure of the Cairo nilometer, we can gain insights into its uses in antiquity. The square stilling well is connected to the Nile by three tunnels, each at a different elevation. Forty-five steps lead down to the bottom of the stilling well, and the column is graded and divided into 19 cubits. Cubits were equal to about 52.35–52.92 cm (Egyptian royal cubits as opposed to later Greek [about 46 cm] or Roman [44.4 cm] cubits), and a cubit was subdivided into 24 digits (Stone 2014). Thus, the water levels can be measured up to about 10 m. As in pharaonic times, the Caliphate used the nilometer measurements to regulate and distribute water and compute the levy of taxes. Held in conjunction with the inundation was the medieval celebration of the Fath al Khalij, the Festival of the Opening of the Canal. When the river reached 16 cubits, a dam was opened to flood the canals. Prayers were said in a nearby mosque, and decorated boats would crowd the river (Cresswell 1979; Ishiguro 2002; Frenkel 2008; Oestigaard 2009).

Continuity in nilometer function and form is seen across time and cultures (Sandri 2017). A sxith-century AD Coptic prayer entreated the Nile flood to reach 16 cubits (Milne 1927: 199-200). A papyrus from Karanis dated to the secondcentury AD records daily observations of the Nile as the flood recedes from its maximum of 16 cubits and 22 digits (Pearl 1956; Zaki 2010). Roman coins minted in Alexandria captured the symbolic importance of the optimal flood level by depicting the river god Nilus holding a cornucopia with the Greek number 16 (Curtis 1955; Clay 1970; Lichocka 2015). A mosaic from Sepphoris in Galilee (Israel), dated to the fifth century AD, depicts a Nile festival. The conically topped nilometer column is graded with the numbers 15 and 16, and a youth is seen working at the top engraving the next number, 17 (*IZ*), with a chisel (Weiss 2008).

Pliny the Elder (*Natural History* 5.17-20), writing in the first century AD,

> recounted the consequences of different flood levels: When the water rises to only twelve cubits, it [i.e. Egypt] experiences the horrors of famine; when it attains thirteen, hunger is still the result; a rise of fourteen cubits is productive of gladness; a rise of fifteen sets all anxieties at rest; while an increase of sixteen is productive of unbounded transports of joy. The greatest increase known, up to the present time, is that of eighteen cubits, which took place in the time of the Emperor Claudius; the smallest rise was that of five, in the year of the battle of Pharsalia.

Herodotus, whom Pliny the Elder references, recorded 16 cubits as the optimum for prosperity in Upper Egypt (Herodotus, *Histories* 2.13.1).

Annual variations in the inundation determined years of famine and years of abundance based on natural meteorological variability (Ludlow and Manning 2016); the flood's optimal elevation, however, also varied according to the latitude of the nilometer along the course of the Nile. Thus, while 16 cubits might be an optimal flood level at Memphis, it would be much lower in the Delta. Plutarch has the only specific mention of a nilometer in Mendes:

> They think that the risings of the Nile have some relation to the illuminations of the moon; for the greatest rising, in the neighbourhood of Elephantinê, is twenty-eight cubits,

> which is the number of its illuminations that form the measure of each of its monthly cycles; the rising in the neighbourhood of Mendes and Xoïs, which is the least, is six cubits, corresponding to the first quarter. The mean rising, in the neighbourhood of Memphis, when it is normal, is fourteen cubits, corresponding to the full moon. (Plutarch, *Concerning Isis and Osiris*, 104-105)

Kees (1961: 50), extrapolating from the Palermo Stone, suggests that from the Thinite period to the 5th Dynasty (2494–2345 BC), the Nile Delta at the site of Diospolis (Tell el-Balamun) averaged a four-cubit rise and that eight cubits and three digits resulted in extensive flooding (Bell 1970; Wilkinson 2000).

As crucial as the nilometers were for the records and festivals of the inundation, they were also designed for use in daily purification, ablution and libation. There may have been variations in how nilometers were used or the status associated with their control, resulting in some sites having multiple and contemporaneous nilometers, as seen at Elephantine, Philae and Tanis.

