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MIDDLE MIOCENE BRYOZOA FROM SIWA OASIS, WESTERN DESERT, EGYPT

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ABSTRACT

Forty bryozoan species relating to the orders Cyclostomata and Cheilostomata have been identified from the Middle Miocene Marmarica Formation in Siwa Oasis. They represent the most abundant bryozoan species in the studied sections. The whole bryozoan assemblage includes more than fifty species, all of them are recorded from this locality for the first time (except four species).

According to their zoarial (=colonial) growth forms, the studied bryofauna are belonging to the following: erect flexible, erect rigid and encrusting groups: cellariiform, adeoniform, eschariform, reteporiform, vinculariiform, membraniporiform and celleporiform.

Holoporella polythele and *Tretocycloecia dichotoma* form a disconnected bryozoan buildups. Such organic "reefal or at least biohermal" bryozoan record represents environmental conditions similar to those found in the same stratigraphic horizon in Matruh to the north.

The studied bryozoan assemblage reflects the following paleobiogeographic conditions: 1. Mediterranean affinity of the studied fauna. 2. Monotonous areal conditions allover the northern Western Desert during the formation of the Marmarica Limestone in the Middle Miocene. 3. Free and continuos connection with North Africa, from Libya to Morocco. 4. Limited connection with the north Eastern Desert, Gulf of Suez, Sinai and the Red Sea.

INTRODUCTION

Siwa depression represents a basin-like asymmetric syncline with axes oriented WNW-ESE, characterized by a gentle dip on its northern flank, and a hinge fault E-W extending between Siwa town and Gebel Takrur. Said (1962), classified the Miocene rocks of the Western Desert into two formations: Moghra Formation at the base of Lower Miocene, which composed of sandstone and shale, and the Middle Miocene Marmarica Formation at the top, which composed of highly fossiliferous limestone and dolostone with marl and shale intercalations.

Only four Bryozoan species have been previously known from the Middle Miocene of Siwa Oasis (Fuchs, 1883). They are: *Holoporella polythele*, *H. palmata*, *H. parasitica* and, *Metrarabdotos moniliferum*. The studied bryozoan fauna were collected from five stratigraphic sections, representing the Middle Miocene Marmarica Formation exposed in the study area. They are from west to east as follow: Bahi El Din, Gebel El Rokham, Um Hyeies, Gebel Tukrur, and Bir 1. (Fig. 1). The stratigraphy and facies analysis of the Marmarica Formation in the study area is discussed in details by the same authors in an another paper published in the same volume (Eweda *et al.*). The main targets of the present work are: the systematic paleontology, biostratigraphy, bio- and paleobiogeography of the studied bryozoan taxa, and their paleoecological implications.

SYSTEMATIC PALEONTOLOGY

(Note: The previously published taxa are not redescribed in this work)

Order Cyclostomata Busk, 1852
Suborder Articulata Busk, 1859
Family Crisiidae Johnston, 1847
Genus *Crisia* Lamouroux, 1816
Crisia hörnesi Reuss, 1847
(Pl. 1, fig. 1)

1848 *Crisia hörnesi* Reuss: 54, pl. 7, fig. 21.
1988 *Crisia hörnesi* Reuss; Moissette: 43, pl.5, fig.5.
1992 *Crisia hörnesi* Reuss; Pouyet & Moissette: 23, pl.1, fig.3.

1994 *Crisia suezensis* El-Safori: 109, pl. 9, figs. 7,8.
1996 *Crisia suezensis* El-Safori; El Dera: 36, pl. 1, figs. 1, 2.

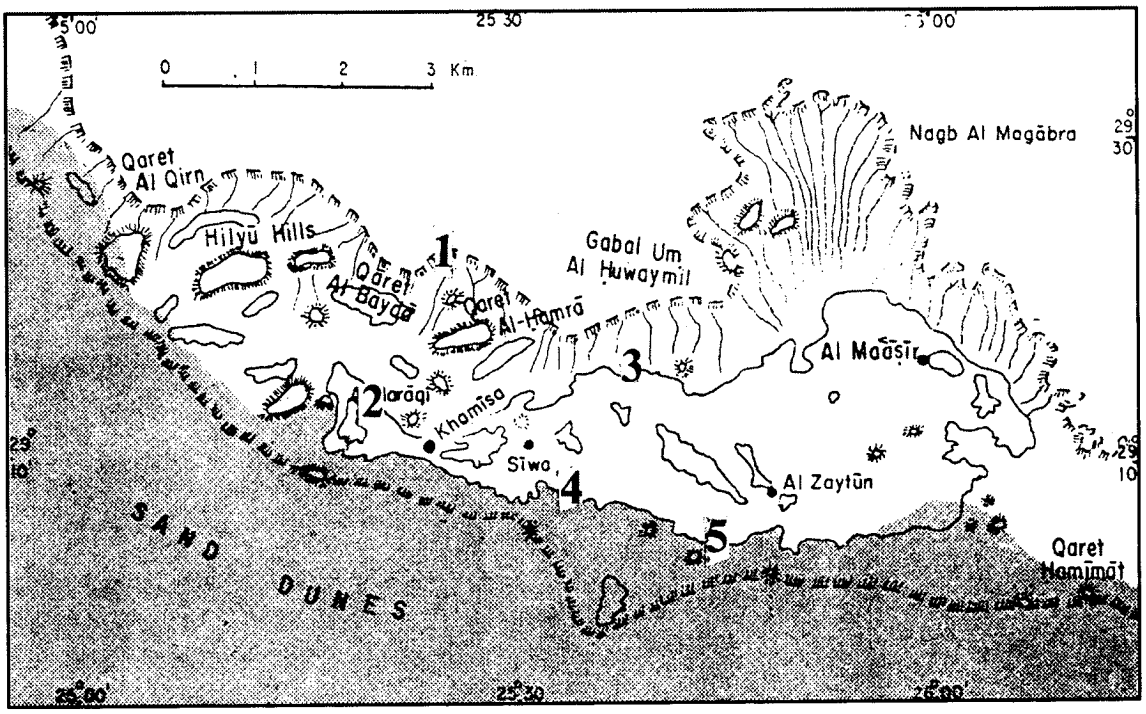

Fig. 1: Geomorphology (After Abu Al-Izz, 1971) and location of the studied sections.
1: Bahi El-Din, 2: Gebel El-Rokham, 3: Um Hyeies, 4: Gebel Takrur, and 5: Bir-1

Description: Zoarium cellariiform, erect, flexible, slender, straight, large, parallel sided except the tapered initial portion. Celluliferous surface (frontal) finely perforated, gently convex particularly at median axis. Non-celluliferous surface (dorsal) also gently convex but without raised median axis, as of the celluliferous one. Zooecia arranged in bilateral alternating manner, tubular, slightly distinct. Zooecial length less than segment width. Orifices and peristomes are circular. Ovicell is not observed in the material in hand.

Measurements:

Diameter of peristomes	0.08-0.09 mm
Distance between apertures	0.28-0.31 mm
Width of segment	0.4 mm
No. of tubes/segment	16

Remarks: The present specimens resembles those described by Canu & Bassler 1929, except their much wider segments. They also resemble *Crisia suezensis* El-Safori, 1994 in the Gulf of Suez, in all aspects and therefore, it is a synonymous. El Dera 1996, described similar specimens from Matruh area, and identified them as *Crisia suezensis* El-Safori, 1994. Furthermore, *Crisia suezensis* El-Safori, 1994 is not a formal specific name, because it is not published.

Occurrence: Bahi El Din : 5, 10; G. Takrur 39; and Bir 1: 1, 10.

Distribution: In Egypt: Middle Miocene of Matruh area and the western side of the Gulf of Suez. Eocene: of France, Italy and North America. Oligocene: Germany, France, Italy and USA. Miocene: CSSR, Greece, Italy, Poland, Romania, Hungry and Portugal. Pliocene-Pleistocene: Italy. Quaternary: Italy.

Habitat: Philippine Sea at depths from 57-162 fathoms (100-300 m), temperature: 11.2°C.

Range: Eocene-Recent

Family Calloporidae Norman, 1903
Genus *Callopora* Gray, 1848
Callopora lineata (Linné, 1758)
(Pl. 3, fig. 1)

1758 *Flustra lineata* Linné: 1301.
1912 *Membranipora lineata* Linné; Canu: 193, pl. 10 fig. 3.
1985 *Callopora lineata* Linné; Ziko: 33, pl. 7, figs. 1-5.
1992 *Callopora lineata* Linné; Pouyet & Moissette: 35, pl. 3, fig. 8.
1992 *Callopora lineata* Linné; Ziko, Hamza & El-Dera: 302, pl. 2, figs. 7, 9.
1996 *Callopora lineata* Linné; Ziko: 129, fig. 4/7.

Measurements:

Lz	0.42-0.57mm	lz	0.37-46mm
ho	0.34-0.43mm	lo	0.17-0.23mm

Occurrence: Bahi El Din: 5, 10; and G. El Rokham: 4.
Distribution: In Egypt: Middle Eocene in Maghagha, Nile Valley. Middle Miocene of Matruh, and west Central Sinai. Miocene of France, Italy, Spain. Quaternary of Italy.
Habitat: North Atlantic between Latitudes 65°N-25°N; not recorded from the Mediterranean. Common in temperate zone of the littoral region in northern hemisphere. Recorded from Lundy, England at 5 m depth during summer.
Range: Eocene-Recent.

