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Samples taken off Jamestown, Saint Helena Island (South Atlantic Ocean)

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ABSTRACT–Three dredgings samples taken off the coast of Saint Helena, reveal two micropalaeontological associations. One is an infralittoral association, characterized by Miliolina (essentially Quinqueloculina), and by Rotaliina with various species of Amphistegina. The other is a circalittoral association, in which the following changes in family distribution may be observed: a decrease in Miliolina and others littoral species, and an increase in Discorbidae, Eponididae, Cibicididae, and Anomalinidae which indicate an increase in sea depth. The presence of relict Amphisteginidae might point to a Holocene stillstand of the transgressive sea.

INTRODUCTION

Saint Helena is situated in the South Atlantic 800 km east of the mid-ocean ridge and 2,600 km from the West African coast (Fig. 1). It consists of Miocene to recent basalt volcanics (Abdel-Monem & Gast, 1987; Baker, 1969, 1973), forming an island with an area of 120 square kilometres, rising to a height of 2,850 feet above sea level.

Our knowledge of hydrological conditions in the tropical south central Atlantic Ocean is very limited; this study is based on the works of Gallardo (1966), Neumann (1965), and Piton et al. (1977). Surface temperatures of the sea range between 20°C and 22°C in the vicinity of St. Helena, with salinity between 35‰ and 36‰.

The three samples studied were collected by the oceanographic vessel "A. Nizery" of the O.R.S.T.O.M. in Pointe Noire, Congo Peoples Republic, by means of a Rallier du Bathy dredge in Jamestown Harbour (15 55'S-5 43'W) (Fig. 1). Dredge sample DSH1 contained two separate sediments, referred to as DSH1a and DSH1b.

The sediments are poorly sorted, and can be classified as muddy sand (DSH1 and DSH3) and sand (DSH2). The carbonate, with a higher percentage in the sand, consists of reworked calcareous algae and madrepores. Molluscan shells are common and the two samples from the shallowest water (DSH2 and DSH3) have abundant amphisteginids (Fig. 2). X-ray diffraction shows the clays to consist of kaolinite, or more rarely smectite interlayering with illite. Table 1 gives details for the samples.

MICROPALAEONTOLOGY

Ostracoda

In the region studied the fauna is very limited. Only five species of ostracods have been found, three of which remain in open nomenclature: *Ruggeria lekkii* Omatsola 1972, *R. martinsoni* Omatsola 1972, *Ruggeria sp., Bairdia sp., Loxoconcha sp.*. These species are not unknown in this region; *Ruggeria* abounds in the Gulf of Guinea, in shallow, coastal waters with a normal salinity (Jouval, 1978; Keen 1972, 1975; Babinot & Kouyoumontzakis, 1985).

Planktonic Foraminifera

Planktonic and benthic foraminifera are considered separately. Given the sampling method, the samples may be considered as average representations of the sediment. Since the "birth" of the Saint Helena volcano dates from the end of the Miocene, a mixture of middle Neogene populations and recent ones is quite possible.

Boltovskoy (1968) recorded planktonic species typically found in tropical waters to be represented in these regions by the following percentages: *Globigerinoides ruber* 36.5%, *G. sacculifer* 1.5%, *G. trilobus* 45%, *Globoquadrina dutertrei* 6.5%, *Globorotalia menardii* 6.5% and accessory species 4%, the number of which varies according to the season. These percentages were calculated from samples taken by trawling with a plankton net in the open ocean, whereas the data used in this study was gathered from coastal dredging. The planktonic foraminifera encountered here cannot therefore be easily compared with Boltovskoy's study.

The most important species are *Globigerinoides trilobus* which represents between 23% and 45% of the planktonic species and *Globigerinoides ruber,* which accounts for between 10% and 36% of the population.