Geology and Morphology of Nilometers

The variation in optimal flood levels demonstrates that engineering nilometers conformed to regional geological and hydrological parameters (e.g., Zaghloul 2017). To fulfil its primary functions, a nilometer had to meet specific requirements. The divine and purifying function required free-flowing articulation with the Nile (Wild 1981; Holst-Warhaft and Steenhuis 2010;). A simple portal would suffice for temples adjacent to the river or, if the ritual space was distant, the river was connected through a more elaborate subsurface conduit. Thus, nilometers differed from standard utilitarian water wells, consisting of a vertical column penetrating the phreatic (underground water table) zone and filling through filtration and capillary action. Unlike wells that might have access features for maintenance and extraction of water, the ritual and pragmatic function required an access stairwell leading to the water crypt, allowing priests to interact with the Nile water and make required measurements.

In the south (Upper Egypt), there are a variety of geological scenarios that could influence the construction of nilometers. The Turin Papyrus (*ca.* 1150 BC) illustrates the level of scientific understanding of geological formations in Egypt (Harrell and Brown 1992), and the engineering of nilometers put this knowledge to use. Where the Nile traverses solid geological formations such as the tectonic up-thrusts of basement rock, solid islands and cataracts occur, as at the island sanctuary of Elephantine. In the far north, where the Nile empties into the Mediterranean, limestone promontories support ancient architecture such as the Serapeum of Alexandria (Said 1993; Noaman and El Quosy 2017). In these cases, the temples sit on solid foundations that channel the currents of the Nile. Construction of nilometers took advantage of their proximity to the Nile and required only a short and easily maintained tunnel or portal rather than a longer connecting channel. In contrast, Upper Egyptian sites built on more recent Holocene sedimentary layers within the narrow Nile Valley faced greater sedimentation and bank erosion challenges. Similarly, nilometers in the Delta (Lower Egypt) had to conform to foundations set in unconsolidated alluvial sediments rather than on bedrock and a broad flood plain with a web of distributaries. Thus, the form of nilometers conformed to fluvial circumstances, as can be seen in the following examples.

Upper Egypt

The 1.2 × 0.4 km river island of Elephantine close to Aswan sits upon Cretaceous bedrock at the First Cataract of the Nile. It held an important position as a garrison and the long-settled southern gateway to Africa (Johnston 1917; Jackson 2008). Khnum, the ram god and sculptor of humanity, Satis, goddess of the flood, and Anuket, goddess of cataracts, formed a triad of gods who were worshipped on the island fortress.

At the southeastern end of Elephantine's Temple of Khnum, a pair of parallel staircases descend to a rectangular nilometer basin. A door cut through the northeast wall of the water crypt leads out a short distance to the Nile. Forty metres northeast of the nilometer of Khnum is a second nilometer. associated with the goddess Satis. This one consists of a single stairwell running down to a small rectangular chamber with a wide opening cut-out of the west wall, where the waters of Nile lap freely against the steps. Along the west wall of the stairs are carved gradations, parallel columns of 12 staggered hash marks, each group a cubit and each mark a digit. The Elephantine nilometers took advantage of the immediate proximity of the Nile, and their depth accommodates the high southern flood levels.

Fifty km north of the island, the nilometer at the Kom Ombo Temple of Horus the Elder on the surface resembles the architectural style of those seen at Tanis and Thmouis. The covered stair is also common to both Delta sites and the side well that may have provided an air release also appears at Tanis; however, the engineering below includes elaborate subterranean channels cut through the rock foundation connecting it to the river (Figure 3). The site sits on the east bank of the Nile, about 95 m asl. The elaborate tunnelling was necessary to connect the stilling well to the Nile. Although some of the west side of the site is lost to erosion, the nilometer appears still to be mechanically intact. In another example, the Temple of Horus at Edfu did not fare as well as Kom Ombo. In this case, fluvial sediments pushed the Nile eastward away from the temple, leaving the nilometer almost 1 km from the river that once fed it.

>>Insert Figure 3 about here<<

Lower Egypt: Tanis

In the Delta, the impact of the river on the landscape was much more dynamic than in Upper Egypt. At Alexandria, the poorly preserved Serapeum nilometer resembles that of the Satis temple at Elephantine discussed above; the softer limestone bedrock, however, made it more vulnerable to erosion and to natural and anthropogenic changes to the river course. The sites of Canopus and Heraklion at the mouth of the Canopic branch of the Nile (see Figure 1, above) appear to have collapsed into the sea because of bank erosion (Stanley *et al.* 2004), and most tells in the Delta bear little resemblance to the riverine situation that existed at the time of their occupation (Trampier 2010; Morriss 2012; Wilson 2012; Bunbury 2013; Blouin 2014; El Gamili *et al.* 2001; Elfadaly *et al.* 2019).

