

Foraminifera from the Bahama Bank West of Andros Island

GEOLOGICAL SURVEY PROFESSIONAL PAPER 683-C



Foraminifera from the Bahama Bank West of Andros Island

By RUTH TODD *and* DORIS LOW

CONTRIBUTIONS TO PALEONTOLOGY

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*Benthonic Foraminifera from short cores taken
on traverses from outer bank edge to western
shore of Andros Island: 79 species, one new*



UNITED STATES DEPARTMENT OF THE INTERIOR

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FORAMINIFERA FROM THE BAHAMA BANK WEST OF ANDROS ISLAND

By RUTH TODD and DORIS LOW

ABSTRACT

The unconsolidated sediment that blankets the bank was sampled by cores taken in several traverses crossing the bank from its outer edge to the western shore of Andros Island. Several Foraminifera species appear to be restricted to the outer edge and several others, to the nearshore areas. Otherwise the fauna is quite consistent, being composed chiefly of peneroplids, miliolids, elphidiids, and agglutinated species, and is dominated by two peneroplids, *Archaias angulatus* and *Peneroplis proteus*.

Seventy-nine benthonic species, about 60 percent of them rare or very rare, are identified. *Rosalina bahamaensis* is described as new. Planktonic specimens form a negligible part of the population; six are identified.

INTRODUCTION

In 1955 a series of bottom samples was taken during seven traverses across Bahama Bank west of Andros Island (fig. 1) while studying the environment of calcium carbonate deposition on the bank (Cloud, 1962).

These bottom samples consisted of short cores of the unconsolidated sediment overlying the rock platform that makes up the bank. Cores from certain of the traverse stations, except the three outermost stations closest to the edge of the bank and six in the western part of traverse *E*, were studied for their Foraminifera.

Acknowledgments.—We are indebted to Preston E. Cloud, Jr., from whom we received the material studied. We are grateful for helpful advice and suggestions received from many colleagues, in particular Wayne D. Bock, Institute of Marine Sciences, Miami, Fla., during the course of our work. Robert H. McKinney photographed the specimens illustrated on plate 1. Those on plates 2 and 3 are photographs retouched by the junior author.

CORES

The cores, taken in traverses that crossed the bank from near its outer edge to near the shore of Andros Island, can be grouped into three general areas: outer

bank, central bank, and nearshore. The area sampled measures about 65 miles from east to west and 75 miles from north to south and ranged in depth from zero to less than 8 meters.

Although the composition of the cores was not precisely consistent from top to bottom, no significance could be placed on the variability within each core; this variability was comparable to the variability between adjacent cores within the limits of the three previously defined areas.

Attempts to distinguish living from dead specimens in the sediment from the tops of the cores, by using Rose Bengal stain, were unsuccessful. We therefore concluded that the precise living places of the various species were undeterminable. Leslie Illing's interpretation (1954, p. 19) of the mixing of dead tests by marine currents to mask local environmental control over species distribution in the Bahama calcareous sands seems to be applicable to those in the area west of Andros Island: "The skeletons become mere sand grains and are distributed and sorted as such * * *. The forms that occur in any samples are thus controlled far more by its mechanical grading than by the local indigenous foraminiferal assemblage."

MATERIAL STUDIED

A total of 280 samples were examined from 46 cores which varied in length from less than 25 to more than 220 cm (centimeters). The samples were washed, screened to size for convenience in picking, and the Foraminifera were picked, mounted, and identified from 113 of the 280 samples studied. A total of 79 benthonic species and six planktonic species were found in the core samples and one bottom sample taken south-southwest of South Riding Rock near the reef edge and close to station *I* of traverse *A*.

