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STRATIGRAPHY OF THE MIDDLE EOCENE SUCCESSION FROM SOUTH EL-FAYOUM PROVINCE, WESTERN DESERT, EGYPT.

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ABSTRACT

This paper deals mainly with the lithostratigraphy and biostatigraphy of the exposed Middle Eocene deposits of south El-Fayoum Province. The sedimentary succession at the studied area is subdivided into four distinct lithostratigraphic units which range in age through Middle Eocene in addition to Pliocene sediments.

The biostratigraphy of the studied rock units based on planktonic foraminifera, ostracoda, nummulites, craterocamerina and bryozoa. They are used together to erect two high resolution biozones of both planktenic foraminefera and nummulites and one biozone of ostracoda, craterocamerina and bryozoa.

INTRODUCTION

The investigated area lies some 25 km south El-Fayoum Province that is bounded by Beni-Mazar on the east and on the west by Wadi El-Rayan. Its southern border is limited by Wadi El-Muweilih (fig. 1). The studied area lies between latitudes 28° 40` and 90° 00` N. and longitudes 30° 25` and 30° 50` E.Several authors have dealt with the geology of suth El-Fayoum area as, Beadnell (1905), Hume (1912), Blanckenhorn (1921),Iskander (1943), Said (1962), Abd El-Kireem (1971), Shamah (1918), Refayi (1986), Swedan (1986), Abu El-Ghar (1991), and Khalifa et.al (1993).

The intention of this paper is to study the lithe-statigraphic units of the Middle Eocene rocks originally classified by Iskander (1942).

Her the oldest rocx unit Iskander (op.cit)considered the is Mueweilih Formabion as the oldest rock unit. In this study, the Samalat Formation is the oldest . Also, This paper dealt with the biosatratigraphic units by different collected fauna. Some fauna studied for the first time such as bryozea and craterocamerina, other types such as planktonic, ostracods, benthonic forminifera and nummulites biozons are previously studied by Shamah (1981) and zalat, (1987).

LITHOSTRATIGRAPHY

The exposed sedimentary rocks in the area under consi-deration range in age from Middle Eocene to Pliocene.

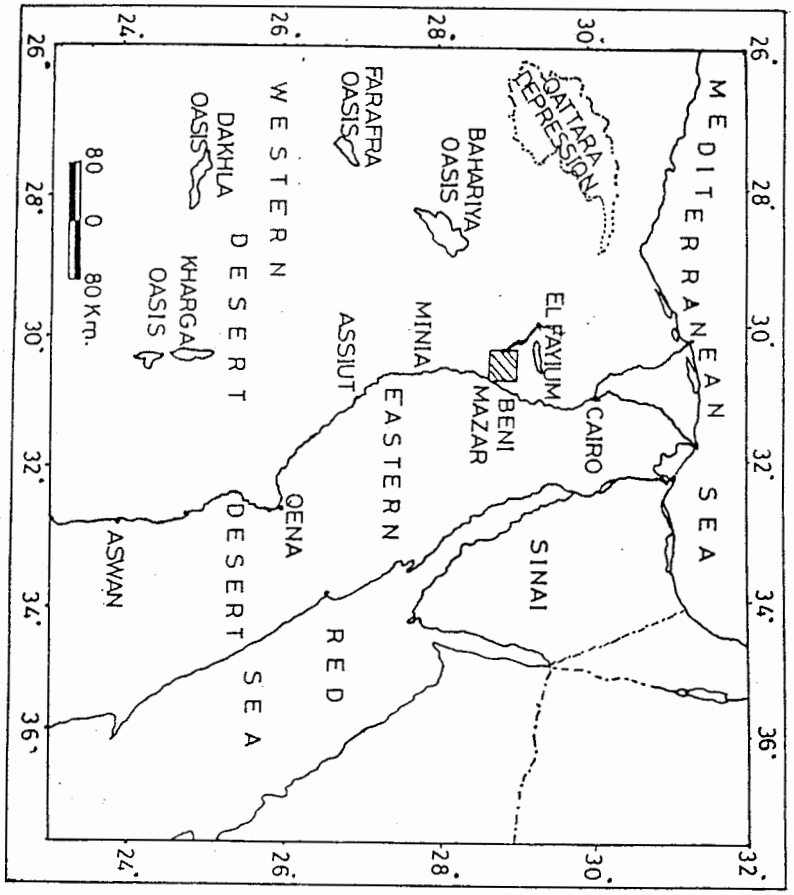


FIG 1 LOCATION MAP OF THE STUDIED AREA ▨.

Four stratigraphic sections have been measured and deseribed in different localities in the studied area, this is to illucidate the vertical and the lateral facies changes of the studied rock units.The boundaries betweenrock units are checked in the field (fig.2). The primary and biogenic structures are described and the faunal association either mega or micro have been identified.

1. The Samalut Formation (Middle Lutetian) :

Bishay (1961) was the first to introduce the term "Samalut Formation" in the stratigraphic of the Eocene rocks occurring east of the Nile Valley . He defined this formation as consitituting the lowermost beds enriched with *Nummulites Gizehensis.*

Bishay (1961) did not give the exact position of the type locality of the Samalut Formation, however, it is understood that its type section lies to the east of the Samalut Town, where, the formation attains about 160 m. in thickness. Said (1962) was of the opinion that the limestones with *Nummulites gizehensis* at the base of the Mokattam Formation is a useful mappable unit that can be followed for long distance. Later on, Said (1971) accepted the opinion of Bishay (1961) in considering that the Samalut Formation overlies and underlies the Minia and Mokattam Formation respectively. The lower contact of this formation at its type locality is between the alveolinal limestones of the Upper Minia Formation and the yellow limestones crowded with the *Nummulites gizehensis* of the lower Samalut Formation.