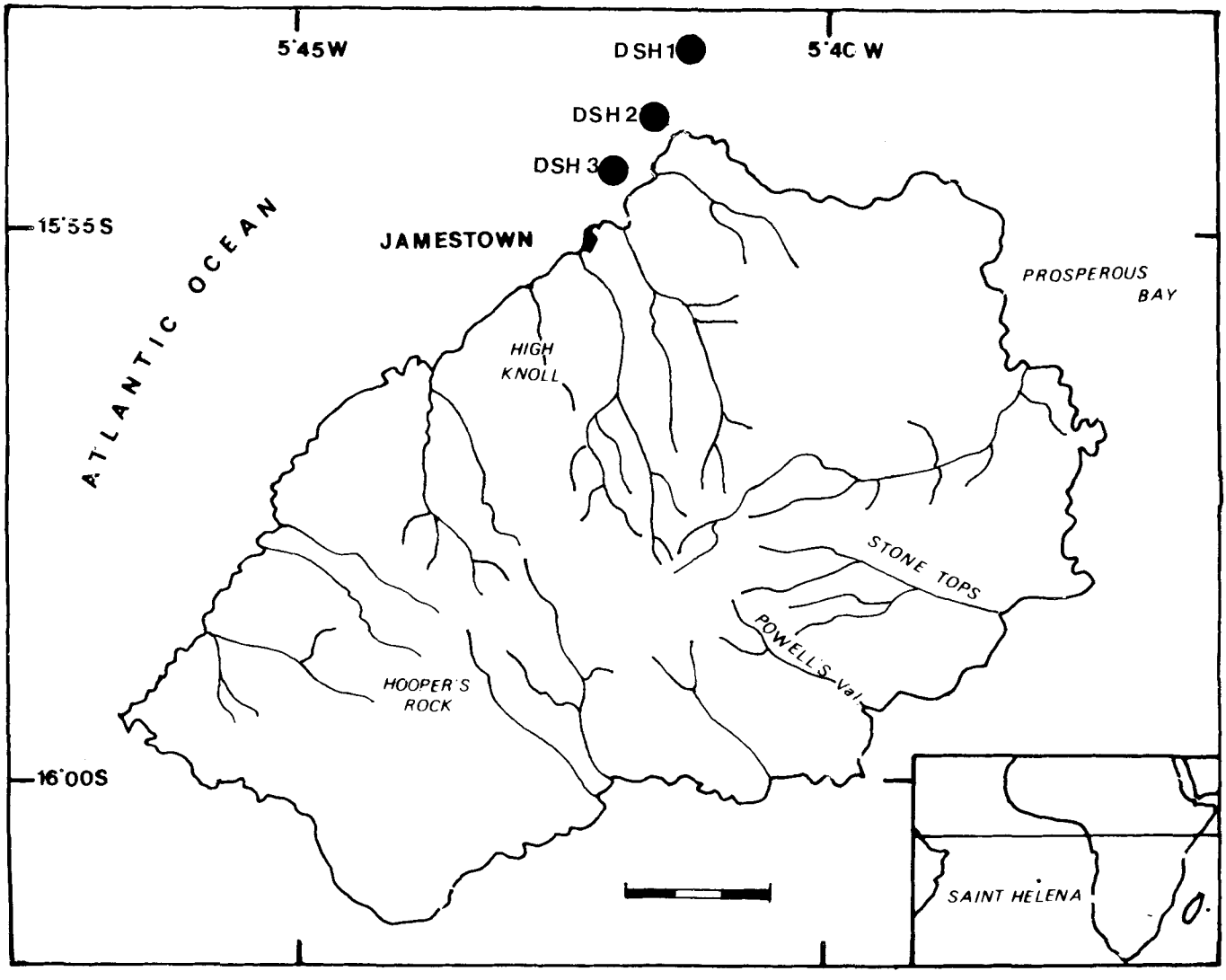

Fig. 1. Saint Helena island, showing dredging samples position.

Globorotalia crassaformis gp. form between 14% and 35% of the planktonic fauna, being more abundant in the samples from deeper water. The quantity of the planktonic species as a percentage of the total foraminifera microfauna increases with depth: 7.5% of the microfauna at 50m, compared with 32% at 96m (Table 2).