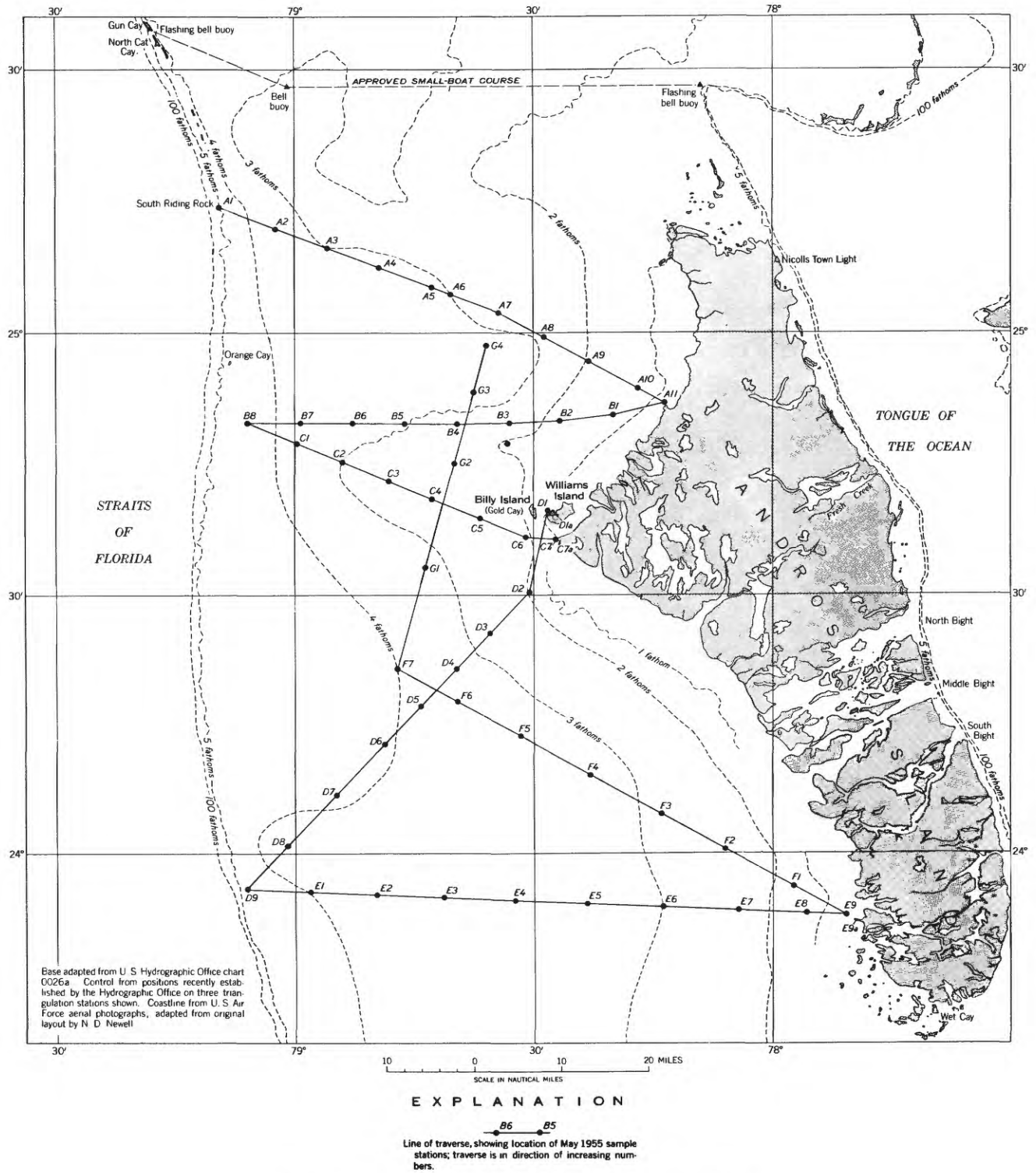


FIGURE 1.—Location of core stations, west of Andros Island.

The plastic core liners containing the bank sediment were split lengthwise, and material was taken at 10- or 20-cm intervals from one of the core halves for our examination of the Foraminifera. Original data on these cores, as derived from P. E. Cloud's 1955 field notebook, are given in table 1. Our samples were taken

subsequent to those removed for the studies published by Cloud in 1962. Hence, the complete cores were not available to us, and a measurement given for our cuts as being from the top of a core or from a certain number of centimeters below the top is an estimation of the correct position of the cut within the core.

TABLE 1.—Data on cores studied from the Bahama Bank

[All figures derived from field notebook of P. E. Cloud, Jr., 1955, unless otherwise noted. Stations are located in figure 1]

Traverse and station	Water depth (meters)	Length of core (cm)	Traverse and station	Water depth (meters)	Length of core (cm)	Traverse and station	Water depth (meters)	Length of core (cm)
A2-----	7	110	C1-----	7	213	E7-----	4	48
3-----	6	69	2-----	6	213	8-----	3	137
4-----	6	80	3-----	5	91	9-----	Missing	¹ 12
5-----	7	91	4-----	5	30	9A-----	Intertidal	68
6-----	6	121	5-----	5	18		zone	
7-----	5	107	6-----	5	48	F1-----	3	121
9-----	4	100	7A-----	Intertidal	120	2-----	5	¹ 50
10-----	4	61		zone		3-----	5	> 152
11-----	High tide level	111	D1A-----	< 0.3	106	4-----	7	129
B1-----	4	81	2-----	4	30	5-----	8	160
2-----	4	56	3-----	5	151	6-----	8	129
3-----	5	¹ 106	4-----	7	60	7-----	8	76
4-----	5	170	5-----	7	¹ 49	G1-----	7	180
5-----	6	126	6-----	8	74	2-----	6	30
6-----	6	162	7-----	8	228	3-----	7	180
7-----	7	48	8-----	6	¹ 27	4-----	7	76

¹ No core length given in field notes. This figure is that of our deepest sample.

