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Full Length Research Paper

Recent benthic foraminifera of shallow marine environment from the Egyptian red sea coast.

Hashem Abbas Madkour

National Institute of Oceanography and Fisheries, Red Sea branch, Hurghada, 85411 Egypt.
E-mail: madkour_hashem@yahoo.com

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Sixty-nine samples have been collected from three coastal lagoons Abu-Shaar, Umm al-Huwaytāt and Marsa Shūni Lagoons along the Egyptian Red Sea coast. Coastal lagoons are areas of hyper- saline waters protected by linear barrier reefs. Seagrasses and algae are widely distributed especially in Marsa Shūni Lagoon on the soft muddy and sandy carbonate sediments on the flanks of the reefs and channels between them. The distinctive species are taxonomically identified in the marine sediments of the shallow marine environments from the coastal lagoons are carried out along the Egyptian Red Sea. They compared with the benthic foraminiferal assemblages of the other parts of the northern Red Sea coast and the Eastern Mediterranean. Their percentage distribution is relatively similar to that of other littoral assemblages of the Red Sea coast. This resemblance is less marked with that of the Eastern Mediterranean Sea coasts.

Keywords: Benthic foraminifera, taxonomy, comparison, Coastal lagoons, Red Sea, Egypt.

INTRODUCTION

Foraminifera are very useful in studying marine sediments and ecology, because of their frequent occurrence in large numbers in these sediments. For these reasons many institutions in the world are interested in the study of these organisms. In Egypt, fossil foraminifera have been intensively used for stratigraphical and paleoecological purposes. On other hand, the study of recent foraminifera has been relatively neglected especially along the Egyptian Red Sea coast (Madkour and Ali, 2011).

In this study, shallow marine environment represented by three coastal lagoons along the Egyptian Red Sea offers an excellent opportunity to study a warm shallow water fauna of hyper-saline environment. The recent foraminifera of the northern Red Sea and particularly of coastal lagoons have not previously been described and figured, although the foraminifera of other parts of the Red Sea have been studied by a few authors during the last hundred and fifty years.

Recent foraminifera of the Egyptian Mediterranean coast have been dealt with by Said and Kamel, (1954, 1957); Mohammed (1972); El-Halaby, (1975) & Abu El-Enein, (1979). Although the north eastern- most appendix of the Red Sea, the Gulf of Aqaba, is foraminiferally one the best studied areas in the world (e.g., Reiss et al.,

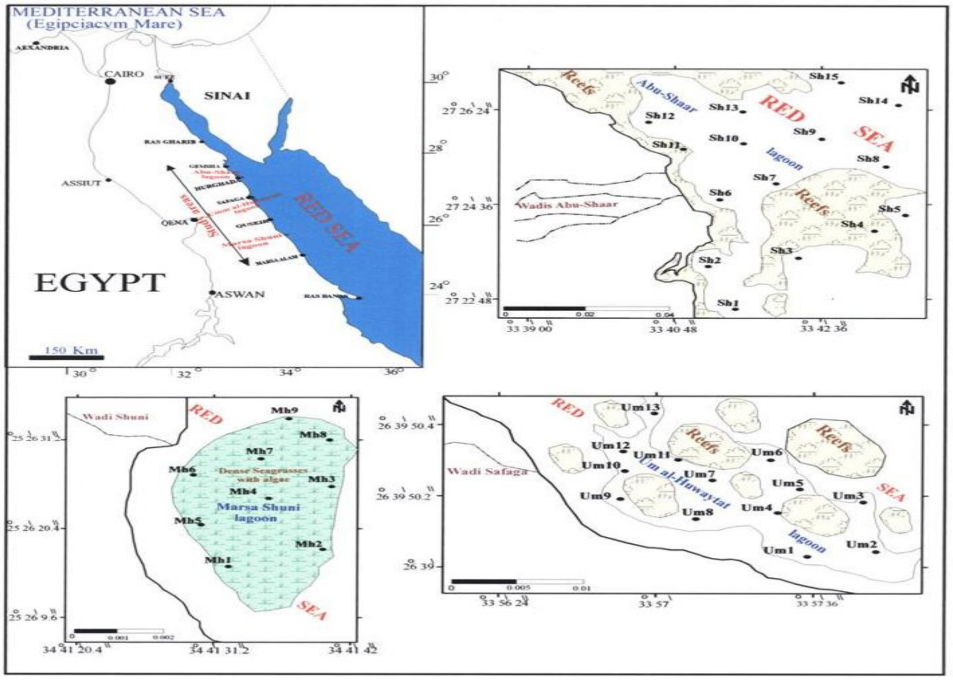


Figure. 1 Study areas and sampling stations along the Red Sea coast, Egypt.

(1977); Gabrie and Montaggioni, (1982); Reiss and Hottinger, (1984); Hottinger et al., 1993), only a very few studies deal with shallow water benthic foraminifera – particularly foraminiferal distribution- in the Red Sea proper. Said, (1949, 1950a,b), El-Deeb, (1978) surveyed large areas and provided very important information. More recent studies were carried out by Bahafzallah, (1979); Bahafzallah and El-Askary, (1981); Yusuf, (1984); Montaggioni et al., (1986); Abou Ouf et al., (1988); Abou Ouf, (1992) and Abou Ouf and El-Shater, (1993) along the Saudi Arabian coast, also more recent studies were carried out by El-Nakhal, (1980) along the Red Sea shores of Yemen Arab Republic and by Anan, (1984); Obaidalla, (1988); Mohamed, (1996); Badawi, (1997), Haunold et al., (1997), Aref and Madkour (1999 and 2000); Madkour (2000 and 2004), Madkour and Ali (2009) and Madkour and Ali (2011) at different localities of the upper continental shelf of Red Sea. A distributional study of foraminfera was done by Azazi, (1990) in the Gulf of Suez. Still missing, to date, is a detailed actuopaleontological distributional study of foraminifera in the Red Sea proper, particularly one covering a wide facial range.

