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Botanical Note

A fossil rhizome at the mangrove site of Wadi Hitan, Egypt

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A dichotomized rhizome fragment comparable to that of *Nypa fruticans* Wurmb, but much smaller in size, is reported from the Late Middle Eocene Camp White Layer which represents a prominent mangrove root horizon at the top of Gehannam Formation in Wadi Hitan, west of the Fayum Depression. Botanical and palaeobotanical illustrations and comments are given and suggestions made.

Keywords: Egypt, Eocene, Fayum, Gehannam Formation, mangrove, *Nypa*, rhizome, Wadi Hitan.

An exposed fossil mangrove bed was identified in Wadi-el-Hitan or simply Wadi Hitan (Whales Valley) by Bown in 1985, i.e. about 80 years later than the discovery of the less conspicuous but more famous fossil whales of this valley (Andrews, 1904; Beadnell, 1905). Wadi Hitan area lies about 35 km southwest of Birket Qarun in the Fayum Depression at about 29º 15′ – 29º 19′ N and 29º 58′ – 30º 7′ E (Fig. 1). The fossil mangrove bed of this valley lies in the Camp White Layer at the top of Gehannam Formation (Late Middle Eocene, Bartonian and/or Priabonian; about 42 million years B.P.) (Bown & Kraus, 1988; Haggag, 1990; Gingerich, 1992). This bed represents a prominent mangrove root horizon showing a succession of vertical pneumatophores (respiratory roots) dissected by wind

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erosion and capped by an extensive hard limestone resistant-to-erosion top layer (Fig. 5) (Gingerich, 1992 and Dolson *et al*., 2002). Mangrove pneumatophores and anchor roots eroding from this Camp White Layer spread over a broad area in Wadi Hitan; beds rich in plant remains appear a kilometer or so to the east and southeast of Minqar Abyad in this wadi (Gingerich, 1992) (Fig. 1). Furthermore, the vertical mangrove pneumatophores found in the thick limey hard bed at Minqar el-Hut which lies about one kilometer to the south of Wadi Hitan (Fig. 1) is almost certainly the same mangrove-rich bed of the Camp White Layer of Wadi Hitan (Gingerich, 1992).

