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Newly Recorded Larger Foraminifera from the Early Eocene Rocks of Gabal Um El Ghanayem, Kharga Oasis, Egypt

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With 3 text figures and plate 1-2

Abstract

This paper deals with the larger foraminifera, which are recorded for the first time from the Early Eocene rocks of Gabal Um El Ghanayem, Kharga Oasis. On the basis of these large foraminiferal content, biostratigraphic zonation of these rocks from this locality has been attempted.

Introduction

Gabal Um El Ghanayem is a conspicuous hill lying in the depression of the Kharga Oasis, some 228 km to the south of Assiut town. It is about 19 km to the east of the Kharga town, and only 8 km to the southeast of the Meheriq village (Fig. 1). Much attention has been given to the geology, structural geology, and micropaleontology of Kharga Oasis. The only micropaleontological study on Gabal Um El Ghanayem was carried out by Nakkady (1959). The sedimentary sequence in the area comprises from base to top the following well defined lithological units:

Nubia Formation, Phosphate Formation, Dakhla Shale, Tarawan Chalk, Esna Shale and Thebes Formation (Fig. 1). The age of these rock units ranges from the Pre-Maestrichtian to the Ypresian.

The early Eocene rocks exposed in Gabal Um El Ghanayem crops out in the form of a high limestone plateau, occupying the above portion of this locality. It comprises the upper part of the Esna Shale unit and the Thebes Formation above.

The Thebes Formation (Said, 1960, 1962) is a massive limestone unit that overlies the Esna Shale in many localities in Egypt. It is recognized since Zittel (1883), who designated it as the "Ältere Abteilung der Libyschen Stufe", which is the lower part of his "Libysche Stufe". This formation is refered to in the literature as "Lower Libyan", as "*Operculina* limestone" or as "Limestone with flint". The type locality of this formation is at Thebes, opposite Luxor. Bishay (1961) subdivided the rocks of this formation in the country to the east of the Nile between Assiut and

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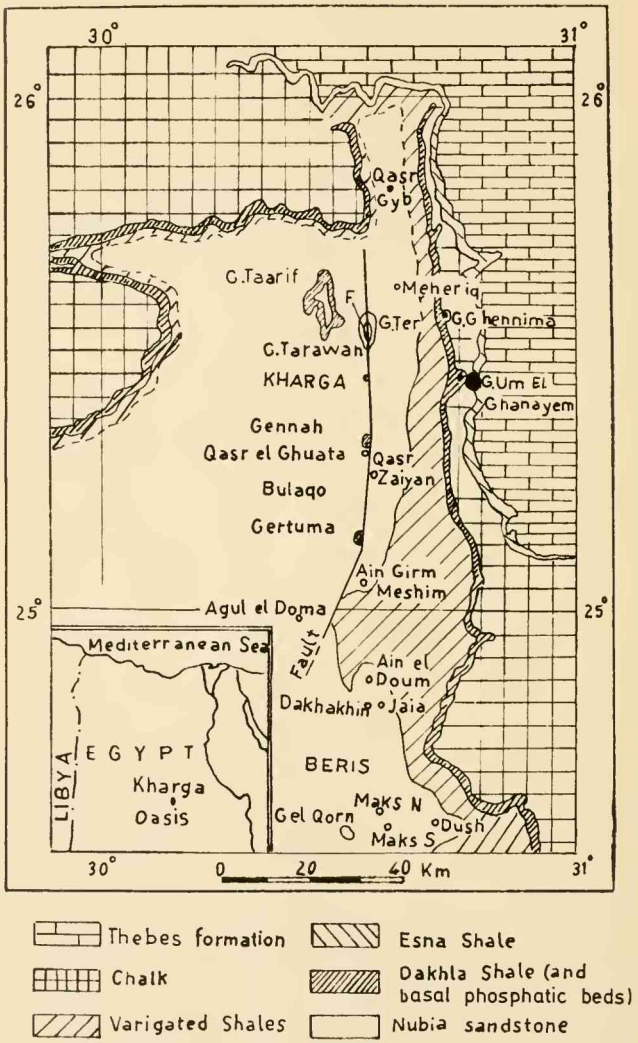
Minia, into a lower nonfossiliferous limestone with flint (Assiuti Formation) and an upper Nummulitic limestone unit (Manfaluti Formation). The Thebes Formation belongs mostly to the Lower Eocene, but its upper part may be Middle Eocene in age (Youssef, 1949, 1968).

The Farafra limestone (Said, 1962; Said and Kerdany, 1961) is the reefal equivalent of the Thebes Formation, and its age is the same. Its type section is in El Guss Abu Said, Farafra Oasis. This formation is composed of hard, medium to crystalline alveolinid limestone (Said, 1962). It overlies the Esna Shale, which is



Text fig. 1: Geological map of Kharga Oasis showing the location of Gabal Um El Ghanayem (after Ball 1900 and Beadnell 1909).

calcareous near its top. The gradual passage between the Esna Shale and the Farafra limestone as well as the abundance of alveolinids and the yellowish colour of the latter, distinguish it from the Thebes Formation, which has a sharp boundary between the underlying shale, it is devoid of alveolines; it contains operculines and nummulites and it is white in colour (Youssef and Abdel Aziz, 1971).