Genus *Alderina* Norman, 1903
Alderina peduncolata (Manzoni, 1870)
(Pl. 3, fig. 2)

1870 *Membranipora peduncolata* Manzoni: 329, pl. 2, fig. 7.
1988 *Alderina* aff. *peduncolata* Manzoni; Moissette: 81, pl. 12, fig. 12; pl. 13, fig. 1.
1992 *Alderina peduncolata* Manzoni; Pouyet & Moissette: 36, pl. 3, fig. 10.

Description: Zoarium membraniporiform, unilamellar, encrusting on *M. moniliferum*. Zooecia distinct, mostly oval and elliptical, of variable dimensions, arranged in quincunx, separated from each others by wide and deep furrows. Opesia oval, entire, distally wide. Mural rims crenulated. Ovicell hyperstomial, often brocken in present specimen. Avicularia interzooecial, large, with open-channeled rostrum.

Dimensions:

Lz	0.34-0.46mm	lz	0.20-0.34mm		
ho	0.26-34mm	lo	0.14-0.31mm	Lav	0.20mm

Occurrence: G. Takrur: 1.
Distribution: Miocene of Algeria. Pliocene of Italy.
Habitat: Indian Ocean.
Note: This is the first record of this species from Egypt.
Range: Miocene-Recent.

Family Microporidae Hincks, 1880
Genus *Micropora* Gray, 1848
Micropora coriacea (Johnston, 1947)
(Pl. 3, fig. 4)

1847 *Flustra coriacea* Johnston: 349, pl. 56, fig. 8.
1988 *Micropora coriacea* (Johnston); Moissette: 93, pl. 14, fig. 9.

Description: Zoariun membraniporiform, encrusts other bryozoans. Zooecial length less than twice width. Zooecia distinct, elongated, of smoothed hexagonal outlines, separated from each others by sharp threads, arranged in alternating longitudinal rows. The ancestrula is unfortunately not observed. Opesia transverse, semilunal, distal convex, proximal straight or slightly concave. Mural rim thin and salient. Cryptocyst shallow, finely perforated and granulated. Ovicell endozooecial, smooth, small, little inflated. A pair of opesules always ocupied the distolateral corners of the frontal cryptocyst, just below apertures.

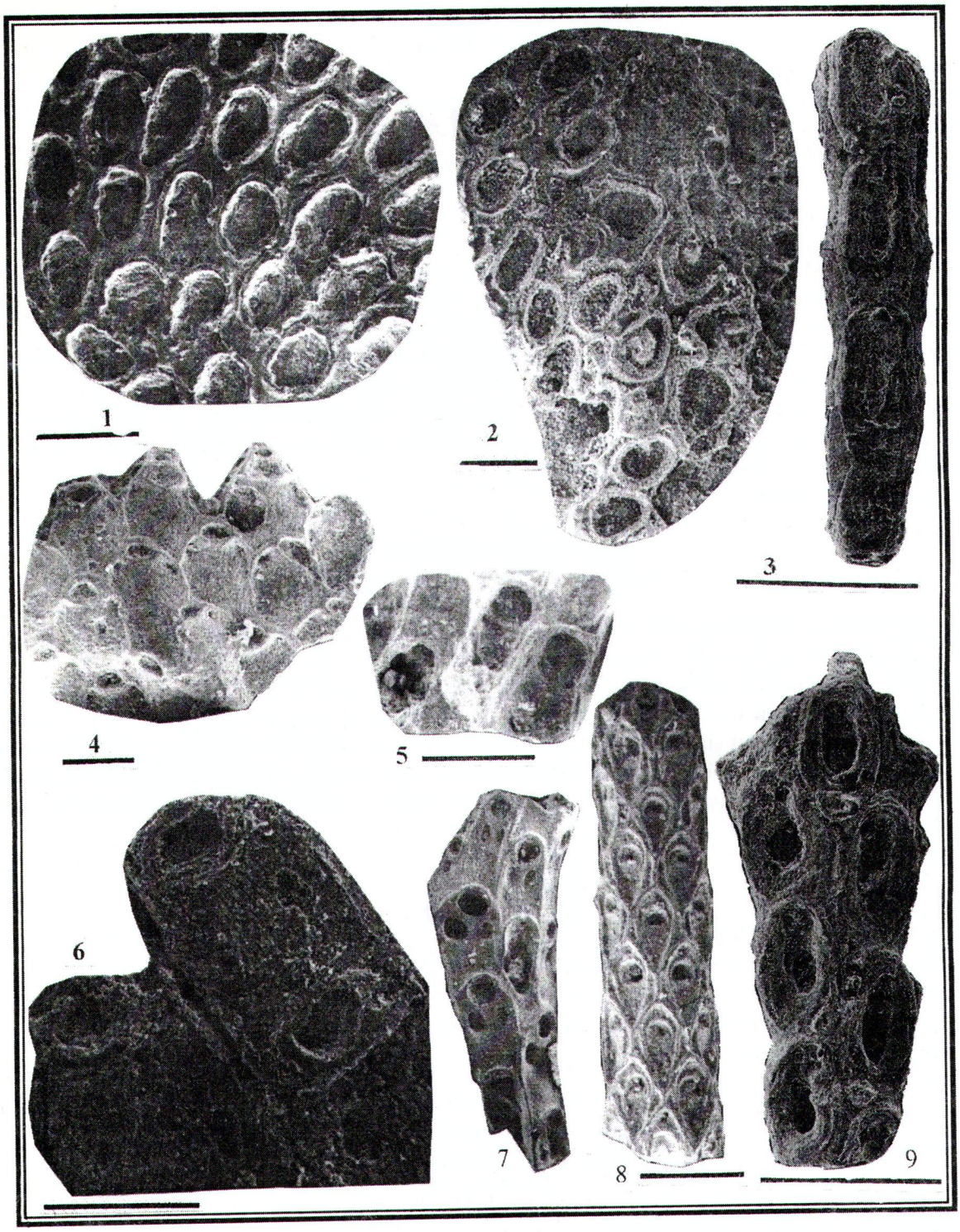

Plate 3

Fig. 1: *Callopora lineata* (Linné, 1758). Fig. 2: *Alderina peduncolata* (Manzoni, 1870). Fig. 3: *Nellia tenella* (Lamarck, 1816). Fig. 4: *Micropora coriacea* (Johnston, 1947). Fig. 5: *Steginoporella elegans* Pouyet & David, 1979. Fig. 6: *Calpensia nobilis* (Esper, 1797). Fig. 7: *Thalamoporella spathulata* David, 1949. Fig. 8: *Cellaria sinuosa* (Hassall, 1841). Fig. 9: *Scrupocellaria elliptica* (Reuss, 1848).

(Bar Scale of all figures = 400 μm)

Measurements:

Lz	0.40-0.50 mm	lz	0.28-0.38 mm
ho	0.06-0.10 mm	lo	0.16-0.20 mm

Occurrence: Bir 1: 10.
Distribution: Eocene of France, Italy, Poland and USA. Oligocene of France, Hungary, USA and Australia. Miocene of France, Italy, Morocco, Algeria, USA, Australia. Pliocene of Itali and Japan. Pleistocene of Italy and USA.
Habitat: Cosmopolitan. Depth range 0-800m, in Mediterranean 30-100m on different substrates.
Range: Eocene-Recent.
Note: This is the first record of this species in Egypt.

Family Calpensiidae Canu & Bassler, 1923
Genus *Calpensia* Jullien, 1888
Calpensia nobilis (Esper, 1797)
(Pl. 3, fig. 6)

1797 *Cellepora nobilis* Esper: 145, pl. 7.
1904 *Micropora impressa* (Moll); Canu: 227.
1963 *Calpensia nobilis* (Esper); Annoscia: 228, pl. 4, fig. 1.
1985 *Calpensia nobilis* (Esper); Ziko: 42, pl. 9, figs. 1-3.
1986 *Calpensia nobilis* (Esper); Zabala: 289, fig. 78.
1988 *Calpensia nobilis* (Esper); Moissette: 96, pl. 16, figs 11, 12.
1992 *Calpensia nobilis* (Esper); Pouyet & Moissette: 43, pl. 5, fig. 9.
Measurements:

Lz	044-0.56 mm	lz	0.12-0.28 mm
ho	0.06-0.08 mm	lo	0.10-0.12 mm

Occurrence: Bahi El Din, Bed: 5.
Distribution: In Egypt: Eocene of Minia. Eocene of France. Oligocene of Italy, England. Miocene of France, Italy, Morocco, Algeria. Pliocene of Italy and Tunisia. Pleistocene of Italy
Habitat: East Atlantic and Mediterranean, depth range 0-60 m.
Range: Eocene-Recent.

Family Steginoporellidae Bassler, 1953
Genus *Steginoporella* Smitt, 1873
Steginoporella elegans Pouyet & David, 1979
(Pl. 3, fig. 5)

1979 *Steginoporella elegans chattiensis* Pouyet & David: 777, pl. 1, figs. 2, 3.
1996 *Steginoporella elegans* Pouyet & David; El-Dera: 87, pl. 9, figs. 1, 2, 6.
Description: Zoarium encrusting, membraniporiform, unilamellar. Zooecia distinct, flask-shaped, arranged in alternating longitudinal raws, separated by their salient, elevated mural rims. Cryptocyst deep, well developed, finely perforated , distally depressed. Opesia terminal, semi-circular, with straight proximal marginal and rounded distal one. Opesules hardly visible in the available material. The small available zoarial part do not allow the examination of B-zooecia.
Dimensions: (of normal zooids)

Lz	0.62-0.71mm	lz	0.28-0.43mm
ho	0.14-0.26mm	lo	0.17-0.23mm

Occurrence: G. Takrur: 1.
Distribution: In Egypt: Middle Miocene Marmarica Formation in Matruh area. Oligocene of Germany.
Range: Oligocene-Miocene.