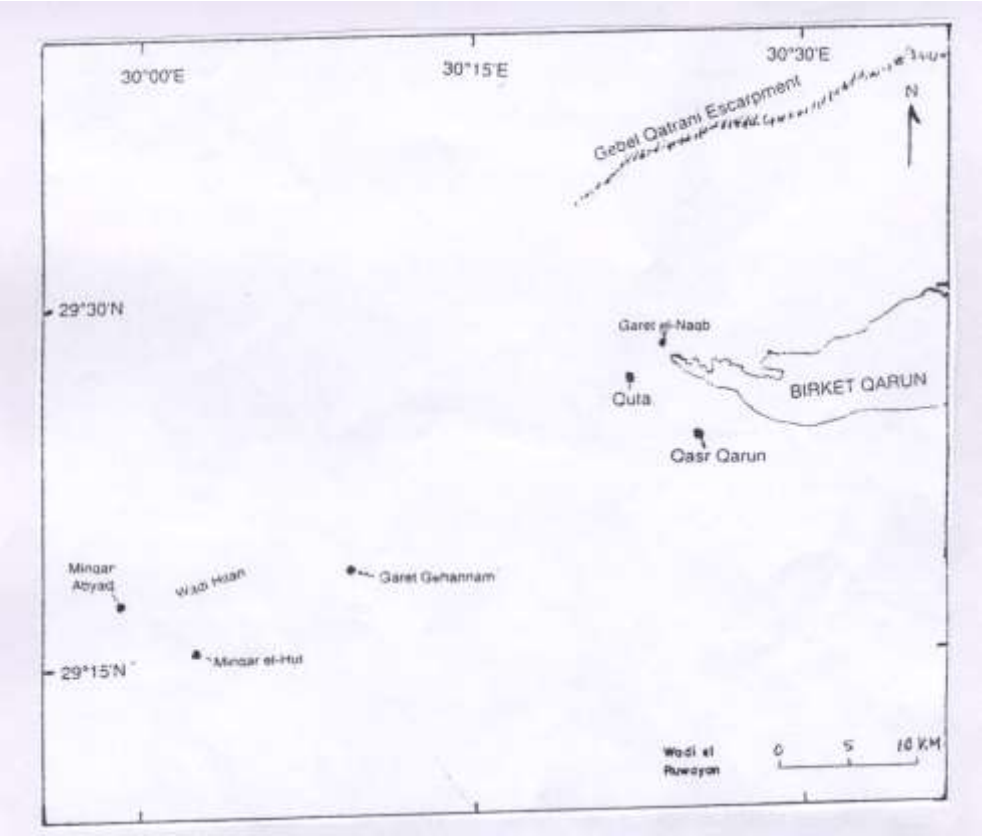

Fig. 1: Map of the western part of the Fayum Depression showing part of Birket Qarun and the location of the sites mentioned in the text. Mainly after Bown *et al*., 1982 & Gingerich, 1992.

So far, no palaeobotanical work has been done on the fossil mangroves of Wadi Hitan. However, during a visit to this wadi on 19.12.2002 by the author (among a scientific team) a fossil plant specimen was found loose at the main mangrove site (C.W.L.) of the wadi at 29º 16´ 15"N and 30º 01´ 26" E. The available morphological features of the specimen (Figs. 2,3) resemble those of the old dichotomized rhizome of the extant mangrove palm *Nypa fruticans* Wurmb particularly in the cross sections of the branches illustrated by Tomlinson (1994, P. 66) and reproduced here (Fig. 4) for comparison. But the present fossil specimen is much smaller in size and, therefore, represents the rhizome of a naturally smaller and as yet unknown plant or, otherwise, its diminished size may be due to loss of outer older leaves and shrinkage of the remaining core during fossilization. Unfortunately no cellular structure of the fossil specimen is preserved to allow for more detailed comparisons.

It is worthy to mention that fossil fruits of *Nypa* (El-Saadawi *et al*., 2002), fossil leaves of many genera including *Cynometra* (Leguminosae), *Nelumbo* (Nelumbonaceae), *Salvinia* (Salviniaceae) (Bown, 1982; Wing & Tiffney, 1982) and other plant remains, particularly petrified wood logs, of the families Anacardiaceae, Bombacaceae, Boraginaceae, Celastraceae, Comberataceae, Ebenaceae, Guttiferae, Leguminosae, Malvaceae, Palmae and Sterculiaceae (El-Saadawi & Kamal-El-Din, 2004; El-Saadawi *et al*., 2004; Kamal-El-Din & El-Saadawi, 2004) known to have species that grow in association with mangroves (Tomlinson, 1994), have been reported from Gebel Qatrani (Fig. 1) and other nearby or farther away areas in Egypt. Therefore, an at length palaeobotanical investigation of this and naturally other mangrove sites in Egypt is worthwhile. Plant species whose logs are abundant in the nearby deserts might be identified in the mangrove sites particularly that it is known that these logs do not occur in growth position and sedimentologic evidence indicates that most of them were transported a short distance (El-Saadawi & Kamal-El-Din, 2004), probably from the mangrove sites, prior to burial. The proposed detailed palaeobotanical investigation is hoped to throw more light on two other points referred to in the geological literature:

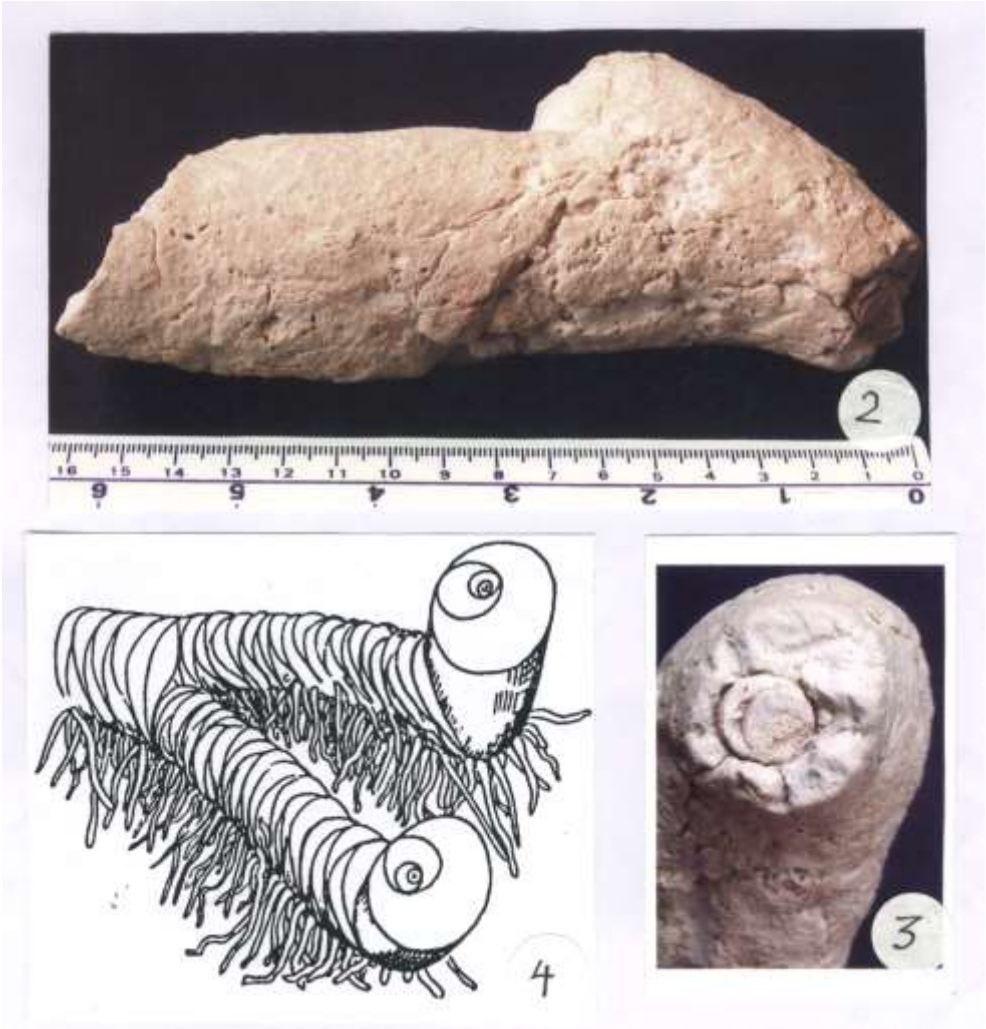

Fig. 2: The fossil dichotomized rhizome of Wadi Hitan with only the basal part of the right (upper) branch preserved. X 0.8. Photo by Dr. K. Imam, in 2004.

Fig. 3: Top view of the transverse cut of the fossil rhizome. X ca Nat. size .

Fig. 4: An old dichotomized rhizome of *Nypa fruticans* showing top view of the transversely-cut branches among other features. Much reduced. After Tomlinson (1994). Compare with Fig. 3.

Fig. 5: The 1.5 m high isolated block of the Camp White Layer showing vertical roots capped by a hard top layer X Ca 0.333. Compare with Fig. 6; notice that the green massive leafy shoot system of the extant mangrove is not found in the fossil block.

Fig. 6: A group of *Rhizophora mucronata* trees growing in off shore shallow waters in isolation from the nearby thick mangrove forest on Shalatin shore of the Red Sea, Egypt. Photo by Dr. A.A.M. Khalaf-Allah, in 1998.

First: The 1.5 m high isolated block of the Camp White Layer (Fig. 5) which lies in Wadi Hitan at 29° 16′ 15" N and 30° 01′ 25" E quite near to and having the same structure of the above mentioned main mangrove bed. Does it represent a broken block (Gingerich, 1992) or a naturally occurring one ? In present-day mangroves one can see trees growing singly or in small groups on slightly raised ground in nearshore swamps in isolation from the main forest on the shore, see for example *Rhizophora mucronata* Lam. (Rhizophoraceae) trees of Fig. 6.

Second: The 18 m long petrified trunk located along a palaeoshore line in Wadi Hitan at 29° 16′ 18" N and 30° 01′ 30" E. Is it, in fact, an entirely worm-bored tree trunk in which borings had been filled with celestite (strontium sulfate) ? (Gingerich, 1992 and Dolson *et al*., 2002). More sound proof is really needed in favour of or against this statement, particularly in view of the close similarity of the fossil object to basal parts of palm trunks or their rhizomes that are profusely covered with adventitious roots having strikingly similar size and form to the mineral-filled holes, particularly also that some Palmae (e.g., *Nypa* which is known since the end of the Cretaceous, i.e., about 69 million years B.P.) are known to be mangrove associates (Tomlinson, 1994) with their root-covered rhizomes growing horizontally near or along shore lines.

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