FAUNAL COMPOSITION

As shown in table 2, the faunal composition is fairly consistent over the entire area (about 4,000 square miles) of the present study. However, the following several species are largely restricted to the outer edge of the bank:

Acervulina inhaerens Schultze
Amphistegina lessonii d'Orbigny
Articulina mexicana Cushman
Asterigerina carinata d'Orbigny
Cibicides lobatulus (Walker and Jacob)
Planorbulina acervalis Brady
Rotalia rosea d'Orbigny

and the following other species are largely restricted to the nearshore areas:

Biloculinella eburnea (d'Orbigny)
Discorbis aguayoi Bermudez
Elphidium morenoi Bermudez
Helenina anderseni (Warren)
Parrina bradyi (Millett)

The Bahama Bank fauna is dominated by *Archaias angulatus* (Fichtel and Moll) and *Peneroplis proteus* d'Orbigny. Common and well distributed, except near shore, are the following species, mostly miliolids, elphidiids, and agglutinated forms:

Articulina mucronata (d'Orbigny)
Clavulina angularis d'Orbigny
Cribrulimina polystoma (Parker and Jones)

Cyclorbiculina compressa (d'Orbigny)
Elphidium discoidale (d'Orbigny)
mexicanum Kornfeld
poeyanum (d'Orbigny)
Miliolinella labiosa (d'Orbigny)
Pyrgo subspherica (d'Orbigny)
Quinqueloculina lamarckiana d'Orbigny
poeyana d'Orbigny
torrei Acosta
Rosalina bahamaensis Todd and Low, n. sp.
Triloculina linneiana d'Orbigny
bassensis Parr
oblonga (Montagu)
reticulata d'Orbigny
Valvulina oviedoiana d'Orbigny

In addition, 32 more species in the following list occur rarely, but do not seem to have any ecologic or geographic restriction:

Ammonia beccarii (Linné)
beccarii tepida (Cushman)
Articulina sagra d'Orbigny
Bolivina compacta Sidebottom
pulchella (d'Orbigny)
rhomboidalis (Millett)
striatula Cushman
Buliminella milletti Cushman
Cornuspira planorbis Schultze
Cymbaloporetta bradyi (Cushman)
Elphidium advena (Cushman)
sagra (d'Orbigny)
Fissurina lucida (Williamson)

Guttulina cf. *G. spicaeformis australis* (d'Orbigny)
Marginopora vertebralis Quoy and Gaimard
Miliolinella fichtelliana (d'Orbigny)
Neoconorbina terquemi (Rzehak)
Peneroplis bradyi Cushman
Pseudononion grateloupi (d'Orbigny)
Pyrgo denticulata (Brady)
Quinqueloculina goesi Todd and Bronnimann
polygona d'Orbigny
 (*Dentostomina*) *agglutinans* d'Orbigny
Rosalina floridana (Cushman)
rugosa d'Orbigny
Rotorbinella mira (Cushman)
Schlumbergerina alveoliniformis occidentalis Cushman
Spirolina arietina (Batsch)
Triloculina fiterrei meningoi Acosta
schreiberiana d'Orbigny
sidebottomi (Martinotti)
trigonula (Lamarek)

Finally, single occurrences of the following 15 species give evidence of their presence on the Bahama Bank:

Angulogerina occidentalis (Cushman)
Bolivina (Lorostomum) limbata costulata Cushman
Clavulina nodosaria d'Orbigny
Conicospirillina atlantica Cushman
Eoeponidella nitidula (Chaster)
Florilus cf. *F. sloanii* (d'Orbigny)
Glabratella brasiliensis Boltovskoy
Hopkinsina pacifica Cushman
Lamarekina sp.
Rectobolivina advena (Cushman)
Spirillina vivipara Ehrenberg
vivipara revertens Rhumbert
Textularia agglutinans d'Orbigny
Tretomphalus bulloides (d'Orbigny)
Virgulina punctata d'Orbigny

As planktonic Foraminifera make up a negligible part of the population on the bank, they were not included in table 2. The following species were observed as very rare individuals in several core samples mostly from close to the outer edge of the bank, where they

might be expected to have originated from the oceanic water of the adjacent Straits of Florida:

Species	Traverse and station	Depth in core (cm)
<i>Globigerina bulloides</i> d'Orbigny	D7	9. 5-10
<i>rubescens</i> Hofker	D8	Bottom
<i>Globigerinella aequilateralis</i> (Brady)	G1	29. 5-30
<i>Globigerinoides trilobus</i> (Reuss)	C1	9. 5-10
	D8	9. 5-10
<i>Globorotalia hirsuta</i> (d'Orbigny)	D8	9. 5-10
<i>menardii</i> (d'Orbigny)	A2	49. 5-50
	C1	9. 5-10
	D8	Bottom

A bottom sample taken south-southwest of South Riding Rock, close to station A1, contains a typical reef-edge assemblage. As this sample does not appear in the check list of cores, its assemblage is listed below. Only the two starred species do not occur also in the core samples.