Family Thalamoporellidae Levinsen, 1902
Genus *Thalamoporella* Hincks, 1887
Thalamoporella spathulata David, 1949
(Pl. 3, fig. 7)

1949 *Thalamoporella spathulata* (Canu) David: 241, pl. 20, fig. 7.
1972 *Thalamoporella spathulata* David; David, Mongereau & Pouyet: 26, pl. 8, fig. 1.
1994 *Thalamoporella spathulata* (Canu) David: El-Safori, pl. 14, fig. 6.
1996 *Thalamoporella spathulata* (Canu) David; El-Dera: 88, pl. 9, fig. 4.

Description: Zoarium adeoniform, bilamellar, consisting of two compressed back to back laminae, rarely branched. Zooecia distinct, elongated rectangular, distal border curved, arranged in alternating longitudinal raws, separated by linear raised and sharp mural rims. Mural rims intimately united among themselves. Opesia more or less orbicular. Cryptocyst deep, flat, more deeper distally just below opesia, finely granulated

Measurements:

Lz	0.32-0.38 mm	lz	0.17-0.19 mm
ho	0.06-0.11 mm		
Lav	0.47 mm	lav	0.19 mm
ho (avic.)	0.15 mm	lo (avic.)	0.08 mm

Occurrence: G. Takrur: 1, 39.

Distribution: In Egypt:Middle Miocene, Marmarica Formation in Matruh area, Sadat Formation in the eastern side of the Gulf of Suez. Miocene of Italy, France and England.

Division Pseudostega Levinsen, 1909
Family Cellariidae Hincks, 1880
Genus *Cellaria* Ellis & Solander, 1786
Cellaria sinuosa (Hassall, 1841)
(Pl. 3, fig. 8)

1841 *Farcimia sinuosa* (Hassall, 172, pl. 6, figs. 1-6.
1973 *Cellaria sinuosa* (Hassall, Ziko: 79, pl. 10, figs. 5, 8, 9.
1988 *Cellaria sinuosa* (Hassall, Moissette: 105, pl. 3, fig. 5, pl. 17, figs 6,7.
1991 *Cellaria sinuosa* (Hassall, El-Dera: 98, pl. 5, fig. 7.
1992 *Cellaria sinuosa* (Hassall, Ziko, Hamza & El-Dera: 307, pl. 2, fig. 2.
1994 *Cellaria sinuosa* (Hassall, El-Safori: 161, pl. 15, fig. 3.
1996 *Cellaria sinuosa* (Hassall, El-Dera: 93, pl. 7, fig. 2.

Measurements:

Lz	0.20-0.26 mm	lz	0.10-0.14 mm
ho	0.03-0.07 mm	lo	0.05-0.07 mm

Occurrence: G. Takrur: 1.

Distribution: In Egypt: Middle Miocene in Matruh area and Cairo Suez district. Pliocene of England, France, Portugal, and Italy. Pleistocene of Italy.

Habitat: East Atlantic and Mediterranean, optimum depth range 80-100 m, but reachs 160 m in the Mediterranean in Gasegone Gulf.

Range: Miocene-Recent.

Division Cellularina Smitt, 1867
Family Farciminariidae Busk, 1884
Genus *Nellia Busk*, 1852
Nellia tenella (Lamarck, 1816)
(Pl. 3, fig. 3)

1816 *Cellaria tenella* Lamarck: 135.
1912 *Facimia oculata* Busk; Canu: 191, pl. 10, fogs. 16, 19.
1985 *Nellia tenella* Lamarck; Ziko: 58, pl. 13, figs. 4-6.
1991 *Nellia oculata* Busk; El Dera: 101, pl. 5, fig. 6.

1920 *Tetraplaria australis* Tension-Woods; Canu & Bassler: 367, fig. 110, A.
1929 *Tetraplaria australis* Tension-Woods; Canu & Bassler: 394, fig. 150, A.
1953 *Tetraplaria australis* Tension-Woods; Bassler: 217, fig. 163, 5.
Description: Zoarium articulated. Segments quadrangular, narrowed at the base, enlarged at the summit. Zooecial length more than twice width. Zooecia arranged in four longitudinal rows at right angles to each other, distinct, separated by deep furrows, much elongated, lozenge shaped. Frontal much convex, seems to be finely perforated by fine tremopores (seems with difficulty in the available material). Aperture orbicular. Ovicell originally endozooecial but not observed in the studied matterial.
Measurements:

Lz	0.78-0.92 mm	lz	0.26-0.28 mm
ho	0.12-0.16 mm		

Occurrence: Bir 1: 11.
Distribution: Miocene of Australia.
Note: This is the first record of this species in Egypt.

Family Celleporidae Busk, 1852
Genus *Costazia* Neviani, 1895
Costazia caminata (Waters, 1879)
(Pl. 6, fig.3)

1879 *Cellipora retusa* var. *caminata*, Waters: 194, pl. 13, fig. 1.
1930 *Costazia caminata* (Waters); Canu & Bassler: 82, PL. 11, figs. 13-16.
1986 *Costazia caminata* (Waters); Ziko, Ayad & Bassiouni: 108.
1987 *Costazia caminata* (Waters); Ziko & Hamza: 305, figs. 18, 19.
1994 *Costazia caminata* (Waters); El Safori: 214, pl. 20, fig. 4.
1994 *Costazia caminata* (Waters); Ziko, Hamza & El Safori: 228.
Measurements:

Lz	0.36-0.40 mm	lz	0.26-0.34 mm
ho	0.14-0.18 mm		

Occurrence: Bahi El Din: 10; G Rokham: 1, 4; Bir 1: 1; and G. Takrur: 39.
Distribution: In Egypt: Pleistocene and Recent.
Habitat: Mediterranian in Tunisian waters, East Atlantic Ocean in England.
Range: Miocene-Recent.

Genus *Holoporella* Waters, 1909
Holloporella polythele (Reuss, 1848)
(Pl. 6, figs. 4, 5)

1848 *Cellepora polythele* Reuss: 77, pl. 9, fig. 18.
1883 *Cellepora polythele* Reuss, Fuchs: 18, figs. 1, 2.
1912 *Holporella polythele* (Reuss); Canu: 217, pl. 8, fig. 6.
1965 *Holporella polythele* (Reuss); Souaya: 1141, pl. 139, figs. 1, 2.
1973 *Holporella polythele* (Reuss); Ziko: 113, pl. 20, fig. 7, pl. 23, figs. 1, 2, 3, 5.
1976 *Holporella polythele* (Reuss); Abbass & El Senousi: 166, pl. 4, figs. 1-3.
1977 *Cellepora polythele* (Reuss); Vávra: 155.
1992 *Holporella polythele* (Reuss); Ziko, Hamza & El-Dera: 313, pl. 5, fig. 5.
1996 *Holporella polythele* (Reuss); Ziko: 139, fig. 5: 4, 5.
Measurements:

Lz	0.32-0.40 mm	lz	0.24-0.36 mm
ho	0.12-0.16 mm	lo	0.08-0.12 mm
Lav	0.26-0.32 mm	lav	0.10-0.12 mm

Occurrence: Bahi El Din: 10; G. Rokham: 1, 4; Bir 1: 1; and G. Takrur: 39.
Distribution: In Egypt: Middle Miocene of Matruh area, Cairo-Suez district, western side of the Gulf of Suez. Miocene of Austria, Netherlands, France, CSSR, Hungary, Italy.
Habitat: Mediterranian, optimum depth 10-20 m.
Range: Miocene-Recent.

PLAEOECOLOGY

The paleoecologic interpretation of the studied Middle Miocene bryozoans of Siwa area is based on the zoarial (colonial) growth-forms ; and the habits and habitats of the extant species (tables 1, 2).

Zoarial Growth-Forms: It is known that the environmental parameters affect the relative distribution of the different colonial growth types (Stach 1939, Lagaaij & Gautier 1969, and Schopf 1969). The studied bryozoan species are classified according to their zoarial (colonial) growth forms into encrusting (18 species or 45%) and erect forms (22 species or 55%).

A- The Encrusting Zoarial Growth Forms: Among the encrusting species, two zoarial growth-forms are present: membraniporiform "A" (15 species) and celleporiform (3 species). It is worth mentioning that the abundance of the membraniporiform group is very low, while it is very high for the celleporiforms. Dead pelecypod and adeoniform bryozoan fragments were available enough to offer such substratum.

1. The Membraniporiform Zoarial Growth-Form: This form is usually consisting of unilamellar colonies, with dorsal wall of skeleton entirely calcified, generally encrusting a solid substratum. The membraniporiform colonies attain highest percentages in the littoral and sublittoral zones; in areas of low rates of sedimentation (10 cm./10^3 yrs.), and moderate current velocities. The membraniporiform species are the highest represented one in the Marmarica Formation in the study area. It attains 37.5% of the total identified species (15 species). This percentage may be in reality higher because the present material comprises many other in-identified membraniporiform species.

2. The Celleporiform Zoarial Growth-Form: The colonial habit in which individuals heaped irregularly in multilamellar masses of variable shape, inherent with incrustation on or around a flexible substratum. This colonial form is chiefly distributed in the littoral and sublittoral areas where no active transport and sedimentation of sand takes place (but only in very limited minor percentages). It is also frequent in environments with moderate current velocities and low rates of sedimentation as the previously mentioned type. The celleporiform colonial form occupies the fifth frequent one in the Marmarica Formation in the study area. It attains 7.5% of the total identified species (3 species).