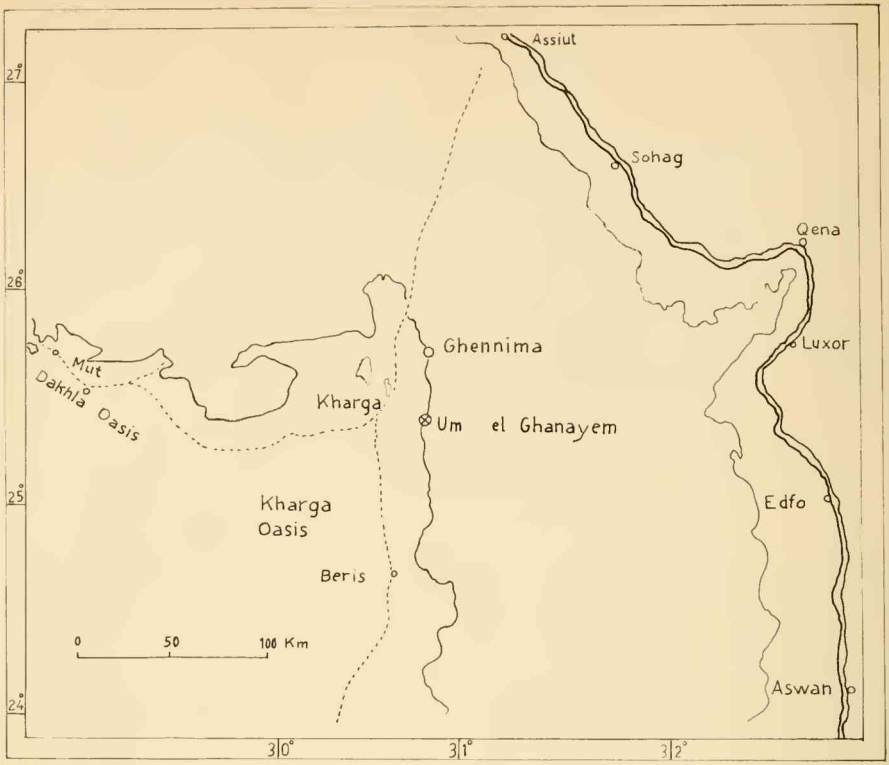
Said (1962) mentioned that at Gabal Um El Ghanayem, the Thebes Formation has a total thickness of at least 110 m and marks a huge complex of well bedded white and greyish limestone with abundant silicification. The top layer in the succession is composed of peculiarly weathered siliceous limestone which is highly polished and eroded into sharp ridges with abundant *Operculina libyca.*

El Naggar (1970) agreed with Zittel to consider the "Libyan" as a distinct group. He suggested a new name "Libyan Desert Group" to the early Eocene rocks in Egypt. He divided this group into two formations and two members as follows:

Libyan Desert Group
- 2. Drunka Formation
  - Thebes Limestone Member
- 1. Luxor Formation
  - Qurnah calcareous shale Member

According to El Naggar (1970) the Luxor Formation is proved to be of Early Eocene (Ypresian) age, while the Drunka Formation is of Early Middle Eocene age. He suggested that the term "Farafra Limestone" introduced by Said (1960) representing the reefal facies of the Early Eocene, should be dropped. El Naggar (1970) concluded that the Farafra Limestone is separated from the underlying calcareous shales by an unconformity surface, along which the equivalent of the Thebes Limestone is missing. In his opinion, the Farafra Limestone is only a part of the basal Middle Eocene "Drunka Formation" and therefore the name "Farafra Limestone", should be suppressed. Youssef & Abdel Aziz (1971) studied the biostratigraphy of the Upper Cretaceous-Lower Tertiary of three sections in Farafra Oasis. They observed that the limestone overlying the Esna Shale in the north Gunna section, distinctly differs from the typical Farafra Limestone in containing a few operculines and nummulites, and is devoid of alveolinids and in the same time its boundary with the underlying shale is sharp. They concluded that this limestone represents a deep water variant of the alveolinid-nummulitic reefal limestone of Farafra Limestone; therefore, they gave a composite formational name "Thebes-Farafra Limestone" to refer to both facies collectively. They assigned a Lower and "probably" Middle Eocene age to this formation.

The present authors noticed that the upper limestone in Gabal Um El Ghanayem section has a sharp boundary with the underlying Esna Shale unit, and is devoid of alveolines in its lower part and contains a large number of nummulites, operculines and assilines. The lower limestone is therefore much more similar to the Thebes Formation than to the Farafra Limestone Formation. In the upper part, however, the limestone is recrystallized and hard, with abundant alveolines which distinguishes the Farafra Limestone. It seems to represent a shallow water variant of the nummulitic limestone of the Thebes Formation. Therefore the authors agree with Youssef & Abdel Aziz (1971) in giving the upper limestone a composite formational name "Thebes — Farafra Limestone" Formation in this locality.



Text fig. 2: Location map of Gabal Um El Ghanayem.

Paleontology

Larger foraminifera

In Egypt, as in many other parts of the world, the large foraminifera are the most common fauna in the Eocene rocks. The early Eocene larger foraminifera are known in bands which intercalate the otherwise open sea facies of this age, in many parts of Egypt. In other localities, they are known in reefal developments such as the scarp of Farafra Oasis, which form the Farafra limestone complex.