Most of these works are devoted to conventional taxonomic descriptions of fauna or to rather superficial interpretations of their ecology. Modern data processing techniques, involving the use of computers for the systematic exploration of the relation of the taxa among themselves and with their ecological environment have been used by some authors El-Halaby, (1975); El-Deeb, (1978) & Haunold et al., (1997), Madkour (2000), Madkour (2004), Madkour and Ali (2009) and Madkour and Ali (2011).

In the present work, the percentage of the different species according the present data will be compared with those previous works at the northern Red Sea coasts and the eastern Mediterranean Sea. For the sake of comparison, the data of El-Halaby (1975), Abu-El-Enein (1979), El-Deeb (1978), Anan (1984), Ouda and Obidalla (1998) and Madkour (2000) are considered.

The present work is an attempt to study systematically the distinctive recent benthic foraminiferal taxa in the marine sediments of shallow marine environment represented by three coastal lagoons of the Egyptian Red Sea coast as well as their geographical distribution. The percentage of the different species according to the present data will be compared with those of the previous work at the northern Red Sea coasts and the Eastern Mediterranean Sea.

MATERIALS AND METHODS

In this study, using a small fishing boat sixty -nine sediments samples have been collected from extension of three selected coastal lagoons along the Egyptian Red Sea at Abu-Shaar , Umm al-Huwaytāt and Marsa Shūni lagoons (Fig.1) with a small Van grab sampler and some samples were taken by scuba diving. Samples were immediately stained on board in an alcohol/ Rose- Bengal

Table 1. Description of the distinactive species in shallow marine environment of the castal lagoons along the Egyptian Red Sea coast.

Species	Wall					Test		Chambers		Periphery		Sutures		Apertural end		Aperture				Tooth & Tooth Number			
	rough	smooth	ornam-entation	No ornam.	coarse	inflated	com-pressed	inflated	not inflated	rounded	angled	dep-ressed	flush	neck	no neck	lip	no lip	round-ed	slit	simple	bifid	single	double
Hypramina laevigata	X					X		X				X						X					
Textularia aegyptica	X																						
Textularia agglutinans	X						X	X		X		X			X				X				
Eggerella advena					X	X		X		X		X			X				X				
Clavulina angularis	X					X			X			X			X			X					
Clavulina parisiensis			X						X		X	X			X			X				X	
Clavulina tricarinata	X								X		X	X			X			X					
Vertebralina striata		X	X				X					X				X			X				
Spiroloculina angulata		X	X				X				X	X		X		X		X			X	X	
Spiroloculina indica	X			X			X		X		slightly	X		X		X		X			X		
Spiroloculina communis	X			X			X		X		slightly	X		X		X		X			X		
Quinqueloculina agglutinans	X				X	X		X		X		X		X		X					X		
Q. mosharrafi					X	slightly				X		slightly			X	X				X			
Q. neostraitulata			X			slightly				X		slightly			X		X				flat		
Q. pseudoreticulata			X			X				X		X		X		X					X		
Hauerina diversa		X	X				X		X	X					X			pores					
Flintina sidebottomi		X		X		X		X		X		X			X	X							
Pesudomassilina pacificensis	X			X		X		X			X	X			X	X			X				
Triloculina affinis		X		X		slightly		X		slightly								X					
Articulina sagra		X	X			X		X							X	X							
Nodophthalmidium antillarum			X			X		X					X		X				X				
Borelis schlumbergeri			X			X		X					X		X			pores					
Peneroplis planatus			X				X		X			X						pores					
Peneroplis pertusus			X				X		X			X							X				
Spirolina arietina			X				X		X			X						pores					
Sorites marginalis			X				X		X	X								pores					
Cymbaloporetta bradyi			X				X		X				X		umbilical								
Cibicides equipunctatus	X		X			X		X			X	X			X								
Amphistigina lessonii		X	X			X		X			X	X			X				X				
Ammonia beccarii		X	X			X				X		X			umbilical								
Calcarina calcar		X	X			X				X		radial							narrow				
Eliphidum advenum	X		X			X		X			subacute	X			X			row of pores					
Eliphidum crispum	X		X			X		X			keeled	slightly			X			pores					

mixture for several days, washed over a 63 µm sieve and air-dried (Haunold et al., 1997).

There is no standard method for the quantitative study of recent foraminifera. Each author uses the technique, which he finds most suitable for his purpose. In the laboratory all samples were washed again a 63 µm sieve and oven-dried. Washed and dried samples were split by use of a microsplitter to reduce the amount of sediment and the number of foraminifera. The faunal investigations were carried out on four fractions of sediments (1, ½, ¼ & 1/8mm) so as to pick a fraction which yielded about a minimum 200 tests. Separate dead and living assemblage counts were made each of 200 – 250 individuals. Some errors may have occurred in the counting process. The human factor cannot be eliminated during counting, and it is likely that some specimens are missed, occasionally, one may be misidentified. The foraminiferal species in each sample were identified based on the classification of foraminifera by Loeblich & Tappan (1988). For illustration, the foraminiferal taxa are photographed by using the Scanning Electron Microscope (JSM-5400LV) of South Valley University, (plates 1 & 2).