B- The Erect Zoarial Growth Forms: The erect forms are those colonies attached only by their bases to hard substratum, while the rest of colony grows free from it. Most of the encountered free species form rigid colonies, e.g. adeoniform (6 species), reteporiform (2 species), and one vinculariiform (6 species). The erect flexible forms belong to the cellariiform (8 species).

1. The Cellariiform Zoarial Growth-Form : Cellariiform bryozoans are those erect flexible (jointed); approximately cylindrical attached to the substratum by rootlets. Internodes consisting of numerous individuals; orifices arranged on all aspects of the curved face of the cylinder. Stach (1936) noted that the cellariiform zoarial growth-form is adapted for life in the littoral zone where algae usually form the basis of attachment and the effect of wave action is overcome by the articulation of the long narrow internodes. Lagaaij & Gautier (1965) stated that this type extends (in the Rôhne delta marine area) in the moderate deposition environments, since it combines erect growth with great flexibility and the inherent ability passively to "shake off" settling clay particles. According to Schopf (1969), cellariiform bryozoans prefer the flexible substratum at first, but it can occasionally attached to hard or particular types. They also occur in frequent association in environment with moderate current velocities, but also occur in occasional association in both low and high ones. Concerning the rate of sedimentation, this type is also occur in frequent association in environments with high rates of sedimentation (100-1000 cm/ 10^3 yrs.); but also occur in occasional association in both low and high ones. In the present study this type represent the second diverse zoarial growth type.

2. The Adeoniform Zoarial Growth-Form: It is an erect rigid colonial growth-form, bilamellar (in which colonies are consisting of two lamina back to back), lobate, firmly attached to a solid substratum by a calcareous base. While the eshariform zoarial growth-form is the same as the adeoniform but the branches are much wider, and the colony is strongly calcified

and foliaceous. The two forms are here lumped together because they have more or less the same environmental significance. Both are of frequent association in environments with available hard substratum, moderate current velocities (<20->100 cm/sec.) and low rates of sedimentation (cm/10^3 yrs.) Six of the identified bryozoan species of the Marmarica Formation in Siwa Oasis exhibit adeoniform and eschariform zoarial types.

	Growth Forms					
	Encrusting		Erect Rigid			E. Flexible
	Membranipo-riform	Celleporifom	Adeoniform & Escariform	Reteporiform	Vincularii-form	Cellariiform
Stomatopora parvipora						
Proboscina boryi						
Lichenopora mediterrania						
Membranipora savartii						
Electra monstachys						
Callopora lineata						
Alderina peduncolata						
Micropora coriacea						
Calpensia nobilis						
Steginoporella elegans						
Thalamoporella spathulata						
Cribrilaria radiata						
Schizoporella longirostrata						
Schizoporella tetragona						
Microporella coronata						
Tretocycloecia dichotoma						
Costazia caminata						
Holoporella polythele						
Mesentripora meandrina						
Plageoecia sarniensis						
Umbonula gigantea						
Umbonula macrocheila						
Porella cervicornis						
Metrarabdotos moniliferum						
Sertella beaniana						
Iodyctum rubeschi						
Exidmonea atlantica						
Idmonea milneana						
Mesonea radians						
Tervia gracilis						
Entalophora proboscidea						
Cosiniopsis vestita						
Crisia hörnesi						
Crisia serrata						
Cellaria sinuosa						
Nellia tenella						
Scrupocellaria elleptica						
Caberea boryi						
Margaretta cereoides						
Tetraplaria australis						

Table 1: Zoarial growth form distribution of the studied bryofauna.

	Depth Range (in meters)	Biogeography				
		Atlantic	Mediterranean	Red Sea	Pacific	Indian
Proboscina boryi	--			—		
Lichenopora mediterrania	36-500		—		—	
Membranipora savartii	10-15	—		—	—	—
Electra monstachys		—	—		—	
Callopora lineata	5	—				
Alderina peduncolata						—
Micropora coriacea	30-100		—			
Calpensia nobilis	0-60	—	—			
Cribrilaria radiata	50-80	—	—			
Schizoporella longirostrata	20-60		—			
Microporella coronata	20-30	—	—	—	—	
Crisia hörnesi	100-300				—	
Crisia serrata	24-28				—	
Cellaria sinuosa	0-100	—	—			
Nellia tenella	20-28	—	—	—	—	—
Scrupocellaria elleptica		—	—		—	
Caberea boryi	20-60	—	—		—	—
Margaretta cereoides		—	—	—	—	
Plageoecia sarniensis	80 optimum	—	—		—	
Porella cervicornis	40-60	—	—	—		
Costazia caminata		—	—			
Holoporella polythele	10-20		—			
Sertella beaniana		—	—			
Exidmonea atlantica	--	—	—		—	
Idmonea milneana	13-690	—	—		—	—
Mesonea radians					—	
Entalophora proboscidea	100 optimum	—	—	—	—	—
Cosiniopsis vestita	27-49				—	

Table 2: Biogeographic distribution of the extant bryozoan species, and their depth ranges.

3. The Vinculariiform Zoarial Growth-Form: Colony erect, rigid, consisting of dichotomous subcylindrical branches (rodlike), firmly attached to a solid substratum by a calcareous base, the orifices open on all aspects of the curved surface. Stach (1936) observed that this group is adopted for life in deeper or sheltered waters where wave action is absent and currents scarcely active, and therefore typifies growth in quiet water. Schopf (1969) regarded that this colonial growth-form is of frequent association in environments rich in hard substratum, low current velocities, and low rates of sedimentation. Six of the identified bryozoan species of the Marmarica Formation in Siwa Oasis exhibit vinculariiform zoarial type.

4. The Reteporiform Zoarial Growth-Form: Colony is erect, rigid, strongly calcified, fenestrate or reticulate, firmly attached to a solid substratum by a calcareous base. According to Stach (1936) this type is adapted for life in regions where wave action and currents are strong, these factors being overcoming by the rigidity and fenestration of the colony. Schopf (1969) concluded that this type of colonial growth-forms have similar environmental parameters as in adeoniform, i.e. hard substratum, moderate current velocities, and low rate of sedimentation. Two of the identified bryozoan species of the Marmarica Formation in Siwa oasis exhibit reteporiform zoarial type.

Implications of the Colonial Shape Distribution

Table 1 shows the relative distribution of zoarial growth forms of the studied bryozoan species of the Marmarica Formation in Siwa area. The following ratios throw some light on the

paleoenvironment of them: 1. The ratio of erect to encrusting species is 5 : 3. 2. The ratio of erect rigid to erect flexible species exceeds 2 :1 (exactly equals 17 : 6). Such distribution indicates that the "Marmarica Sea" in general was: a)Littoral to sublittoral zone, b)Availability of enough solid substratum, c)Low to moderate current velocities (> 20 - < 100 cm/sec.) d)Low rates of sedimentation (> 10 - < 100 cm/10^3 yrs.), and e) As in the Marmarica Formation of Matruh area, the celleporid cheilostome *Holoporella polythele* and the cyclostome *Tretocycloecia dichotoma* are acting as frame builders. In addition to the branched massive stems of both species, *Holoporella polythele* forms hemispherical masses of diameters attaining 6 cm. Pores regularly and irregularly penetrate most of the large colonies, which seems to serve as ventilators in such less agitated environment. The presence of such organic buildups in Siwa facilitates the correlation of that unit with its similar one 300 km to the north in Matruh area.

Habits of the Extant Species

The bathymetric ranges of the extant species shown in table 2 suggest that, the depth of the environment in which the Marmarica were deposited between 20-60m. Very little is known about the water temperatures in which those extant bryozoan species are still living, but they are mostly living in the tropical seas, and consequently with tropical water temperature as those prevailing in the southern Mediterranean today (20°-25°C surface temperature according to Dodd & Stanton, 1990). The Extant species of the Marmarica in Siwa area attains a total number of 28 species. Of them, 18 are now living in the Atlantic Ocean, 20 in the Mediterranean Sea, 7 in the Red Sea, 16 in the Pacific Ocean, and 6 in the Indian Ocean. This biogeographic distribution reflects the Atlantic-Mediterranean affinity of the studied Middle Miocene bryozoans in Siwa Oasis.

Spatial Distribution

The identified bryozoan species could be classified according to their geologic distribution into tow groups, namely the extant which attains 70% of the total studied taxa, and the extinct one which attains 30% (Table 3)

a) The extant group: 28 out of the 40 identified species are still living in modern seas, 11 of them since the Eocene, 4 since the Oligocene, and 13 since the Miocene. Such spatial distribution means that these 28 extant species inhabited the shallow Tethyan Egyptian territories since the Miocene time (or even earlier from the Eocene and the Oligocene). Most of these species are recorded from the Neogene and Quaternary shallow marine sediments of North African countaries as well as the southern Europe ones. Less abundant are those extant species recorded from other Neogene and Quaternary sediments outside the Tethyan Sea.

b) The extinct group: Within the identified bryozoan species, 12 species are extinct, two ranges in age from the Eocene to the Miocene, one from the Oligocene to the Miocene, 2 from the Eocene to the Plio-Pleistocene, and 7 are found restricted to the Miocene.

Paleobiogeoraphic Distribution in Egypt: Twenty six of the identified bryozoan species of the Middle Miocene Marmarica Formation in Siwa area are previously recorded from other Middle (and locally Lower Miocene) occurrences in Egypt, as follow: 24 from the northern Western Desert at Matruh area, 13 species from the Cairo-Suez District, 10 species from the western side of the Gulf of Suez, and 11 species from east central Sinai. These Egyptian-wide Miocene bryozoans represent 65% of the total identified species.