The fauna included in the Lower Ypresian, apart of the presence of the Landenian species: *Nummulites deserti, N. solitarius, N. fraasi, Operculina libyca* and *Discocyclina nudimargo, N. rotularius N. subramondi, N. praecursor, N. atacicus, N. exilis* and *Assilina nili.* In the Upper Ypresian appear the species of Nummulites: *N. pernotus, N. globulus, N. partschi, N. burdigalensis, N. planulatus* and *Assilina granulosa;* also included here are the primitive types of Alveolines which have flosculinized wall such as *Alveolina decipiens* and *A. pasticillata.*

Schwager (1883) worked on the Rohlf's expedition collections from El Guss Abu Said, Farafra Oasis, and described *Heterostegina ruida* and *Operculina libyca*

from the upper part of the Esna Shale unit, which he called "Operculinen Horizont". Also, he described two new species of alveolines from the overlying "Alveolinen Horizont", which is equivalent to the Farafra Limestone; *Alveolina (Flosculina) decipiens* and *A. (Flosculina) pasticillata.*

Nakkady (1959) mentioned only *Nummulites deserti* and *Operculina libyca* from the upper limestone of Gabal Um El Ghanayem, and assigned it to the Montian.

Bishay (1961) recorded the following species of larger foraminifera from the Lower Eocene of the Nile Valley between Assiut and Manfalut: *Discocyclina archiaci, D. nudimargo, D. varians, Nummulites atacicus, N. deserti, N. discorbinus, N. pomeli, Operculina libyca, O. subammonea* and *Orbitolites pharonum.*

Said and Kerdany (1961) described numerous specimens of alveolines: *Alveolina decipiens, A. decipiens dolioliformis* and *A. pasticillata,* from the Upper Farafra limestone of Ain Maqfi section, Farafra Oasis. They assigned an Ypresian age to this limestone, and regarded it as representing the reefal facies of the Egyptian Ypresian.

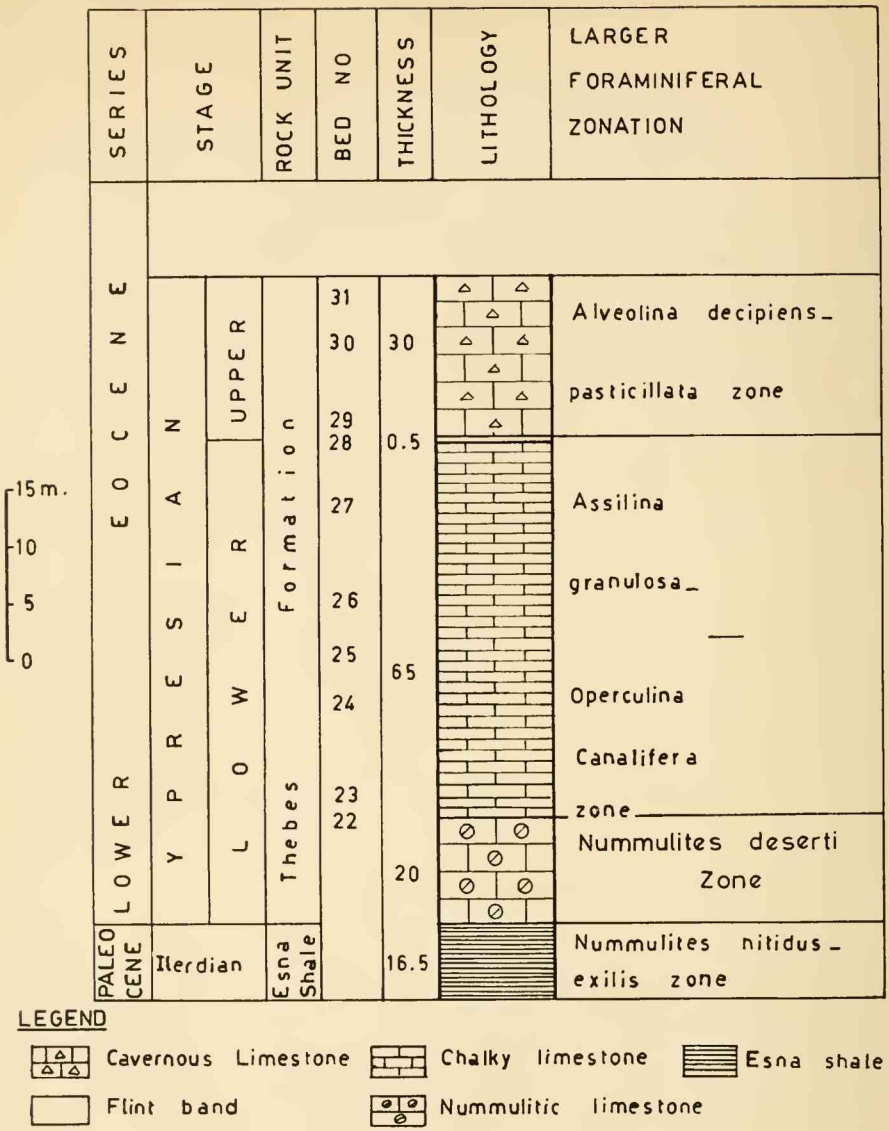
El Shinnawi (1964) recorded the following large foraminifera from the upper nummulitic limestone of Gabal Ghanima section to the south of Gabal Um El Ghanayem: *Nummulies deserti, N. solitarius, N. subramondi, N. globulus, Operculina libyca, O. canalifera* and *Operculinoides* sp. He gave an Ypresian age to this limestone.

