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Holocene alluvial history and archaeological significance of the Nile floodplain in the Saqqara-Memphis region, Egypt

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ABSTRACT

A suite of drill cores undertaken on the Saqqara-Memphisfloodplain revealed an array of Late Pleistocene-Holocene sediment facies that show a complex of spatio-temporal changes in sediment related to migration of the River Nile, Nile flood variations, settlement sites and climate change. The recovered data enhance our understanding of the history of the modern River Nile and its relationship to the emergence and continuity of Egyptian civilization.

The floodplain of the Saqqara-Memphis area reveals a sequence of aggradation and degradation events comprising six clearly marked sedimentary units (I-VI), overlying Late Pleistocene fluvial sand and gravel (unit I). Deposition of unit II resumed during a period of high Nile flow, rapid sea level rise and locally wet climatic conditions. As a result, the floodplain was occupied by swamps and anastomosing channels. Subsequently, the Nile changed to a more stable meandering channel system with well-developed levees and flood basins (unit III). This aggradation unit was subsequently eroded by the end of Old Kingdom (ca. 4.2 kyr cal BP). The degradation hiatus was followed by a widespread layer of alluvial silt and sand indicating very high Nile floods that coincide with historical records of very high floods during the Middle Kingdom and frequently high floods during the New Kingdom (unit IV). During the last two thousand years (units VI-VII) floods generally diminished except for several notable lows and highs.

Our calculations of the long-term rate of siltation during the Middle and Late Holocene suggest an average rate of 0.235 m/century rather than the commonly cited 0.09–0.12 m per century. In addition, our study of satellite imagery of the Memphite region in the context of archaeological data combined with our own geological studies reveal that the main Nile in Neolithic and Predynastic times (ca.7.0 –5.0 kyr cal BP) ran along the eastern edge of the current floodplain. A lateral branch of the Nile ran along the western edge of the floodplain. It is on the bank of this branch that the first capital of a unified Egypt was established. Our cores also reveal during the Dynastic period, the western branch shifted eastwards, while the main Nile shifted westwards.

1. Introduction

The rise of great civilizations depended on the availability of sufficient freshwater resources and a sufficiently large area of suitable arable land, amongst many other social requirements (Butzer, 1976; Said, 1993; Woodward et al., 2015; Macklin and Lewin, 2015). In the case of the Egyptian civilization, the River Nile created a linear fertile floodplain and a Deltaic plain fed annually by summer floods from faraway Ethiopia and Equatorial Africa (Williams and Adamson, 1980). Although many aspects of early Egyptian civilization, such as pastoralism, use of bifacial tools, sedentism, and use of pottery began in the Western Desert (Tassie, 2014), it was not until there was a move into the Nile Valley at 8.2 kyr cal BP and again at 7.35 kyr cal BP (Hassan, 2002) that the last pieces were put in place for the Egyptian civilization to flourish. Although there had been manipulation of wild plants in the oases, it was not until groups moved into the Nile Valley and Delta that agricultural practices were established, ca. 7.0 kyr cal BP. Therefore, it can be said that the Egyptian civilization emerged and developed

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on the banks and floodplain of the Nile (Butzer, 1976; Said, 1981; Hassan, 2010). To the present day, the Nile remains the main source of water for Egypt (Hassan, 2010). Accordingly, ancient Egyptians were affected by climatic changes that determined the amount of Nile flood discharge and hence the areas that could be cultivated (Rognon and Williams, 1977; Flohn and Nicholson, 1980; Kutzbach and Otto-Bliesner, 1982; Marriner et al., 2012; Williams et al., 2015). Changes in Nile flood discharge also had a major role in development of the floodplain and making it a very dynamic geomorphological environment (Said, 1981, 1993; Hassan, 2010).

It is now widely accepted that the shifting of the River Nile during and after the Middle Holocene had a great impact on the Egyptian civilization (Butzer, 1976; Jeffreys and Tavares, 1994; Jeffreys, 2008; Bárta, 2013). This was first recognized by Hekekyan Bey (1807-75), who drilled several cores at Memphis during 1852 and indicated a westward shifting of theNile channel (Smith and Jeffreys, 1986; Jeffreys, 2010). Butzer (1976) described an eastward shifting of the Nile River in the area north of Sohag (about 400 km south of Saqqara), using topographic maps (1798 AD to recent) and satellite photography. More recently, Lutley and Bunbury (2008) established a computer model for Nile movement over the last five millennia based on the river's recorded behaviour. They detected movements of the Nile in the Memphis area, and assumed that the River Nile ran along the western margin of the floodplain.

