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()*

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3

14

Lithophyllum,

Mesophyllum spp., *Lithothamnion* spp. *Spongites* spp.

Mesophyllum iraqense (): *Lithophyllum ghorabi* ()

(Sadek, 1959; Metwalli, 1963; Said, 1990).

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(. 1).

(Sadek, 1959; Metwalli, 1963; Souaya, 1963 - ; Cherif, 1966; Hamam, 1966; Said & Metwalli, 1966; Ghorab & Marzouk, 1967; Abdallah & Abdel Hady, 1968; Farag & Sadek, 1968; El Gamal, 1971; Al Ahawani, 1977; Cherif & Yehia, 1977; Hermina et al., 1989; Said, 1990; Said, 1990; Nebelsick & Kroh, 2002; Abdel Ghany, 2003) (.).

()

	Sadek, 1926 & 1959	Abdallah & Abdel Hady, 1966	National Start. Sub- Committee, 1976	Said, 1990	Ismail & Abdel Ghany, 1999	, 2007
-	3					
-	2					
-	1					

(Souaya, 1963),

13

(): *Archaeolithothamnium cyrenicum*
Raineri *Lithophyllum ghorabii* Souaya. (El Gamal, 1971)

(Imam & Refaat, 2000)

15

(): *Lithothamnium undulatum* *Mesophyllum sanctidionysii*.

(El Gamal, 1971).

Ghorab & Marzouk (1967)

(El Gamal, 1971)

1.

(El Gamal, 1971)

(Ismail & Abdel Ghany, 1999)

Globigerinella sp., *Globigerinoides altiapertura*, *G. parawoodi*, *G. immaturus*, *G. primordius*, *G. trilobus* *G. quadrilobatus*,

()

Helicosphaera

ampliapertura (NN4 : Martini, 1971).

(Nebelsick

& Kroh, 2002)

, *Parascutella* spp., *Parascutella deflersi*, *Amphiope bioculata*,
Clypeaster acclivis *Echinolampas ampla*,

()

, *Catapsydrax unicavas*, *Dentoglobigerina venezuelana*, *Globigerina ciperoensis*, *Globigerinoides primordius* *Globigerinoides trilobus*
Lepidocyclina undosa, *L. canelli*, *Elphidium* sp.,

Heterostegina sp., *Siphonina tenuicarinata*, *Miogypsina* sp.,

1

(Berggren et al., 1995).

2.

(). (El Gamal, 1971)

(El

(30-50 %)

(25), (9).
Miogypsina spp., *Heterostegina* spp., *Leipdocyclina* spp. (Cherif, 1963) -
 (Ismail & Abdel Ghany, 1999)

: *Operculina complanata*, *Heterostegina heterostegina*, *Miogypsina intermedia*.
).
 , . *Miosorites americanus*, *Neorotalia mexicana*, *Stillostomella caribbea*, *Heterostegian* sp., *Planostegina costata*, *P. heterostegian* *Operculina complanata*,
 M2 – M3 (Berggren et al., 1995).
Ostrea plicatula, *Ostrea verleti*, *O. frondosa*, *Clypeaster intermedius* *C. subdecagonus*. -
 ().

3. .
 (Gamal, 1971). , ,
 5 , 50 .
 , ,
 (Ismail & Abdel Ghany, 1999) : *Globoquadrina dehiscens*,
Globigerinoides altiapertura, *G. parawoodi* *G. trilobus*,
 ().

4. .
 (Ghorab & Marzouk, 1967) . 20
 26 -
 , -
 (Ismail & Abdel Ghany, 1999) : *Globoquadrina dehiscens*, *Globigerinoides altiapertura*, *G. parawoodi*, *G. trilobus*, *G. bisphericus*, *G. obliquus*, *G. primordius* *Globigerina ciperoensis*,
 ()

Globigerinoides primordius
G. bisphericus *G. obliquus.*

()
 40

(Woelkerling et al., 1993) (Rasser & Piller, 1999).
 (500).

(Woelkerling, 1988) (Woelkerling et al., 1993).

(*Corallinaceae, Rhodophyta*)

(Bosence, 1983; Nebelsick et al., 2003).
 80 %

28 , 10
Lithophyllum Lithothamnion, Mesophyllum, Sporolithon, Spongites
Lithoporella.

90 %
 (*Corallinoideae, 10 %*)

Halimeda sp. *Codiaceae*
 (*Cholorophyta*).
 23

(*Lithophyllum*),
 (Mesophyllum Lithothamnion) (Sporolithon),
 – (Spongites Neogoniolithon),
 . *Lithophyllum prelichenioides* *L. ghorabi*
 30 %
Lithophyllum Mesophyllum
 . Lithothamnion Sporolithon
 . *Lithoporella* spp.

1.

2.

(Rasser, 2000).

Lithophyllum *Lithoporella*.

Lithophyllum prelichenioides (

Lithophyllum) *L. ghorabi*

(*L. pseudoamphiroa*).

30-500

(. I, I).

Amphistegina spp. *Heterostegina* spp.,

3. . 2 ,

(Bosence, 1983).