Youssef and Abdel Aziz (1971) identified the following larger foraminifera from the Thebes-Farafra limestone Formation of El Guss Abu Said section, Farafra Oasis: *Nummulites deserti, N. exilis involutus, N. globulus, N. pernotus, N. burdigalensis, N. nitidus inflatus, N. planulatus cussacensis, N. praelucasi, Operculina libyca, Discocyclina nudimargo, Alveolina decipiens* and *Alveolina sp.* They attributed a Lower Eocene and "probably" Middle Eocene age to this formation.

This paper deals with the description of about 15 species of larger foraminifera, which are recorded for the first time from the Thebes-Farafra limestone Formation of Gabal Um El Ghanayem, these are:

Fabularia sp.
Orbitolites complanatus Lamarck
Orbitolites sp.
Alveolina decipiens Schwager
A. cucumiformis Hottinger
A. pasticillata Schwager
A. oblonga d'Orbigny
A. ovicula Nuttall
A. rotundata Hottinger
Assilina nili De La Harpe
A. granulosa (d'Archiac)
A. laminosa Gill
Miscellanea miscella (d'Archiac & Haime)
Operculina canalifera d'Archiac & Haime

The alveolinid assemblage recorded from the upper limestone unit is unique the world over, these forms are taken as markers for the Upper Ypresian. The *Assilina, Miscellanea* and *Operculina* assemblage are taken as markers for the Lower Eocene age.



Text fig. 3: Larger foraminaferal zonation of the Thebes Formation at Gabal Um El Ghanayem, Kharga Oasis.

Larger foraminiferal zonation:

The systematic study of the larger foraminifera in the Early Eocene rocks of Gabal Um El Ghanayem section lead to the recognition of the following 4 zones (Fig. 3).

1. *Nummulites nitidus-exilis* zone

The top most part of the Esna Shale unit (14 m) yields primitive species of *Nummulites,* that appears for the first time in this locality such as *Nummulites nitidus* SCHAUB, *N. exilis* DOUVILLÉ, *N. praecursor* DE LA HARPE together with *N. deserti* DE LA HARPE and *N. solitarius* DE LA HARPE. HOTTINGER & SCHAUB (1960) attributed the age of these *Nummulites* assemblage to a new stage, which is older than the Ypresian and younger than the Landenian, and which they gave it the name "Ilerdian".

2. *Nummulites deserti* zone

This zone coincides with the lower 20 meters of the Thebes-Farafra Formation. It is characterized by the abundance of *Nummulites deserti,* together with *Nummulites subramondi* DE LA HARPE and *N. planulatus* (LAMARCK). *N. deserti* is considered by DE LA HARPE as the most primitive of all nummulites. It characterizes the Egyptian Landenian and extends till the Lower Ypresian. (SAID, 1962; SCHAUB, 1951)

3. *Assilina granulosa-Operculina canalifera* zone

This zone comprises 66 meters of the Thebes-Farafra Limestone Formation (chalky limestone) and is characterized by the presence of the following large foraminifera assemblage: *Assilina granulosa* (D'ARCHIAC), *A. nili* DE LA HARPE, *A. laminosa* GILL, *Operculina canalifera* D'ARCHIAC & HAIME and *Miscellanea miscella* (D'ARCHIAC & HAIME). The index species of this zone are considered by DE LA HARPE (1883), SCHAUB (1951) and GILL (1953) as early Ypresian age.

4. *Alveolina decipiens-pasticillata* zone

This zone is confined to the upper 30 meters of the cavernous limestone, which is characterized by the frequency of *Alveolina decipiens* SCHWAGER, *A. pasticillata* SCHWAGER, together with *A. oblonga* D'ORBIGNY, *A. ovicula* NUTTAL, *A. rotundata* HOTTINGER, *A. cucumiformis* HOTTINGER, *A. ellipsoidalis* SCHWAGER, *Orbitolites complanatus* LAMARCK, *Orbitolites* sp. and *Fabularia* sp.

According to HOTTINGER (1960), these alveolines assemblage assigned an Upper Ypresian age. SAID & KERDANY (1961) recorded *Alveolina decipiens* and *A. pasticillata* from the Ypresian of Farafra Oasis.

Systematic Descriptions

The thin slides figured in this study are housed in the Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich, West Germany. (Nr. 1464 to 1469 a/75)

Family MILIOLIDAE Ehrenberg, 1839
Subfamily Fabulariinae Ehrenberg, 1839
Genus *Fabularia* Defrance, 1820
Fabularia sp. (pl. 1, fig. 4a, b)

Test nearly oval in front view, biconvex, longer than broad. Longitudinal section measures about 3.0 mm in diameter; transverse section is 2.0 mm. The periphery is broadly rounded; early chambers quinqueloculine, later chambers biloculine. Sutures distinct, depressed. Aperture a large opening, bordered by slightly projecting lip. Transverse section shows the large embryonic chamber, the bilocular arrangement of the chambers, which have thick wall and are normally subdivided into two rows of irregularly shaped chamberlets.

Occurrence: The present record is of particular interest, in that it extends the geologiccal range of the genus, previously known from the Upper Eocene of Europe, North Africa, and America and the Lower Pliocene and Pleistocene of Australia to the Lower Eocene in Egypt.