The presence of 24 bryozoan species in Siwa and Matruh areas reflects the homogeneity of the "Marmarica Sea" over this wide area. While the comparison between the northern Western Desert paleogeographic province (Matruh at the north and Siwa at south) in one hand; and Cairo-Suez, the Gulf of Suez and east central Sinai on the other shows that there is a significant paleogeographic and paleoenvironmental contarsts between them. The two depocenters of Said (1990) to the north of Qattara play no significant role as biogeographic barriers; may be because they were too narrow to prevent dispersal of species in this wide shallow platform carbonate factory. Bryozoan species -as many other benthonic organism are capable to disperse around such deep barriers.

	Eocene	Oligocene	Miocene	Pliocene	Plistocene	Holocene
Stomatopora parvipora	•	•	•			
Proboscina boryi			•	•	•	•
Lichenopora mediterrania			•	•	•	•
Membranipora savartii	•	•	•	•	•	•
Electra monstachys		•	•	•	•	•
Callopora lineata	•	•	•	•	•	•
Alderina peduncolata			•	•	•	•
Micropora coriacea	•	•	•	•	•	•
Calpensia nobilis	•	•	•	•	•	•
Steginoporella elegans		•	•			
Thalamoporella spathulata			•			
Cribrilaria radiata	•	•	•	•	•	•
Schizoporella longirostrata			•	•	•	•
Schizoporella tetragona			•			
Microporella coronata			•	•	•	•
Tretocycloecia dichotoma			•			
Costazia caminata			•	•	•	•
Holoporella polythele			•	•	•	•
Mesentripora meandrina			•	•		
Plageoecia sarniensis			•	•	•	•
Umbonula gigantea			•			
Umbonula macrocheila			•			
Porella cervicornis	•	•	•	•	•	•
Metrarabdotos moniliferum			•	•		
Sertella beaniana			•	•	•	•
Iodyctum rubeschi			•			
Exidmonea atlantica	•	•	•	•	•	•
Idmonea milneana	•	•	•	•	•	•
Mesonea radians			•	•	•	•
Tervia gracilis	•	•	•			
Entalophora proboscidea		•	•	•	•	•
Cosiniopsis vestita			•	•	•	•
Crisia hörnesi	•	•	•	•	•	•
Crisia serrata			•	•	•	•
Cellaria sinuosa			•	•	•	•
Nellia tenella	•	•	•	•	•	•
Scrupocellaria elleptica	•	•	•	•	•	•
Caberea boryi		•	•	•	•	•
Margaretta cereoides		•	•	•	•	•
Tetraplaria australis			•			

Table 3: The stratigraphic ranges of the studied bryofauna.

The presence of the South Delta block may be the major paleogeographic barrier between the north Western Desert basin and other Middle Miocene basins in Egypt. This barrier reduce the number of the species present to the east of it to the half. The main environmental contrasts between the north Western Desert and other Middle Miocene basins to the east of the south Delta block may be one or both of the following factors:1. The local salinity increase, especially around the Gulf of Suez, where thick evaporitic sequences occur. 2. The higher rates of clastic sediments driven from the south Delta block and/or the rifting of the Red Sea.

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1994 *Nellia tenella* Lamarck; Ziko, Hamza & El-Safori: 228.
1994 *Nellia tenella* Lamarck; El-Safori: 162, pl. 15, fig. 4.
1995 *Nellia oculata* Busk; Ziko & El Sorogy: 84, figs. 4, 5.
Measurements:

Lz	0.39-0.40 mm	lz	0.20-0.21 mm
ho	0.16-0.18 mm	lo	0.04-0.6 mm

Remarks: *Nellia oculata* Busk, 1852 is considered by many authors (Cheetham 1963, Ziko, 1985) as synonym of the older known *Nellia tenella (*Lamarck, 1816).
Occurrence: Bahi El Din: 5,10; and Bir 1: 1.
Distribution: In Egypt: Middle Eocene of Mokattam (Cairo), Maghagha; Late Eocene of Mokattam, Beni Suef, Baharyia. Middle Miocene of Mersa Matruh, Cairo-Suez district, Western side of the Gulf of Suez. Eocene and Oligocene of Europe, Africa and America. Miocene of Africa, Asia, Europe, America. Pliocene-Pleistocene of Asia and America.
Habitat: Cosmopolitan in tropical regions, from depths ranging between 17-450m, but much frequent from 20-28m.
Range: Eocene-Recent.

Family Scrupocellariidae Levinsen, 1909
Genus *Scrupocellaria* Van Benden, 1845
Scrupocellaria elliptica (Reuss, 1848)
(Pl. 3, fig.9)

1848 *Bactridium ellipticum* Reuss: 56, pl. 9, figs. 7, 8.
1965 *Scrupocellaria elliptica* Reuss; Souaya: 1137, pl. 137, figs. 7, 8.
1969 *Scrupocellaria elliptica* Reuss; Annoscia: 65, pl. 2, figs. 4, 5.
1973 *Scrupocellaria elliptica* Reuss; Ziko: 81, pl. 11, figs. 4, 5, 7, 8.
1991 *Scrupocellaria elliptica* Reuss; El Dera: 103, pl. 5, figs. 2,4.
1992 *Scrupocellaria elliptica* Reuss; Ziko, Hamza & El Dera: 308
1994 *Scrupocellaria elliptica* Reuss; El-Safori: 163, pl. 15, figs. 5, 6.
1994 *Scrupocellaria elliptica* Reuss; Ziko, Hamza & El-Safori: 228.
1995 *Scrupocellaria elliptica* Reuss; Ziko & El-Sorogy: 84, fig. 4: 3-5.
1996 *Scrupocellaria elliptica* Reuss; El Dera: 98, pl. 10, figs. 2-4.
Description: Zoarium free, erect, with tapered initial part Zoarial segment bearing eight zooecia arranging in biserial alternating manner. Zoœcia distinct, elliptical, separated from each other by relatively wide grooves. Mural rim thick and rounded bears one small distal avicularium. Avicularia adventitious, elliptical, without pivot. Ovicell hyperstomial, of rounded outline (broken in all specimens). On the dorsal side the zooecia are distinct and little convex. Vibraculum oblique, with large rounded radicular pore (almost filled with spary calcite).
Measurements:

Lz	0.30-0.40 mm	lz	0.20-0.23 mm
ho	0.13-0.16 mm	lo	0.05-0.07 mm
Lav.	0.07 mm	hov	0.08 mm

Occurrence: Bahi El Din: 5, 10; Bir 1: 1, 4; and G. Takrur: 39.
Distribution: In Egypt: Middle Miocene of Cairo-Suez, western side of the Gulf of Suez, Mersa Matruh; Pleistocene of the Red Sea coast. Eocene of Spain, France, Italy and USA. Oligocene of France and Italy. Miocene: France, Austria, Poland, Romenia and Algeria. Pliocene: Portugal, Spain, England, Italy, Rhodes, Tunisia. Pleistocene of Italy and USA.
Habitat:West Atlantic at Brasilia and Canada, East Atlantic at Cap Vert Island, Mediterranean, Pacific and Arctic.
Range: Eocene-Recent.

Genus *Caberea* Lamouroux, 1816

Caberea boryi (Savigny-Audouin, 1826)

(Pl. 4, fig. 1)

1826 *Crisia boryi* Audouin: 242; Savigny: 12, fig. 4.
1912 *Caberea boryi* Audouin; Canu: 198, pl. 10, fig. 17.
1986 *Caberea boryi* (Audouin); Zabala: 310, pl. 1, figs. E-F.
1992 *Caberea boryi* (Audouin); Pouyet & Moissette: 47, pl. 6, figs. 3-5.

Description: Zoarium cellariiform straight and biserial. Zooecia distinct, united at their mural rim, arranged in two longitudinal rows, rectangular. Mural rim relatively thick and rounded. Opesia very large, elliptical. Ovicell hyperstomial, large globular, convex, transverse and smooth. Two types of avicularia occur: small frontal and large lateral. Frontal avicularia small, salient, located on the proximolateral corner of zooecia. Lateral avicularia large, falciform, with open channeled rostorum. Vibracular chamber large and covers almost all the dorsal of the zooecia, the groove is prolonged to the median axis.

Dimensions:

Lz	0.32-0.41 mm	lz	0.17-0.18 mm
ho	0.18-0.24 mm	lo	0.09-0.11 mm
Lav (small)	0.05-0.07 mm	lav (large)	0.05-0.15 mm
hov	0.18 mm	Width of segment	0.38 mm

Occurrence: G. Takrur: 1.

Distribution: Oligocene of USA. Miocene of Australia. Pliocene and Pleistocene of Italy.

Habitat: West Atlantic (Brazil and Gulf of Mexico), East Atlantic (Madera and England), Pacific (California, Australia, Newzealand , Japan), Indian Ocean and, Mediterranean. In the Mediterranean the species occur in depth range between 1-100 m but become of maximum abundance between 20-60m, and on different substrates.

Range: Oligocene-Recent.

Note: This is the first fossil record of this species in Egypt.