Accumulations of clay and alluvial sediments form durable *geziras* (islands) in the Delta known as 'turtle-backs' (Pennington *et al.* 2017). These raised mounds were favoured for settlements because they offered a foundation elevated against the flood. Engineering nilometers in the Delta thus required adaptive strategies to address construction in unconsolidated sediments and to contend with a volatile hydrologic remodelling, as opposed to those in the southern Nile Valley where geological formations were solid (Dahms and Willems 2016). Some temples on the Upper Egyptian flood plain, however, faced some similar problems, as demonstrated by the Edfu nilometer, as noted above now nearly 1 km from the river. The closest parallel in engineering to the Tell Timai nilometer appears to be those at the temples of Mut and Amun at Tanis. There are a variety of designs there, including square and round water crypts and parallel structures of adjacent nilometers with shared stairwell walls. The diameters of the wells range from 2.0 to 6.4 m, the largest being the square well. The conjoined nilometers at the Mut temple are connected to the Tanitic branch of the Nile by a southwest-running lateral channel approximately 150 m long, constructed of large limestone blocks. The channels are ventilated by what appears to be an air shaft near the nilometer wells (Figure 4). The nilometers at the temple of Mut are the closest in form to the one at Tell Timai.

>>Insert Figure 4 about here<<

The Nilometer at Tell Timai

Although mentioned by Plutarch (*Concerning Isis and Osiris*, 43), no nilometer had been found in the Mendesian nome until the discovery at Tell Timai. The location and dating of the nilometer provide insights into the hydrography and cultural development of Thmouis. Like Tanis, Thmouis rests upon *geziras*, although the mound size was more modest than Tanis but similar in scale to the four northeast–southwest palaeolevies that support Mendes (Redford 2010: 211-12; Morriss 2012: 35). The high point of Tell Timai is on a large mudbrick structural mound in the centre of the tell at 12.1 m asl, and the lower edges drop down to sea level; however, these points are all in occupation levels, and the foundational soils have only been determined in a few locales. A sondage in the centre (Unit R13-2) of the site reached a depth of -1.45 m asl, at which point signs of significant settlement were not present. Materials above that depth do not appear earlier than the fifth century BC (Littman and Silverstein 2013: 29). Excavations and observations in looters' pits from the tell's northern periphery show fourth-century BC occupation at approximately -1.0 to -1.5 m asl, with little evidence of occupation below that. However, there has been a significant sea-level rise in the eastern Mediterranean, as well as land subsidence in the Nile Delta, meaning that current measurements in above mean sea level should not be assumed to reference the elevation during the city's occupational history (Benjamin *et al.* 2017; Stanley and Clemente 2017). Moreover, the construction of the Aswan Dam significantly modified the hydrologic regimen of the Delta.

Standard Ptolemaic nilometer architectural features present at Thmouis include a circular water crypt 2.7 m diameter, accessible from a lintelled stairwell on the north side. The well has not been pumped or excavated beyond the initial water line (it has since filled up through filtration), and it is unknown if there is an opening for a lower channel that would have articulated with the Nile **(**Figures 5–6**)**. While the full depth of the well is not known, probing suggests it exceeds 5 m from the top course of stones. The distance from the top of the opening door in the well wall to the top of the stair is approximately 2 m (Figures 7–8**)**. Like Tanis, the construction used large limestone blocks to maintain the structural integrity within the unconsolidated alluvial soils.

>>Insert Figures 5-8 about here<<

Reconstructions of the palaeocourse of the Mendesian branch of the Nile indicate a channel running along the west side of Thmouis, near the west wall of the nilometer well (Taha 1998; El-Awady 2009; Morriss 2012). Thus, unlike the nilometers of Tanis or Kom Ombo, it appears that extensive underground ducts or airflow openings were not required to maintain access to the flowing waters of the Nile. Uniquely, the Thmouis nilometer articulates with an above-ground, open aqueduct leading from the stairwell and running from the north to an unknown destination. There is a dam stone in the channel at the head of the stairwell.

There appear to be multiple episodes of construction. The lower register of limestone blocks in the well and the lintelled stairwell appear well-formed and fit, and likely represent the initial construction. The well widens slightly, creating stepped lips between bands of courses. The top courses of stones around the well seem to be constructed with reused, irregular and poorly fit limestone blocks, suggesting at least two phases of construction: an initial one with high investment and planning, and a later repair that was improvised. It is unclear if the aqueduct was part of the original design or an annex added after the initial construction.