A large number of sections of this species are seen with different species of alveolines in the upper part of the Thebes-Farafra Limestone of Gabal Um El Ghanayem.

Age: Upper Ypresian.

Family SORITIDAE Ehrenberg, 1839
Subfamily Soritinae Eehrenberg, 1839
Genus *Orbitolites* Lamarck, 1801
Orbitolites complanatus Lamarck, 1801
(pl. 1, fig. 6d, 8e)

1883 *Orbitulites* cf. *complanatus* Lamarck. — Schwager, p. 90, pl. 14, figs. 10a-d.
1925 *Orbitolites complanatus* Lamarck. — Nuttall, p. 447.
1939 *Orbitolites complanatus* Lamarck. — Silvestri, p. 44, pl. 6, figs. 4-5.

Remarks: This species is flat, thin, of medium size; it attains the diameter of 25 mm. The axial section shows that the test is thin in the central part and thick at the periphery.

Occurrence: This well-known species occurs abundantly in the upper part of the Thebes-Farafra Limestone Formation in Gabal Um El Ghanayem.

Age: Lower Eocene (Upper Ypresian).

Orbitolites sp.
(pl. 1, fig. 3b, 5d)

This species occurs rarely in the sections of the Thebes-Farafra Limestone. The diameter of the test measures about 8.0 mm, it is characterized also by a distinct elevation at the centre of the test.

Age: Upper Ypresian.

Family ALVEOLINIDAE Ehrenberg, 1839
Genus *Alveolina* d'Orbigny, 1826[2])
Alveolina decipiens Schwager, 1883
(pl. 1, fig. 3a, 5a, 6a)

1883 *Alveolina (Flosculina) decipiens* Schwager, p. 103, pl. 26, fig. 1.
1960 *Alveolina decipiens* Schwager. — Hottinger, p. 123—126, pl. 8, figs. 1-8, textfig. 66a-c.
1961 *Alveolina decipiens* Schwager. — Said & Kerdany, p. 326, textfig. 11.

Test small, oval, with rounded edges. It measures 3.8 mm in length, and the width is about 2.2 mm. The average ratio of length to width is 1.7 to 1. There are 6 to 8 whorls, the inner whorls are tight, the rest whorls are flosculinized. The septulae are parallel and continuous; the chamberlets are oval. The preseptal canal is well developed, the postseptal is small and poorly developed.

Occurrence: This species is abundant in the upper cavernous limestone of Gabal Um El Ghanayem section.

This species was described for the first time by Schwager (1883) from the *Alveolina* Limestone of El Guss Abu Said, Farafra Oasis. Said & Kerdany recorded the same species from the Ypresian of the Farafra Oasis. Hottinger (1960) gave a Middle Ilerdian age to this species.

Age: Upper Ypresian.

Alveolina cllipsoidalis Schwager, 1883
(pl. 1, fig. 6c; pl. 2, Fig. 3)

1883 *Alveolina ellipsoidalis* Schwager, p. 96, pl. 25, figs. 1-2.
1960 *Alveolina ellipsoidalis* Schwager. — Hottinger, p. 64, pl. 2, figs. 1-8, textfig. 20c, 33a, b.

Test medium, oval, with rounded ends. The length is 4.2 mm and the width is 2.8 mm. There are about 11 whorls, the inner 4 whorls are tight and the rest of whorls increase regularly in height as added.

Occurrence: Large number of sections belonging to this species, are observed in the upper part of the Thebes-Farafra Limestone Formation in the studied section.

Schwager (1883) described this species from the Eocene of Wadi Natfe in the Arabian Desert, Egypt. Hottinger (1960) recorded the same species from the Lower Ilerdian of Fabas "Petites Pyrénées", France.

Age: Upper Ypresian

Alveolina pasticillata Schwager, 1883
(pl. 1, fig. 5b, 6b, 7b, 8b)

1883 *Alveolina (Flosculina) pasticillata* Schwager, p. 104, pl. 26, fig. 2.
1960 *Alveolina pasticillata* Schwager. — Hottinger, p. 88, pl. 4, figs. 26-33; textfig. 20a, 44, 45.
1961 *Alveolina pasticillata* Schwager. — Said & Kerdany, p. 326, textfig. 13.

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[2]) According to Loeblich & Tappan (1964) the generic name *Alveolina* d'Orbigny 1826 is invalid. The valid name is *Fasciolites* Parkinson 1811. (Note of the editor)

Test cylindrical, medium. The axial diameter is 4.0 mm, the equatorial diameter is 2.5 mm. It is composed of 5 whorls, the whorls are fewer than that of *A. decipiens*. The chamberlets are rounded, there are about 12 per millimeter in the last whorl.

Occurrence: In Gabal Um El Ghanayem section, this species is recorded from the upper part of the Thebes-Farafra Limestone Formation.

Schwager (1883) described this species from the Eocene beds of El Guss Abu Said section, Farafra Oasis and from the Eocene of Wadi Natfe in the Arabian Desert. Hottinger (1960) recorded this species from Minerve (Montagne Noire), France.

Age: Upper Ypresian

Alveolina oblonga d'Orbigny, 1826
(pl. 1, fig. 7a, 8a)

1925 *Alveolina oblonga* d'Orbigny. — Nuttall, p. 440, pl. 24, figs. 7, 8.
1927 *Alveolina oblonga* d'Orbigny. — Davies, p. 282—283, textfig. 5.
1960 *Alveolina oblonga* d'Orbigny. — Hottinger, p. 141, pl. 9, figs. 4-16, textfig. 5, no. 10-12.