(Wehrmann
et al., 1995) 200 (Adey & Macintyre, 1973; Bosence, 1983; Littler et
al., 1991)

(Steneck, 1985)
(Braga & Martin, 1988).

2 6 ,

(. 2).

Lithophyllum, *Lithothamnion*, *Mesophyllum*, *Sporolithon*,
Spongites , , *Lithoporella*.

Lithophyllum *Lithoporella*.

(. I, 2),
Lithophyllum *Lithothamnion*
Lithoporella sp., *Mesophyllum* sp. , , *Sporolithon* spp. , ,

(Bosence,

1990).

(. I, I) *Mesophyllum*
spp. (*Mesophyllum sanctidionysi* *Mesophyllum laffitei*
Lithophyllum spp. , *Lithoporella* sp.).

(3-5),

, 70 90 (Adey &
MacIntyres, 1973).

,
.
(,) ,
()

.
(,)
(Bosence, 1983).

. Bosence (1983) ,
(2-4)
() (4-6)

.
: (1)
; (2)
; (3)

28

22

Lithophyllum ghorabi, *Mesophyllum lemoineae* *Lithophyllum prelichenoides*.

(/)

(.3).

2003) (.4).

yclostomata
Miogypsina sp. *Heterostegina* sp.).

(Steneck, 1985; Nebelsick et al.,

– (*hielostomata*
(*Amphistegina* sp.,

Lithophaga sp.,

(Bosence, 1985, Rasser, 1999).

(Souaya, 1963)

13

: *Mesophyllum lemoineae* *Lithophyllum ghorabi*.

(): *Lithophyllum ghorabi* Souaya *Archaeolithothamnium cyrenicum* Raineri, (Vindobonian,). (El Gamal, 1971)

(Imam & Refaat, 2000)

(): *Lithothamnium undulatum*
Mesophyllum sanctidionysii.

***Lithophyllum ghorabi*.**

L. ghorabi.

Formation,

90 103

24

31

, *L. ghorabi* (), *L. prelichenoides*, *L. simplex*, *Spongites albanense*, *Lithothamnium saxorum*, *Mesophyllum sanctidionysii* *M. vaughani*.

(*L. prelichenoides*, *M. sanctidionysii*),

(). , *L. ghorabi*
S. albanense (. 5, 6).

***Mesophyllum iraqense*.**

M. iraqense,

104-118

(32-40).

Lithothamnion disarmonicum, *L. aggregatum*,
L. undulatum, *Mesophyllum iraqense*, *M. lemoineae*, *M. vughanii*, *M. sanctidionysii*,
Lithoporella melabesioidea, *Lithophyllum prelichenioides*, *L. simplex*, *L. pseudoamphiora*,
Corallina sp. (. . . 5, 6).

(Woelkerling, 1988),
« . . . » « . . . » “ . . . ”
“ . . . ” . . . , . . . (Braga et al.,
1993) . . . : Woelkerling et al., 1993.
-
(. . .) ,
(. . .) .

: *Rhodophyta* Wettstein, 1901
: *Rhodophyceae* Rabenhorst, 1863
: *Corallinales* Silva & Johansen, 1986

: *Corallinaceae* Lamouroux, 1816
: *Lithophylloideae* Setchell, 1943

***Lithophyllum* Philippi, 1837**

(Woelkerling, 1988). *Lithophylloideae*

Mastrophoroideae *Melobesioideae*
(Bassi, 1995, 1998).

Lithophyllum:

***L. ghorabi* Souaya, 1963 (. I, I)**

L. ghorabi – Souaya, 1963a, . 1211, 1212, . 163, . 1, . 164, . 1-4, Souaya,
1963b, . 247, . 6, . 7 – Edgell & Basson, 1975, . 173, . 2, . 5 – Youssef et
al., . 240, . 14A – Imam, 1991, . 153, 154, . 22, . 1, 4, . 24, . 3 –
Imam, 1996, . 8, . 3 – Imam & Refaat, 2000, . 392, . 5.
, 580-770 . (180-
320 .),

11-27 . 20-44 ..
(300-430)
25-32 . 10-19 .
, (Souaya, 1963a),
().

***Lithophyllum pseudoamphiora* Johnson, 1964 (. I, 2)**

L. pseudoamphiora – Johnson, 1964, . 22, . 7, . 1 4 – Johnson, 1964b, . 482,
. 3, . 4, 6 – Edgell & Basson, 1975, . 173, . 2, . 6 – Imam, 1991, . 153-
154, . 22, . 2 – Imam, 1996, . 8, . 3 – Imam & Refaat, 2000, . 398, . 7.

(260-580)
24-41 . 15-21
(180-430).

***L. prelichenioides* Lemoine, 1917 (. I, 7)**

L. prelichenioides – Lemoine, 1917, . 262-267, . 8-9; Lemoine, 1939, . 99, . 65,
66; Johnson & Ferris, 1949, . 195, . 38, . 3; Edgell & Basson, 1975, . 172,
. 2, . 1-5; Bosence, 1983, . 165, . 18, . 2; Imam, 1996, . 8, . 3; Imam
& Refaat, 2000, . 396, . 5.

. C
10-13 ., 15-19
15-23 ., 13-
17 .