Benthic Foraminifera

There is very little difference between the microfauna encountered in this study, and that found on the African coasts (Kouyoumontzakis, 1982). Sixty species are found of which seven are in open nomenclature. Textulariina are almost totally absent from the studied sediments. Two thirds of the species found are often represented by a single specimen, and have therefore only a limited value (Table 3).

Eleven species are commonly present: *Quinqueloculina kerimbatica, Q. pulchella, Q. pseudoreticulata, Q. venusta, Lenticulina suborbicularis, Eponides repandus, Amphistegina bilobata, A. gibbosa, A. lessonii, A. radiata* and *Ceratobulimina pacifica.* Seven species found in these sediments are not encountered on the continental shelf of the gulf of Guinea: *Quinqueloculina* aff. *crenulata, Q. pseudoreticulata, Q. venusta, Massilina robustior, Lenticulina atlantica, Ceratobulimina pacifica, Lamarckina atlantica.*

The absence of Textulariina could be attributed to hydrological factors, or to the fact that agglutinated foraminifera are unable to find particles that are fine enough for them to form their test. The quantity of Miliolina is more or less constant at around 13%, mainly represented by five species: *Quinqueloculina pulchella, Q. venusta, Q. kerimbatica, Q. pseudoreticulata* and *Q.* aff. *crenulata.*

The number of Rotaliina varies between 45% (DSH1) and 79% (DSH3) depending on the presence or absence of Amphisteginidae. This family, the percentage of which are very high in the two most

littoral sediments, DSH3 (50m) 77% and DSH2 (75m) 72%, is renowned for its reef way of life, and its presence in Gulf of Guinea is well known (Kouyoumontzakis, 1982; Lagaaij, 1973). The state of wear of these Amphisteginidae makes it possible to compare them with those found on the Congolese continental shelf, and could correspond to a stillstand of the sea during the Holocene transgression; this thanatocoenosis dates from 12,000 years B.P. off the coast of the Congo (Delibrias *et al.*, 1973). Radiocarbon dating was not carried out since too few Amphisteginidae tests were picked out.

	DEPTH	% PELITS	% CARBONATES	σ 68
DSH1a	96	44.38	30.4	1.65
DSH1b	96	44.24	40.8	1.41
DSH2	75	15.78	58.8	1.55
DSH3	50	36.49	47.2	1.75

Table 1. Sedimentological characters of the samples.

In the deepest sediments (DSH 1b and DSH 1a), littoral species are replaced by Rotaliina whose habitat is circalittoral. Amphisteginidae account for only 25% of the benthic microfauna in these areas; the species which take their place are *Lenticulina suborbicularis, Eponides repandus, Eponides repandus* var. *concomeratus, Ceratobulimina pacifica.*

CONCLUSIONS

The study of just three dredging samples cannot serve as a basis for generalizations concerning associations of Foraminifera around Saint Helena island, but the study does demonstrate that the microfauna found here is quite similar to that encountered on the coasts of the Gulf of Guinea, and this is true for both Ostracoda and Foraminifera.

Schematically, two associations of Foraminifera can be defined (Fig. 2): The first association from depths of up to 75m includes calcareous algae, and could correspond to an infralittoral *fauna* characterized by *Spiroloculina concava, Quinqueloculina kerimbatica, Q.* aff. *crenulata, Q. pseudoreticulata, Q. venusta, Amphistegina bilobata, A. gibbosa, A. lessonii, A. radiata.* The sediments are characterized by quite high levels of CaCO3; 58.8% and 47.2%. These calcium carbonate level are due to the presence of numerous calcareous algal arbusculs and large foraminifera. The Amphisteginidae could be the type of foraminifera that produces the most calcium carbonate. Experiments conducted in the Pacific ocean, show that *Amphistegina madagascariensis* produces 500g of Ca CO3 by square meter every year (Muller, 1974).

