

A new Eocene marine mammal site in the Qattara depression (Egypt)

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Here we report the discovery of a new Eocene fossil site in the Egyptian Western Desert, yielding both archaeocetes and sirenians. The site is 360 km west of the well-known Wadi Hitan site. A preliminary faunal inventory suggests the cetacean fauna to be roughly comparable to the fauna recorded at Wadi Hitan; other faunal elements however are indicative of a distinctively different palaeoenvironmental setting.

KEY WORDS – Archaeocetes, sirenians, Eocene, Tibaghbagh, Egypt

Introduction

While travelling the Sahara desert in Egypt during a holiday trip in 2007, the first author and his fellow traveller Theo Paymans stumbled upon a rich vertebrate fossil site in the Qattara depression. As a follow-up, after contacting the Egyptian Environmental Affairs Agency in Cairo, a preliminary site assessment was made in early 2010, the results of which are presented in this contribution. Presently, some 75 clusters of bones, including partial skeletons of marine mammals, have been identified; the high density of articulated skeletal remains, as well as the excellent state of preservation of some of the fossils call for an extended research project.

Geological setting

The fossil site is located within the Qattara depression, a remarkable geological feature which extends for some 280 x 120 km in the Western Desert of northwestern Egypt. The base of depression is at certain places as low as 134 m below sea level. Age and origin of this structure are not entirely clear (Tawadros, 2001). Apart from intracratonic subsidence, aeolian activity (deflation) may have played a role in its formation. The topography also shows clear signs of erosion by ancient river systems or floodwaters. The abundance of salt in the subsurface may have further enhanced the topography of the basin (Aref *et al.*, 2002).

The area is characterised by extensive Cenozoic exposures. Upper Eocene shales and limestones of the Dabaa

Formation are found in the southern part of the western margin of the Qattara Depression (Said, 1990). In the west the Eocene strata are overlain by Miocene strata, subdivided in the Moghra, Mamura, Gebel Khashab and Marmarica Formations (Tawadros, 2001). In the east Miocene strata unconformably overlie Oligocene rocks. The depression floor is at many places covered with Quaternary aeolian and alluvial fan deposits that form a sabkha.

Inventory of fossil sites

All skeletons identified so far are exposed in a single layer that crops out along the border of a deep sabkha plain (-80 m) in Minqar Tibaghbagh in the most southwestern part of the Qattara depression (fig. 1). During the first exploration, and the subsequent brief inventory project with the EEAA staff in early 2010, we were able to document concentrations of bones in a small, elongated area of about 10 km from southwest to northeast; interpretation of aerial photographs (Google Earth) suggests the layer to continue for a considerable distance beyond. The fossiliferous layer is right on top of a marked yellowish-brown siltstone, generally exposed at the base of an escarpment of more than 100 m height (fig. 2); an initial assessment by the second author places the layer some 10-13 m above the base of the Dabaa Formation.

At the southwestern edge of the studied area, the fossiliferous stratum is at about 45 m below sea level. A single sirenian rib has been found in a different level about 20 m higher.