***L. simplex* Johnson, 1964 (. II, 3)**

L. simplex – Johnson, 1964, . 480, . 1, . 6 – Edgell, 1978, . 176, . 2, . 4-6
– Imam, 1996, . 10, . 4 – Imam & Refaat, 2000, . 396, . 4.

(300)., 19-23 . 10-13 .,

***Lithophyllum* sp.**

, 300-500 ..
(150-220),
15-23 . 9-13 .

(350-460)

12-16 . 10-14 .
240-410 . 120-180 .

Mastrophoroideae Setchell, 1943

***Lithoporella* (Foslie) Foslie, 1909**

(Woelkerling, 1988; Rasser & Piller, 1994)

2-3 (5)

(Braga et al., 1993)

Lithoporella

***L. melobesioides* (Foslie) Foslie, 1909 (. I, 8)**

L. melobesioides – Johnson & Ferris, 1949, . 196, . 37, . 4-6, . 39, . 2-9;
Johnson, 1954, . 542, . 197, . 2, 3; Edgell & Basson, 1975, . 176, . 5, . 2,
3; Imam, 1991, . 154, . 21, . 1, 2 5; Rasser, 1994, . 198, . 3, . 3; Imam,
1996, . 10, . 2; Imam & Refaat, 2000, . 393, . 4.

42-58

14-23 . , 80-120 . 70-130 .

***Spongites* Kützing, 1841**

(Braga & Martini, 1988)

Spongites

Neogoniolithon.

***S. albanensis* Lemoine, 1924 (. II, 3)**

S. albanensis – Lemoine, 1924, . 281, . 8, 9; Bosence, 1983, . 160, . 17, . 1-4;
Braga & Martin, 1988, . 295, . 9; Imam, 1991, . 153-154, . 22, . 1, 4,
. 24, . 3; Imam, 1996, . 8, . 3; Imam & Refaat, 2000, . 392, . 5.

(0,5-1,9

10-19

9-12 .,
13-25 . 12-17 . 290-430 . 160-180

Lithophyllum,
Lithophylloideae.

Mastrophoroideae,

***Spongites* sp.** (. II, 5)

35 . 11-22 . 15-
10-21 . 10-17 . -
360 . 140-150 . 250-

***Melobesioideae* Bizzorzero, 1897**

***Lithothamnion* Heydrich, 1897** (= *Lithothamnium* Rhilippi, 1837)

***L. aggregatum* Lemoine, 1939** (. I, 3)

L. aggregatum – Lemoine, 1939, . 66, 67, . 1, . 12, . 3, . 4; Johnson, 1955, . 71, . 7, . 1; Beckmann & Beckmann, 1966, . 16, . 2, . 26; Imam, 1991, . 155-156, . 22, . 3, 4, . 24, . 6; Imam, 1996, . 8, . 7; Imam & Refaat, 2000, . 396, . 8.

13 . 4 .
, 7-14 . 9-22 .
7-10 . 9-12 .

***L. operculatum* Conti** (. I, 5)

L. operculatum – Edgell & Basson, 1975, . 173, . 2, . 5; Imam, 1991, . 153, 154, . 22, . 1, 4, . 24, . 3; Imam, 1996, . 8, . 3; Imam & Refaat, 2000, . 392, . 5.

11-16 . 8-11 .
, 8-18 ., 9-15 .
, 190-500 . 110-140 .

***Lithothamnion saxorum* Capeder, 1900 (. II, 6)**

L. saxorum – Maslov, 1956, . 143, . 45, . 2; Souaya, 1963, . 1209, . 161, . 1; Imam, 1991, . 136-137, . 28, . 8; Imam & Refaat, 2000, . 392, . 5.

12-27 . 10-15

10-18 . 7-11

, 260-320 . 110-140 .

***L. undulatum* Capeder, 1900 (. II, 7)**

L. undulatum – Capeder, 1900, . 187, . 6; Lemoine, 1926, . 246, . 48, . 2; Edgell & Basson, 1975, . 176, . 5, . 1; Imam, 1996, . 8, . 9; Imam & Refaat, 2000, . 392, . 7.

, 50-90 . 7-12

. 10-15 .

, 290-420 . 140-170 .

***Mesophyllum* Lemoine, 1928**

***M. iraqense* Johnson, 1964 (. II, 8)**

M. iraqense – Johnson, 1964, . 480, . 1-5; Edgell & Basson, 1975, . 176, . 5, . 4-6; Buchbinder, 1987, . 433, . 4, . 6, . 5, . 1, 2; Imam, 1996, . 10, . 4; Imam & Refaat, 2000, . 396, . 4.

7-11 . 15-22 .

9-13 .

15-20 .

***M. lemoinae* Souaya, 1963 (. II, 4)**

M. lemoinae – Souaya, 1963, . 1209, . 165, . 1-4; El Gamal, 1971, . 167, . 26, . 1, 2; Edgell & Basson, 1975, . 173, . 3, . 6; Buchbinder, 1990, . 420, . 3, . 1; Imam & Refaat, 2000, . 396, . 3.

, 300-500 .

7-11
15-22
, 240-430 . 130-190
Lithoporella spp.