SPECIES	DSH3	DSH2	DSH1a	DSH1b	BOLTOVSKOY
Globorotalia crassaformis & aff.	17,1	14,7	32	35,7	
G. menardi	15	11	8,5	5,6	6,5
G. scitula			1,5	0,5	
G. tumida	2,2	2,5	6,4	1,7	
G. truncatulinoides	1,4	1,6	2,4	0,9	
Globoquadrina dutertrei	2,2		0,6	4,7	6,5
Globigerinoides conglobatus		4,5		0,9	
G. ruber	20	20	10,3	12	36,5
G. sacculifer	0,7	1	6	3,3	1,5
G. trilobus	40	43	23	32,5	45
Orbulina universa	0,7	0,7	0,3	0,5	
Pulleniatina obliquiloculata	0,7	1	1,8	1,6	
TOTAL	100	100	92,8	99,9	96

Table 2. Numerical repartition of planktonic species.

The second association for which only one sample was found, can be termed circalittoral, and is characterized by an increase in the quantity of benthic Rotaliina: *Lenticulina suborbicularis, Cancris auriculatus, Eponides repandus, Eponides repandus* var. *concomeratus,* Cibicididae, Anomalinidae and *Ceratobulimina pacifica.* It is also characterized by a decrease in the number of Amphisteginidae. A striking fact is the absence of the Textulariina in these littoral environments, which are poor in fine particles.

The presence of relict Amphisteginidae would seem to indicate that the sea level has undergone fluctuations, and that the overall eustatic schema of the Gulf of Guinea may be applied to this island.

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REFERENCES

Abdel-Monem, A., Gast P. W. 1967. Age of volcanism on St. Helena. *Earth and Planetary Sci. Letters* **2** 415–418.

Baker, I., 1969. Petrology of the volcanic rocks of Saint Helena Island, South Atlantic. *Geol. soc. Amer. Bull.,* **80**, 1283–1310.

Baker, I., 1973. Islands of the South Atlantic *In* Nairn. A.E.M., Stehli, F. G. (Eds.) *The oceans basins and margins,* Plenum Press, New York, London, 493–553.

Boltovskoy, E., 1969. Living planktonic foraminifera of the Eastern part of the tropical Atlantic. *Rev. Micropal.*, **11**,2, 85–89.

Delibrias, G., Giresse. P. & Kouyoumontzakis. G., 1973. Géochronologie des divers stades dans la transgression holocène au large du Congo. *C. R. Acad. Sci. Paris,* **276** (26 février 1973) série D, 1389–1391.

Gallardo, Y., 1966. Contribution à l'hydrologie du Bassin de l'Angola. *Doc. Sci., Centre O.R.S.T.O.M. Pointe-Noire,* **345 SR.**

Jouval, J., 1978. Microfossiles de la Côte d'Ivoire, Foraminifères et Ostracodes. Le Néogéne et la limite Paléocéne-Néogéne. *Thése doct. 3éme cycle Univ. Aix-Marseille I.*

Keen, M. C., 1972. Recent ostracod assemblages from the coast and shelf of Sierra Leone. *Actes du IV. Coll. Africain de Micropal.*, 195–208.

Keen, M. C., 1975. Some Ruggieria-like ostracods from the Tertiary and Recent of West Africa. *Proc. V. African Coll. on Micropal.*, 451–469, 2pl.

Kouyoumontzakis, G., 1982. Les associations de Foraminifères du plateau continental congolais: Foraminifères benthiques. *Cahiers de Micropaléontologie* (2), 155–162.

Kouyoumontzakis, G., 1984. Les Amphisteginidae (Foraminifera) du plateau continental congolais, dans le cadre de la marge ouest africaine. *Revue de Micropaléontologie* **27,** 3, 196–208.

Lagaiij, R., 1973. Shallow water Bryozoa from Deep-sea Sands of the Principe Channel, Gulf of Guinea, *in* Larwood G. P. Edit., *Living and Fossil Bryozoa* London, Academic Press, 139–152.