Division Cribrimorpha Lang, 1916

Family Cribrilinidae, Hincks, 1880

Genus *Cribrilaria* Canu & Bassler, 1929

Cribrilaria radiata (Moll, 1803)

(Pl. 4, figs. 2, 4)

1803 *Eshcara radiata* (Moll, 63, pl. 4, fig. 17
1965 *Cribrilaria radiata* (Moll, Souaya: 1138, pl. 137, fig. 3.
1973 *Cribrilaria radiata* (Moll, Buge, Debourle & Deloffre: 14, pl. 9, fig. 6.
1987 *Cribrilaria radiata* (Moll, Ziko & Hamza, 305, fig.15.
1988 *Cribrilaria radiata* (Moll, Ziko & Hamza, 224, pl. 1, fig. 2.
1992 *Cribrilaria radiata* (Moll, Ziko, Hamza & El-Dera, 308, pl. 4, fig. 4.
1994 *Cribrilaria radiata* (Moll, Ziko, Hamza & El-Safori, 228.

Measurements:

Lz	0.21-0.29 mm	lz	0.16-0.25 mm
ho	0.05-0.07 mm	lo	0.04-0.06 mm
hov	0.13 mm	lov	0.09 mm

Occurrence: G. Takrur: 39.

Distribution: In Egypt: Middle Miocene of Matruh area, Cairo-Suez District, western side of the Gulf of Suez and, east central Sinai. Pliocene of Kom El-Shelloul (Giza). Post-Pliocene of the Giza Pyramids plateau. Eocene of USA, England. Oligocene of Italy, USA. Miocene of Algeria, Austria, Italy, Poland, CSSR. Pliocene of Italy, Austria.

Habitat: Atlantic and Mediterranean, optimum depth 50-80 m, depth range in the Mediterranean 10-400 m.

Range: Eocene-Recent.

Suborder Ascophora Levinsen, 1909
Family Umbonulidae Canu, 1904
Genus Umbonula Hincks, 1880
Umbonula gigantea Canu, 1912
(Pl. 4, fig. 3)

1912 *Umbonula gigantea* Canu: 216, pl. 11, figs. 9, 14-17.
1973 *Umbonula gigantea* Canu; Ziko: 89, pl. 13, figs. 1-5; pl. 15, figs 1-4.
1976 *Umbonula gigantea* Canu; Abbass & El-Senoussi: 161, pl. 3, figs. 6-9.
1991 *Umbonula gigantea* Canu; El-Dera: 108, pl. 6, figs. 2-4.
1992 *Umbonula gigantea* Canu; Ziko, Hamza & El-Dera: 310, pl. 4, fig.9
1994 *Umbonula gigantea* Canu; El-Safori: 172, pl. 16, fig. 2.
1996 *Umbonula gigantea* Canu; El-Dera: 103, pl. 11, fig. 6.

Measurements:

Lz	0.83-1.00 mm	lz	0.33-0.50 mm
ho	0.22-0.28 mm		
Lav.	0.28-0.39 mm	lav.	0.17-0.22 mm

Occurrence: Bahi El Din: 5, 10; and G. El Rokham: 1, 4.
Distribution: This fossil species was endemic in Egypt during the Middle Miocene. It is recorded from Matruh area, Cairo-Suez District, and from the western side of the Gulf of Suez.

Umbonula macrocheila (Reuss, 1848)
(Pl. 4, fig. 5)

1848 *Eschara macrocheila* Reuss: 65, pl. 8, fig. 14
1974 *Umbonula macrocheila (*Reuss); David & Pouyet: 147, pl. 8, fig. 2.
1977 *Umbonula macrocheila (*Reuss); Vavra: 110.
1989 *Umbonula macrocheila (*Reuss); Schmid: 31, pl. 5, figs. 1-4.
1990 *Umbonula macrocheila (*Reuss); Li: 44.

Description: Zoarium adeoniform, bilamellar. Zooecial length more or less twice width. Zooecia distinct, elongated flask shaped, separated from each other by deep furrow. Zooecia surrounded by single row of areolar numerous and rounded pores. Frontal wall thick tremocyst, with salient umbo, costulated. Avicularia frontal, suboral. Orifice more or less orbicular, surrounded by thick orbicular peristome. Ovicell hyperstomial, but not observed in the material in hand.

Measurements:

Lz	0.64-0.72 mm	lz	0.20-0.30 mm
ho	0.14-0.20 mm	lo	0.14-0.18 mm
Lav.	0.06-0.14 mm		

Occurrence: G: Takrur: 39.
Distribution: Miocene of Austria, Portugal and France.
Range: Miocene.
Note: This is the first record of this species in Egypt.

Family Gigantoporidae Bassler, 1935
Genus *Cosciniopsis* Canu & Bassler, 1927
Cosciniopsis vestita (Hincks, 1885)
(Pl. 4, fig. 6)

1885 *Lepraria vestita* Hincks: 256, pl. 9, fig. 9
1929 *Cosciniopsis vestita* Hincks; Canu & Bassler: 275, fig. 112 A, B.
1953 *Cosciniopsis vestita* Hincks; Bassler: 198, fig. 148-6.
1996 *Cosciniopsis erecta* Hincks; El-Dera: 108, pl. 11, figs. 1, 5.

Description: Zoarium erect, vinculariiform, of rounded cross section. Zooecia arranged in 4-5 longitudinal raws per zoarial segment in alternating manner. Zooecia large, distinct, elongated,

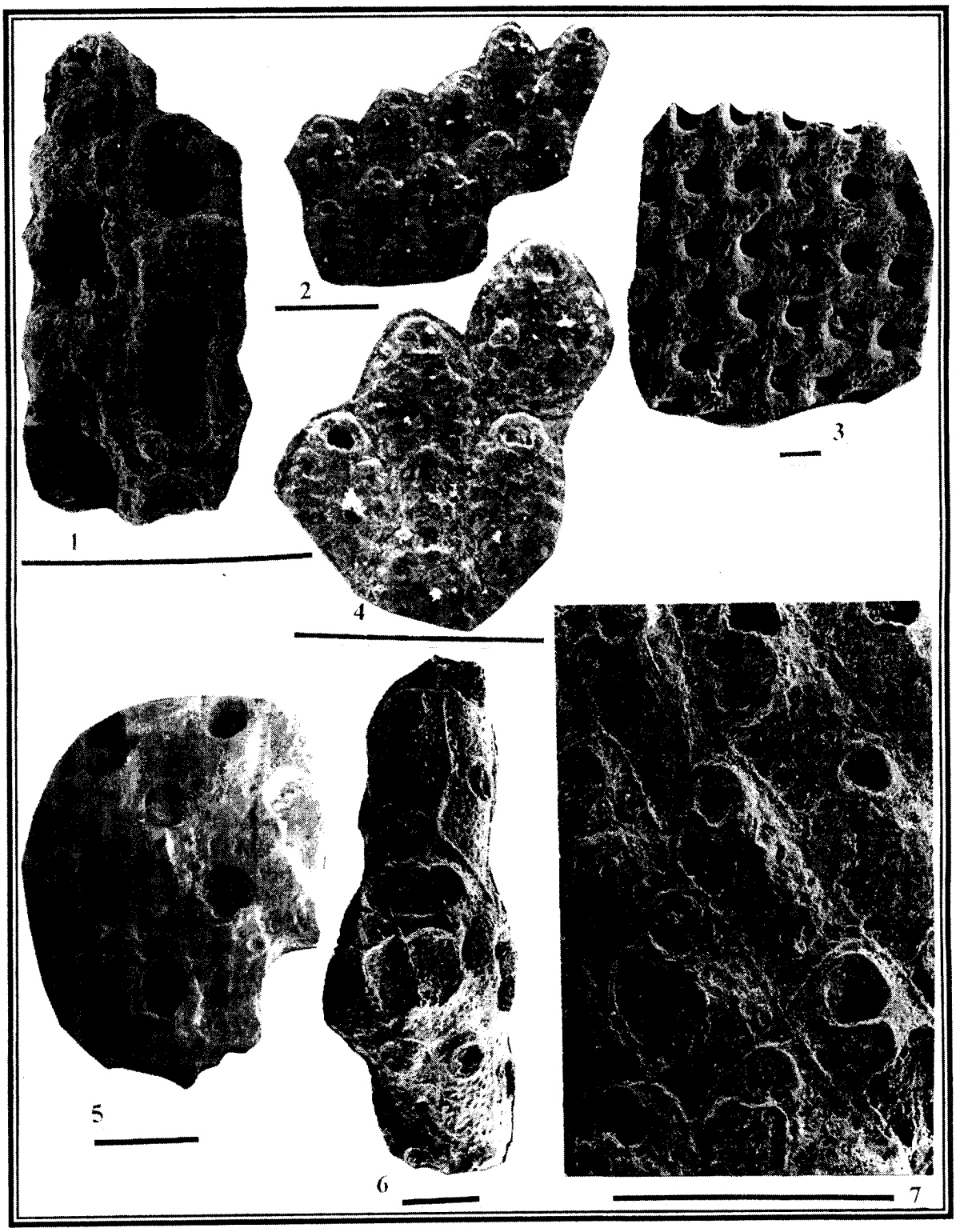

Plate 4

Fig. 1: *Caberea boryi* (Savigny-Audouin, 1826). Figs. 2, 4: *Cribrilaria radiata* (Moll, 1803). Fig. 3: *Umbonula gigantea* Canu, 1912. Fig. 5: *Umbonula macrocheila* (Reuss, 1848). Fig. 6: *Cosciniopsis vestita* (Hincks, 1885). Fig. 7: *Schizoporella longirostrata* Hincks, 1886
(Bar Scale of all figures = 400 µm)

of more or less rectangular outline, more wide in the middle, separated from each other by thin salient and raised thread. Frontal slightly convex, tremocyst; tremopores numerous, rounded, regularly distributed. Orifice nearly circular, but slightly transverse, with proximal straight and convex distal borders. Ovicell hyperstomial, large, inflated, perforated by the tremopores similar to frontal. Ovicelled zooecia with two rounded avicularia located below orifice on the distolateral corners of the frontal. Avicularia of non-ovicelled zooecia are also paired and located on the distolateral corners of the frontal, with pivot.