**Amphistegina lessonii* d'Orbigny
Archaias angulatus (Fichtel and Moll)
Articulina mexicana Cushman
Asterigerina carinata d'Orbigny
Neoconorbina terquemi (Rzehak)
Peneroplis proteus d'Orbigny
Quinqueloculina torrei Acosta
 (*Dentostomina*) *agglutinans* d'Orbigny
Rosalina bahamaensis Todd and Low, n. sp.
 **Rotalia rosea* d'Orbigny
Textularia agglutinans d'Orbigny
Triloculina reticulata d'Orbigny

TAXONOMIC CORRECTIONS

A distribution table of our preliminary identifications from seven stations representing the three general areas studied on the bank was included in Cloud (1962, table 12, p. 34-35). As there are discrepancies between this table and the final identifications as included in the present paper, table 3 lists the earlier and the current names.

TABLE 3.—Corrected identifications of species

Names in Cloud (1962, table 12)	Names in present paper
<i>Quinqueloculina reticulata</i> (d'Orbigny)	<i>Triloculina reticulata</i> d'Orbigny
<i>Triloculina quadrilatera</i> d'Orbigny	<i>Triloculina bassensis</i> Parr
<i>Triloculina tricarinata</i> d'Orbigny	Included with <i>T. trigonula</i> (Lamarek)
<i>Dentostomina bermudiana</i> Carman	<i>Quinqueloculina (Dentostomina) agglutinans</i> d'Orbigny
<i>Pyrgo carinata</i> (d'Orbigny)	Included with <i>P. denticulata</i> (Brady)
<i>Miliolinella circularis</i> (Bornemann)	Included with <i>M. labiosa</i> (d'Orbigny)
<i>Nonionella atlantica</i> Cushman	<i>Pseudononion grateloupi</i> (d'Orbigny)
<i>Sorites marginalis</i> (Lamarek)	<i>Cyclorbiculina compressa</i> (d'Orbigny)
<i>Bolivina subexcavata</i> Cushman and Wicken- den?	<i>Bolivina compacta</i> Sidebottom
<i>Rosalina candeiana</i> d'Orbigny	<i>Rosalina bahamaensis</i> Todd and Low, n. sp.
<i>Rosalina opima</i> (Cushman)	<i>Rosalina floridana</i> (Cushman)
<i>Buccella?</i> sp. A	<i>Helenina anderseni</i> (Warren)
<i>Cymbaloporetta?</i> sp.	<i>Cymbaloporetta bradyi</i> (Cushman)
<i>Elphidium</i> cf. <i>E. gunteri</i> Cole	<i>Elphidium morenoi</i> Bermudez
<i>Homotrema rubrum</i> (Lamarek)	Indeterminate, left out.

PREVIOUS REPORTS OF FORAMINIFERA FROM THE BAHAMAS AND NEARBY AREAS

Margaret Illing (1952) studied the Foraminifera from several areas on the Bahama Banks: Ragged Island area in the southeast corner of the banks and areas around New Providence and Great Abaco Islands and west of Andros Island. In these areas, at depths of no more than 16 fathoms (about 30 m), she found nearly twice the number of species that we found in the area presently studied west of Andros Island. She noted (1952, p. 278) that wherever the bottom was covered by calcareous mud rather than calcareous sand, as in the widespread area west of Andros Island, the foraminiferal fauna was scanty. The fauna, partially listed by Illing (1952, p. 281-284, fig. 2), includes several species—particularly *Eponides antillarum*, *E. repanda*, and *Heterostegina antillarum*—not found in our samples from the shallow shelf west of Andros Island. We believe the lack of these species is due to the shallowness of our stations, none deeper than 8 meters, and their protected situation away from the exposed edge of the reef.

The Bahama fauna has much in common with faunas reported from Florida, although it is less varied. The scarcity of species in the area west of Andros Island as compared with Floridian areas may be due to differences in the substrate, particularly the kind and abundance of the associated biota. Lynts (1962, 1965) and Moore (1957) described and listed assemblages of Foraminifera found in upper Florida Bay and Stubbs (1940), in Biscayne Bay. Depths in Florida Bay are down to about 40 feet (about 12 m) and those in Biscayne Bay, to 20 feet (about 6 m).

Cushman's early reports on faunas from Jamaica (Cushman, 1921) and the Dry Tortugas, west of Key West, Fla. (Cushman, 1922a), include many species also known on the Bahama Banks, particularly in the shallower samples from these two regions.

Norton, in studying the ecologic relationships of Foraminifera, included several Bahamian and West Indian samples. He found that in the shallow-water zone of 0-5 fathoms (zero to about 9 m) the Miliolidae and Peneroplidae were common to abundant, and that they decreased markedly at depths below 5 fathoms (about 9 m) (Norton, 1930, p. 368).

SYSTEMATIC CATALOG

Family TEXTULARIIDAE

Genus TEXTULARIA DeFrance, 1824

Textularia agglutinans d'Orbigny

Textularia agglutinans d'Orbigny, 1839a, p. 144, pl. 1, figs. 17, 18, 32-34.