The nilometer complex was conjoined with the adjacent eastern hill by a staircase, where the modern cemetery is situated (Figure 9). The stairway on the east slope runs up from the nilometer basin toward this, a hill that appears to be an anthropogenic mound likely formed from a Ptolemaic temple. The stair is made from well-fit foundational and step stones, demonstrating that skilled artisans and adequate funding supported the original construction. The majority of the stairway, however, is a haphazard assemblage of irregular reused stones, including column segments, a libation table and, on the north supporting face, what appears to be a stone with a calendric matrix carved into it (Figure 10a, 10b). Thus, later repairs and modifications to the stairs were made with limited skill that reused scattered architectural materials. One stray stone suggests an early Ptolemaic date (*ca.* 250 BC).

>>Insert Figures 9, 10a, 10b about here<<

Dating the Dedication Stone

Determining the date of nilometers can be problematic. For example, the nilometer at Elephantine was constructed in the Ptolemaic period and undoubtably was still in use during the Roman occupation; it was reopened and modified in the nineteenth century AD (Seidlmayer 2001). At Tell Timai, we get some inclination of the date from nearby contexts. Salvage excavations to expand the cemetery to the southeast of the nilometer found graves and artefacts dating from the early Ptolemaic (332–180 BC), Roman (30 BC–AD 642) and early Islamic periods (AD 642–750), with most from the earlier periods (Al-Sayed Mansour and Al-Morsi Abdel-Ghani 2003). The earliest datable item from the nilometer itself is a limestone block with an inscription from the third century BC, based on orthography (Figure 11). Unfortunately, the inscription was not recovered from a primary context, but from secondary-context materials used in the reconstructed hillside stairway. Other materials used in the stair dated from the Ptolemaic and Roman periods.

The use of the inscription in the later stairway suggests that it originally came from a nearby structure. Inscribed in the stone was a list of names of men and women, followed by a number. There is no indication of what the numbers refer to, but it is reasonable to surmise that they are amounts of money, since it was common in the Greek world, as it is in the modern, to acknowledge the donors to public buildings. . Since nilometers are usually found within a temple or a temple complex, we could speculate freely that this could have been a dedicatory inscription to patrons for a public construction of a nearby temple or for the nilometer itself.

>>Insert Figure 11 about here<<

The inscription reads as follows:

1. … κυσα̣ [
2. Ἀρ̣ι̣σ̣τ̣ό̣κριτος (δρ.) β
3. Διονυσόδωρος (δρ.) δ
4. Βάκχιος [(δρ.) .]
5. Πατροφίλα (δρ.) α
6. Φιλτὼ (δρ.) α
7. Διονυσόδωρος (δρ.) α
8. Ῥοδωπίς (δυοβ.)
9. Θεύδωρος (δρ.) α

Translation:

1. […] kusa […]
2. Dionysodoros 3
3. Aristokritos 2
4. Bacchios […]
5. Patrophila 1
6. Philto 1
7. Dionysodorus 1
8. Rhodopis [2?]
9. Theudoros 1

The names are otherwise unknown, although not uncommon; all are Greek rather than Egyptian. The two female names are Rhodopis and Patrophila.

Hydraulic Engineering

The hydrological situation of the Thmouis nilometer dictated the engineering adaptations required. Unlike other nilometers, the one at Thmouis was constructed at a low elevation in alluvial soils adjacent to the Nile. The proximity to the Nile meant that only a limited channel would have been required to articulate with the Nile waters. Unlike other nilometers in immediate proximity to the Nile, however, the deltaic flood cycle would have produced extensive alluvial accumulation. Evidence of the level of alluvial deposition is perhaps represented by a late fourth-century BC silt deposit that contained a barnacled skull washed up against the wall of a building in the northern portion of the site (Grid N7) (Figure 12) (Littman and Silverstein 2013). If there was a channel opening on the west side of the nilometer well wall that gave access to the river, it likely required near-continuous dredging and clearing to maintain open water flow. The aqueduct at the Thmouis nilometer may be a unique adaptation designed to deliver flowing Nile water from an overland source. Sketches by the late Mohamed Gabr indicate that the aqueduct flowed into the nilometer in what appears to be an otherwise unknown method of connecting the nilometer to living Nile waters through an overland conduit. If this was the case, the dam stone might be set at an ideal flood level so that when the water filled this part of the aqueduct, the dam could be opened to allow the waters to flow into the nilometer. This is supported by the fact that the stair leading down to the nilometer from the cemetery joins the nilometer complex at the dam point of the aqueduct. It may be that the stair was used in a ritual for the opening of the dam festival (Fath al Khalij) discussed above. Another possibility is that the aqueduct was a later phase of construction. If there is a lower lateral channel articulated with the Nile, it is possible that this culvert failed due to siltation or the meander of the river, necessitating an innovative modification to keep the nilometer functioning.