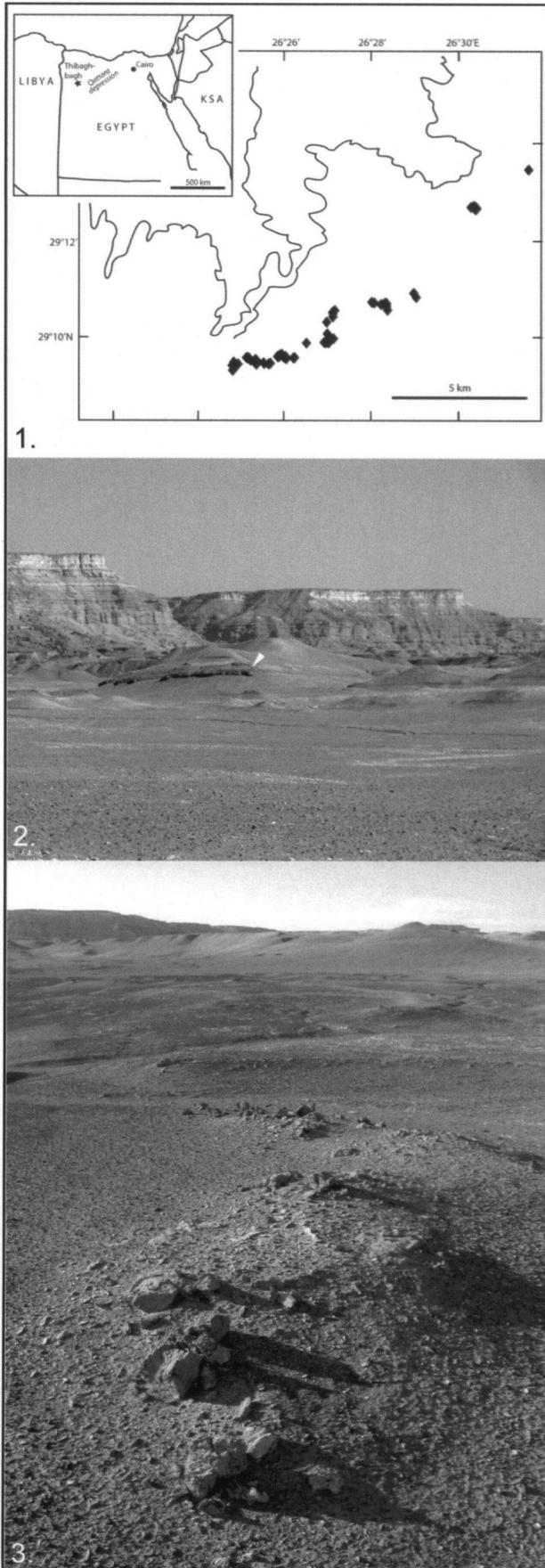


Figure 1-3.

Approximately one km to the east the main fossil bearing layer is about 50-55 m below sea level. It is about 75 cm thick, consisting of grey, but at some places bright green fine sand and silt with small pebbles. It conformably overlies a solidified layer of brown sandstone more resistant to erosion than the strata above and underneath it. Further eastward, the fossiliferous layer, 0.5 to 1 m thick, is about 60-65 m below sea level and is slightly above or at the same level of the sabkha plain. Many pyrite concretions, some of which representing shell casts, are found at the surface; the amount of gypsum veins increases markedly. Here too, the fossil layer can be discerned from the grey marls above and underneath it by its dark green to red colour. After some eight km to the northeast, the continuity of the layer could no longer be traced with certainty, but isolated outcrops have been found throughout the area at an altitude of approximately -55 to -60 m. Further to the south a few isolated outcrops were recognized at, e.g., Garet Gehannem, an isolated hill and marked topographic feature within the sabkha plain.

At the southern border of the sabkha plain Eocene strata are exposed as well. These are of a different character, a yellow sandstone containing mostly carbonate fossils such as sea urchins, nummulites, oysters, and few fish remains. A single, so far unidentified bone fragment was observed there as well. The regional northward dip of the strata suggests that these southern strata are older than those containing the abundant mammal fossils reported here.

Fossil content

Vertebrates – Seventy-five clusters of bones or partial skeletons of whales and sirenians were observed. Sirenian ribs were recognized by the pachyostotic nature of their ribs and the shape of the vertebrae; so far we were able to identify a total of 32 clusters of sirenian remains. Whale skeletons were tentatively identified as *Dorudon atrox* Andrews, 1906 and the much larger *Basilosaurus isis* Andrews, 1906, characterized by its large, elongated vertebrae (Uhen, 1998). Twenty of the bone clusters can be attributed with reasonable confidence to *B. isis*. At three places associated remains of crocodiles have been found. One cluster of eroded bones suggests the presence of a large turtle. Shark teeth, mostly weathered and broken, are abundant.

Figure 1: Locality of the Qattara depression with general area of the fossil site indicated. Precise fossil localities are on file with the authors and the EEAA.

Figure 2: General view of the western escarpment containing the brownish stratum directly under the mammal-bearing beds (arrow). The height of the escarpment is approximately 75-125 m.

Figure 3: Semi-articulated skeleton of *Basilosaurus isis*.

Figure 4: Partial sirenian cranium.