This cosmopolitan species was originally described

from Cuba, St. Thomas, Martinique, and Jamaica. Only two specimens were found from near the reef edge, but both are of good size and typical of the species.

Family VALVULINIDAE

Genus CLAVULINA d'Orbigny, 1826

Clavulina angularis d'Orbigny

Plate 1, figure 6

Clavulina angularis d'Orbigny, 1826, p. 268, pl. 12, fig. 7.

Clavulina tricarinata d'Orbigny, 1839a, p. 111, pl. 2, figs. 16-18.

Clavulina pacifica Cushman, 1924, p. 22, pl. 6, figs. 7-11.

The three species cited above, described respectively from the Mediterranean, the West Indies, and the Pacific, seem indistinguishable. Most of the specimens are triangular to the top, but some are rounded over the last several chambers. It is common and well distributed in the Bahama material.

Clavulina nodosaria d'Orbigny

Plate 2, figure 1

Clavulina nodosaria d'Orbigny, 1839a, p. 110, pl. 2, figs. 19, 20.

Clavulina nodosaria is a small, fragile, cylindrical species with a triangular initial stage typical of the genus. Described from sands of Cuba and Martinique and reported only from the West Indies, it is rare in our Bahama Bank material.

Genus VALVULINA d'Orbigny, 1826

Valvulina oviedoiana d'Orbigny

Plate 1, figure 4

Valvulina oviedoiana d'Orbigny, 1839a, p. 103, pl. 2, figs. 21, 22.

Cushman, 1922b, p. 64, pl. 11, figs. 2-5.

Cushman (part), 1931a, p. 17, pl. 3, figs. 6, 7 (not figs. 8-10).

Subsequent to its description from shore sands of Cuba, *Valvulina oviedoiana* d'Orbigny has been cited as a common species in the West Indian region. Specimens considered as the microspheric form by Cushman (1931a, p. 17, pl. 3, figs. 6, 7) are included here, whereas those he cited as megalospheric forms (Cushman, 1931a, p. 17, pl. 3, figs. 8-10) are identified in this study as *Cribrobulimina polystoma* (Parker and Jones). Both species are well distributed in the Bahama Bank material.

The early stages of both species are similar, being triserial and angled with flattened sides. The later chambers of *Valvulina oviedoiana* are large and broadly rounded, three or four final ones curving gently into the apertural depression at the top of the specimen. The ventral area may be slightly tilted to the side of the test, but the final coil of chambers is not twisted. On the

other hand, the final whorl of *Cribrbulimina polystoma* consists of a loose spiral of at least five chambers that encircle the apertural area like a rolled collar twisted to one side of the test. The valvular tooth of *C. polystoma* when intact, fills the aperture with small separations (or supplementary openings) around the edge; that of *V. oviedoiana* is large and flat but never joins the edge of the aperture. Length 0.85–1.23 mm; diameter across final chambers 0.65–0.98 mm.

Genus CRIBROBULIMINA Cushman, 1927

***Cribrbulimina polystoma* (Parker and Jones)**

Plate 1, figure 3

Cribrbulimina polystoma (Parker and Jones). Cushman, 1937a, p. 27, pl. 3, figs. 19–22.

Cribrbulimina mixta (Parker and Jones). Cushman, 1927, p. 80, pl. 11, figs. 1–5.

Cribrbulimina mixta Cushman. Loeblich and Tappan, 1964, p. C279, C281, figs. 187, 7–10.

Valvulina oviedoiana d'Orbigny of Cushman (part) (not d'Orbigny), 1931a, p. 17, pl. 3, figs. 8–10 (not figs. 6, 7).

Lynts (not d'Orbigny), 1965, p. 67, pl. 7, figs. 1–4.

Cribrbulimina polystoma is well distributed in the Bahama Bank material with the closely related *Valvulina oviedoiana* d'Orbigny. Their distinguishing features are compared under the latter species. Although its distinctive valvular flap is often missing or partially hidden by matrix, *C. polystoma* is easily identified by the shape and arrangement of the final chambers. Length 1.0–1.3 mm; diameter across final chambers 0.52–0.75 mm.

These features are quite evident in the illustrations by Cushman (1931a) and Lynts (1965) cited in the synonymy. Lynts' identification followed that of Cushman from the Dry Tortugas (Cushman colln. 15480), now in the U.S. National Museum, but he illustrated only the form now placed in *Cribrbulimina*.

The following slides in the U.S. National Museum collections contain specimens originally identified as *Valvulina oviedoiana* but are considered here as *Cribrbulimina polystoma*:

Cushman colln. 15480, 19782, and 19815 from the Dry Tortugas and off Key West, Fla.

USNM 16900 (but not 16900a) from Lisbon Creek Reef, Bahamas.

C. polystoma was described from Australia and its only other recorded occurrences are from that area. The genus has been reported from beds of Eocene age in Florida.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

***Quinqueloculina goesi* Todd and Bronnimann**

Plate 2, figure 3

Quinqueloculina goesi Todd and Bronnimann, 1957, p. 27, pl. 3, fig. 11.