Test medium, cylindrical, with rounded edges; composed of 17 whorls. The whorls are lax. It measures 8.0 mm in length and 3.4 mm in width. There are about 20 chamberlets occurring within the length of 1.0 mm in the last whorl, they are oval in shape.

Occurrence: In Um El Ghanayem section, *A. oblonga* is observed together with other *Alveolina* species in the *Alveolina decipiens-pasticillata* zone.

Nuttall (1925) described this species from the Lower Eocene of the Laki Series of parts of Sind and Baluchistan (India).

Hottinger (1960) recorded this species from the Lower Eocene (Cuisian) of the upper part of Gabal Telemet, Wadi Araba, Egypt. Hottinger determined also this species from the Lower Eocene of south Spain (Malaga). Also he recorded this species from the Aquitaine, France.

Age: Upper Ypresian.

Alveolina ovicula Nuttall, 1925
(pl. 1, fig. 5c, 8d; pl. 2, fig. 4)

1925 *Alveolina ovicula* Nuttall, p. 439, pl. 24, figs. 9-10.

Test medium, spherical, its length is 5.0 mm. It is composed of 13 whorls; the early 5 whorls are tight, then become separated from each other and moderately widely spaced. In the last whorl, there are about 15 chamberlets per millimeter.

Occurrence: In Gabal Um El Ghanayem section, large number of sections of this species are found in the upper part of the Thebes-Farafra Limestone.

Nuttall (1925) described this species from the Lower Eocene of the Laki series in Baluchistan (India).

Age: Lower Eocene (Upper Ypresian).

Alveolina cucumiformis Hottinger, 1960
(pl. 1, fig. 1b, 7c, 8c)

1960 *Alveolina cocumiformis* Hottinger, p. 135, textfigs. 71, 72, 73.

Test small, elongated, with slightly tapering edges. It measures about 4.3 mm in length and 2.4 mm in width. There are 8 whorls in this species. The chamberlets are rectangular.

Occurrence: A few number of sections of this species are observed in the upper part of the Thebes-Farafra Limestone of Gabal Um El Ghanayem section.

This species was first described by HOTTINGER (1960) from the Lower Ilerdian of Fabas, Aquitaine in southern France; and from Campo, Catalonia, Spain.

Age: Upper Ypresian.

Alveolina rotundata HOTTINGER, 1960
(pl. 2, fig. 1)

1960 *Alveolina rotundata* HOTTINGER, p. 132, pl. 6, fig. 18-21; textfig. 70.

Test small, elongated, with tapering ends. The length is 4.5 mm and the width is 2.0 mm. The test is composed of 9 whorls, the whorling is lax. The proloculum is spherical, it is about 4.0 mm in diameter.

Occurrence: In the present section, this species is identified from the upper part of the upper cavernous limestone.

HOTTINGER (1960) described this species from the Upper Paleocene of Tremp, Catalonia, Spain; and from the Montagne Noire, Aquitaine, southern France.

Age: Upper Ypresian.

Family NUMMULITIDAE DE BLAINVILLE, 1825
Subfamily Nummulitinae DE BLAINVILLE, 1825
Genus *Nummulites* LAMARCK, 1801
Nummulites deserti DE LA HARPE, 1883
(pl. 1, fig. 2)

1883 *Nummulites deserti*. — DE LA HARPE, p. 177, pl. 31, figs. 20-25.
1951 *Nummulites deserti* DE LA HARPE. — SCHAUB, p. 96, figs. 19-21.
1961 *Nummulites deserti* DE LA HARPE. — SAID & KERDANY, p, 324, textfig. 7, 1a-c.

Test small, surface shows straight septal filaments. In the middle, there is a medium tubercle, which has rather indistinct contour. In the equatorial section, the nucleoconch is small, consisting of two unequal chambers. There are 3 whorls, the width of the spacing of whorls increases very slowly. The septa are nearly upright, somewhat arcuate. The height of the chambers is larger than their width. The axial section is characterized by its biconvex form, by its thin marginal cord and by its triangular spiral cavity.

Occurrence: Different sections from this species are found in the Lower part of the Thebes-Farafra Limestone Formation of Gabal Um El Ghanayem section.

Age: Lower Ypresian.

Genus *Assilina* D'ORBIGNY, 1826
Assilina granulosa (D'ARCHIAC), 1847
(pl. 2, fig. 8)

1919 *Assilina granulosa* D'ARCHIAC. — DOUVILLÉ, p. 72, pl. 4, fig. 15-17.
1925 *Assilina granulosa* D'ARCHIAC. — NUTTALL, p. 441, pl. 26, fig. 1-5.
1929 *Assilina granulosa* (D'ARCHIAC). — LLUECA, p. 229, pl. 17, fig. 7-11.

Test medium, lenticular, has a diameter of 4.2 mm and a thickness of 0.8 mm, the centre is somewhat depressed. The surface is covered with granules, which are numerous at the centre. The whorling increases in the last two whorls; spiral lamina thick. The last whorl is 1½ time higher than the preceeding. The septa are thin, nearly upright.

Occurrence: This species is abundant in the chalky limestone beds, above the nummulitic limestone of the Thebes-Farafra Limestone in Gabal Um El Ghanayem section.