RESULTS AND DISCUSSION

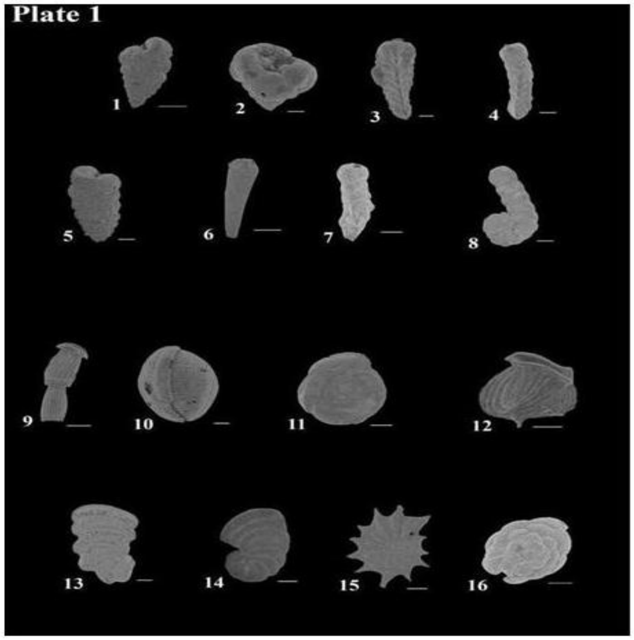
Taxonomy and geographical distribution:

The systematic position has been represented the distinctive species of the study areas along the Egyptian Red Sea coast according to classification of Loeblich and Tappan (1988). The description of the study distinctive species was observed in table (1). Suborder: *Textulariina* Delage & Herouard, 1896

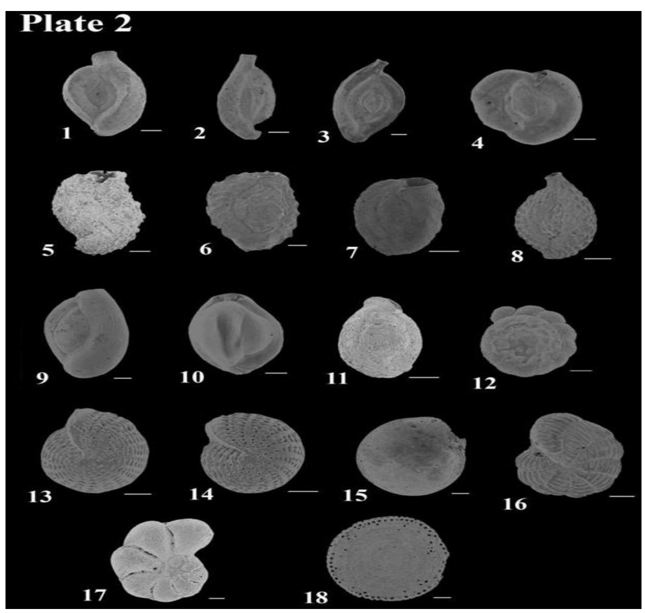
Genus : *Hyperammina* Brady, 1878 Hyperammina *laevigata* Wright, 1839 pl. 1 , fig. 6

Hyperammina elongata Brady, var. laevigata Wright = *Hyperammina laevigata* Wright,

(Alve & Nagy, 1986, pl. 1, fig. 4); (Madkour, 2000,p. 165, pl. 1, figure. 11).



1. *Textularia aegyptica*, SH-10, (bar= 500 µ); 2. *Eggerella advena*, Sh-10, (bar= 200 µ); 3. *Clavulina angularis*, Sh-10, (bar= 200 µ); 4. *Clavulina tricarinata*, Sh-10, (bar= 200 µ); 5. *Textularia agglutinaus*, Sh-4, (bar= 200 µ); 6. *Hypramina laevigata*, Um-8, (bar 500 micron); 7. *Clavulina parisiensis*, Sh-1, (bar= 200 µ); 8. *Spirolina arietina*, Sh-1, (bar= 200 µ); 9. *Nodophthalmidium antillarum*, Sh-8, (bar= 200 micron); 10. *Borelis schlumbergeri*, Sh-4, (bar= 200 µ); 11. *Hauerina diversa*, Sh-10, (bar= 200 µ); 12. *Articulina sagra*, Sh-2, (bar= 100 µ); 13. *Vertebralina striata*, Mh-2, (bar=200 µ); 14. *Peneroplis planatus*, Sh-4, (bar= 200 µ); 15. *Calcarina calcar*, Sh-3, (bar= 200); 16. *Cymbaloporetta bradyi*, Sh-11, (bar= 100 µ).



1. *Spiroloculina angulata*, Sh-8, (bar= 200 µ); 2. *Spiroloculina indica*, SH-2, (bar= 200 µ); 3. *Spiroloculina communis*, Sh-3, (bar= 100 µ); 4. *Flintina sidebottomi*, Sh-2, (bar= 100 µ); 5. *Quinqueloculina agglutinans*, Sh-3, (bar=200 µ); 6. *Quinqueloculina mosharrafi*, Sh-1, (bar=200 µ)7. *Quinqueloculina neostraitulata*, Sh-14, (bar=200 µ); 8. Qunquiloculina pseudoreticulata, Sh-1, (bar= 200 µ); 9. *Triloculina affinis*, Sh-5, (bar= 100 µ); 10. *Triloculina affinis,* Sh-6, (bar= 100 µ); 11. *Pesudomassilina pacificensis*, Sh-1, (bar=200 µ); 12. *Ammonia beccarii*, Sh-8, (bar=200 µ); 13. *Eliphidum crispum*, Um-2, (bar= 200 µ); 14. *Eliphidum advenum*, Sh-8, (bar= 200 µ); 15. *Amphistigina lessonii*, Um-2(bar=100 µ); 16. *Peneroplis pertusus*, Sh-1, (bar= 100 µ); 17. *Cibicides equipunctatus*, Um-2, (bar= 100 µ); 18. *Sorites marginalis* Sh-5, (bar= 200 µ).