Quinqueloculina goesi has a distinctive appearance of light and dark banding resulting from opaque and translucent areas within the angled chambers. Our specimens compare exceptionally well with the types from the Gulf of Paria. Although it is not common in our material, it is well distributed. It is not as sharply angled as *Q. polygona*, with which it occurs, and appears more delicate as a result of the translucent parts of its wall.

***Quinqueloculina lamareckiana* d'Orbigny**

Plate 2, figure 10

Quinqueloculina lamareckiana d'Orbigny, 1839a, p. 189, pl. 11, figs. 14, 15.

Phleger and Parker, 1951, p. 7, pl. 4, fig. 1.

This species appears to have a worldwide distribution and occurs in almost all our samples. In general the Bahama specimens are not as sharply angled on the periphery as indicated in d'Orbigny's figures or as observed on the Gulf of Mexico specimens, but the identification seems good.

***Quinqueloculina poeyana* d'Orbigny**

Plate 2, figure 4

Quinqueloculina poeyana d'Orbigny, 1839a, p. 191, pl. 11, figs. 25–27.

Cushman, 1929, p. 31, pl. 5, fig. 2.

Described from this area and widely recorded elsewhere, *Quinqueloculina poeyana* is typical of warm shallow waters. This small, milky-white species with fine striations is found throughout the Bahama Banks.

***Quinqueloculina polygona* d'Orbigny**

Plate 2, figure 5

Quinqueloculina polygona d'Orbigny, 1839a, p. 198, pl. 12, figs. 21–23.

Cushman, 1929, p. 28, pl. 3, fig. 5.

This widely distributed miliolid with acutely angled chambers is less common in our samples than *Quinqueloculina poeyana*. It seems to have no restricted pattern of occurrence on the Bahama Banks.

Quinqueloculina torrei Acosta

Plate 2, figure 11

Quinqueloculina torrei Acosta, 1939, p. 3, pl. 1, figs. 1-5.

The original citation is the only record we could find for the agglutinated species, *Quinqueloculina torrei*. The illustrations are excellent showing the unique wide open, recurved aperture. Our specimens are less elongate than the holotype but otherwise compare well. It was described from off Cuba and is widely distributed in our material.

Subgenus DENTOSTOMINA Carman, 1933**Quinqueloculina (Dentostomina) agglutinans d'Orbigny**

Plate 1, figure 7

Quinqueloculina agglutinans d'Orbigny, 1839a, p. 195, pl. 12, figs. 11-13.*Dentostomina bermudiana* Carman, 1933, p. 31, pl. 3, fig. 6.

Despite their outward appearance, two kinds of agglutinated specimens included here are probably the same. The larger ones are rugged and quinqueloculine with a round aperture on a distinct neck. In some specimens the aperture is rimmed by inward-projecting cog-like teeth in addition to the normal nooth. Smaller quinqueloculine specimens with slenderer necks and no teeth are probably juveniles. We feel the inward-projecting apertural teeth indicate a mature or advanced stage of the species; hence, we have designated *Dentostomina* as a subgenus to include all our specimens.

Records for the species *agglutinans* are worldwide from both warm and cold waters. Those for "*bermudiana*" are from Bermuda, from where it was described, and from waters off Cuba. It is not common in our material but is well distributed.

Genus TRILOCULINA d'Orbigny, 1826**Triloculina bassensis Parr**

Plate 2, figure 8

Triloculina bassensis Parr, 1945, p. 198, pl. 8, fig. 7.

Lynts, 1965, p. 68, pl. 7, figs. 7-9.

Miliolina angularis Flint, 1899 (not Howchin 1889), p. 300, pl. 46, fig. 1.*Triloculina marshallana* Todd, in Cushman, Todd, and Post, 1954, p. 339, pl. 85, fig. 13.

This species was described from Barwon Heads, Victoria, Australia, and has been reported as *Miliolina angularis* from Yucatan Channel, west of Cuba, and as *Triloculina marshallana* from the Marshall Islands, the Marianas, and Onotoa in the Pacific. Lynts reported it in Florida Bay as a form varying greatly in amount of inflation.

Triloculina bassensis has slightly angled chambers that are flat to gently convex. Its surface is matte, yet bright. We originally considered the specimens to be *T. quadrilateralis* d'Orbigny, but that is a quite sharply angled species and its chambers are concave.

Triloculina bassensis occurs abundantly in southern Florida and the Caribbean and is found in most of our samples.

Triloculina fiterrei meningoi Acosta

Plate 2, figure 6

Triloculina fiterrei var. *meningoi* Acosta, 1940a, p. 26, pl. 4, figs. 1-5.