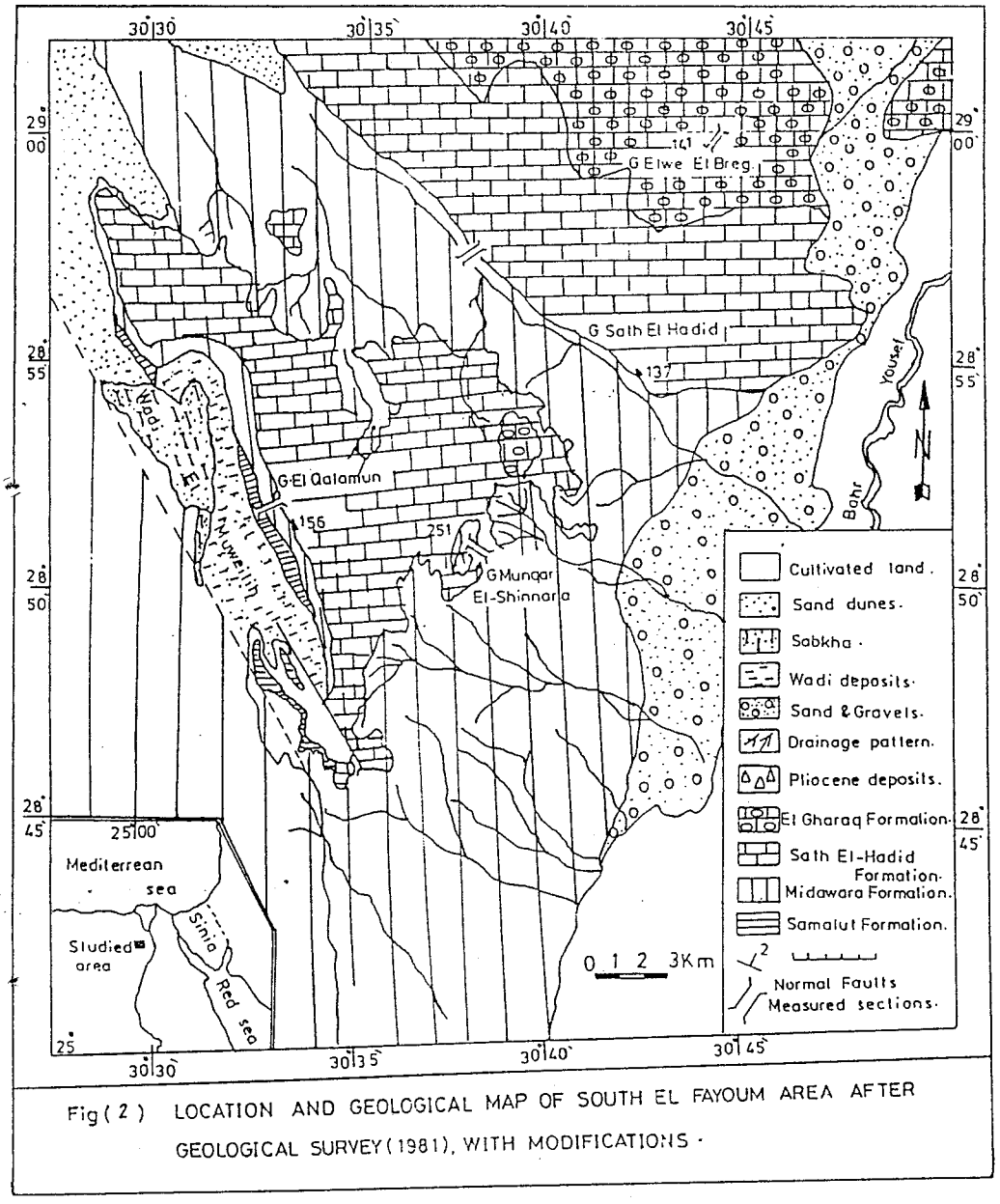


Fig (2) LOCATION AND GEOLOGICAL MAP OF SOUTH EL FAYOUM AREA AFTER GEOLOGICAL SURVEY (1981), WITH MODIFICATIONS .

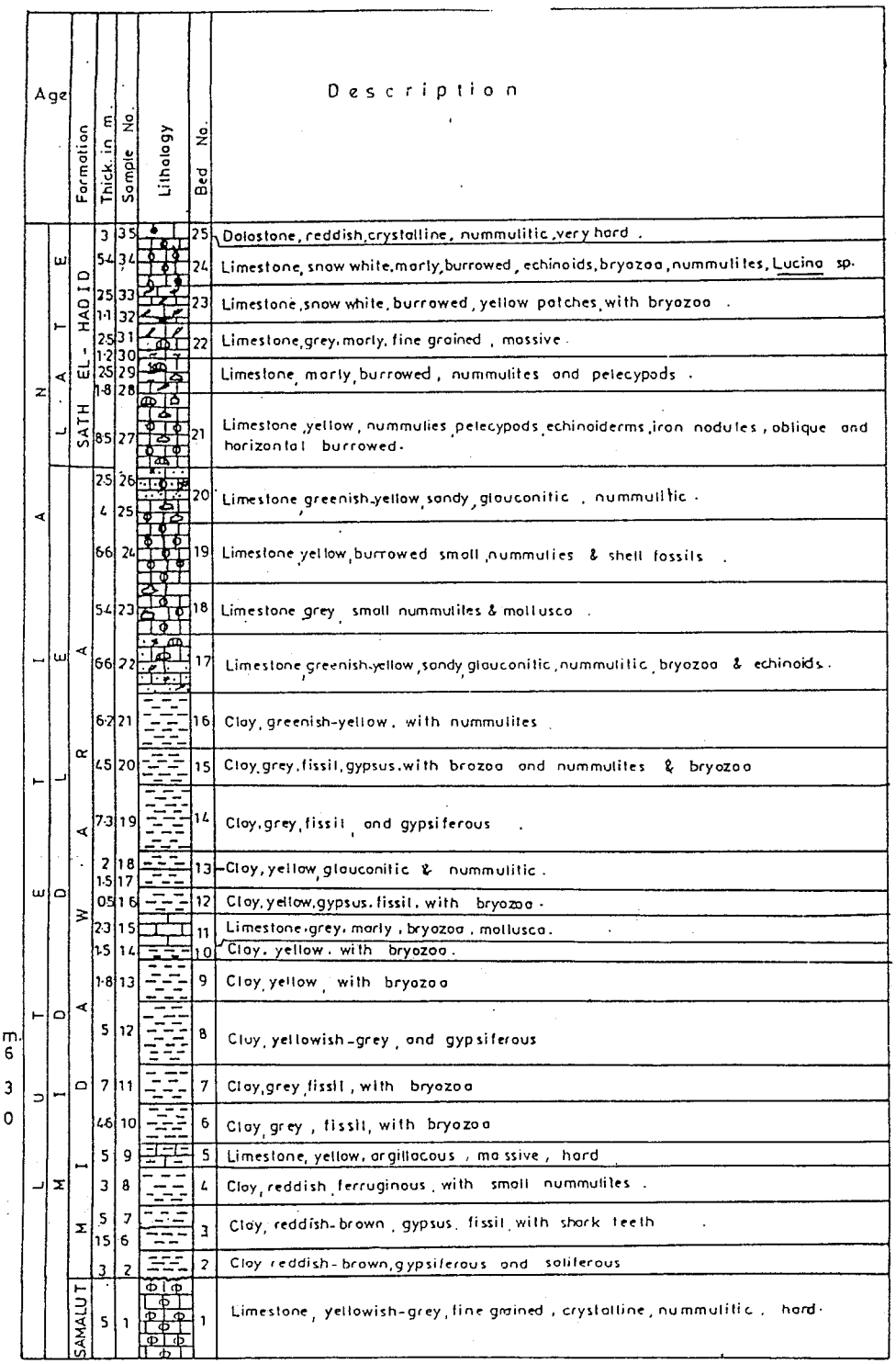
In the investigated area, the base of the Samalut Formation is unexposed, while 10 km. South of the studied area (south of Gebel El-Qalamun), this contact can be observed above the snow white limestones with dark grey siliceous concretions of the uppermost Minia Formation (Khalifa, 1981).The upper contact of the Samalut Formation with the overlying Midawara Formation is of unconformable relation. This is noticed at the entrance of Wadi El-Muweilih from the Nile Valley. The unconformable contact is expressed by the presence of iron concretions and gypsum nodules.