Measurements:

Lz	0.50-0.63 mm	lz	0.35-0.45 mm
ho	0.17-0.20 mm	lo	0.20-0.23 mm

Occurrence: G. Takrur: 39.

Distribution: In Egypt: Miocene of Matruh.

Habitat: Pacific Ocean, depth range 27-49m.

Range: Miocene-Recent.

Family Schizoporellidae Jullien, 1903

Genus *Schizoporella* Hincks, 1877

Schizoporella longirostrata Hincks, 1886

(Pl. 4, fig. 7)

1886 *Schizoporella unicornis* forma *longirostris* Hincks, 226, pl. 10, fig. 2.

1988 *Schizomavella longirostrata* Hincks; Moissette: 125.

1989 ? *Schizoporella longirostris* Hincks; Schmid: 39, pl. 11, figs. 5-8.

1994 *Schizomavella longirostrata* Hincks; Ziko, Hamza & El-Safori: 228.

1994 *Schizomavella longirostrata* Hincks; El-Safori: 176, pl. 16, fig. 6.

Description: Zoarium membraniporiform, encrusting on adeoniform bryozoa, unilamellar. Zooecial length twice width. Zooecia arranged uniformly in parallel longitudinal alternating raws. Zooecia rectangular, with distinct boundaries, separated by thin deep thread, surrounded by one raw of rounded areolar pores. Frontal wall tremocyst, convex, with weak umbo just proximal opesia. Tremopores rounded, slightly larger but less obvious and less regular than areolar pores. Orifice more or less rounded, with distal straight border, i.e. D-form, with proximal sinus. Avicularia single, large, adjacnt to the orifice. Rostrum directed upward. Ovicells not observed in the studied material.

Measurements:

Lz	0.47-0.60 mm	lz	0.26-0.33 mm
ho	0.13-0.17 mm		
Lav.	0.32-0.36 mm	lav.	0.28-0.37 mm

Occurrence: Bahi El Din: 5,10 and G. Rokham: 1, 4.

Distribution: In Egypt: Middle of Miocene the Gulf of Suez and Cairo-Suez District. Miocene of Austria, France, Italy, and Algeria. Pliocene of Italy Pleistocene of Italy, and USA in Santa Barbara and California (rare).

Habitat: Mediterranean in Tunis and west Mediterranean in general; Atlantic in Moroccan coast, British Islands and Queen Charlotte Islands. Depth range 20-60 m.

Range: Miocene-Recent.

Schizoporella tetragona (Reuss, 1848)

(Pl. 5, fig. 1)

1848 *Cellepora tetragona* Reuss: 78, pl. 9, fig. 10

1984 *Schizoporella tetragona* Reuss; Pouyet & David: 98.

1996 *Schizoporella tetragona* Reuss; El-Dera: 110, pl. 12, fig. 2; pl. 13, fig. 3.

Description: Zoarium membraniporiform, encrusting, unilamellar. Zooecia elongated rectangular, distinct, separated from each others by thin threads, arranged in longitudinal alternating rows, surrounded by linear fine areolar pores. Frontal little convex, finely granulated, perforated by very fine and neumerous tremopores. Orifice semicircular, straight

proximal and convex distal; proximal border with median thin sinus. Peristome thin, salient, more or less orbicular. Avicularia adventiceous, large, single, located on lateral proximal corner of opesia, directed to outside, with pivot, with open channeled short rostorum. Ovicell hyperstomial, large, inflated, with the same tremopores as frontal, rarely observed.
Measurements:

Lz	0.46-0.60 mm	lz	0.18-0.24 mm
ho	0.08-0.12 mm	lo	0.10-0.12 mm
Lav	0.12-0.14 mm		

Occurrence: Gebel Takrur: 39.
Distribution: In Egypt: Middle Miocene of Matruh area. Miocene of Austria, Netherland, CSSR.
Range: Miocene.

Family Microporellidae Hincks, 1880
Genus *Microporella* Hincks, 1877
Microporella coronata (Savigny-Audouin, 1826)
(Pl. 1, fig. 3; Pl. 5, fig. 4)

1826 *Flustra coronata* Audouin: 239, pl. 9, fig.6.
1988 *Microporella coronata* (Audouin); Moissette; 151, pl. 24, figs. 2, 3.
Description: Zoarium membraniporiform, encrusting on adeoniform bryozoan fragment. Zooecia distinct, flask shaped, of more or less hexagonal outlines, separated but relativelyd deep furrows, arranged inalternating longitudinal raws. Frontal fine tremocyst. Apertures semicircular, proximal border straight. Peristomes thin and low, with 5-6 small pores. Avicularia small, directed forward and slightly outward, paired, located on both lateral sides of the proximal border of aperture. Ascopore small, located below the mid-point of the proximal border of aperture, slightly larger than tremopores, and therefore hardly seen. The ovicell hyperstomial, large, inflated, with the same tremopores as frontal.
Measurements:

Lz	0.65-0.86 mm	lz	0.31-0.46 mm
ho	0.11-0.14 mm	lo	0.14-0.17 mm

Occurrence: G. Takrur: 1.
Distribution: Miocene of Morocco and Algeria. Pliocene of Spain and Italy.
Habitat: It is distributed around the world in warmer waters (Osburn, 1950, Mediterranean (rare), Atlantic, Red Sea, Pacific. Depth range 20-100m, optimum depth 20-30m.
Range: Miocene-Recent.
Note: This is the first record of this species in Egypt.

Family Mucronellidae, Levinsen, 1902
Genus *Porella* (Pallas, 1766)
Porella cervicornis (Pallas, 1766)
(Pl. 5, figs. 2, 3)

1766 *Millepora cervicornis* Pallas: 252.
1965 *Porella cervicornis* (Pallas); Souaya: 1138, pl. 137, fig. 11.
1973 *Porella cervicornis* (Pallas); Ziko: 98, pl. 16, fig. 3.
1989 *Porella cervicornis* (Pallas); Schmid: 35, pl. 10, figs. 1-3.
1991 *Porella cervicornis* (Pallas); El-Dera: 114, pl. 7, figs. 2, 4.
1992 *Porella cervicornis* (Pallas); El-Hajjaji: 174, pl. 10, fig. 8.
1994 *Porella cervicornis* (Pallas); Harmelin, Boury-Esnault & Vacelet: 69.
1994 *Porella cervicornis* (Pallas); El-Safori: 201, pl. 19, fig.1.
1996 *Porella cervicornis* (Pallas); Ziko: 135, fig. 3: 4, 5, fig. 4: 4, 6, 8, 9, fig. 5: 1, 6.
1996 *Porella cervicornis* (Pallas); El-Dera: 114, pl. 13, figs. 2, 4, pl. 14, fig.3, pl. 15, figs. 2, 3.
1999 *Porella cervicornis* (Pallas); Elsafori and El Sorogy:361, pl. 5, fig. 4.

Plate 5

Fig. 1: *Schizoporella tetragona* (Reuss, 1848). Figs. 2, 3: *Porella cervicornis* (Pallas, 1766). Fig. 4: *Microporella coronata* (Savigny-Audouin, 1826). Fig. 5: *Margaretta cereoides* (Ellis & Solander, 1786). Figs. 6, 7: *Sertella beaniana* (King, 1846). Fig. 8: *Iodictyum rubeschi* Reuss, 1847.
(Bar Scale of all figures = 400 µm)

Measurements:

Lz 0.70-0.85 mm	lz 0.35-0.45 mm	
ho (outer orifice)	0.35-0.40 mm	lo 0.25-0.30 mm
ho (inner orifice)	0.20 mm	lo 0.10-0.15 mm

Occurrence: G.Takrur: 39; G. El Rokham:1, and Bahi El Din: 10.
Distribution: In Egypt: Middle Miocene of Matruh, Cairo-Suez, western side of the Gulf of Suez and west-central Sinai. Eocene of Hungary, Romania; Oligocene of Italy; Miocene of Tunisia, Morocco, Algeria, France, portugal, Italy, Belgium, Austria, Poland, Spain, Germany. Pliocene of Algeria, Tunisia, Spain, Italy, Portugal; Pleistocene of Italy.
Habitat: Mediterranean, North East Atlantic, Red Sea. Depth range in Mediterranean 12-150m, optimum occurrence 40-60.
Range: Eocene-Recent.

Family Margarettidae Harmer. 1956
Genus: *Margaretta* Gray, 1848
Margaretta cereoides (Ellis & Solander, 1786)
(Pl. 5, fig. 5)

1786 *Cellaria cereoides* Ellis & Solander: 26, pl. 5, fig. B-F.
1965 *Tubucellaria cereoides* (Ellis & Solander); Souaya: 1138, pl. 137, figs. 5, 12.
1987 *Margaretta cereoides* (Ellis & Solander); Ziko & Hamza: 302, fig. 17.
1989 *Margaretta cereoides* (Ellis & Solander); Schmid: 52, pl. 15, figs. 4, 5, 7, 8.
1992 *Margaretta cereoides* (Ellis & Solander); Ziko, Hamza & El-Dera: 312, pl. 4, fig. 8.
1996 *Margaretta cereoides* (Ellis & Solander); Ziko: 136, figs. 4, 5.