This subspecies was described from the south coast of Camaguey, Cuba, and has been recorded from the southwest Texas coast and the Gulf of Cariaco, Venezuela. Wayne Bock reports it as quite common in parts of Florida Bay (written commun., Mar. 23, 1970). It somewhat resembles *Triloculina linneiana* d'Orbigny with which it occurs, but it is smaller and has a much more delicate wall with distinct but irregular costae; its aperture has an everted lip. Our Bahama specimens are scattered and uncommon.

Triloculina linneiana d'Orbigny

Plate 2, figure 15

Triloculina linneiana d'Orbigny. Cushman, 1929, p. 61, pl. 16, figs. 1, 2.

This large miliolid is well represented in the Bahamas. It was described from the West Indian region and is native to warm, shallow waters. It is heavy walled with relatively coarse, rugged ridges. Some of our specimens are nearly smooth and might be compared with *Triloculina planciana* d'Orbigny but are larger than that species, and the striations consist of ridges instead of incised lines as on *T. planciana*.

Triloculina oblonga (Montagu)*Triloculina oblonga* (Montagu). d'Orbigny, 1826, p. 300; Modèles no. 95.

d'Orbigny, 1839a, p. 175, pl. 10, figs. 3-5.

This cosmopolitan species is found throughout the Bahama Bank area. It closely resembles *Quinqueloculina bosciiana* d'Orbigny which was described from this region but was not identified in our samples. *Triloculina oblonga* has an ovate aperture and does not have a neck. *Quinqueloculina bosciiana* is more elongate, has a round aperture on a slight neck, and has more indented sutures.

Triloculina reticulata d'Orbigny

Plate 2, figure 2

Triloculina reticulata d'Orbigny. Fornasini, 1905, p. 60, pl. 1, fig. 4.*Quinqueloculina reticulata* (d'Orbigny) var. *carinata* d'Orbigny. Le Calvez and Le Calvez, 1958, p. 183, pl. 5, figs. 34, 35, 43.

Triloculina reticulata was described from sediments from the Mediterranean, St. Helena, and Australia and seems to have a worldwide distribution. Our specimens are triloculine, not quinqueloculine, and the periphery is rounded, not truncate or carinate as in *T. bicarinata* and *T. carinata* which were both described from Cuba. They have a recurved aperture filled by a prominent tooth; the reticulations are absent on the apertural shoulder. Some specimens described under *Quinqueloculina* (see the Le Calvez and Le Calvez reference given above) are actually triloculine and belong in this genus. The species occurs quite commonly over most of the area.

Triloculina schreiberiana d'Orbigny

Plate 2, figure 9

Triloculina schreiberiana d'Orbigny, 1839a, p. 174, pl. 9, figs. 20-22.

This thick-walled miliolid was described from Cuba, Jamaica, and Martinique but was not recorded as common. It has also been reported from the Mediterranean. Its rounded outline is somewhat similar to *Quinqueloculina seminulum*, but it is not quite as elongate and is consistently triloculine. It is scattered and rare in our samples.

Triloculina sidebottomi (Martinotti)

Plate 2, figure 14

Miliolina subrotunda Montagu. Sidebottom, 1904, p. 8, pl. 3, figs. 1-7; text fig. 2.*Sigmoidina sidebottomi* Martinotti, 1920, p. 280, pl. 2, fig. 29; text figs. 59-61.*Triloculina sidebottomi* (Martinotti). Colom, 1942, p. 24, pl. 5, figs. 106-108.

Triloculina sidebottomi was described from Delos and was subsequently reported from Tripoli, Majorca, and the Gulf of Mexico. It may be confused with *Pyrgo subspherica* d'Orbigny which is also well represented in our samples, but *Triloculina sidebottomi* is compressed and tends to have chambers not quite the full length of the test, so that it has no neck. The apertural tooth may protrude in side view.

Our specimens were also compared with *Quinqueloculina subrotunda* (Montagu), but that species is almost totally lacking an apertural tooth. Also, its test is

more nearly circular and its chambers less embracing and more distinctly separated.

Triloculina sidebottomi is rare but well scattered in the Bahamas.

Triloculina trigonula (Lamarek)*Triloculina trigonula* (Lamarek). Cushman, 1929, p. 56, pl. 12, figs. 10, 11; pl. 13, figs. 1, 2.

Todd and Bronnimann, 1957, p. 27, pl. 3, figs. 18, 19.

This well known miliolid has a worldwide distribution. It is scattered throughout our material but always rare.

Genus ARTICULINA d'Orbigny, 1826**Articulina mexicana Cushman**

Plate 1, figure 2

Articulina mexicana Cushman, 1922a, p. 70, pl. 11, figs. 7, 8.

Articulina mexicana was described from sediments off the Dry Tortugas, Florida, and Jamaica. Our specimens are mostly from the outer edge of the reef, a restriction corresponding to that recorded by Cushman (1922a, p. 70) as being "on the outer or open-ocean side of Loggerhead Key." Its thick smooth or faintly striate wall makes this a more robust species than *A. mucronata* and *A. sagra* which are widely distributed in all areas of the banks.

