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A new Priabonian Chondrichthyans assemblage from the Western desert, Egypt: Correlation with the Fayum oasis

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ABSTRACT

While the Middle/Late Eocene marine vertebrates in Egypt have been largely reported around the Fayum oasis, few reports were made elsewhere. Here we report a new fossil site (Km55) located near the Bahariya Oasis in the Western desert of Egypt. This fossiliferous outcrop has yielded abundant fossil material of invertebrates dated to the Middle/Late Eocene and some chondrichthyan remains that testify of a Priabonian age (MK11). More than twenty Selachian taxa were recovered in one level, including "*Cretolamna*" *twiggsensis, Misrichthys stromeri, Odontorhytis pappenheimi*, ?*Jacquhermania attiai,* and the fauna is quite similar to some recovered from the Fayum area. However, this new association is clearly distinctive of an open marine environment during the extreme Late Eocene while the contemporaneous fossil sites farther east are deposited in shallower (e.g. Wadi Hitan) or continental environments (e.g. BQ-2). This suggests an E–W diachronous change in relative sea level on the Egyptian coastal shelf during the Late Eocene period, with a general deepening along strike to the West.

1. Introduction

Marine Eocene deposits in Egypt are famous both for their fossil content and because they constitute much one of building materials of the Egyptian archaeological treasures from the Cairo area. They consist predominantly in coastal shelfal sandstones and limestones, many with abundant fossil remains. If the marine large foraminifera and invertebrates dominated the fossil assemblage in rocks outcropping around Cairo, many marine Eocene vertebrates were known farther west such as Archaeoceti from the Middle and Late Eocene of the Fayum area (Fig. 1), recently (2005) registered in the UNESCO world Heritage List. In the past much less emphasis has been placed on the Paleogene ichthyofaunas of other localities in the country. Many faunal studies dating from the early 1900s were largely summarized in Case and Cappetta (1990). The largest amount of the selachian teeth described come from the Gehannam Fm. (Late Middle Eocene) and Birket Qarum Fm. (Late Eocene) outcropping in the UNESCO World Heritage Site of Wadi Hitan (formerly "Zeuglodon Valley" in Case and Cappetta, 1990) as recently summarized in Underwood et al. (2011). Some others come from Geziret el Qurun, Qasr ElSagha (Northeastern Fayum) and Mokattam hills (Nile valley). No Eocene selachian association was known in the Western desert, to the southwest of the Fayum depression until the work of Strougo et al. (2007) who reported a rich Lutetian selachian association from the ElGedida glauconitic sandstone, located near the Bahariya oasis. The new fossiliferous site which makes the subject of this paper is located at 55 km of the ElGedida-Cairo asphalt road (Fig. 1), on the northern plateau overhanging the Bahariya oasis. Without any conspicuous fixed point (coordinates 28°48′55.01″N; 29°08′26.48″E), it is named Km55 in text, in relation to its distance by road from the ElGedida iron mine.

2. Geological setting

The bedrock succession having yielded the fossils and presented here, forms a conspicuous butte on the plateau at North of Bahariya Oasis, entirely observable from the road (Fig 2A). The sub-horizontal stratigraphic sequences visible on site Km55 (Fig. 2B) show no obvious syntectonic activity, and is capped by an irregular clastic bed of yellow sandstone.

The Paleogene stratigraphic succession exposed in the study area (Fig. 2E) has been initially called the ElHamra Formation by Said and Issawi (1965). Subsequent work has shown that the succession actually comprizes three different units, distinguished by their lithology and fossil content (Strougo, 1986; Strougo and Hottinger, 1987; Strougo and Boukhary, 1987), previously defined

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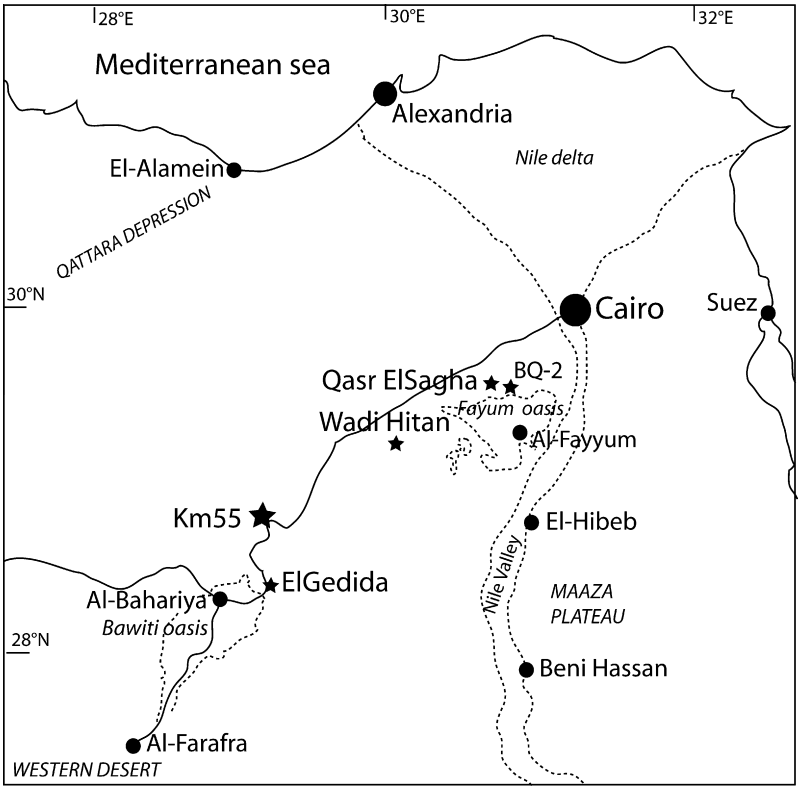