Douvillé (1919) found this species in the Lower Eocene of the Aquitaine. Nuttall (1925) described this species from the Lower Eocene of the Laki Series, India. Llueca (1929) recorded *Assilina granulosa* from the Ypresian of Spain.

Age: Lower Ypresian.

Assilina sublaminosa Gill, 1953
(pl. 2, fig. 6)

1953 *Assilina sublaminosa* Gill, p. 83, pl. 13, figs. 18-19.

Test small, composed of 4 whorls, the maximum diameter is 1.0 mm and the thickness is 0.6 mm. The periphery is subrounded; the spiral lamina is thick. The whorling increases gradually from the first whorl till the end. The fourth whorl is about 1½ time higher than the preceeding. The septa are straight, thin. The pillars are radial, concentrating at the pole of the test.

Occurrence: Large number of this species are found together with other species of *Assilina* in the chalky limestone, underlying the alveolinid limestone of Gabal Um El Ghanayem section.

This species was described by Gill (1953) from the Lower Eocene of the Laki Series, India.

Age: Lower Ypresian.

Assilina nili de la Harpe, 1883
(pl. 2, fig. 5)

1883 *Assilina nili* De La Harpe, p. 213, pl. 6, figs. 35-42.
1951 *Assilina nili* De La Harpe. — Schaub, p. 205, pl. 6, figs. 15-16.

Test small, its diameter is 2.5 mm only and its thickness is 0.4 mm. It is composed of 3 whorls. The spiral lamina is regular and thin.

Occurrence: This species is observed in the chalky limestone of Gabal Um El Ghanayem.

De la Harpe (1883) described this species from the Lower Eocene of Gabal Ter, on the opposit side of Esna, Upper Egypt. Schaub (1951) found this species in the Lower Ypresian of Sörenberg, Luzern, Switzerland.

Age: Lower Ypresian.

Genus *Operculina* d'Orbigny, 1826
Operculina canalifera d'Archiac & Haime, 1853
(pl. 2, fig. 7)

1853 *Operculina canalifera* d'Archiac & Haime, p. 182, 346; pl. 12, fig. 1; pl. 35, fig. 5; pl. 36, fig. 15, 16.
1927 *Operculina canalifera* d'Archiac. — Davies, p. 276, pl. 20, fig. 11-13.
1929 *Operculina canalifera* d'Archiac. — Llueca, p. 251, pl. 19, fig. 5-13, pl. 20, figs. 1-4.

This species is lenticular, flat, measures about 5.0 mm in diameter. It is thick in the centre, thin at the periphery. The surface is covered with granules. Its test is composed of 3 whorls. The proloculum is small. The spiral lamina is thick; the marginal cord is about 1/3 the spiral cavity. The third whorl is three times higher than the previous one. The septa are thin, long, vertical, with a slight bend near the roof of the whorl; there are 10 septa in the last whorl.

Occurrence: This species is found abundantly in the chalky limestone of Gabal Um El Ghanayem.

Davies (1927) described this species from the Lower Eocene of the Ranikot Series, India, Llueca (1929) recorded this species from the Ypresian of Spain.

Age: Lower Ypresian.

Genus *Miscellanea* Pfender, 1935
Miscellanea miscella (d'Archiac & Haime), 1853
(pl. 2, fig. 2)

1853 *Nummulites miscella* d'Archiac & Haime, p. 345, pl. 35, fig. 4.
1927 *Siderolites miscella* (d'Archiac & Haime). — Davies, p. 377, pl. 20, fig. 9.
1937 *Miscellanea miscella* (d'Archiac & Haime). — Davies & Pinfold, p. 43, pl. 6, figs. 1-3, 5, 7, 8.
1954 *Miscellanea miscella* (d'Archiac & Haime). — Smout, p. 72.

Test lenticular, it measures 2.8 mm in diameter and 1.2 mm in thickness. The surface heavily granulated, the granules are more concentrated near the centre; near the periphery, the granules are fine. The test is composed of 4 whorls, the proloculum is large having a diameter of 4.0 mm; spiral lamina is thin, regular. The septa are thin and gently curved.

Occurrence: This species is observed in the sections of the chalky limestone together with the different species of *Assilina* and *Operculina canalifera*.

Remarks: This species was originally described as a granular *Nummulites* by d'Archiac & Haime. Pfender (1935) took it as a type of her new genus. Davies (1927) recorded this species from the Lower Eocene of the Ranikot Series India. Smout (1954) described this species from the Upper Paleocene of Gabal Dukkan area, Qatar Peninsula.

Age: Lower Ypresian.