>>Insert Figure 12 about here<<

Other Elements of Urban Hydraulic Engineering

Two features in the northwest portion of Tell Timai are integral to understanding the role of the Mendesian Nile in the commercial and ritual life of Thmouis. A limestone underground aqueduct and the hypothesised location of a harbour are discussed briefly here, even though our knowledge of the features is limited.

The Aqueduct

A salvage excavation for a school uncovered a section of an elaborate limestone block aqueduct 320 m northeast of the cemetery (Figure 13). The construction included a large channel with hatchways on the top that served as maintenance points or water access wells. The construction made use of large limestone blocks consistent with the other architectural structures built at Mendes and the tell during the Late and Ptolemaic periods. Because the limestone blocks do not include reused blocks as happened in later constructions, this aqueduct may have originally been erected in the fourth or third centuries BC. The aqueduct runs in a northeast direction toward a temple foundation that is 50 m from the prolongation of the aqueduct salvage excavation (Figure 13).

The temple is currently under excavation, but a preliminary assessment suggests that it dates to the Late Period or early Ptolemaic period (Littman and Silverstein 2020). Likewise, the limestone construction of the aqueduct suggests a Ptolemaic date since Roman hydraulic constructions tended to be made of plastered red brick. A bronze situla from the foundation deposit and a statue of Arsinoe/Isis dating to the reign of Ptolemy II recovered in a salvage trench between the aqueduct and the temple support the dating and further suggest that the temple may be the one dedicated to Arsinoe II referenced on the Mendes Stele (Brugsch-Bey 1875; Clarysse 2007; Littman *et al.* 2021). The segment of the aqueduct was removed and reconstructed at the Mansoura Storage Museum.

>>Insert Figure 13 about here<<

The Harbour

The second feature, a Thmouis harbour, is based on locational and topographical analysis and geophysical survey; it remains untested by excavation. The existence of at least one harbour at Thmouis is attested in documentary sources: during the Jewish Wars (66–70 AD), Josephus (*Jewish Wars* 4.656) relates that General Titus sailed his army from Alexandria via the Mendesian branch of the Nile and disembarked at Thmouis for an overland march to Jerusalem. This indicates a major port and the strategic importance of Thmouis as a gateway to the Levant.

Between the Nilometer, the cemetery and the mosque of Abdullah ibn Salam is a thumb-shaped depression protruding into the higher-level surface. The depression could be the result of agricultural development, but that seems unlikely, since agricultural reclamation is usually made with straight-line cuts inconsistent with the irregular shape of the depression and the placement of the feature near the mosque. Currently, however, the basin is used for agriculture, but the wall cuts on the edge of the depression do not appear to have ancient structures in their profile whereas adjacent elevated areas do.

A geophysical survey (Taha 1998; Morriss 2012) reconstruction of a branch of the Nile running along the west side of the tell is supported by the presence of the nilometer, the general morphology of the tell including a wall on the northwest edge, the current channelised distributary that runs through the town of Kafr El-Amir Abd Allah and the organisation of the older homes in the town. Many of these homes, most of which are now collapsing or being torn down, were constructed with reused Roman brick and other materials salvaged from Tell Timai. The geophysical reconstruction of the western Mendesian branch is further supported by the path of some of the earlier roads in the town. The urban design appears to conform to natural topographical features no longer present. Palaeocourses of the Delta are often discernible by house or settlement alignments. The curved pattern of settlements in the older easternmost portion of the town is possibly due to development around a palaeochannel of the Nile. The modification of the current canal, which includes a right angle more than 700 m west of the nilometer and later orthographic expansion of the town to the west, contrasts with the older elements (see Figure 13, above). The geophysical data and urban development of the town support the identification of the harbour and river course. The importance of the harbour area and the sacred precinct (as indicated by the nilometer and cemetery mound) retained significance after the abandonment of ancient Thmouis and the resettlement of the population into the adjacent towns.