Discussion: This species was originally described from Indo-Pacific by Brady (1881). It is rarely found at Umm al-*Huwaytāt* only.

Genus : *TEXTULARIA* Defrance, 1824

Textularia agglutinans d'Orbigny,1839

pl. 1, fig. 5

Textularia agglutinans d'Orbigny = *Textularia agglutinans d'Orbigny*

(Banner & Christopher, 1981, p.93, pl.2, figs. 6,7).

Discussion: This species was originally described from the West Indian region (Cuba) by d'Orbigny (1839). It has been reported from the Red Sea by Said (1949), p.5 depth 17-400m and by (Madkour 2000) from the continental shelf of the Egyptian Red Sea.

Textularia aegyptica Said, 1949 pl. 1 , fig. 1 *Textularia aegyptica* Said = *Textularia aegyptica* Said, (Madkour, 2000, p. 167, pl. 1, fig. 1).

Discussion: This species was originally described from the Red Sea by Said (1949).

Genus : EGGERELLA Cushman, 1937

Eggerella advena (Cushman), 1922 pl. 1, fig. 2Eggerella advena (Cushman) = Eggerella advena (Cushman), (Anan, 1984, pl. 1, fig. 3).

Discussion: This species was originally described by Cushman. It is rarely recorded in the shallow water of the Red Sea Environment. It has been recorded from shallow marine environments along the Egyptian Red Sea by Madkour (2000).

Genus : CLAVULINA d'Orbigny, 1826 Clavulina angularis d'Orbigny, 1826 pl. 1, fig. 3

Clavulina angularis d'Orbigny = Clavulina angularis d'Orbigny,

(Anan, 1984, pl. 1, fig. 5)

Discussion: C. angularis was described from *Corsion* in the Mediterranean. It occurs in large numbers and restricted to the shallow water and coral reef areas in the Red Sea environment (Madkour 2000). It represents the most abundant species of genus *Clavulina*, family *Valvulinidae* and suborder *Textulariina* at the study area. In 1949 Said recorded this species from the Red Sea, depth, 17 – 24m.

Clavulina parisiensis d'Orbigny, 1826 pl. 1, fig. 7 *Clavulina parisiensis* d'Orbigny = *Clavulina parisiensis* d'Orbigny , (Anan, 1984, pl. 1, figs. 6,7)

Discussion: This species was originally described by d'Orbigny (1826). It is restricted, in small numbers, to the shallow water areas of the Red Sea (Madkour 2000). Clavulina tricarinata d'Orbigny, 1826

pl. 1, fig. 4 *Clavulina tricarinata* d'Orbigny = Clavulina tricarinata d'Orbigny, (El-Deeb, 1978, p.182, pl.2, fig.12).

Discussion: This species was originally described by d'Orbigny (1826). Madkour (2000, p. 173) recorded this species from the Red Sea. Also, this species is rare in shallow water of the Red Sea.

Suborder: MILIOLINA Delage and Herouard, 1896 Genus : *VERTEBRALINA* d'Orbigny, 1920 *Vertebralina* striata d'Orbigny, 1826

pl. 1, fig. 13 *Vertebralina striata* d'Orbigny = Vertebralina striata d'Orbigny, Bahafzallah, 1979, p.123, pl. 4, figs 7,8,9).

Discussion: Parker, Jones and Brady (1865, p. 32) list the Mediterranean, Red Sea and South Seas of occurrence. This species is easy to distinguish by its compressed, flattened test, and its ornamentation. Said (1949), p. 20 has recorded V. Striata from the north of the Red Sea, depth 17-24m. it is of world wide distributed (Said, 1949 & Madkour, 2000)

Genus : *NODOPHTHALMIDIUM* Macfadyen, 1939

*Nodophthalmidium antillarum (*Cushman), 1922

pl. 1, fig. 9

Articulina antillarum Cushman = *Nodophthalmidium* antillarum (Cushman),

(Said,1949, p.20, pl.2, fig.3).

Discussion: This tropical Atlantic species is found in small numbers at the shallower stations of the Gulf of Suez and the Red Sea at depth 17 – 64 (Said 1949). Madkour (2000) has been recorded this species in the upper continental shelf of the Egyptian Red Sea.

Genus : *SPIROLOCULINA* d'Orbigny, 182

Spiroloculina angulata Cushman, 1917

pl. 2, fig. 1

Spiroloculina grata Terquem var. angulata Cushman = Spiroloculina angulata Cushman,

(Bahafzallah, 1979, p.119, pl. 3, figs. 5,6).

Discussion: The type is from off Cebu, Philippines. Cushman and Todd (1944) p. 51, recorded this species from the Red Sea. S. *angulata* differ from S. scita in having parallel instead of oblique costae. Madkour (2000) has been recorded this species. It occurs frequently to great numbers at the study areas.

Spiroloculina indica Cushman & Todd, 1944

pl. 2, fig. 2

Spiroloculina indica Cushman & Todd = *Spiroloculina indica* Cushman & Todd,

(Bahafzallah, 1979, p.124, pl.4, fig.3,4).

Discussion: The type is from shore sand, Karachi, Pakistan, and has been reported from the Red Sea, off the study areas and by Madkour (2000). This species also differ from S. licida in the chambers increasing more rapidly as added, strongly overlapping in the greater relative margin thickness of the test and the central part being deeply depressed (Table 1).