The Samalut Formation consists exclusively of limestones which are hard, massive and crowded with *Nummulites gizehensis* (fig.3). The abundance of *N. gizehensis* in this formation suggests that, the age of the Samalut Formation is of Middle Lutetian Age (Bishay, 1961).

As regards the correlation of the Samalut Formation, it can be correlated with the basal part of Gebel Hof Series in the area east of Helwan (Farag and Ismail, 1959) (Fig.4), due to the presence of *Nummulites gizehensis* in both formations.

2. The Midawara Formation (Middle lutetian):

The "Midawara Formation" is introduced by Iskander (1943) to describe the limestones with clay interbeds in the stratigraphy of south of the Fayoum Province. This name refers to the locality known as Midawara.



Fig(3) : Litholog log for Gebel El-Qalamun, S-Fayoum, Egypt .

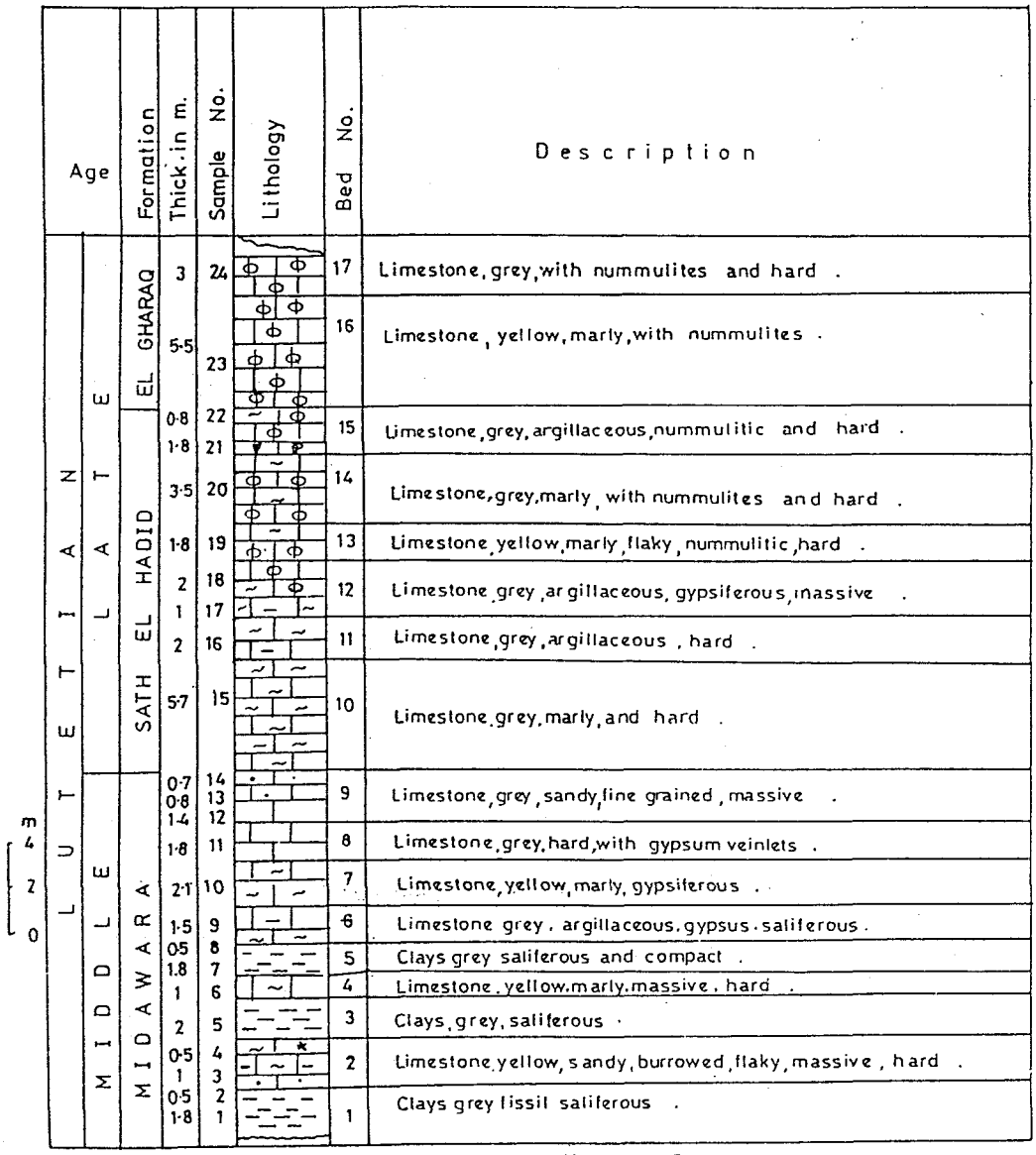
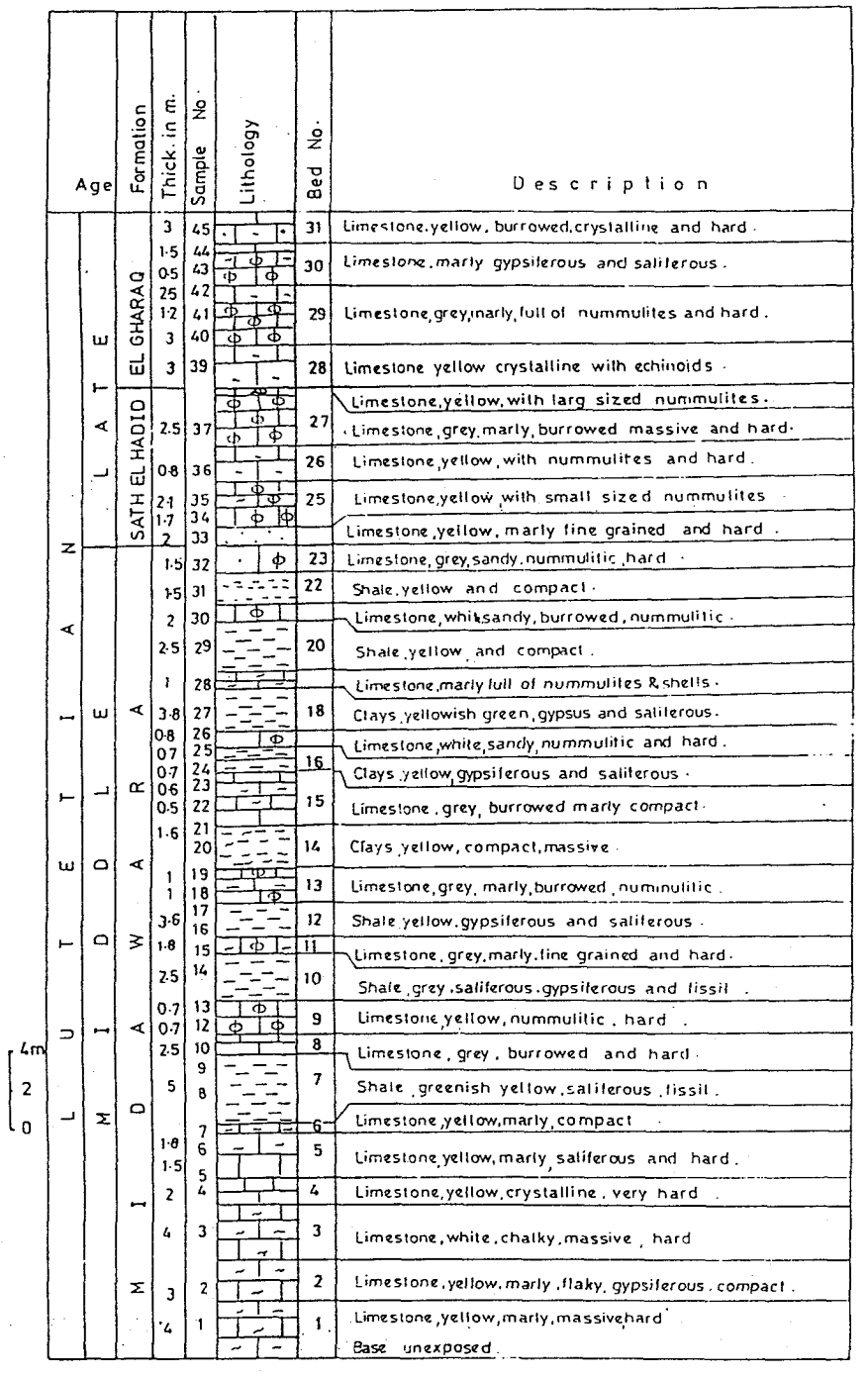


Fig (4): Lithologic log for Gebel Sath El-Hadid S-Fayoum Egypt .

Geomorphologically, this formation exhibites a certain topographic feature that could be readily discriminated on the aerial photograph (1:40.000), it occurs as small separated or connected conical hillocks of relatively low high ranging from 10-20m. above ground level.

This formation is the oldest exposed rock unit at Gebel Sath El-Hadid, Gebel Mun'ar El-Shinnara, and Gebel Elwe El-Breg. At these localities, the base of the Midawara formation is unexposed, while soutward at Wadi-Muweilih, its base is exposed. At the latter locality, the lotter locality, the lower contact of this formation