***Mesophyllum sanctidionysii* Lemoine, 1939** (. II, 2)

M. sanctidionysii – Lemoine, 1939, . 84, . 3, . 5, 6; El Gamal, 1977, . 168, . 24, . 5; Edgell & Basson, 1975, . 178, . 6, . 5, 6; Imam, 1991, . 153, 154, . 22, . 1, 4, . 24, . 3; Imam, 1996, . 8, . 3; Imam & Refaat, 2000, . 393, . 6.

8-10 . 15-18
8-12 . 17-21
220-400 . 140-180

***M. rigidum* Mastrorilli, 1967** (. I, 6)

M. rigidum – Mastrorilli, 1967, . 309-311, . 18, . 3, 4; Imam & Refaat, 2000, . 393, . 4.

23-38
10-12
8-12 . 10-12
, 340-580
. 160-240

***M. vaghani* (Howe), Lemoine, 1928** (. II, 1)

M. vaghani – Lemoine, 1928, . 89-92, . 1, . 11, 15; Johnson, 1965, . 268, . 4, . 5; Mastrorilli, 1966, . 284-286, . 12, . 4; Buchbinder, 1987, . 434, . 6, . 8, . 5, . 1, 2; Imam, 1991, . 153, 154, . 22, . 1, 4, . 24, . 3; Imam & Refaat, 2000, . 392, . 6.

8-12 . 15-19

***Sporolithaceae* Verheij, 1993**

(Verheij, 1993; Rasser & Piller, 1994).

(Verheij, 1993)

Sporolithaceae
Corallinaceae

***Sporolithon* Heydrich, 1897**

(= *Archaeolithothamnium* Rothpletz, 1891)

(Woelkerling, 1988)

***Sporolithon* sp.**

180
14-
23 . 10-12 , 15-27
10-13 ,,
14-35 -
, 100-120 . 50-75 -

***Corallinoideae* Foslie, 1898**

***Corallina* Linnaeus, 1759**

***Corallina* sp.**

300 ,
40-55 . 8-14

: ***Chlorophyta* Pasher, 1914**

: ***Chlorophyceae* Kutzing, 1843**

: ***Siphonales* Wille, In Warming, 1884**

: ***Codiaceae* Zanardini, 1843**

: ***Halimeda* Lamouroux, 1812**

Halimeda sp. (. I, 4)

0,5 1,9 . 1,5-2,6 .

()
() -
24

Rhodophyta.

Lithophyllum, Lithothamnion, Mesophyllum

, *Sporolithon, Spongites Lithoporella.*

Lithophyllum,

L. ghorabi, L. prelichenoides, L. pseudoamphiora L. sp.

Lithothamnion spp.

Mesophyllum spp.,

Lithothamnion saxorum, L. saipanense, Mesophyllum lemoineae, M. laffittei M. sanctidyonesii.

Sporolithons

cyrenicum Sporolithon sp.

Sporolithon

Lithoporella

sp.

Corallina sp.,

. *Codiaceae*

(*Halimeda* sp.).

(): *Lithophyllum ghorabi*

, *Mesophyllum iraqense*

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ALGAL BIOSTRATIGRAPHY OF SOME EARLY MIOCENE SEQUENCES,
NORTH EASTERN DESERT (EGYPT)

The Early Miocene deposits in Gebel Genefe, North Eastern Desert, unconformably overlies the Oligocene and Eocene deposits. They consist predominantly of regressive and transgressive mixed siliciclastic / carbonate sediments of shallow marine environments. The Early Miocene deposits are represented lithostratigraphically by the Gharra Formation that comprises four members, from base to top: Agrud, Sadat, Hommath and Genefe Members. Two measured sections were described and investigated: Gebel Genefe section and Gebel Agrud section. The coralline red algae are highly abundant in Sadat and Genefe members as fragments, crusts and rhodoliths. Large foraminifera, corals, echinoids, bivalves, gastropods, bryozoans, benthic and planktonic foraminifers, dasyclades are also present. These two members consist of dolomitized bioclastic packstone, grainstone to floatstones / rudstone with rhodoliths (up to 3 cm in size). The systematic study led to the recognition of 14 coralline algal species. *Lithophyllum* sp. dominates the coralline associations at the generic level, followed by *Mesophyllum* spp., *Lithothamnion* spp. and *Spongites* spp. The vertical distribution of the coralline red algae in the two concerned sections allowed to subdivide the Early Miocene sequence into two local coralline algal zones, from base to top: *Lithophyllum ghorabi* zone (including the Sadat Member) and *Mesophyllum iraqense* (covering the Genefe Member). The rhodoliths populations in the two sections were analyzed in terms of their size, shape, massiveness, symmetry, algal growth forms, algal species diversity, epibionts and borings. These parameters reflect environmental differences between the two studied sections. A comparison of the two the analyzed rhodoliths populations show common features, but also significant differences are recorded. The rhodoliths populations of Gebel Genefe were formed under low energy conditions characterized by porous rhodoliths with higher primary porosity, less frequent epibionts, more boring and thick coralline algal thalli as well as greater asymmetry. On the contrary, in Gebel Agrud the analyzed rhodoliths population were formed in high energy conditions of more shallower water marine environments and characterized by more mobile, symmetrical rhodoliths, more frequent of epibiont, thin coralline thalli.