Spiroloculina communis Cushman & Todd, 1944

pl. 2, fig. 3

Spiroloculina excavata H. B. Brady = *Spiroloculina communis* Cushman & Todd,

(Obiadalla , p. 61, pl. VI, fig.9).

Discussion: This species was originally described from *Rongelab* Atoll, Marshall Islands. It has been recorded from the Red Sea and Gulf of Aqaba by Said (1950) and in shallow marine environment of the continental shelf along the Egyptian Red Sea (Madkour, 2000).

Genus : *QUINQUELOCULINA*d'Orbigny, 1826

Quinqueloculina agglutinans d'Orbigny, 1839

pl. 2, fig. 5

Quinqueloculina agglutinans d'Orbigny = *Quinqueloculina agglutinans* d'Orbigny,

(Robert, 1960, p. 56, no fig.).

Discussion: The type of this species was from recent sands of the West Indies. Q. *agglutinans* d'Orbigny is distinguished by its size, neck, its rough surface and it's aperture (Table 1). Said (1949) and Madkour (2000) recorded this species from the north Red Sea.

Quinqueloculina mosharrafi Said, 1949

pl. 2, fig. 6

Quinqueloculina mosharrafi Said = *Quinqueloculina mosharrafi* Said,

(Bhatia, 1956, p. 17, pl. 2, fig. 11).

Discussion: Said described this species from the Northern Red Sea, coral reef areas. Q. *mosharrafi* is easy to distinguish by its spherical shape and by its wall appearance.

Quinqueloculina neostraitula Thalmann, 1950

pl. 2, fig. 7

Qinqueloculina straitula Cushman = *Quinqueloculina neostraitula Thalmann*,

(El-Nakhal, 1980, p. 154, pl. 4, figs. 1-3).

Discussion: This species was originally described by Cushman from Mokaujar Anchorage, Fiji Island as Q. *striatula*. In 1950 *Thalmann* renamed this species Q. *neostriatula* because Q. Striatula had been used for another species by Deshayes. This species has been recorded from the Northern Red Sea by Said (1950) and Madkour (2000).

Quinqueloculina pseudoreticulata Parr, 1941

pl. 2, fig. 8

Miliolina reticulata Brady = *Quinqueloculina pseudoreticulata Parr*,

(Bahafzallah,1979, p.140, pl.7, figs.4-7).

Discussion: Brady (1884) described this species from South of New Guinea as M. reticulate d'Orbigny but it differs from d'Orbigny's species in being inflated and having more chambers. In 1941 Parr renamed it. This speces is well regonized by its reticulate ornamentation and its spherical, inflated test. Madkour (2000) has been recorded this species from the Northern Red Sea.

Genus : *HAUERINA* d'Orbigny, 1826 *Hauerina diversa* Cushman, 1946 pl. 1, fig. 11 Hauerina bradyi Cushman = *Hauerina diversa* Cushman, Bahafzallah, 1979, p.171, pl. 13, figs. 11-13).

Discussion: This species differs from H. bradyi Cushman by having three or more chambers in last whorl, test wall being thicker, test involutes and circular in outline. This species was originally described from shallow water off beach at *Hereheretue, Paumotu* Islands by Cushman (1932). H. *diversa* has been recorded from the Red Sea by Said (1949) and Madkour (2000). It represents the most abundant species of genus *Hauerina* and family *Hauerinidae* at the studied areas.

Genus : *FLINTINA* Cushman, 1921 *Flintina sidebottomi* (Martinotti), 1920 pl. 2, fig. 4

Miliolina subrotunda Sidebottom = *Flintina sidebottomi* (Martinotti), (Bahafzallah,1979, p.148, pl.9, figs.1-3).

Discussion: This species was originally described by Martiontti (1920) from Tripoli, Libya, recent. Madkour (2000) has been recorded this species from the Northern Red Sea.

Genus: *PSEUDOMASSILINA Lacroix*, 1938 *Pseudomassilina pacificensis* (Cushman), 1924 pl. 2, fig. 11 *Massilina pacificensis* Cushman = *Pseudomassilina pacificensis* (Cushman), (Bahafzallah, 1979, p.155, pl.10, figs.3-5).

Discussion: Cushman's (1942) original material of this species was from reefs in Soma. P. *pacificensis* has been recorded from the Northern Red Sea by (Madkour 2000).

Genus: *TRILOCULINA* d'Orbigny, 1826 *Triloculina affinis* d'Orbigny, 1826 pl. 2, figs. 9, 10 Triloculina affinis d'Orbigny = *Triloculina affinis* d'Orbigny, (Bahafzallah, 1979, p. 161, pl. 11, figs. 7-9).

Discussion: This species was originally described from the Tertiary of France d'Orbigny (1826). This species differs from T. *tricarinata* d'Orbigny in having a subacute instead of sharply angled periphery with keel and differs from T. trigonula (Lamarck) by having a *subacute* rather than rounded periphery.

Genus : *ARTICULINA* d'Orbigny, 1826 *Articulina sagra* d`Orbigny, 1839 pl. 1, fig. 12 *Articulina sagra* d`Orbigny = Articulina sagra d`Orbigny, (Bahafzallah, 1979, p. 175, pl. 14, figs. 9-11).

Discussion: This species was originally described from Cuba by d'Orbigny (1839). A. sagra d'Orbigny is very close to A. pacifica Cushman but differs from the latter by having sharp, numerous costae and by having a flaring lip.