unconformable with the underlying Samalut Formation. Its upper contact is always conformably demarked only at Gebel El-Qalamun (fig.3) between the yellow glauconitic sandy limestones of the Upper Midawara Formation and snow white thick bedded limestones, enriched with *Lucina pharaoum* and *Gisortia gigantia* of the Sath El-Hadid Formation above. Such contact is difficult to be noticed northwards at Munqar El-Shinnara, Elwe El-Breg and Sath El-Hadid because the limestone facies of the Upper Midawara Formation and the Lower Sath El-Hadid Formation become closely similar in colour and bedding which is difficult to be differentiated. Infact, the contact could be placed randomly within a zone of yellow limestone beds near the top of the sequence.

Lithologically, this formation shows a radical facies change from south to north. In the southern exremity at Gebel El-Qalamun, the clastic facies which form the bulk of the rock sequence (60%) at this locality are represented by sandy clays and shales measuring about 72 m. in thickness, The sandy are commonly reddish*brown in colour,



Fig(6): Lithologic log for Gebel Elwe El-Breg, S-Fayoum, Egypt.

hard and massive. Upward, the two thirds of the formation (about 38m. thick.) consists of cyclic sediments each cycle consists of clay at the base and topped with marl and fossiliferous limestone at its top. The clay is usually grey, yellowish-green in colour, compact, saliferous, gypsiferous, fissil, with gypsum veinlets.The limestones are usually grey, yellowish, marly, sandy, burrowed with vertical and horizoutal burrows.