Fig. 1. Global map showing the location of new fossiliferous locality (large star symbol, Km55) and the previous ones having delivered the main Eocene selachian remains (small star symbol) discussed in text.

in the Fayum area. In the study area, the main characters of these three units are as follows, from base to top:

(1) *ElGharaq* Formation – Mainly bioclastic silty limestones and calcareous siltstones, light colored, white-yellow to yellow green, packed with nummulites, with several thick oyster banks and a large assortment of molluscs. The leading nummulites of this formation are *N.* gr. *gizehensis* at the base, followed in the upper part by smaller forms as *N. cyrenaicus* and *N. decrouezae*. In the study area, the thickness of the ElGharaq Formation attains nearly 15 m.

(2) *Birket Qarun Formation.* – A 10 m thick, dark-colored unit, consisting of brown, coarse-grained calcareous sandstones, highly fossiliferous, interbedded with dark gray clay. Nummulites are much less abundant than in the lower formation, restricted to the basal part of the unit, and include two species – *N. striatus* (common) and *N. ptukhiani* (rare). Two important macroinvertebrates appear at the base of the Birket Qarun Formation, the echinoid *Clypeaster fourtaui* and the enigmatic hydrozoan(?) *Qerunia cornuta*.

(3) *Qasr ElSagha Formation.*–As in the Fayum, the lower boundary of the Qasr ElSagha Formation is defined by the first appearance of the large anomid bivalve *Carolia placunoides placunoides* which occurs in one or more closely spaced prominent banks. The rest of the succession consists of dark brown sandy mudstones and gray clays interbedded with poorly consolidated sandstones. Several monospecific shell beds intercalate the succession either packed with gastropods *Mesalia* or *Turritella* or with oysters *Ostrea (Turkostrea) multicostata strictiplicata* or *Nicaisolopha clotbeyi*. However, the lower part of the Qasr ElSagha Formation includes a pink sandy limestone layer that yields a very rich and highly diverse macroinvertebrate assemblage composed of bivalves, gastropods, echinoids, crustaceans, serpulids, and bryozoans. Most importantly, this layer contains numerous examples of *Nummulites fabianii*, first reported in this area by Strougo and Hottinger (1987). The vertebrate assemblage discussed in this paper was found in a sandy mudstone layer (Fig. 2C–D), about 1 m thick, lying some 10 m above the *N. fabianii* bed.

On top of the Qasr ElSagha Formation comes an interval of crossbedded sandstones and massive, pebbly sandstones, devoid of any fossils, and forming the top of the succession in the study area. A thin layer of conglomerate separates these sandstones from the underlying beds. Whether this interval still belongs in the Qasr ElSagha Formation or to some younger stratigraphic level remains to be seen.

Concerning the age of the studied succession which appears thinner than in Fayum area, the ElGharaq Formation of the northern plateau of the Bahariya oasis is generally regarded as marking the upper part of the middle Eocene, that is the Bartonian (Strougo, 1986; Strougo and Hottinger, 1987; Strougo and Boukhary, 1987), whereas the Birket Qarun and Qasr ElSagha Formations are placed in the upper Eocene, that is the Priabonian (Strougo, 1992, 2008). In local chronostratigraphic terms, the nummulite and macroinvertebrate assemblages allow to place the ElGharaq Formation in the middle Mokattamian, and more precisely in the level MK7 of Strougo (2008). Likewise, the Birket Qarun Formation falls in the level MK8. In the Qasr ElSagha Formation, the First *Carolia placunoides* Biohorizon indicates the level MK9, while the bed with *Nummulites fabianii* indicates the level MK10. Since the vertebrate assemblage discussed here occurs above the latter bed, it should most certainly be assigned to the level MK11, and, therefore, to a younger part of the Priabonian.