Genus : *BORELIS* de Montfort, 1808 *Borelis schlumbergeri* (Reichel), 1937 pl. 1, fig. 10

Neoalveolina pygmaea (Hanzawa) var. Schlumbergeri Reichel =Borelis schlumbergeri (Reichel),

(Bahafzallah, 1979, p. 182, pl. 15, figs. 11,12)

Discussion: This species was originally described by *Reichel* (1937) from Madagascar. It has been recorded by Said (1949) and Madkour (2000) from the Red Sea at different depths.

Genus : *PENEROPLIS* de Montfort, 1808 *Peneroplis planatus* (Fichtel & Moll), 1798 pl. 1, fig. 14

Nautilus planatus Fichtel & Moll = Peneroplis planatus (Fichtel & Moll), (Anan, 1984, pl. 1, fig. 15).

Discussion: This a cosmopolitan species was originally described from the coast of Italy by (Fichtel & Moll, 1798). The cosmopolitan species occurs numerous at depth (0.5-

35m), with (7.97%) of the studied fauna. It represents the most abundant species of genus *Peneroplis* and family *Peneroplidae* at the study areas. *Peneroplis pertusus* (Forskal), 1775 pl. 2, fig. 16 *Nautilus pertusus Forskal* = *Peneroplis pertusus* (Forskal), (Chasens, 1981, pl. 1, fig. 13).

Discussion: P. pertusus was originally described by *Forskal* (1775) as Nautilus *pertusus*

Genus: *SPIROLINA* Lamark, 1804 *Spirolina arietina* (Batsch), 1691 pl. 1, fig. 8 Nautilus (lituus) *arietinus* Batsch = *Spirolina arietina* (Batsch), (Anan, 1984, pl. 1, fig.16).

Discussion: This species was originally described by Batsch (1791) from recent sand of Italy. S. arietina is easily distinguished by its prominent longitudinal striae and by its aperture pores. This species has been reported by Said (1949) and Madkour (2000) from the Red Sea at different depths from 5- 24m.

Genus : *SORITES* Ehrenberg, 1839 *Sorites marginalis* (Lamarck), 1816 pl. 2, fig. 18

Orbulites marginalis Lamarck = *Sorites marginalis* (Lamarck), (Bahafzallah, 1979, p. 180, pl. 15, figs. 6-8).

Discussion: S. *marginalis* has been recorded from the Red Sea by (Said 1949) p. 25, depth 17-24. This species is commonly attached to *seagrass*. The type of this species is recent European form.

Suborder : *ROTALIINA* Delage and He'roard, 1896.

Genus : *CYMBALOPORETTA* Cushman, 1928 *Cymbaloporetta bradyi* (Cushman), 1915

pl. 1, fig. 16 Cymbalopora poeyi Brady = *Cymbaloporetta bradyi* (Cushman), (*Bahafzallah*, 1979, p. 211, pl. 19, figs. 11-13).

Discussion: The type is from an Albatross station, off the Hawaiian Islands. Said (1949) p. 40 recorded this species from the Red Sea, depth 30-120m.

Genus : *CIBICIDOIDES* *Thalmann*, 1939 *Cibicidoides equipunctatus* Hofker, 1951 pl. 2, fig. 17

Cibicidoides equipunctatus Hofker = *Cibicidoides equipunctatus Hofke*r, (El-Halaby, 1975, p. 126, pl. 3, fig. 21).

Discussion: C. *equipunctatus* was originally described by Hofker (1951) in the Pacific. Madkour (2000) has been recorded this species in shallow marine environment of the Red Sea.

Genus: *AMPHISTEGINA* d'Orbigny, 1826 *Amphistegina lessonii* d'Orbigny, 1826 pl. 2, fig. 15

Amphistegina lessonii d'Orbigny = Amphistegina lessonii d'Orbigny, (Debenoy, 1985, p. 168, pl. 1, fg. 2).

Discussion: This species was originally described from the Red Sea by d'Orbigny (1826). It increases in the coarse and medium size sediments (Madkour 2000).

Genus : *AMMONIA* Brünnich,1772 *Ammonia beccarii* (Linne'), 1758 pl. 2, fig. 12 Nautilus *beccarii Linne'* = *Ammonia beccarii* (Linne'),

(Anan, 1984, pl. 1, fig. 22).

Discussion: The type locality of this species of *Linne's* specimens was not designated by him but the Miditerranean and Adriatic Seas are listed. A. *beccarii* has been recorded by Said (1949) p.37 from the Red Sea, depth 17-512m and by Madkour (2000) in the shallow marine environment along the Egyptian Red Sea.

Genus: *CALCARINA* d'Orbigny, 1826 *Calcarina calcar* d`Orbigny, 1826 pl. 1, fig. 15 *Calcarina calcar* d`Orbigny = *Calcarina calcar* d`Orbigny, (Chasens, 1981, pl. 2, figs. 7,8).

Discussion: the original specimens of this spies come from the the West Indies. Recorded by Graham and Militante (1959) from Philippines near the reefs. Madkour (2000) has been recorde this species in shallow marine environment along the Egyptian Red Sea.

Genus : *ELPHIDIUM* de Montfort, 1808 *Elphidium advenum* (Cushman), 1922 pl. 2, fig. *14 Polystomella subnodosa* Brady = *Elphidium advenum* (Cushman),

(*Bahafzallah*, 1979, p. 198, pl. 18, figs. 1,2).

Discussion: this species was originally described by Cushman from southern Florida. E. *advenum* differs from E. *crispum* by having less chambers and in being smaller in size. It has been recorded from the Red Sea by Said (1949), 50-106m and by Madkour (2000). Elphidium crispum (Linne'), 1758 pl. 2, fig. 13

Nautilus *crispus Linne'* = *Elphidium crispum* (Linne'), (*Bahafzallah*, 1979, p. 199, pl. 18, figs. 3,4).