Keywords : coralline red algae, Early Miocene, species diversity, morphology, Egypt.

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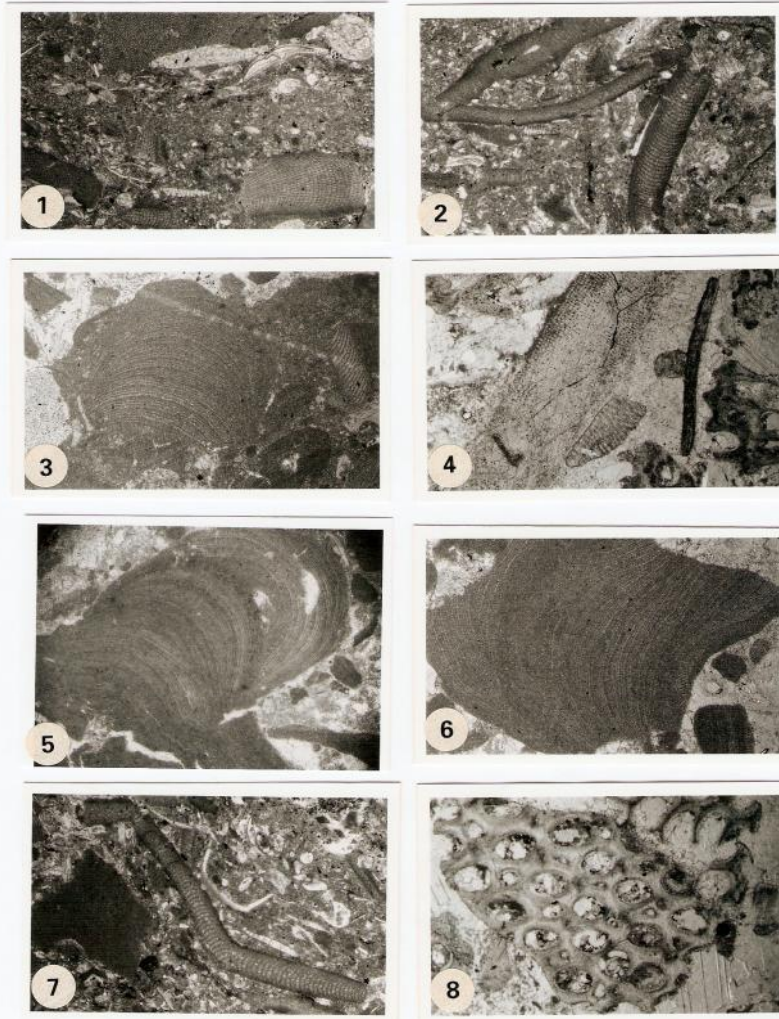
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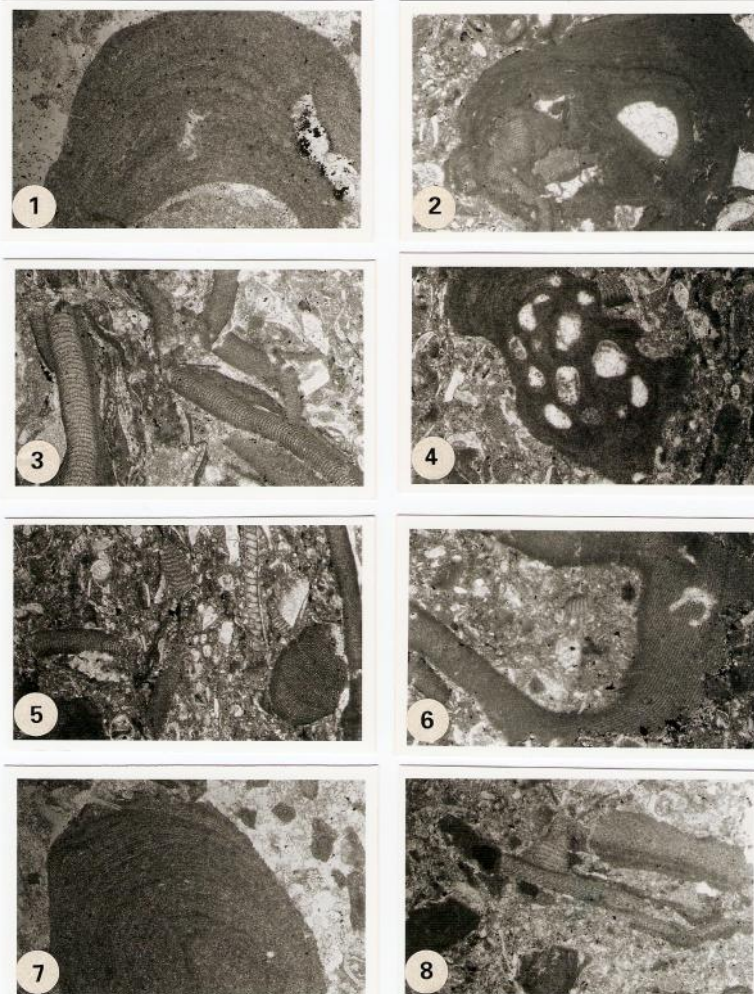
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PLATE 1