Muller, P. H., 1974. Sediment production and population biology of the benthic foraminifera *Amphistegina madagascariensis. Limology & Oceanography* **19,** 5, 802–809.

Neumann, G., 1964. Oceanography of the Tropical Atlantic. *Acad. Brasiliera Cien.,* **37,** 62–72.

Piton, G., Perrin, R. & Gausi. J. P. 1977. Nouvelles considérations sur les saisons marines et la circulation dans le Golfe de Guinée. *Doc. Sci., Centre O.R.S.T.O.M. Pointe-Noire,* **49** nlle. série.

SPECIES	DSH3	DSH2	DSH1a	DSH1b
Spiroloculina excavata				0,04
S. concava	1	0,75	0,3	0,7
S. tenuimargo	0,05			
S. sp.			0,07	
Quinqueloculina bicarinata	0,4			0,08
Q. cliarensis				0,04
Q. aff. crenulata	0,3			
Q. disparilis			0,07	
Q. kerimbatica	2	1,1	0,4	0,32
Q.lamarckiana	0,1	0,5		0,12
Q.pulchella	6,16	5,4	11,1	8,5
Q. pseudoreticulata	0,4			
Q. schlumbergerii	4			
Q. seminulum		0,7		0,23
Q. venusta	1,4	0,2	1,6	1,5
Q.ssp.	0,6	1,7	0,7	2,02
Biloculina labiata		0,07	0,23	0,08
Massilina robustior				0,08
Amphicoryna scalaris	0,15		0,23	1,5
Nodosaris catesbyi		0,45	0,48	
Lenticulina atlantica	0,05	0,07	0,23	0,12
L. aff. calcar		0,03		
L. cultrata			0,07	0,04
L. suborbicularis	0,1	1,2	5,7	3,2
Marginulina aff. costata				0,4
Frondicularia sp.				0,04
Glandulina laevigata		0,03		
Bolivina aff. striata				0,02
Brizalina sp.	0,05			
Rosalina candeina	0,1	0,03		0,04
Cancris auriculatus				1,3
C. oblungus	0,05	0,03		
C. sagrum			0,23	0,18
Siphonina aff. bradyana		0,03		
S. reticulata				0,08
Rotalia sp.	0,05			0,04
Ammonia beccarii				0,08
Eponides repandus	1,2	3,5	6,8	3,75
E. repandus var. concomeratus	0,4	0,17		1,6
E. procerus			0,23	
Poroeponides lateralis	0,1		0,48	
Elphidium complanatum	0,05			
Cribroelphidium sp.		0,03		
Amphistegina spp	73	72		
Amphistegina bilobata			0,94	0,9
A. gibbosa			9,2	2,9
A lessonii			19,2	3,9
A. radiata			4,11	11,7
Cibicides lobatulus			0,07	0,04
C. pseudoungerianus			0,03	0,12
C. umbonatus		0,17		0,04
Planorbulina mediterranensis		0,03		0,04
Planulina sp.		0,03		
Sphaerogypsina globulus		0,14		
Cassidulina laevigata				0,04
Osangularia sp.				0,4
Gyroidina sp.		0,03		0,12
Hanzawaia nitidula		0,03		0,04
H. ornata				0,04
Robertina bradyi				0,04
Ceratobulimina pacifica	0,3	1,2	10,7	12,3
Lamarckina atlantica			0,3	0,42
BENTHICS	92,5	89,3	74	64,3
PLANKTONICS	7,5	10,7	26	35,7

Table 3. Numerical repartition of benthic species.