Discussion: the original specimens of this species came from the Mediterranean Sea. E. *crispum* is easy to distinguish by its large size, its umbilical bosses and its numerous chambers. This species has been recorded by Said (1949) from the Red Sea, depth 17-59m and by Madkour (2000).

Comparison of the recent benthic foraminiferal species of the studied fauna with those of northern Red Sea and eastern Mediterranean

Table (2) shows the frequency of various *foraminiferal taxa* in the present study and that recorded from the eastern Mediterranean by El-Halaby (1975) from Naxos and Abu-Enein (1979) from Alexandria and from the northern Red Sea which recorded by El-Deeb (1978) from different localities of the northern part of the Red Sea, Anan (1984), Ouda and Obaidalla (1998) from Marsa Alam – Ras Banas and Aref and Madkour (2000) from different localities in-front of the mouth of some famous wadis along the Egyptian Red Sea.

The suborder Miliolina is the most abundant one (92.5 % in summer and 92.3 % in winter) at the studied areas, from which the *superfamilies Soritacea* and *Miliolocea* constitute significant parts. The super family *Soritacea* (71.1 % in summer and 73. 12 % in winter) are

Table 2. The frequency distribution of the foraminiferal taxa in the study area, Eastern Mediterrean and Northern Red Sea.

Suborder	Superfamily	Family	Subfamily	Genus	Eastern Mediterranean		Northern Red Sea					
					Naxos El-Halay 1975	Alexandria A.El Enein 1979	El-Deep 1978	Anan 1984	Ouda & Obidalla 1998	Aref & Madkour 2000	Study areas	
											Summer	Winter
Textulariina	Hippocrenpinacea	Hippocrepinidae	Hyperammininae	*Hyperammina*	--	--	--	--	0.39	0.003	0.010	0.004
	Textulariacea	Textulariidae	Textulariinae	*Textularia*	0.024	0.07	9.38	1.16	1.27	2.63	1.330	0.860
		Eggerellidae	Eggerellinae	*Eggerella*	--	--	--	1.47	0.10	0.01	0.070	0.040
		Valvulinidae	Valvulininae	*Clavulina*	--	--	0.13	--	1.31	1.65	0.350	0.370
Miliolina	Cornuspiracea	Fischerinidae	Nodobaculariellinae	*Vertebralina*	0.01	--	--	0.17	0.38	0.72	0.130	0.080
		Nubeculariidae	Nodophthalmidiinae	*Nodophthalmidium*	2.78	0.97	--	--	--	0.11	0.010	0.030
	Miliolacea	Spiroloculinidae		*Spiroloculina*	1.98	2.66	2.29	2.67	1.34	1.70	2.880	3.720
		Hauerinidae	Haueríninae	*Quinqueloculina*	26.28	35.68	5.34	12.76	12.92	10.63	10.350	7.350
				Massilina	--	--	--	--	1.10	1.22	0.580	0.575
				Hauerina	--	--	0.03	--	0.39	4.36	1.840	2.550
			Miliolinellinae	*Flintina*	--	--	0.23	--	--	0.16	0.010	0.010
				Milolinella	1.38	1.6	0.27	2.04	1.99	0.22	0.030	0.030
				Pesudomassilina	--	--	--	--	--	1.37	1.870	1.313
				Pyrgo	--	--	1.11	--	0.01	0.91	0.020	0.070
				Triloculina	0.26	5.65	1.04	0.28	7.16	3.75	1.350	1.510
			Tubinellinae	*Articulina*	--	--	0.03	--	0.10	0.19	0.010	0.020
				Parrina	--	--	--	--	--	0.28	0.020	0.010
			Siphonapertinae	*Shlumbergerina*	--	--	0.18	--	--	0.17	0.020	0.004
	Alveolinacea	Alveolinidae		*Borelis*	--	--	1.05	--	--	9.09	1.830	1.880
	Soritacea	Peneroplidae		*Peneroplis*	23.01	11.37	2.85	42.07	16.65	11.91	21.330	21.430
				Spirolina	--	--	--	--	4.87	2.57	0.940	0.850
				Coscinospira	--	--	--	--	--	--	--	0.013
		Soritidae	Soritinae	*Sorites*	0.23	6.26	1.47	11.86	9.87	9.44	49.250	50.550
				Amphisorus	--	--	--	--	8.65	1.33	--	0.310
Rotaliina	Bolivinacea	Bolivinidae		*Bolivina*	--	0.17	0.09	0.06	0.32	0.08	--	--
				Brizalina	--	--	--	0.12	--	0.11	--	--
	Buliminacea	Reussellidae		*Reussella*	--	--	0.02	--	0.09	0.05	--	--
	Discorbacea	Bagginidae	Bagginidae	*Cancris*	--	--	0.02	--	--	0.005	--	--
		Eponididae	Eponidinae	*Eponides*	0.05	6.64	1.26	--	0.02	0.33	0.010	--
		Discorbidae		*Discorbis*	--	--	0.18	--	2.36	0.45	--	--
		Rosalinidae		*Rosalina*	--	--	--	--	1.10	0.29	--	0.004
	Discorbinellacea	Parrelloididae		*Cibicidoides*	--	--	3.13	--	--	0.17	--	--
	Planorbulinacea	Planulinidae		*Planulina*	--	--	--	--	0.06	0.11	0.030	
		Planorbulinidae	Planorbulininae	*Planuorbulina*	1.66	0.45	--	0.15	0.03	1.14	0.060	0.060
				Planorbulinella	--	--	0.97	--	--	0.11	--	--
		Cymbaloporidae	Cymbaloporinae	*Cymbaloporella*	--	--	--	0.5	--	0.26	0.020	0.064
				Cymbaloporetta	--	--	0.02		--	0.38	0.070	0.047
		Cibicididae	Cibicidinae	*Cibicides*	9.05	4.2	1.35	--	0.01	0.34	0.140	0.081
	Asterigerinacea	Alfredinidae		*Epistomaroides*	--	0.24	0.00	2.64	--	0.09	--	--
		Amphisteginidae		*Amphistegina*	14.15	0.29	28.30	8.3	0.96	8.91	0.030	0.038
	Rotaliacea	Rotaliidae	Ammoniinae	*Ammonia*	10.42	2.07	0.05	5.41	2.98	8.64	1.890	2.034
		Calcarinidae		*Calcarina*	--	--	2.09	--	11.75	0.65	0.370	0.567
		Elphidiidae	Elphidiinae	*Elphidium*	5.34	10.34	0.51	4.84	4.48	6.98	3.160	3.517
				Cellanthus	--	--	--	--	--	0.23	--	
	Nummulitacea	Nummulitidae		*Heterostegina*	--	0.03	1.10	--	--	0.31	--	--
				Operculina	--	--	2.13	--	--	1.58	0.010	0.009
				Operculinella	--	--	0.15	--	--	3.90	--	--