Cultural Continuity

The persistence of Egyptian religion in Christian and Islamic practices is seen in rituals, incantations, fertility rites, festivals, apotropaic magic, iconography and hymns (Hansen 1995). Because the Nile is central to existence in Egypt, it follows that its role in the spiritual and mundane life of Egyptians persisted regardless of the political and religious superstructure imposed on the population. Archaeological studies of ritual landscapes in general, and even more so in Egypt, tend to embrace synchronic perspectives based on dynastic chronologies or cultural imperialism (i.e., Hellenistic, Roman, Coptic, Islamic). Obvious continuities in the evolution of syncretic deities like Serapis, Harpocrates or Hermanubis serve as examples of imperial appropriation. Less often perceived is resistance to change within folk communities, particularly in Egyptological studies. Diachronic perspectives offer opportunities to understand better the evolution of sacred landscapes and cultural memory, but such studies often fall outside the scope of an excavation and require a multidisciplinary approach. These communities show incredible resilience and continuity, even over thousands of years of forceful attempts to eradicate ancient Egyptian traditions after the Christianisation of the Roman Empire, particularly as expressed by the iconoclastic Theodosian Decrees (AD 389–391) (*Codex Theodosianus* 16.10.10).

A well-known example of ritual continuity and cultural memory stretching across Egyptian history is the festival of the *moulid* (birthday) of Sheik Yusuf Abu el Hagag el Uqsuri, a thirteenth-century AD Islamic saint. On 14 Shaaban, two weeks before Ramadan begins, boats mounted on wheels and wagons are towed through the streets. This is almost the same ritual as was practised in the Opet Festival that became prominent in the Eighteenth Dynasty (1550–1298 BC). The main event there was the transportation of statues of the god Amun, his consort Mut and their son Khonsu on boats from the Karnak to the Luxor temples. The boats were sometimes carried on land and other times on the Nile and towed between temples. Another point of contact is that the Mosque of Abu el Hagag was constructed within and integrated into the middle of the Luxor Temple to Amun-Ra, the same temple involved in the boat procession during New Kingdom Egypt. The descendants of Abu el Hagag still reside in Luxor and oversee the annual festival to their ancestor.

At Tell Timai, rituals associated with the seasonal cycles of the Nile and the role of the nilometer likewise persisted (Gesler 1992). Folk tradition had memorialised the location of the stair and nilometer in local fertility and thaumaturgical rituals that persisted long after the nilometer and its associated architecture were buried and forgotten. In 1990, at the age of ten, Abdelaziz Farouk had come from the southern town of Quf (Qufti) with his clan of professional excavators to work at the site. In 2013, after the discovery of the nilometer, Abdelaziz, now working as Reis (clan chief) with the Tell Timai Project, related a story that he believed demonstrated sacred continuity from ancient to modern times. It was mid-August, and the people of Kafr al-Amir were engaged in the annual celebration of the birth of Abdullah ibn Salam. Abdelaziz remembers seeing a number of people rolling down and spinning around atop the high dusty mound situated above the nilometer, a stone's throw from the mosque itself. Legend spoke of a man named al-Maragha who suffered from an affliction due to the touch of a jinn. In search of a cure, al-Maragha went to the hill near the Mosque of Ibn Salam and threw himself to the ground, rolling and spinning in the dirt, and thus was cured. Abdelaziz was told that those who wanted to be healed or relieved from jinns visited the mound and were cured. He witnessed one woman who suffered from infertility rolling down the hill. When he returned to the town in the following year, he learned that she indeed had become pregnant. He exclaimed: 'She [went] there, al-Maragha […] and after a while, a pregnancy occurs, is [this] a blessing from ibn Salam [and] the gift of the Nile?'

It is not uncommon to have syncretic continuity of sacred spaces in Egypt or in other places (Volokhine 1998). At Tell Timai, the persistence of the ritual over the long lost nilometer—as well as the location of the mosque—provide some indications of the role it played in the ancient city. The Mosque of Abdullah ibn Salam continues to be visited by pilgrims annually, especially in mid-August. As discussed above, the annual flood was also celebrated in August, most likely on 15 August, coincident with the Osirian festival. The legend of the mosque says that forty pieces of Abdullah ibn Salam's body were spread across the Mansoura region at sacred sites, his head being at the Abdullah ibn Salam mosque. This tradition parallels the myth of Osiris' body parts being spread around Egypt by Isis. The similarities between Abdullah ibn Salam and Osiris illustrate one persistence of the sacred landscape (Stauth 2007).