The thickness of this formation is variable through the studied area from SW to NE, it is about 98.5 m.at Gebel El-Qalamun, 17.5m. at Gebel Munqar El-Shinnara and Gebel Sath El-Hadid and 58.5m. at Gebel Elwe El-Breg.

Paleontologically, this formation is highly fossiliferous with both macro and macro-fossils. The macrofossils include peleccypodes and gastropodes, represented by Wackuline sp., *Ostrea* sp. and *Spondylus* sp., *Turretella* sp. and *Marsella* sp., also, echinoderms e.g.:*Echinolams rangi* and corals can be observed.

The microfossils include various of fossil such as benthonic and planktonic foraminifera which show abundant distribution, while, ostracda and bryozoa are less abundant.

Bentonic foraminifera are identified to include; *Cibicides* sp., *Nonion latescens, Nonion acutidorsata, Uvigerina spinocostata, Cassidella* sp., *Bulmina truncana, Robulus limbatus, Eponides lotus, Uvigerina seriata, Lagena* sp., *Quinquloculina* sp. and *Triloculina* sp.

Nummulites are identified as: *N.cuvillieri, N.gizehensis* (A.form) *N.beaumonti, N.discorbinus, N.praediscorbinus, N.bullatus decrouezae, N.bullatus, N.somalensis, N.delaharpi, N.discorbinus lybica, N.variolarius, N.obsus, Operculina praespira, Craterocamerina corrugata, C.vulgaris glypta, C.tumida lata and C.vulgaris.*

Planktonic foraminifera are defined as *Truncorotaloides rhori, T.topilensis, T.libyansis, Globigerina eoceana, G.linaperta, G.officinalis* and *Globorotalia bolivariana.*

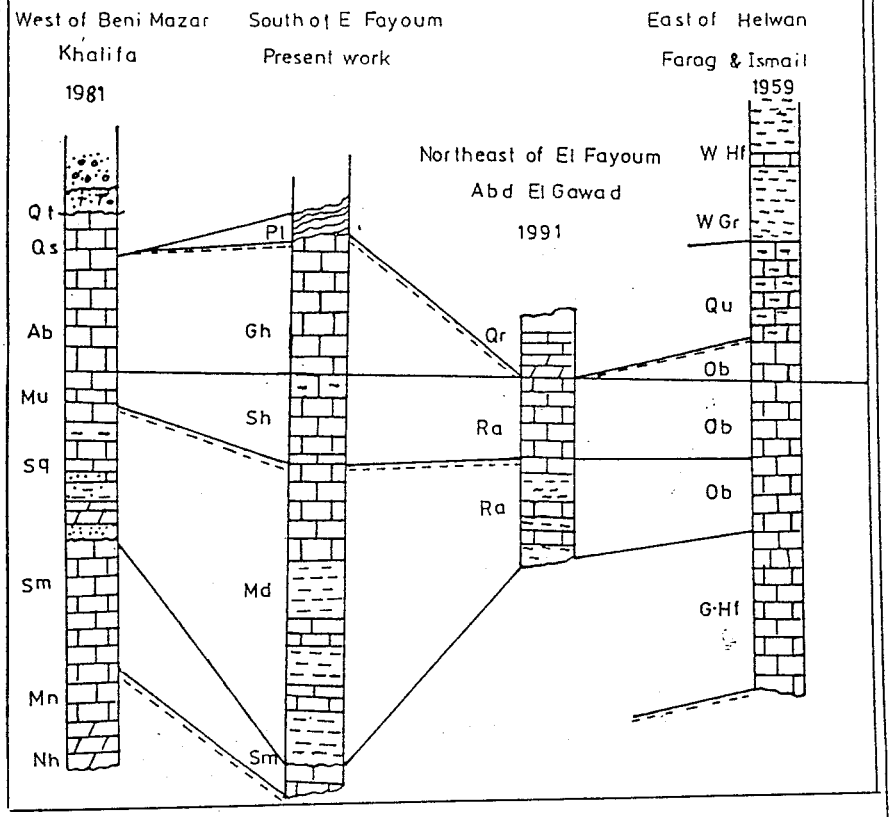
Ostracoda are defined as : *Cytherella compressa, Costa humblodti, C.praetricostata, Asymmetricthere asymmetrella, Trachyleberis nodosus, Xestoleberis subglobasa, Uroleberis* sp. and *Costa crassireticulata.*

Bryozoa are defined as *Vincularia maghahaensis V.davisi, Nellia tenella, Tremogastrina fourtaui* and *Tubecella pappillosa.*

The Midawara Formation can be correlated with the El-Saqqal Formation at west Beni-Mazar (Khalifa, 1981). In the area northeast of El-Fayoum at Gebel Lahun and Gebel Naloun, it could be correlated with Ravine Formation.
In the area east of Helwan, it is correlated with the Observatory formation (fig.7).

The age of this formation is dated Middle Lutetian by Iskander (1943) and Refayi (1986), the present writer accepted the above opinion in considering the Midawara Formation is to be of Middle

Fig.(7) Correlation chart of the Middle Eocene rock units in the studied area and their corresponding in the adjacent localities.



Legend

Qt: Quaternary.
Qs: Oasr el-Sagha Formation.
Ab: Abu Ali Formation.
Mu: Muweilih Formation.
Sq: Saqqal Formation.
Sm: Samalut Formation.
Mn: Minia Formation.
Nh: Nashfa Formation.
Qu: El-Qurn Formation.

Pl: Pliocene deposits.
Gh: Gharaq Formation.
Sh: Sath El-Hadid Formation.
Md: Midawara Formation.
Qr: Qarun Formation.
Ra: Ravine Formation.
G-Hf: Gebel Hof Series.
Ob: Observatory Formation.

W.Gr Wadi Grawy Series
W-Hf Wadi Hof Series.
— Rock Unit contact
— Time Unit contact
0 5 10m. V.S.
Horizontal distance are not to scale.

Lutetian due to the presence of fossil contents such as *Truncorotaloides rhori, T.topilensis* and *N.gizehensis.*

3. Sath El-Hadid Formation (Late Lutetian):

The name "Sath El-Hadid Formation" was suggested by Iskander (1943) in the stratigraphic sequence of the El-Fayoum Province. He mentioned that the type locality of this formation is situated at Gabl Sath El-Hadid (Lati-tude 29^0 2' N. and longitude 30^0 37' E.).