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Plate Explanation

Plate 1

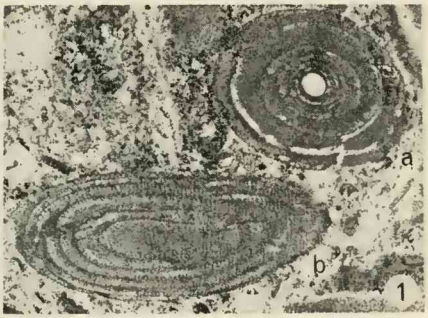
1. a: *Alveolina pasticillata* Schwager, equatorial section;
   b: *Alveolina cucumiformis* Hottinger, axial section; ×10.
2. *Nummulites deserti* De la Harpe, axial, equatorial, tangential sections; ×5.
3. a: *Alveolina decipiens* Schwager, equatorial section;
   b: *Orbitolites* sp., axial section; ×10.
4. *Fabularia* sp., a: longitudinal section; b: transverse section; ×10.
5. a: *Alveolina decipiens* Schwager, tangential section;
   b: *Alveolina pasticillata* Schwager, axial section;
   c: *Alveolina ovicula* Nuttall, axial section;
   d: *Orbitolites* sp.; ×10.
6. a: *Alveolina decipiens* Schwager, equatorial section;
   b: *Alveolina pasticillata* Schwager, oblique section;
   c: *Alveolina ellipsoidalis* Schwager, oblique section;
   d: *Orbitolites complanatus* Lamarck, axial section; ×5.
7. a: *Alveolina oblonga* D'Orbigny, axial section;
   b: *Alveolina pasticillata* Schwager, axial section;
   c: *Alveolina cucumiformis* Hottinger, axial section; ×6.
8. a: *Alveolina oblonga* D'Orbigny, axial section;
   b: *Alveolina pasticillata* Schwager, axial section;
   c: *Alveolina cucumiformis* Hottinger, axial section;
   d: *Alveolina ovicula* Nuttall, axial section;
   e: *Orbitolites complanatus* Lamarck, axial section; ×5.

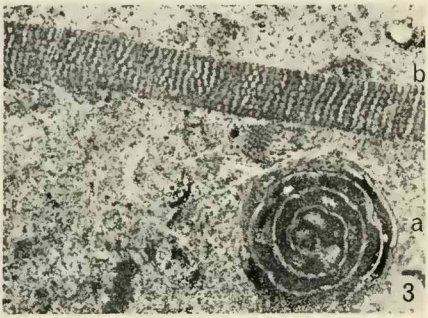
Fig. 1, 3-8: Upper cavernous limestone, Thebes-Farafra Limestone Formation; Fig. 2: Lower nummulitic limestone, Thebes-Farafra Limestone Formation.

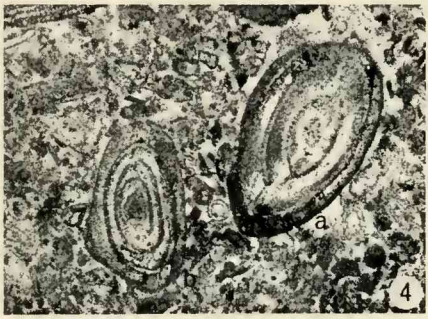
Plate 2

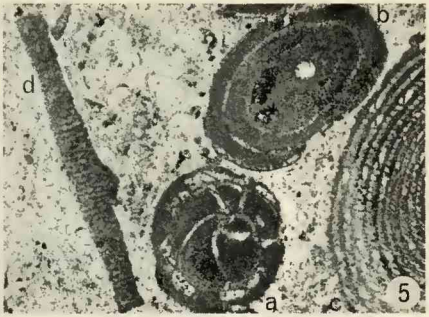
1. *Alveolina rotundata* Hottinger, axial section; ×10.
2. *Miscellanea miscella* (D'Archiac & Haime), a: equatorial section, b: axial section; ×10.
3. *Alveolina ellipsoidalis* Schwager, equatorial section; ×10.
4. *Alveolina ovicula* Nuttall, axial section; ×5.
5. *Assilina nili* De la Harpe, axial section; ×10.
6. *Assilina sublaminosa* Gill, axial section; ×10.
7. *Operculina canalifera* D'Archiac & Haime, axial section; ×10.
8. *Assilina granulosa* (D'Archiac), axial section; ×5.

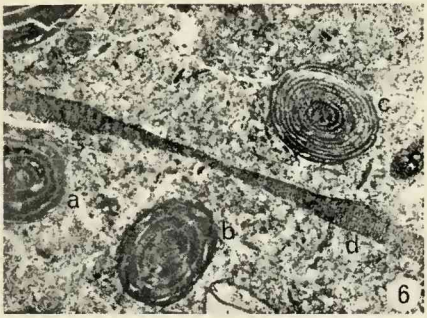
Fig. 1-4: Upper cavernous limestone, Thebes-Farafra Limestone Formation; Fig. 5-8: Chalky limestone, Thebes-Farafra Limestone Formation.

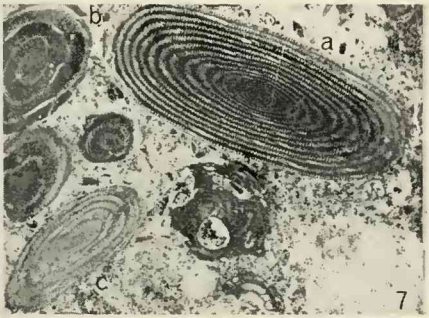


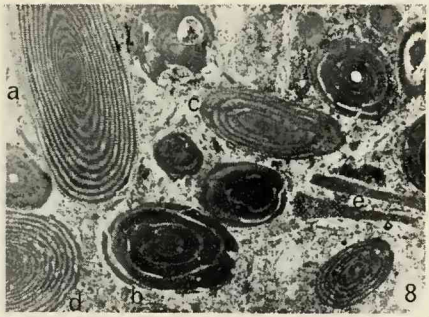












Omara, S. & A. I. Kenawy: Larger Foraminifera from Egypt **Tafel 1**