Conclusion

Nilometers served as a nexus of sacred and profane landscapes. They were a point of communication with the divine aspect of the Nile and an almanac integral to the seasonal agricultural and ritual cycles. At Thmouis, the discovery of this nilometer provides a rare example of an intact structure with known ritual and economic significance in an otherwise highly disturbed portion of the tell. The nilometer appears to have been constructed originally during the third century BC, based on the materials excavated in the vicinity and the reused inscription stone indicating that the status of Thmouis was already in ascendence on the sacred landscape of the Mendesian nome.

Unlike its northern sister city Mendes, there is a distinctly syncretic Ptolemaic character to the features being uncovered on the northern and western portions of the tell at Thmouis. Although attempts have been made to explain the usurpation of the nomarchy by Thmouis from a natural perspective based on the meanders of the deltaic distributaries (Holz 1980; Blouin 2014;), the perfume industry (Littman *et al.* 2021) and the sacred and administrative role indicated by the nilometer invite reconsideration.

The relationship between Greek immigrants and Egyptians was, to put it mildly, complicated (Frankfurter 1998; Lewis 2001; Reden 2010; Johstono 2017). Political manoeuvring and competition occurred between temple priests and the Macedonian Dynasty, including the rise of Hellenised settlements that provided counterpoints or complements to the regional control of Egyptian temple complexes (Abd el Gawad 2011; Gorre 2013; Gorre and Honigman 2013). These factors should not be ignored when viewing the changes in the Mendesian nome and the shift of the seat of nomarch to the Hellenistic urban interloper.

The nilometer of Thmouis is likely the one referenced by Plutarch, and the material correlation strengthens the historicity of his account. It also contributes to the understanding of the palaeohydrology of Thmouis and provides a piece of the puzzle in reconstructing the articulation of the city with the river. Of particular importance is that it seems close to a likely harbour location, an observation that may have evaded us had the nilometer not been discovered.

The persistence in the identification of the nilometer location as sacred space where rituals of fertility and apotropaic magic could be performed illustrates the longevity of syncretic behaviours in regional contexts, despite anti-pagan policies of Christianity and Islam (Hahn *et al.* 2008). The depth of such traditions is to be expected, as made clear when Libanius pleaded on behalf of temples to Emperor Theodosius in AD 386 in his oration *For the Temples*:

> Temples, Sire, are the soul of the countryside: they mark the beginning of its settlement and have been passed down through many generations to the men of today.
>
> In them, the farming communities rest their hopes for husbands, wives, children, for their oxen and the soil they sow and plant. (Libianius, *Orations* 30.9-10)

The hard lines often drawn in history dividing cultural transitions and temporal phases tend to shroud the persistence of indigenous religion in the countryside as expressed in Libanius' impassioned oration. As Ghisleni (2018) observed in her study of Romanisation in Britain, binary boundaries of historical horizons fail to capture realities and subtleties of imperial acculturation. The connection of data drawn from archaeology, history, contemporary folk tradition and religious practice highlights these behavioural continuities that are often invisible to archaeology alone. While many questions remain, the discovery of the Thmouis nilometer represents a significant milestone in decoding the city's growth, its religious and political role in the Ptolemaic landscape, the worship of fertility deities in the Nile Delta and the resilience of the sacred landscape and cultural memory to even the most aggressive forms of cultural replacement.

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About the Authors

Jay E. Silverstein is an Affiliate Professor at the Cranfield Forensic Institute. His primary research interests are the archaeology of militarism, Ptolemaic Egypt, hydrological adaptations, remote sensing and the rise and fall of complex societies. He is the Co-Director of the Tell Timai Excavation.

Robert J. Littman is Professor of Classics at the University of Hawaii at Manoa and Director of the Tell Timai Excavation. He specialises in Greek history, archaeology and Graeco-Roman Egypt.

Stacey Anne Bagdi is a PhD candidate in Egyptology at Ludwig Maximilian University in Munich. Her primary research is in ancient pilgrimage and religious ritual, particularly the archaeological evidence associated with the worship of Osiris at Abydos, Egypt. She is also a curator in London.

Elsayed F. Eltalhawy works for the Ministry of Antiquities, Dakahlia Governorate, and serves as the General Supervisor of the Antiquities of Dakahlia and Damietta. He is also the General Supervisor of the Affairs of Lower Egypt and Director of the Kom El- Khilgan and Tell El Balamun projects.