1. 1 – *Lithophyllum ghorabi* Souaya, *Journal of Botany of the Faculty of Science, Assiut University*, 103, 1978, p. 103, *fig. 1*, x80; 2 – *L. pseudoamphiora* Johnson, *Journal of Botany of the Faculty of Science, Assiut University*, 95, 1978, p. 95, *fig. 2*, x60; 3 – *Lithothamnium aggregatum* Lemoine, *Journal of Botany of the Faculty of Science, Assiut University*, 40, 1978, p. 40, *fig. 3*, x80; 4 – *Halimeda* sp., *Journal of Botany of the Faculty of Science, Assiut University*, 83, 1978, p. 83, *fig. 4*, x50; 5 – *L. operculatum* Conti, *Journal of Botany of the Faculty of Science, Assiut University*, 40, 1978, p. 40, *fig. 5*, x80; 6 – *Mesophyllum rigidum* Mastrorilli, *Journal of Botany of the Faculty of Science, Assiut University*, 28, 1978, p. 28, *fig. 6*, x50; 7 – *Lithophyllum prelichenoides* Lemoine, *Journal of Botany of the Faculty of Science, Assiut University*, 95, 1978, p. 95, *fig. 7*, x60; 8 – *Lithoporella melobesioideae* (Foslie) Foslie, *Journal of Botany of the Faculty of Science, Assiut University*, 83, 1978, p. 83, *fig. 8*, x50.

PLATE 2



- . II. 1 – *Mesophyllum vaughani* (Howe) Lemoine. 98,
 , 50; 2 – *M. sanctidionysii* Lemoine. 98,
 , 50; 3 – *Spongites albanensis* Lemoine. 103,
 , 50; 4 – *Mesophyllum lemoin e* Sonaya. 98,
 , 50; 5 – *Spongites* sp. 103,
 , 50; 6 – *Lithothamnion saxorum* Capeder. 69,
 , x60; 7 – *Lithothamnion undulatum* Capeder. 69,
 , x60; 8 – *Mesophyllum iraqense* Johnson. 103,
 , 50.

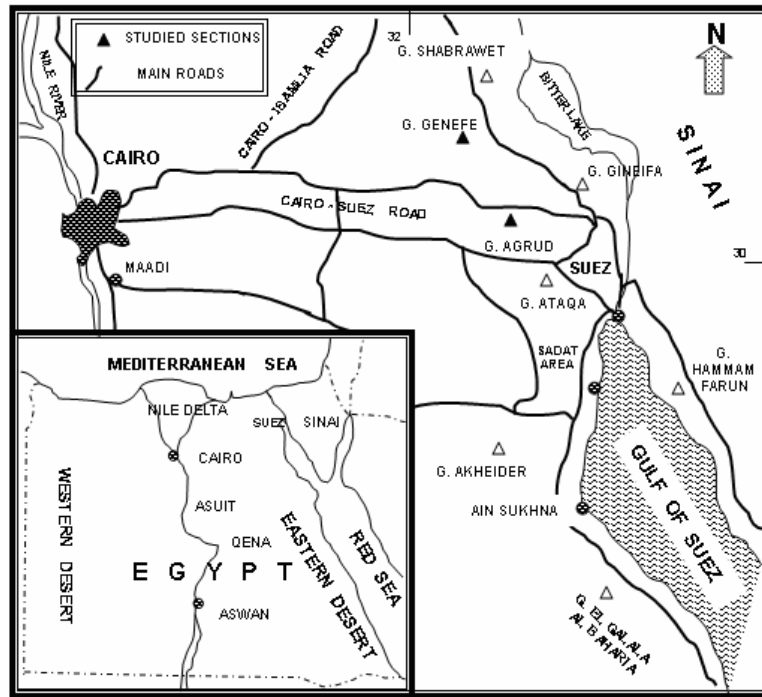


Figure 1. Location map showing the studied sections.