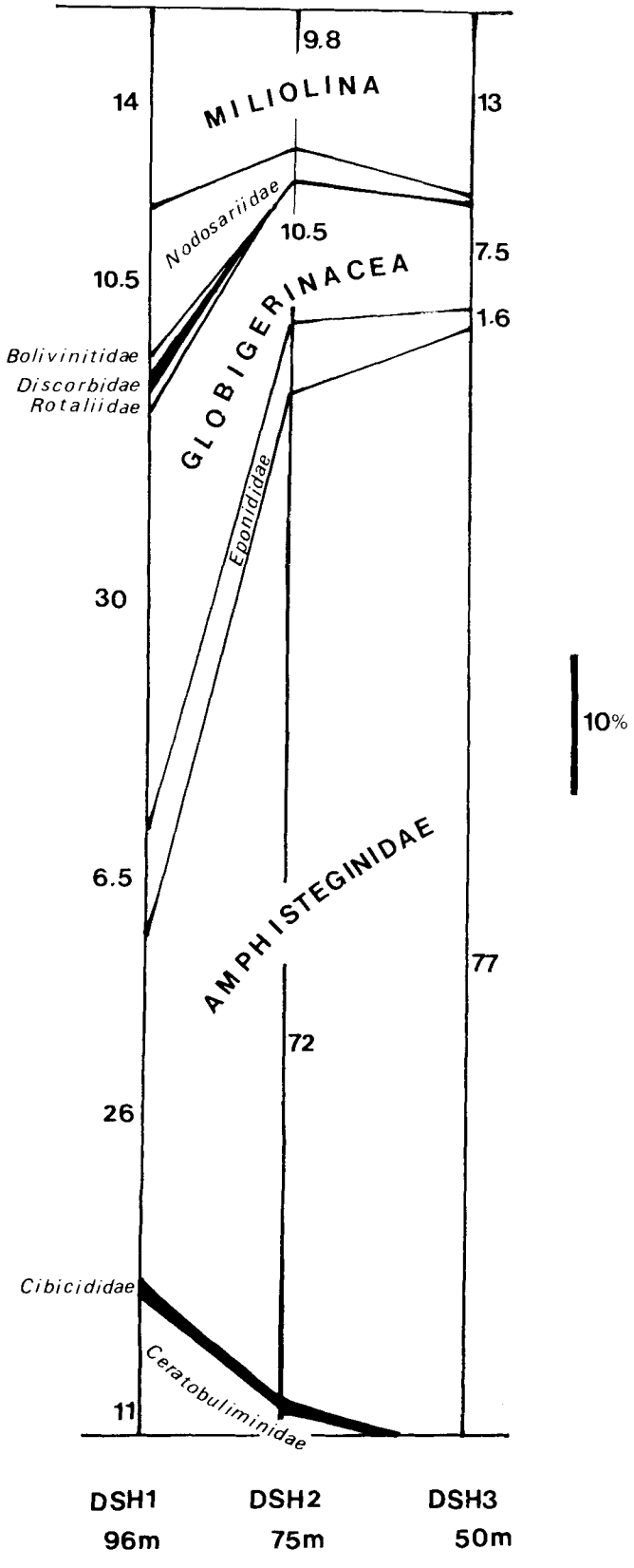


Fig. 2. Composition of foraminiferal fauna in the samples.