Figure 5: Juvenile archaeocete skeleton. Paper label scale is approximately 10x10 cm wide.



Figure 4-5.

The following species could be identified: *Carcharocles auriculatus* de Blainville, 1818, *Isurus praecursor* Leriche, 1905, *Carcharhinus* sp., *Carcharias* sp., *Galeocerdo* sp., as well as a few teeth of the ray *Aetobatis* sp. Spines of *Pristis* are not uncommon; also spines of a billfish (Xiphioidei) have been found. Precise co-ordinates of the fossil clusters are on file with the authors and the EEAA.

Invertebrates – Echinodermata are represented by a few casts of *Conoclypeus* sp. Nautiloid shells (*Aturia* sp.) are common especially to the west-south west. Some compressed turrillid gastropods as well as a low number of pectinid bivalves were found. At some places pyrite casts of bivalves and gastropods are common. Solitary corals are found as well.

Discussion

Two well-known areas yielding Eocene sirenians and archaeocetes in Egypt are the Fayum Oasis and Gebel Mokattam. At the northern shore of Birket Qarun in the Fayum Oasis, 100 km southwest of Cairo, Schweinfurth found in 1879 the first whale fossils in Egypt (Simons & Rasmussen, 1990). Further reports of whale fossils from Wadi Hitán in the Fayum Region were made in the first decade of the 20th century (Dolson *et al.*, 2002) located about 30-60 km southeast of the Schweinfurth locality. In 2005, the Wadi Hitán site has been designated as a World Heritage Site of UNESCO in order to preserve the abundant remains of archaeocetes and sirenians discovered there. *Basilosaurus isis* Andrews 1906, has been reported from the Gehannam Formation, the Birket Qarun Formation and the Qasr el Sagha Formation of the Fayum Oasis (latest Bartonian to earliest Priabonian: Uhen, 1998). Another archaeocete fauna containing *Saghacetus osiris* Dames 1894 has been reported in strata of the late Priabonian in the Fayum Oasis (Gingerich, 1992). The presence of *B. isis* in the Qattara Depression may indicate a late Bartonian or early Priabonian age for these strata.

At Gebel Mokattam south of Cairo, Schweinfurth discovered in 1883 a whale later described as *Protocetus atavus* Fraas, 1904, in the Lower Building Stone Member. It is probably middle Lutetian in age. A second whale, *Eocetus schweinfurthi* Fraas, 1904, from the Guishi Formation of Gebel Mokattam is probably early Bartonian (Gingerich, 1992. p.73). Also of note are reports about a new site north of Khashm el-Raqaba in Wadi Tarfa with whale and sirenian fossils from the Gebel Hof Formation (or equivalent) of Bartonian age (Gingerich, 2008).

The Late Eocene deposits in the Wadi Hitán in the Fayum depression represent a shallow sea, probably a 'favoured calving ground' for whales (Dolson *et al.*, 2002). The sheltered bay was separated from Tethyan oceanic realm to the north by shallow thresholds of the Kattanya Horst. Both the presence of sirenians and a mangrove root horizon

indicate very shallow nearshore conditions at the time the Wadi Hitán deposits were formed. Large shark teeth are only rarely found there. Approximately 500 (partial) skeletons of archaeocetes (Gingerich, 2008, p. 117) have been reported from Wadi Hitán so far, and only 27 of sirenians (Domning & Gingerich, 1994).

The new site described here, is located about 360 km west of the Wadi Hitán localities, at the other side of the Kattanya Horst. Although the whale fauna is similar, other aspects of the faunal composition recognized here so far are markedly different from the Wadi Hitán site. About 40% of the Qattara clusters belong to sirenians, which could be indicative of a shallow marine setting. A shallow-marine environment is however contradicted by the presence of nautiloid shells and the high abundance of teeth of large sharks.

The new fossiliferous Qattara localities are consistent with earlier projections (Gingerich, 1992; Dolson *et al.*, 2002). Gingerich (1992, p. 79) stated that 'Finding new cetaceans and sirenians in new environments and new time intervals is largely a matter of effort ...'. Further discoveries are well possible with further fieldwork in the Egyptian desert. More research is required into the age and depositional context of this Qattara fauna, which for now remains to be systematically excavated.

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