This unit is made up of yellowish-grey skeletal limes-tones enriched with Bryozoa sp. , Gisortia gigantia and Lucina pharaonum.

The lower contact of the Sath El-Hadid Formation at its type locality conformably overlies the Midawara Formation.
Such contact is represented by marly bryozoan limestone of the Uppermost Midawara Formation. Its upper contact with the overlying the El-Gharaq Formation is sharp and is represented by snow white bryozoan limestone enriched with N. lyelli of The El-Gharaq Formation.

The thickness of the Sath El-Hadid Formation is different from one locality to another in the studied area. It measures about 28.1m. at Gebel El-Qalamun, 17.1m. at Gabel Munqar El-Shinnara, 18.3m. at Gebel Sath El-Hadid and 9.6m. at Gebel Elwe El-Breg.In general, it decreases in thickness toward the northeast direction.

From the lithological view point, Sath El-Hadid Formation exhibits lateral facies changes from southwest to northeast direction. At the southwest side, at Gebel El-Qalamun, this formation is made up of snow white limestone, massive to thick bedded. Further northeastward at Gebel Munqar El-Shinnara and at Gebel Elwe El-Breg, the rocks of this formation displays a relatively facies change, where, the snow white limestone that recorded at Gebel Sath El-Hadid and Gebel El-Qalamun is changed to grey, yellow, marly to argillaceous limestone. Thus, it is difficult to differentiate, this limestone facies from the grey limestone beds of the underlying Midawara Formation at these localities (figs 3,4,5,6)

Plaleontologically, the Sath El-Hadid Formation is highly fossiliferous with both macro and miccro-fossils. The macro-fossils are represented by *Wackulina* ap., corals, *Echinolampas* sp., *Marsella* sp., *Ostrea* sp., *Spondylus* sp., *Lucina pharaomum* and *Gisortia gigantia* especially at Gebel El-Qalamun section. This formation contains a reco gnizable bryozoa fossils such as *Tremogastrina fourtaui, Nellia tenella, Adenfera sphingis, Tubecella mamilaris, T.papillosa, Vincularia maghaghensis, V. davisi and Heteropora sp.*

Planktonic foraminifera are recorded with less abundant such as *Truncorotaloides rhori, T.topilonsis, T.libyansis, Globigerina linaperta, G.eoceana, G. officinalis* and *Gioborotalia bolivariana.*

Benthonic formineferа is recorded with abundant distribution such as *Bolivina* sp., *Anomalina* sp. *Gumblina* sp.,*Cibicides* sp., *Nonion accutidorsatus*, N.*latescense*, *Textu-laria* of *agglutimins*, *Lagena* sp., *Cassidella* sp. and *Uvigerina seriata.*

Ostracoda are also abundant in this formation. The identified ostracoda species are *Loxoconcha* ap., *Xestoleberis subglobosa, Trachyleberis nodosus, Asymmeticythere yousefi, A. asymmetrella, Novocypris eoenana, Cytherella compressa* and *Bairdi. gliberti.*

Nummulites are less abundant and are represented by *Nummulites beaumonti, N.gizehensis N.cyrenaicus, N.bullatus decrouezae, N.discorbinus, N. cuvillieri* and *N.bullatus. Sraterocamerina* spp. is also recorded in this formation.

This formation can be corrlated with El-Muweilih Formation at west Beni-Mazar (Khalifa, 1981), (fig.7) Also, it can be correlated with the upper part of the Observatory Formation at east of Helwan (Farag and Ismail, 1959). It also can be correlated with the limestone beds that cap the Ravine beds Formation at Gebel Naloun and Gebel Lahun in the northeast of El-Fayoum, due to the similarity in faunal assemblages.

The age of this rock unit is Late Lutetian on the basis of identefied Nummulites and Planktonic foraminifera.

4. El-Gharaq Formation (Late Lutetian):

The name "El-Gharaq Formation was suggested by Iskander (1943) in the stratigraphic sequence of the Fayoum Province.
The name refers to the locality known as El-Gharaq Soltani town. The term "El-Gharaq" is an arabic word means that the ground water level is so raised that the area is laways covered with water.

Rocks of this formation can be easily differntiated from the underlying Sath El-Hadid Formation being composed entirely of pale reddish marly limestone crowded with large sized *Nummulites lyelli*. While, the underlying Sath El-Hadid Formation is made up entirely of white limestones enriched with *Bryozoa* spp.

This formation conformably overlies the Sath El-Hadid Formation and inconoformably underlies the Pliocene sediments. The unconformity surface at Munqar El-Shinnara is represented by clay and chert nodules with some caliche deposits.

The maximum thickness of this formation is observed at Munqar El-Shinnara section (33.2m.). Its thickness decreases at Gebel Elwe El-Breg and Gebel Sath El-Hadid, where the thickness is about 16.1m. and 7.5 m., respectively.

Lithologically, the El-Gharaq Formation displays uniform regressive carbonate cyales especially at Munqar El-Shinnare and Elwe-El-Breg (figs 5,6). Each cycle begins at the basal part with yellowish marly limestone crowded with large-sized *Nummulites lyelli* in addition with echinoid, bryozoa and corals. The upper part of the cycle shows a sharp and undulated contact with the overlying cycles, and is composed of crystalline limestone, harder than the base. The upper part of the cycle consists usually of reworked fossils and debris derived from Nummulites, echinoids and corls and form a gullies between the cycles. At Gebel Sath El-Hadid section, the base of this formation is marly limestone (fig.4), Which is grey, yellowish in colour, marly, crystalline and hard. Most of the marly limestones are burrowed

with greenish patches which may be resulted from concentration of glauconites.