represented by two families comparable only with that recorded from northern Red Sea by Anan (1984) (53.93%) and Ouda and Obidalla (1998) (40.03%), but it is not comparable with that recorded from Naxos (23.24%) by El-Halaby (1975), Alexandria (17.6%) by Abu-El Enein (1979) and northern Red Sea by El-Deeb (1978) (4.31%) and Aref and Madkour (2000) (25.25%).

Soritacea represented by five genera of which the *Sorites* and *Peneroplis* are the most abundant one in the present study, the northern Red Sea and the eastern Mediterranean (Table 2). The super family *Miliolacea* (18.98 % in summer & 17.16 % in winter) is represented by 12 genera comparable with those recorded from Naxos in Greece (29.9 %) by El-Halaby (1975) and northern Red Sea (17.75 %) by Anan (1984), (25 %) by (Ouda and Obidalla, 1998), (24.96 %) by Aref and Madkour (2000). The frequency of Miliolacea is similar that recorded by Anan (1984) along the Quseir – Marsa Alam along stretch of the Red Sea. They are not comparable with that recorded from Alexandria (45.59 %) by Abu-El Enein (17979) and northern Red Sea by (10.51 %) by El-Deeb (1978). The *Quinqueloculina* is the most abundant genus in the present study, the northern Red Sea and eastern Mediterranean.

Thus, it may be suggest that an abundance of *Soritacea* and *Miliolocea* may be taken as a criterion for shallow, sheltered, warm marine environment. This agrees with what is known the locality is a sheltered bay with relatively weak wave action (Abu-El Enein, 1979). This agrees with what is known from the ecologic distribution of these taxa (Murray, 1973). The markedly greater abundance of these genera in Arabian Gulf may be, furthermore, considered to be due to the warmer nature of this water body (20 – 40 oC).

The suborder Rotaliina is less abundant in (6.3 % summer and 6.84 % winter) and represented by 16 families and 21 genera. The most abundant family of Rotaliina are two families Elphidiidae and which represented by one genera *Elphidium*, and Rotaliidae which represented by one genera *Ammonia*. The high proportion of Elphidiidae (3.16 % in summer and 3.52 % in winter) in the studied localities as in the localities of the eastern Mediterranean and northern Red Sea supports the well known opinion of (Loeblich & Tappan, 1964) that the species of this family active environment, like that of the studied areas. In the studied areas, the salinity reaches more than 40 ‰, thus the high abundance of Rotaliidae as represented by one species *Ammonia beccarii* supports the well – known fact that *Ammonia beccarii* increases in frequency under abnormal environmental conditions such as abnormal salinity (Pokorny, 1965). According to Boltovsky et al., (1980), the euhaline and hyperhaline water range from 30 – 40 ‰ and 40 – 75 ‰. Because the salinity of the Red Sea at the studied localities gradually increase from 40.53 ‰ in Marsa Shuni lagoon to 43.53‰ in Umm al-Huwaytāt lagoon. The Red Sea is considered as euhaline – hyperhaline waters. Their restriction to the Red Sea basin can be used as an indicator from warm environments of euhaline – hyperhaline waters.

The suborder Textulariina is represented by four genera belonging to 4 families and has a low frequency (1.85 in summer and 1.27 % in winter) in the studied areas. Textularia is the most dominant genus of Textulariina in the northern Red Sea and eastern Mediterranean. The frequency of fauna differs from that recorded by (El-Deeb, 1978) from the northern part of the Red Sea basin. The difference is essentially related to the shallower nature of water and the reefal sandy carbonate facies compared with the off-shore of the Red sea where the samples of the study of El-Deeb (1978) ecologically represent an open and much deeper environment.

CONCLUSIONS

Sixty-nine samples have been collected and studied from three coastal lagoons along the Egyptian Red Sea coast. These localities, namely: Abu-Shaar lagoon, Umm al-Huwaytāt lagoon and Marsa Shuni lagoon. Study areas include the systematic position of thirty-three of the distinctive species of benthic foraminifera in shallow marine environments of the coastal lagoons along the Egyptian Red Sea. These species are identified and illustrated in two plates. Benthic foraminifera of the study coastal lagoons along the Egyptian Red Sea are generally a calm energy environment when compared with the coasts of the eastern Mediterranean localities. This reflected by the abundance of Soritacea and Miliolacea and low percentage of Rotaliacea.

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