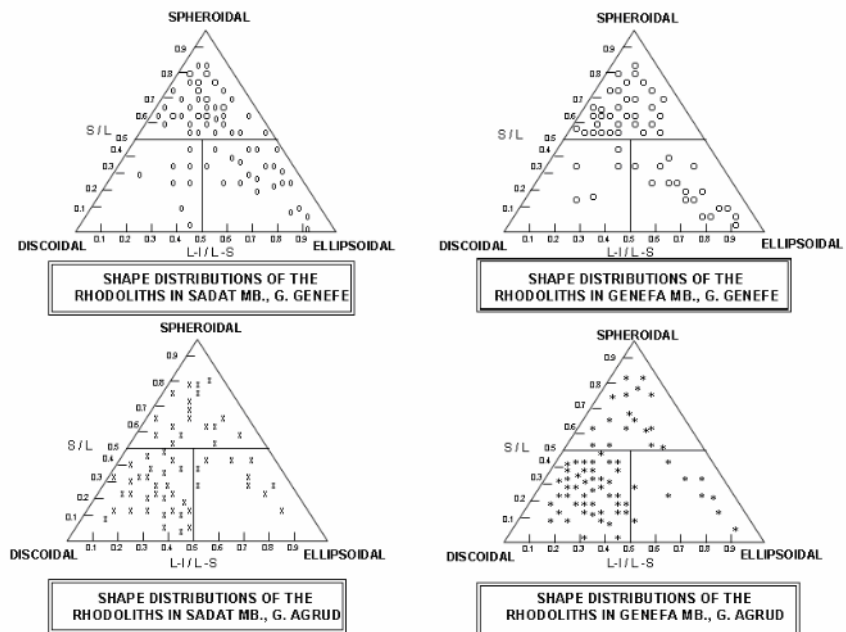
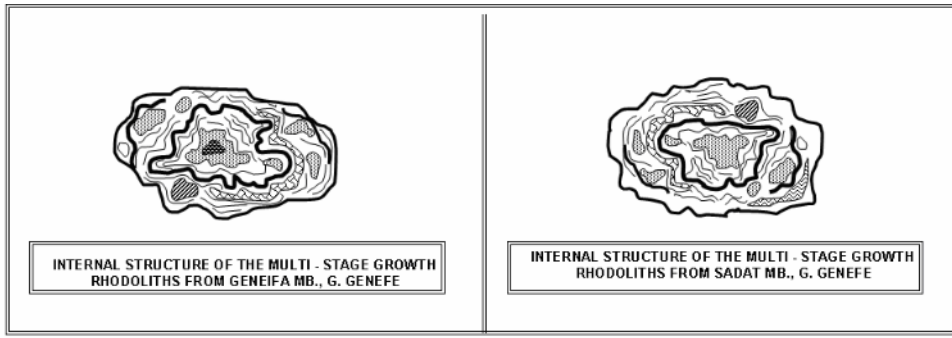


Figure 2. Shape distribution of the rhodoliths populations in Gebel Genefe and Gebel Agrud, North Eastern Desrt, Egypt.



- PRIMARY POROSITY
 FRAGMENTED CORALS
 BRYOZOANS
 REEFAL LIMESTONE
- SERPULIDS
 BIOCLASTICS
 CORALLINE RED ALGAE
 1 cm

Figure 3. Schematic diagrams showing the internal structure of multi-staged growth rhodoliths , Sadat Member, Gharra Formation, Gebel Genefe.

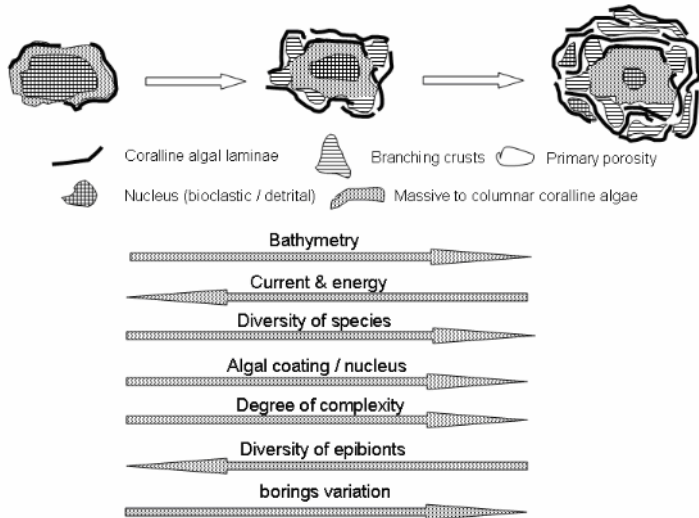


Figure 4. Conceptual model for rhodolith development in both Gebel Genefe and Gebel Agroud, North Eastern Desert, Egypt.
Modified from Braga & Martin (1989)