Paleontologically, this formation is fossiliferous with abundant nummulites such as *Nummulites lyelli, N.bulchellus, N.cyrenaicus, N.discorbinus, N.striatus, N.bullatus decrouezae* and *N.beaumonti.*

Bryozoa are less abundant in this formation. They are represented only by two species, these are *Tremogastrina fourtaui* and *Nellia tenella.*

Benthonic foraminifera are abundant and represented by *Bolivina* sp., *Nonion acutedorsatum, Anomalina* sp., *Gumbline* sp., and *Uvigerina spinocostata* Planktonic foraminifera are less abundant and represented by *Truncorotaloides rhori*, T.*topilensis*, T.*libyaensis* and *Globortalia bolivariana.*

Ostraccoda are recorded in less abundant such as *Loxoconcha vetustopunctatella, Novocypris eocenana, Cytherella Compressa, Bairdia gliberti, Asymmetricythere asymmetrella, Trachyleberis nodosus.*

The mega fossila are represented by Pelecypoda and gastropoda, which include *cardium* sp., *Vulsella crispata*, *Ostrea* sp., *Natica* sp. and *Turretella* sp.; *Echinolampas* sp. and Sea craps and also identified.

This formation can be correlated with Abu-Ali Formation (Khalifa, 1981) at west Beni-Mazar area. It is also, correlated with the

upper part of the Observatory Formation in the area to the east of Helwan (Ismail, 1965; Farag and Ismail, 1959 and Kolkila etal., 1984). This is due to the similarity in their fossil association such as Nummulites and Discocyclina (fig.7)

Age assignment of El-Gharaq Formation is dated to be of Late Lutetian on the basis of the presence of index fossils such as *Truncorotaloides rhori* and *Nummulites lyelli.*

5. Pliocene Sediments :

These sediments unconformably overlie the El-Ghraq Formation, the unconformity surfacce is represented by clays and caliche deposits with chert nodules. The thickness of the pliocene sediments are variable from one area to another, the average thickess of 10m. can be recognized at Munqar El-Shinnara (fig.4).

Lithologically, the Pliocene sediments are mainly of clays and caliche deposits. Clays are palegrey in colour, and contain numerous white, pale grey caliche deposits. The chert nodules form the cap of the Pliocene sediments. They have variable thickness varying from 3-9m.

Paleontologically, these sediments are fossiliferous with some fresh water gastropods.

6. Quaternary Deposits:

They are mostly represented by pebbles, gravels and sands at Munqar El-Shinnara and Elwe El-Breg with average thickness of 8m. The gravels are brown and grey in colour and more or less well sorted. They are well rounded, and limestones.

7. Sand Dunes (Recent):

The recent deposits at south of the Fayoum Province are represented by aeolinan Sand-dunes (seif type). They cover an extensive area to the northwestern part of the studied area.

BIOSTRATIGRAPHY

The exposed Middle Eocene sediment of south of El-Fayoum area are crowded with different types of faunal assemblages such as Planktonic and benthonic forminifera, Ostracoda and Bryozoa. This led to the recognition of the following biozones as table (I):

1- PLANKTOKIC FORAMINIFERA BIOZONES :

Truncorotaloides rhori is the only planktonic foraminiferal biozone recognized from the studied sections.

***Truncorotaloides rhori* zone :** (Bolli, 1957).

- Definition :-

This zone is defined as the interval from the first occurrence of *Trunccrotaloides pseudodubius* to the last occurrence of *Truncorotaloides rhori.*

- Association :-

Truncorotaloides topilensis, T.libayensis, T. rhori, Globigerina bolivariana, G.linaperta, G.eocena, G. officinalis and *hantkenina sp.*

Table (I) : Correlation of the different types of biozones in the studied area with their age relation.

Biozonation: Age	Biozonation: Rock units	Planktonic biozones	Nummulite biozones	Cratero-camerina biozones	Ostracoda biozones
Eocene – Late Lutetian	El-Gharaq	Truncorotaloides rhori.	Nummulites gizehensis	Craterocamerina vulgaris .	Trachyleberis nodosus nodosus .
Eocene – Late Lutetian	Sath El-Hadid.		Nummulites lyelli.		
Eocene – Middle Lutetian	Midawara		Nummulites gizehensis .		

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- Occurrence:

This zone occurs in the Midawara, Sath El-Hadid and El-Gharaq Formation in all the studied sections (figs. 3,4,5,6,).

- Age :-

Late Lutetian to Bartonian.

DISCUSSION :

This zone is recognized by Viotti (1968) from the Nile Delta, Egypt to distinguish the uppermost Upper Lutetian. Bassiouni *et al.*, (1974) also recorded this zone from Minia, Beni-Suef reach (Nile Valley, Egypt) where it overlies the *Morozovella lehneri* zone and underlies the *Gloigerapsis semi-involuta* zone.

Krasheninnikov and Ponikarov (1964) recorded this zone from Syria, where, it overlies the *Hantkenina alabamensis* zone and underlies the *Globigerina corpulenta* zone.

Bolli (1957) defined the Middle/Upper Eocene boundary as the upper limit of the stratigraphic range of *Truncorotaloides rhori.* He placed this zone between *Porticulasphaera mexicans* and an upper *Globigerapsis semi-involuta.*

This zone corresponds to *Porticulashaera mexicana* zone of Beckmann *etal.*, (1969), *Trubotalia cerroazulensis cerroazulensis / Turborotalia cerroazulensis pomeroli* zone of Boukhary and Abdel-Malik (1983) in Egypt and of Toumarkine and Bolli (1970) in North Italy.

2- Larger Foraminifera Biozones :

Two nummulites biozones are recognized from the studied sections of the three recorded formations, these two biozones were previously reported by Shamah (1981) and Zalat (1987) and they are as follows :

- *Nummulites lyelli* zone, Upper Late Lutetian.
- *Nummulites gizehensis gizehensis* zone, Lower Late Lutetian.

Nummulites gizehensis gizehensis zone : (Forskal, 1775)

- Definition :

In the studied sections, this biozone is defined by the first appearance of *Nummulites gizehensis gizehensis* to the first appearance of *Nummulites lyelli.*

- Association :

Nummulites beaumonti, N. discorbinus, N. variolarius, N. bullatus, N. bullatus decrouezae, N. praediscorbinus, N. chavannesi, N. gizehensis, N. cuvillieri, Operculina praespira praespira, O. schwageri and *O. parva.*

- Occurrence :

This biozone characterizes the Midawara and Sath El-Hadid Formations at Gebel Elwe El-Breg, Gebel Munqar El-Shinnara and G. El-Qalamun. It is also recorded in the Sath El-Hadid and El-Gharaq Formations at Gebel Sath El-Hadid (Figs. 3,4,5,6).