Hamdy Ahmed Mashaly has worked with the Egyptian Ministry of Antiquities, Dakahlia Governorate, since 1993, and now serves as a Director of Antiquities there. He has extensive experience working with Egyptian and international expeditions including the predynastic sites of Tell al-Samara and Tell Ghazaleh, and at Tell Timai, Tell Tebilla, Tell al-Raba, and Tell El Farkh.

Emad Hassan Mohamed is a 2009 graduate of the Faculty of Archaeology, Fayoum University. He has significant experience both as an inspector of antiquities in Egypt and as a member and a director of many excavations over multiple seasons in Egypt.

Mohammed Abd al-Aziz Gabr earned his degree at Tanta University and he served as an Inspector of Archaeology with the Ministry of Antiquities in the Dakahlia inspectorate from 2002 until his death in 2018. He worked on more than twenty archaeological projects including Behbeit El-Hagar, Tell Timai, Giza, Tell Tebilla, Taposiris Magna and Sa El-Hagar. He specialised in core survey, geomorphology and excavation. He also directed the Behbeit El-Hagar field school.

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Figure Captions

Figure 1. A map of Egypt and the Levant identifying sites referenced in the text: 1. Timai/Mendes; 2. Tanis; 3. Busiris; 4. Behbeit el Hagar; 5. Sebennytos; 6. Diospolis (Tell el-Balamun); 7. Alexandria; 8. Canopus; 9. Heraklion; 10. Rhoda; 11. Karanis; 12. Edfu; 13. Luxor; 14. Karnak; 15. Philae; 16. Kom Ombo; 17. Elephantine; 18. Mandulis at Kalabsha; 19. Sepphoris.

Figure 2. Satellite image showing Tell Timai (Thmouis) and Tell el Rub'a (Mendes) and the modern towns that flank Tell Timai (image 13 February 2015, World View-2, produced from European Space Agency remote sensing data).

Figure 3. Photogrammetric 3D model of the Kom Ombo nilometer by Mohammed Abd el Azez. The subsurface morphology of the Nilometer system is missing the channel that connected the system directly to the Nile, because it was buried by backfill at the time the photogrammetry was undertaken, but it does exist deeper in the main well.

Figure 4. Satellite image of Tanis showing the temples of Amon Re and Mut/Khonsu. Nilometers associated with the Temple of Amon Re are visible at A and two nilometers associated with the Temple of Mut are visible at B' What appears to be collapsed subterranean aqueducts aligned with nilometers are visible at C. These channels appear to be laterally connected to the Tanitic branch of the Nile (sources: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN and the GIS User Community).

Figure 5. Plan of the nilometer (J. Silverstein).

Figure 6. Photogrammetric 3D image of nilometer (J. Silverstein).

Figure 7. The well and door opening to the stairwell of the Tell Timai nilometer, view northwest (photograph by Mohamed Gabr).

Figure 8. The descending stair (photograph by Tell Timai Project).

Figure 9. The ascending staircase to the cemetery (photograph by Mohamed Gabr).

Figure 10. A: The Calendar stone reused in the ascending stair, view south, with the stone within the stair wall; B: a close-up of the calendric matrix.

Figure 11. The reused limestone block found originally inscribed in the third century BC (photograph by Mohamed Gabr; RTI [Reflectance Transformation Imaging] conducted by S. Chapman to visualise faint elements of the inscription).

Figure 12. Barnacle-covered skull.

Figure 13. Satellite image with a proposed palaeocourse of the Mendesian branch of the Nile running along the west side of the tell, and the proposed location of the harbour (sources: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN and the GIS User Community).

Table 1. Chronological periods mentioned in this study

Period	**Ruling dynasty/Caliphate**	**Approximate dates**
Late Period	26th Dynasty (Saite dynasty) 27th Dynasty (First Achaemenid period) 28th Dynasty (Saite pharaoh) 29th Dynasty (Mendesian dynasty) 30th Dynasty (Sebennytic dynasty) 31st Dynasty (Second Achaemenid Period)	525–332 BC
Early Ptolemaic	Ptolemaic Dynasty (I–V)	332–185 BC
Middle Ptolemaic	Ptolemaic Dynasty (V–VIII)	185–116 BC
Late Ptolemaic	Ptolemaic Dynasties (Ptolemy X–Cleopatra VII)	116–32 BC
Early Roman	Roman Empire	32 BC–AD 350
Late Roman / Byzantine	Eastern Roman Empire / Byzantine Period	AD 350–640
Islamic	Umayyad Caliphate (AD 641–750) Abbasid Caliphate (AD 750–1517) Destruction of Thmouis (AD 851)	AD 641–851