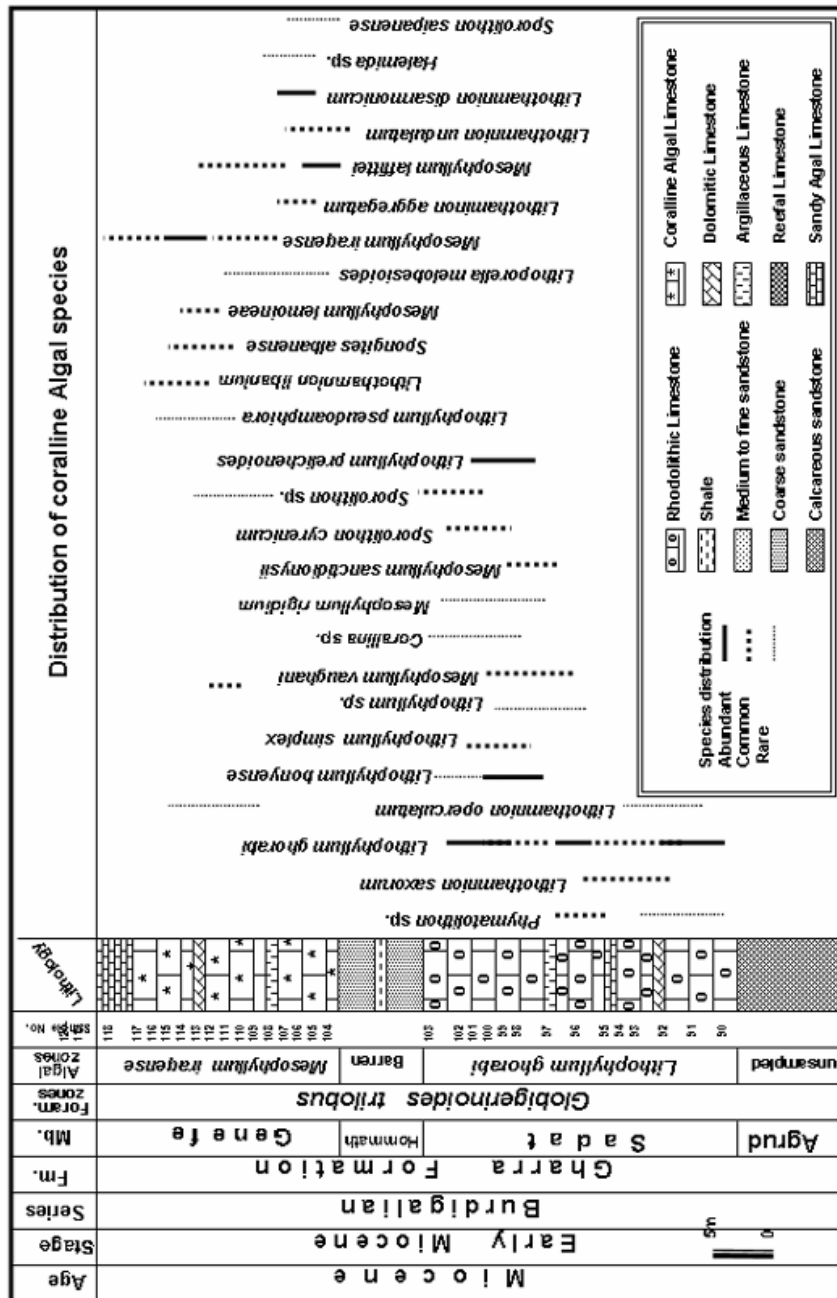


Figure 5. Stratigraphic distribution of the Early Miocene coralline red algae in Gebel Genefe, North Eastern Desert, Egypt

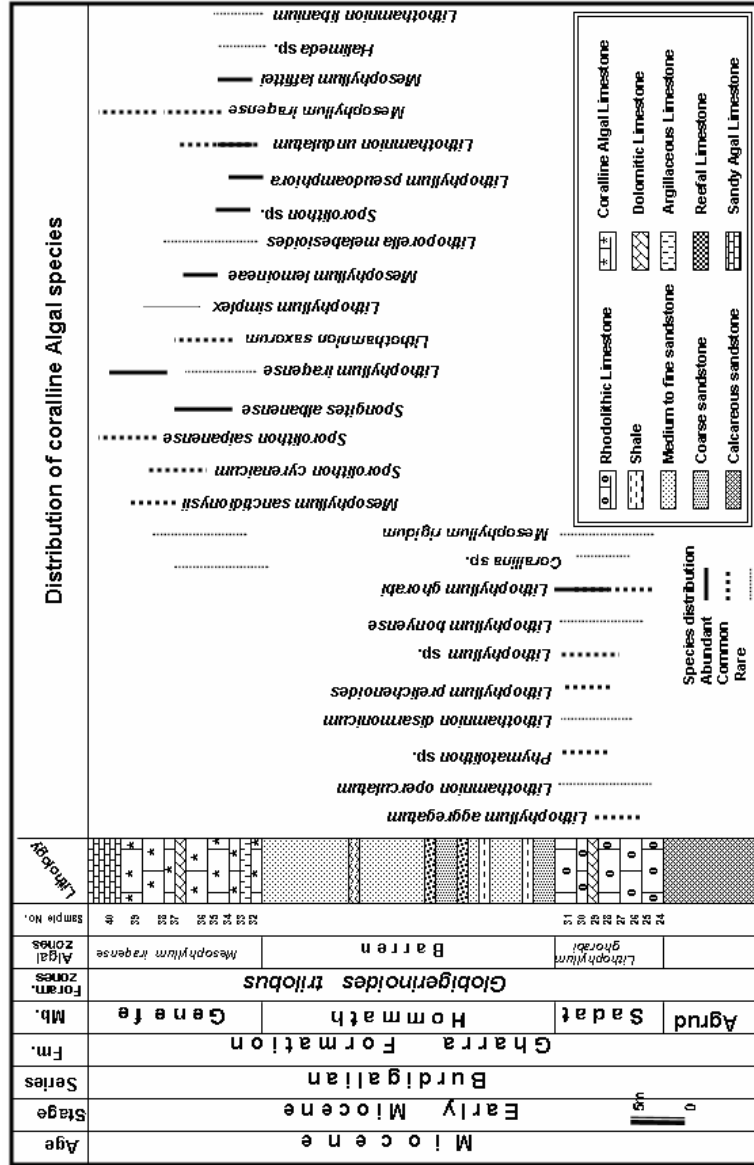


Figure 6. Stratigraphic distribution of the Early Miocene coralline red algae in Gebel Agrud, North Eastern Desert, Egypt .