- Age :

Early Late Lutetian.

- Discussion :

Many authors discussed the stratigraphic position of the *Nummulites gizehensis* group.

Fourtau (1916) assigned the *Nummulites gizehensis* beds in Tunis and Algeria to the Early Eocene. Flandrin (1938) recorded this species from the Early Lutetian of North AFrica.

Cuvillier (1930) regarded the *Nummulites gizehensis* to delineate the start of the Late Lutetian in Egypt. Nearly all the researches of the Eocene have followed Cuvillier in considering this species as a guide fossil for the Upper Lutetian. Bishay (1966) stated that the Nummulites species recorded in the gizehensis zone come to an end by the Upper Lutetian except *N. beaumonti* and N. variolaris which persist into the Late Eocene. Khalifa (1974) assigned that this species is recorded in the Early Eocene of Beni-Mazar area. Kenawy (1978) also reported this species from Early Upper Eocene sediment of El-Midawara surface section at Wadi El-Rayan region.

Blondeau *et al.*, (1984) assigned that this zone represents the Middle Lutetian in Egypt. Shamah (1981) established this zone for the first time in Fayoum area as marker zone in the Middle Lutetian. Zalat (1987) reported this zone from Gebel Mishgigah section and assigned it to the Lower Late Lutetian.

***Nummulites lyelli* zone :** (D'Archiac and Haime, 1853)

- Definition :

In the studied sections, this biozone is defined by the first appearance of *Nummulites lyelli* to the top of the studied sections.

- Association :

Nummulites beaumouti, N. striatus, N. bulchellus, N. cyrenaicus, N. discorbinus, N. bullatus decrouezae, N. lyelli, Operculina schwageri.

- Occurrence :

This biozone characterizes the upper 33.5m. of the El-Gharaq Formation at G. Munqar El-Shinnara and G. Elwe El-Breg section (thick about 40.0m.) representing the upper part of the Midawara, Sath El-Hadid and El-Gharaq Formations, (Figs. 3,4,5,6).

- Age :

Late Lutetian.

- Discussion :

Shamah (1981, 1990) reported this zone from the Fayoum Depression at Wadi El-Rayan and assigned it to Late Lutetian. Zalat (1987), also recognized it from G. Mishgigah south of the Fayoum Province.

- *Craterocamerina vulgaris* zone : (Omara and Kenawy, 1979)

- Definition :

Shamah, K.

This zone is defined as the interval from the first appearance of *Craterocamerina* (genus) to an abundant *Craterocamerina vulgaris* (sp.)

- Association :

Craterocamerina vulgaris glypta, C. vulgaris spirogranulata, C. tumida lata, C. corrogata, C. vulgaris glabella, C. vulgaris and *C. extimuata parva.*

- Occurrence :

Craterocamerina zone characterizes the Midawara Formation at Munqar El-Shinnara section, Middle part of the Midawara Formation at El-Qalamun section. It is also occured at the Midawara and Sath El-Hadid Formations at Elwe El-Breg section.

- Discussion :

This zone is introduced for the first time in the biostratigraphy of Egypt in the Nile Valley by Omara and Kenawy (1979). The present writer recognized this biozone in south of El-Fayoum Province.

3- OSTRACODA BIOZONES :

The identified ostracoda species from the studied sections is simillar to that recorded from the *Trachyleberis nodosus nodosus* biozone of Zalat (1987).

- Definition :

This zone is defined as the total range of *Trachyleberis nodosus nodosus.*

- Association :

Bairdia gliberti, Novocypris eocenana, Asymmetricythere yousefi, Leguminocythereis africana, Trachyleberis nodosus nodosus, Cytherella compressa, Costa humblodti, C. praetricostata praetricostata, C. mokattamensis, C. crassireticulata, Loxoconcha vetustopunctatella, Xestoleberis subglobosa, Uroleberis sp., *Acanthocythereis projecta, Buntonia faresi, Peterygocythere minor* and *Limburgina moosi.*

- Occurrence :

This zone is recorded in the Midawara, Sath El-Hadid and El-Gharaq Formations at El-Qalamun, Munqar El-Shinnara, Sath El-Hadid and Elwe El-Breg sections (Figs. 3,4,5,6).

- Age :

Late Lutetian.

Summary & conclusions :

In southern part of El-Fayoum Province, the Eocene rocks exhibit, a recergnizable vertical and lateral lithologic change from El-Qalamun section, Mungar El-Shinnara section, Sath El-Hadid section and Elwe El-Breg section along SW-NE direction.

The southernwest of the studied area (G.El-Galamun) is deeper than other section., this is evidenced by i-the oldest rock unit Samalut Formation in the studied area is only recorded in El-Qalamun section ii-The maximum thickiness of the Midawara Formation is occurred in this

section. iii-The facies of the Midawara Formation is grey clay and planktonic forminifera is more abundant in the Qalamun section.

The study of range charts of the identified planktonic foraminifera, ostracods, nummulites, bryozea and craterocamerina taxa led to the specification of the following biozones (Middle Eocene rocks). This biozenes are listed as fellows; Turncorotaloides rhori biozone; *Trachyleberis nodosus nodosus* biozone; *Nummulites gizehensis gizehensis, Nummulites lyelli* biozone; *Tremogastrina fourtaui* biozene and *craterocamerina vulgaris* biozene respectively.

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إستراتجرافية رواسب الأيوسين المتوسط من منطقة جنوب الفيوم، الصحراء الغربية، مصر

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تهتم هذه الدراسة بالليثوستراتجرافية والبيوستراتجرافية لرواسب الأيوسين المتوسط المنكشفة فى منطقة جنوب الفيوم وقد تم تقسيم التتابعات الرسوبية فى المنطقة إلى أربعة وحدات ليثوستراتجرافية، والتى تتراوح فى العمر من الأيوسين المتوسط إلى الباليوسين.

والدراسة البيوستراتجرافية بنيت أساسا على البلانكتون والأستراكودا والنيموليت والكراتوكميرنا والبروزوا (الجماعيات)، وقد استخدمت سويا لتحديد نطاقين حيويين مبنيين على التحليل العالى للطبقيه لكل من البلانكتون والنيموليت وواحد فقط للكراتوكميرنا والبروزوا.