Ancient Memphis is located about 30 km south of Cairo and it was recurrently the administrative centre of the politically unified state of Egypt in Pharaonic times. The exact location of this ancient city has been subject to much archaeological debate, with many concluding that Memphis occupied a location just east of Saqqara, focused on an area of 6 km^2 near the modern town of Mit Rahina (Love, 2003: 70; Rzeuskyr, 2013). The ruin-fields at Mit Rahina consist of several koms, such as Kom el-Arbain, Kom el-Fakhry, Kom el-Nawa, Kom el-Qala, Kom el-Rabia and Kom Tuman (Engelbach et al., 1915; Petrie, 1909, 1909a, 1911; Petrie et al., 1910, 1913; Rzeuskyr, 2013; Trindade Lopes and Fonseca Braga, 2011). The majority of the archaeological remains discovered at Mit Rahina, date from the Middle Kingdom onwards, even parts of the White Walls have recently been found at Kom Tuman (Krol, 2015), which although they are probably not the original First Dynasty walls, may be later embankment walls. In 2014 Middle Kingdom remains and a temple from the reign of Tuthmose III (1479-1425 BCE) were found at Tell el-Aziz in the nearby town of Badrshein. However, the exact boundaries of Memphis have never been formally identified. Love (2003) suggests that ancient Memphis should be regarded as the whole region from Giza, possibly even as far north as Abu Roash, down to Dahshur. This larger area for Memphis had already been suggested by an Egyptian historian ca. 1400 BCE who had documented Memphis as being 30 miles (48 km) long by 20 miles (31 km) by wide (Jeffreys, 2010).

Memphis was founded by King Narmer, the first king of the First Dynasty ca.3060 BCE to break the kinship ties with the region of Abydos and also gain greater control of the Delta and trade routes to the Levant (Campagno, 2003; Jeffreys and Tavares, 1994; Love, 2006). Herodotus (II: 99) states that he dammed or diverted the Nile to allow for the building of this new city. According to Manetho his son, King Aha, was the first king to build a palace there (Love, 2003). At this period Memphis was located near the mouth of the Wadi Abusir and was known as *Ineb-hedj* (White Walls or White Fortress). However, evidence for settlement in the region goes back to the Protodynastic Period. During the Early Dynastic Period, tombs of some of the highest officials in the land were located on the North Saqqara Escarpment overlooking the city of Memphis (Cervelló Autuori, 2002; Love, 2006). During the Second Dynasty the kings were generally buried at Central Saqqara, apart from Peribsen and Khasekhemwy, who went back to the ancestral burial ground at Abydos (Van Wetering, 2004). King Netjerykhet (Djoser) was the first to build a huge pyramid complex at Saqqara, starting ca. 2686 BCE, and although some of his Third Dynasty successors followed him in locating their tombs at Saqqara, several did not (Wilkinson, 1999). During the Old Kingdom the capital/royal residence moved several times – following the location of the pyramid – and by the time of King Pepi I (ca. 2321-2287 BCE) of the Sixth Dynasty his pyramid town called *Men-nefer* (established and beautiful) was located just east of what is now termed South Saqqara, ca. 5 km farther south than *Ineb-hedj*. Memphis is a Greek word stemming from the hieroglyphic name, *Men-nefer* (Smith and Jeffreys, 1986: 88). The reasons for locating the capital at the apex of the Delta were to control the trade and travel routes that converged on the Nile Valley from the Nile Delta, Levant, Red Sea and Saharan oases (Jeffreys, 2010).

Although Saqqara was the largest of the Memphite necropoli (cemetery areas), there were several other royal burial grounds or pyramid sites associated with Memphis, such as Abu Roash, Abusir, Dahshur, Giza and Zaweiyet el-Aryan. Love (2003) suggests that possibly as early as the Third Dynasty the pyramid towns were peripatetic, moving with the location of the king's pyramid. After the end of the Old Kingdom these towns fell into disuse with the exception of *Men-nefer*, which grew to become the remains now found at Mit Rahina. These pyramid towns may be regarded as Greater Memphis, with fields and villages scattered between them. Petrie (1909a) compared Memphis with the various towns and villages that make up greater London, proposing that Memphis was a large zone filled with gardens and fields that had agglomerated together to create a large city. However, the central city of Memphis was that located just to the east of Saqqara.

Although the administrative capital of Egypt changed several times after the end of the Old Kingdom, Memphis remained an important city until the Ptolemaic era, although the most obvious monuments at Memphis date to the New Kingdom or Late Period, such as the Temple of Ptah (Engelbach et al., 1915) or the Palace of Apries at Kom Tuman (Trindade Lopes and Fonseca Braga, 2011). The Nile floodplain at Memphis was utilised by the ancient Egyptians for urban, agricultural and other human activities for over 3000 years. As such, the earliest phases of occupation have become deeply buried underneath thick Nile alluvium, although vestiges of it were still clearly visible in the 12th century AD (Jeffreys, 1985). Since 2007, a geoarchaeological project (scientific cooperation between the Geology Department, Cairo University, Egypt and the Department of Geography, University College London, UK) has been carried out in the floodplain area between Dahshur in the south to Abusir in the north. About 30 cores were drilled in the floodplain in order to reconstruct the geologic evolution of River Nile.

The present paper focuses on the study of the alluvial history of the Nile floodplain in the Saqqara-Memphis area and its implications for (1) changing Nile flood conditions and shifts in the palaeohydrographic regimes of the Nile during the Middle and Late Holocene, (2) evolution of the riverine landscape and palaeoenvironments, and (3) impact of the changing landscape on cultural developments in the region and the survival of archaeological materials.

2. Methods

The present study is based mainly on the Nile sediment recovered from seven large diameter (37 cm) cores (SAQA1, 2, 3, 6, 18, 21, 22) drilled (2006–2008) in the Saqqara-Memphis floodplain area (Fig. 1). High resolution sediment core descriptions and magnetic susceptibility measurements (using a Bartington MS portable meter) were carried out in the field. Archaeological material