APPENDIX
TAXONOMIC LIST

BENTHIC FORAMINIFERA

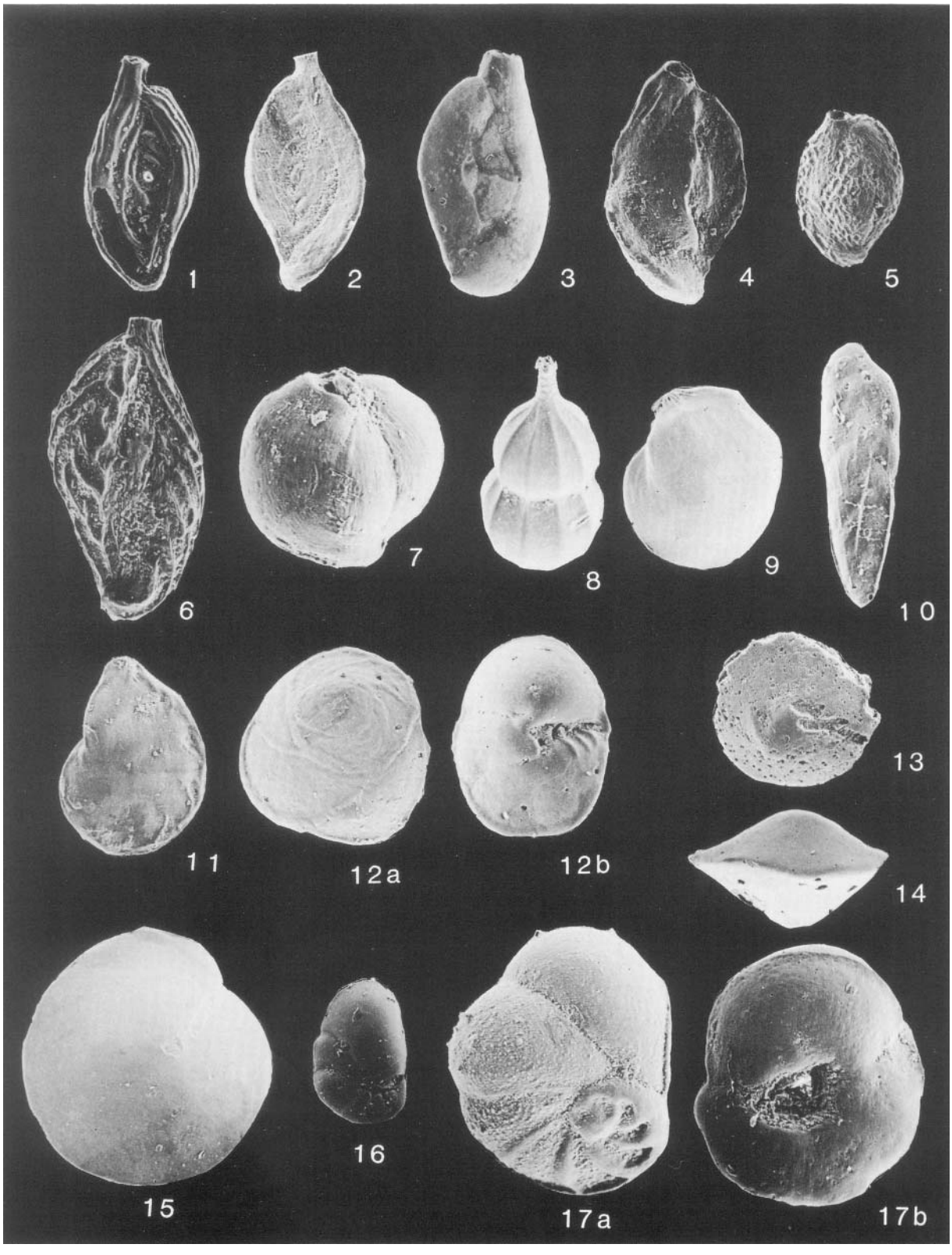
Spiroloculina excavata	d'Orbigny, 1846
S. concava	Petri, 1954
S. tenuimargo	Cushman, 1917
S. Depressa	d'Orbigny, 1826
Quinqueloculina disparilis	d'Orbigny, 1825
Q. bicarinata	d'Orbigny, 1826
Q. cliarensis	Heron-Allen & Earland, 1930
Q. aff. *crenulata*	Cushman, 1932
Q. kerimbatica	(Heron-Allen & Earland, 1930)
Q. pulchella	d'Orbigny, 1826
Q. pseudoreticulata	Parr, 1959
Q. schlumbergerii	(Heron-Allen & Earland, 1930)
Q. seminulum	(Linné, 1758)
Q. venusta	Karrer, 1868
Biloculina labiata	(Schlumberger, 1891)
Massilina robustior	Cushman & Valentine, 1939
Amphicoryna scalaris	Barker, 1960
Nodosaria catesbyi	d'Orbigny, 1839
Lenticulina atlantica	Barker, 1960
L. aff. *calcar*	(Linné, 1767)
L. cultrata	(de Montfort, 1808)
L. suborbicularis	Parr, 1950
Marginulina aff. *costata*	(Batsch, 1791)
Frondicularia sp.	
Glandulina laevigata	(d'Orbigny, 1826)
Bolivina aff. *striata*	Cushman, 1922
Brizalina sp.	
Rosalina candeina	d'Orbigny, 1839
Cancris auriculatus	de Montfort, 1808
C. oblungus	(Williamson, 1858)
C. sagrum	Cushman & Todd, 1942
Siphonina aff. *bradyana*	Cushman, 1927
S. reticulata	(Czjezk, 1848)
Rotalia sp.	
Ammonia beccarii	(Linné, 1758)
Eponides repandus	(Fichtel & Moll, 1803)
E. repandus (F.&M.) var. *concomeratus*	(Williamson, 1858)
Poroeponides lateralis	(Terquem, 1878)
Elphidium complanatum	(d'Orbigny, 1839)
Cribroelphidium sp.	
Amphistegina bilobata	d'Orbigny *in* Fornasini, 1903
A. gibbosa	d'Orbigny, 1839
A. lessonii	d'Orbigny, 1826
A. radiata	Terquem, 1880
Cibicides lobatulus	(Walker & Jacob, 1798)
C. umbonatus	Phleger & Parker, 1951
Planorbulina mediterranensis	d'Orbigny, 1826
Planulina sp.	(Reuss, 1847)
Sphaerogypsina globulus	
Cassidulina laevigata	d'Orbigny, 1826
Osangularia sp. Hanzawaia nitidula	Bandy, 1953
H. ornata	Le Calvez, de Klasz & Brun, 1971
Robertina bradyi	Cushman & Parker, 1936
Ceratobulimina bradyi	Cushman & Harris, 1927
Lamarckina atlantica	Cushman, 1931