Measurements:

Lz	0.67-0.87 mm	lz	0.23-0.33 mm
ho	0.17-0.20 mm	lo	0.10-0.17 mm

Occurrence: G. El-Rokham: 4, 5 and, Bahi El Din: 31, 39, 41.
Distribution: In Egypt: Middle Miocene of Mersa Matruh, Cairo-Suez district; Post-Pliocene of the Giza Pyramids Plateau. Oligocene of Germany, Italy, Poland, Rumania, CSSR; Miocene of France, Poland, Rumania, CSSR; Pliocene of Italy, North Africa,, Central America.
Habitat: Mediterranean, Adriatic, Pacific, Red Sea. In Atlantic, only in tropical and subtropical regions.
Range: Oligocene-Recent.

Family Sertellidae Smitt, 1867
Genus *Sertella* Jullien, 1903
Sertella beaniana (King, 1846)
(Pl. 5, figs. 6, 7)

1846 *Retepora beaniana* King: 237
1988 *Sertella beaniana* (King); Moissette: 166, pl. 27, figs. 1, 2, 3.
1990 *Sertella beaniana* (King); Li: 64, pl. 7, figs. 7, 8.

Description: Zoarium reteporiform, erect, unilaminar, reticulated, fenestrate of variable size. Branches varying from 0.47-70mm wide, reverse solid, the surface generally smooth, occasionally minute granulose. Fenstrules elliptical, less wide than branches. Zooecia indistinct, elongated flask-shaped, arranged more or less on alternating longitudinal raws, at least three zooecial raws occur. Opesia semi-circular, with straight proximal and curved distal borders. Frontal convex, finely perforated by tremopores. Avicularia numerous, with pivot, at least one located just below the middle part of the straight proximal border of opesia. Ovicells hyperstomial, often broken.

Measurements:

Length of fenstrules:	055-1.00mm	Width of fenstrules:	0.25-0.40mm
Lz	0.27-0.33mm	lz	0.17-0.27mm
ho	0.06-0.08mm	lo	0.09-0.12mm
Lav.	0.06mm	lav.	0.05mm

Occurrence: Bahi El Din: 5, 10; and Gebel Takrur: 16, 39.
Distribution: Miocene of France. Pliocene of Netherland, France and Italy. Pleistocene of Italy.
Habitat: Mediterranian, and East Atlantic.
Note: This is the first record of this species in Egypt.
Range: Miocene-Recent.

Genus: *Iodictyun* Harmer, 1933
Iodictyum rubeschi Reuss, 1848
(Pl. 5, fig. 8)

1848 *Retepora rubeschii* Reuss: 48, pl. 6, figs. 35-37.
1989 *Iodictyum rubeschi* (Reuss); Schmid: 54, pl. 16, figs. 1-5.
1991 *Iodictyum rubeschi* (Reuss); El-Dera: 115, pl. 6, fig. 6; pl. 7, figs 1-5.
1992 *Iodictyum rubeschi* (Reuss); Ziko, Hamza & El Dera: 312, pl. 4, fig. 5.
1994 *Iodictyum rubeschi* (Reuss); El-Safori: 206, pl. 19, figs. 7-8.
1996 *Iodictyum rubeschi* (Reuss); El-Dera: 125, pl. 16, figs. 2-4.
1998 *Iodictyum rubeschi* (Reuss); Ziko: 139, fig. 5: 2-3.

Measurements:

Lz	0.46-0.60mm	lz	0.18-0.21mm
ho	0.08-0.10mm	hov	0.16mm

Occurrence: G. Takrur 39.
Distribution: In Egypt: Miocene of Cairo-Suez, western side of the Gulf of Suez, east central Sina. Miocene of Austria and France.
Range: Miocene.

Family Metrarabdotosidae, Vigneaux, 1949
Genus: *Metrarabdotos* Canu, 1914
Metrarabdotos moniliferum (Milne-Edwards, 1836)
(Pl. 6, fig. 1)

1836 *Eschara monilifera* Milne-Edwards: 327, pl. 1, figs. 1, 1a-d.
1883 *Eschara monilifera* Milne-Edwards; Fuchs: 34, pl. 13, fig. 8.
1912 *Schizoporella monilifera*; Canu: 210.
1963 *Trigonopora monilifera* (Milne-Edwards); Annoscia: 223. pl. 15, fig. 1; pl. 16, figs 1, 2.
1973 *Trigonopora monilifera* (Milne-Edwards); Ziko: 112, pl. 13, figs. 1-6.
1992 *Metrarabdotos monilifrera* (Milne-Edwards); Ziko, Hamza & El-Dera: 312, pl. 5, fig. 2.
1996 *Metrarabdotos* (*Metrarabdotos*) *moniliferum* (Milne-Edwards); Ziko: 134, fig. 2: 6, fig. 3: 2, 6.

Measurements:

Lz	0.88-1.10 mm	lz	0.32-0.40 mm
ho	0.18-0.12 mm	lo	0.14-0.16 mm
Lav	0.08 mm	lav	0.03 mm

Occurrence: Bahi El Din: 5, 10; G. El Rokham: 4; Bir 1: 1; and G. Takrur: 39.
Distribution:In Egypt: Miocene in Matruh and Cairo-Suez district. Miocene of Italy, Germany, Austria, France. Pliocene of Italy, England, Belgium, Netherlands. Pleistocene of England and Italy.
Range: Miocene-Pliocene.

Family Tetraplariidae Harmer, 1957
Genus *Tetraplaria* Tension-Woods, 1878
Tetraplaria australis Tension-Woods, 1878
(Pl. 6, fig. 2)

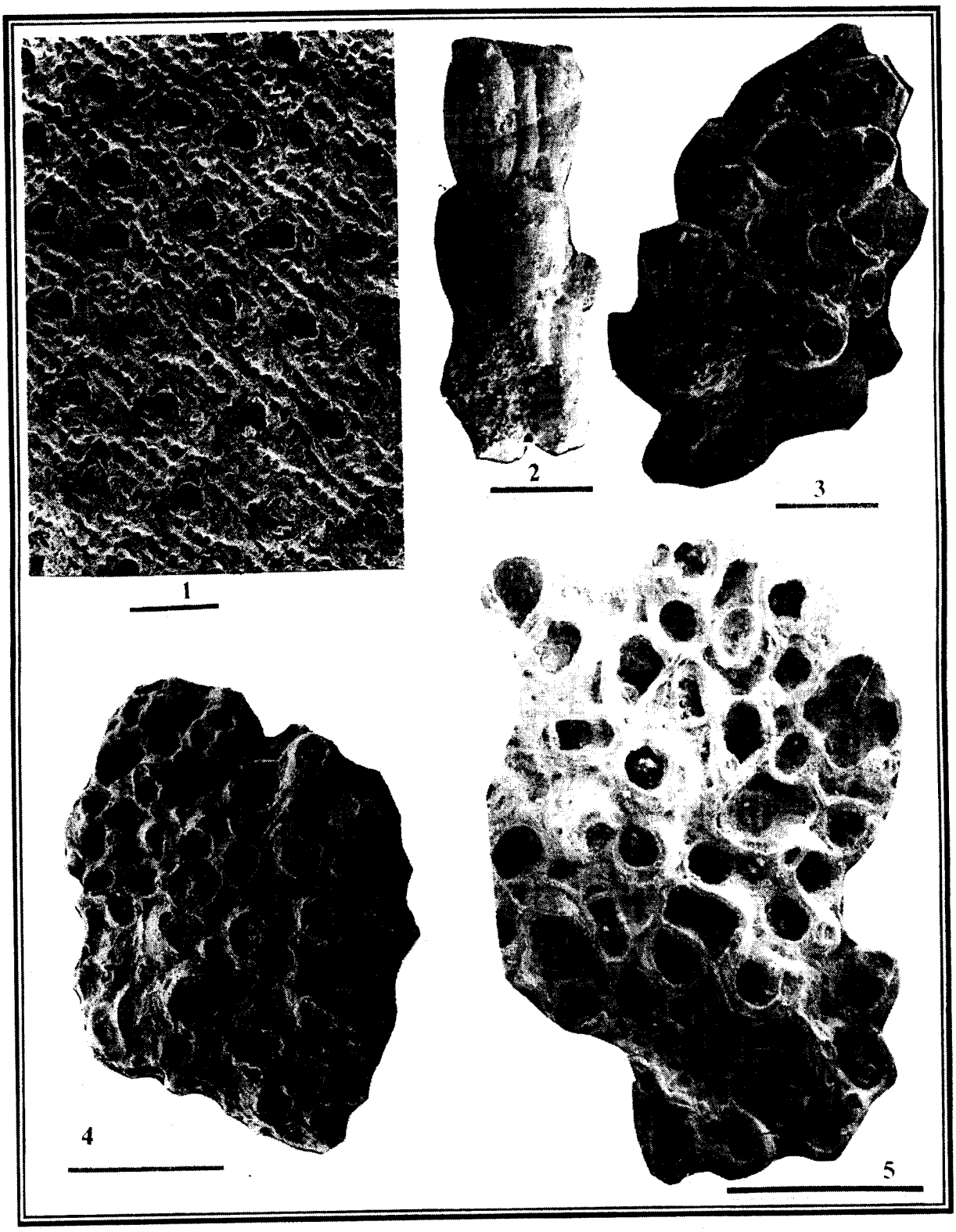

Plate 6

Fig. 1: *Metrarabdotos moniliferum* (Milne-Edwards, 1836). Fig. 2: *Tetraplaria australis* Tension-Woods, 1878. Fig. 3: *Costazia caminata* (Waters, 1879). Figs. 4, 5: *Holloporella polythele* (Reuss, 1848).
(Bar Scale of all figures = 400 µm