PLANKTONIC FORAMINIFERA

Globorotalia crassaformis	(Galloway & Wissler, 1927)
G. menardii	(d'Orbigny, 1826)
G. scitula	(Brady, 1882)
G. tumida	(Brady, 1884)
G. truncatulinoides	(d'Orbigny, 1839)
Pulleniatina obliquiloculata	(Parker & Jones, 1862)
Globoquadrina dutertrei	(d'Orbigny, 1839)
Globigerinoides conglobatus	(Brady, 1879)
G. ruber	(d'Orbigny, 1839)
G. sacculifer	(Brady, 1877)
G. trilobus	(Reuss, 1850)
Orbulina universa	d'Orbigny, 1839

Explanation of Plate 1

Fig. 1. *Spiroloculina excavata* (×30).
Fig. 2. *Spiroloculina concava* (×30).
Fig. 3. *Quinqueloculina cliarensis* (×20).
Fig. 4. *Quinqueloculina pulchella* (×30).
Fig. 5. *Quinqueloculina kerimbatica* (×30).
Fig. 6. *Quinqueloculina* aff. *crenulata* (×60).
Fig. 7. *Quinqueloculina venusta* (×60).
Fig. 8. *Amphicoryna scalaris* (×60).
Fig. 9. *Lenticulina suborbicularis* (×30).
Fig. 10. *Bolivina* sp. (×60).
Fig. 11. *Lenticulina atlantica* (×30).
Fig. 12a. *Eponides repandus,* spiral side (×30).
Fig. 12b. *Eponides repandus,* ombilical side (×30).
Fig. 13. *Amphistegina gibbosa,* reworked test (×30).
Fig. 14. *Amphistegina gibbosa,* lateral view (×30).
Fig. 15. *Amphistegina lessonii* (×20).
Fig. 16. *Cancris auriculatus* (×30).
Fig. 17a. *Ceratobulimina pacifica,* spiral side (×30).
Fig. 17b. *Ceratobulimina pacifica,* ombilical side (×30).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