Articulina mucronata (d'Orbigny)

Plate 1, figure 1

Articulina mucronata (d'Orbigny). Cushman, 1944, p. 12, pl. 2, figs. 11-18.

This is a widely distributed West Indian species, having been described from sediments off Cuba, Jamaica, and Martinique. It has also been recorded off Brazil. *Articulina mucronata*, with its distinct striations, is well distributed in our samples except near shore and is the most common of our three species of *Articulina*.

Articulina sagra d'Orbigny

Plate 1, figure 9

Articulina sagra d'Orbigny, 1839a, p. 183, pl. 9, figs. 23-26. Cushman, 1944, p. 11, pl. 2, figs. 6-10.

Articulina sagra was described from the same Antillean area as *A. mucronata* and has been reported from the Mediterranean and off Australia as well. Although less abundant than *A. mucronata* in our Bahama samples, *A. sagra* is well distributed. It is much more delicate than *A. mucronata*, and the chambers of the slender uniserial section do not flare as widely as in that species.

Compared to *A. lineata* Brady, a species known also in the West Indies, *A. sagra* is slenderer, more attenu-

ated, and less strongly compressed. The elongate chambers of *A. sagra* increase in breadth at the base as added whereas in *A. lineata* the chambers are of equal breadth throughout.

Genus PYRGO DeFrance, 1824

***Pyrgo denticulata* (Brady)**

Biloculina ringens var. *denticulata* Brady, 1884, p. 143, pl. 3, figs. 4, 5.

Pyrgo denticulata (H. B. Brady). Cushman, 1929, p. 69, pl. 18, figs. 3, 4.

This widely recorded species occurs only rarely in our samples from the northernmost traverses and at station D8 on the southwestern edge of the Bank. It lacks the distinct neck of *Pyrgo nasutus* Cushman which was described from a depth of 17 fathoms off Puerto Rico.

***Pyrgo subspherica* (d'Orbigny)**

Biloculina subspherica d'Orbigny, 1839a, p. 162, pl. 8, figs. 25-27.

Pyrgo subspherica is a well-rounded miliolid described from the shore sands of Cuba and Jamaica. It is well represented at the Bahama Banks, more commonly than *P. denticulata*.

Genus MILIOLINELLA Wiesner, 1939

***Miliolinella fichteliana* (d'Orbigny)**

Tritoculina fichteliana d'Orbigny, 1839a, p. 171, pl. 9, figs. 8-10.

This costate species was described from Cuba and Jamaica. It is not as common in the Bahama material as the smoother species, *Miliolinella labiosa*. It has been reported from many areas in the Atlantic and is also known from the Pacific.

***Miliolinella labiosa* (d'Orbigny)**

Tritoculina labiosa d'Orbigny, 1839a, p. 178, pl. 10, figs. 12-14.

This cosmopolitan species was described from the shore sands of Cuba. It is well represented on the Bahama Banks.

Genus BILOCULINELLA Wiesner, 1931

***Biloculinella eburnea* (d'Orbigny)**

Plate 2, figure 7

Tritoculina eburnea d'Orbigny, 1839a, p. 180, pl. 10, figs. 21-23.

Tritoculina bermudezi Acosta, 1940b, p. 37, pl. 4, figs. 1-5.

This smoothly compact miliolid is well represented in the nearshore areas of Andros Island. Acosta's species *Tritoculina bermudezi* was described from off the Bahamas and appears to be a slightly more circular triloculine stage of *Biloculinella eburnea*. The aperture

is filled with a distinctive T-shaped tooth that does not project above the margin of the test.

Genus SCHLUMBERGERINA Munier-Chalmas, 1882

***Schlumbergerina alveoliniformis occidentalis* Cushman**

Schlumbergerina alveoliniformis occidentalis Cushman, 1929, p. 36, pl. 7, fig. 2.

This subspecies was described from the Dry Tortugas and differs from the Indo-Pacific species in its smaller size. Typical specimens occur rarely in the Bahamas.

Genus PARRINA Cushman, 1931

***Parrina bradyi* (Millett)**

Parrina bradyi (Millett). Cushman, Todd, and Post, 1954, p. 342, pl. 85, figs. 31-34.

Parrina bradyi is widely reported from warm shallow waters, mostly in the Pacific. Seiglie (1964, p. 501, pl. 3, figs. 1-12) found it on the Los Testigos reefs off northeast Venezuela. Our specimens are rare at two stations in the nearshore area northwest of Andros Island. They are small, limited to the initial stage.

Family OPHTHALMIDIIDAE

Genus CORNUSPIRA Schultze, 1854

***Cornuspira planorbis* Schultze**

Cornuspira planorbis Schultze. Phleger and Parker, 1951, p. 8, pl. 4, figs. 8, 9.

This easily identifiable simple species has a worldwide distribution at all latitudes. It occurs rarely in scattered samples on the Bahama Banks.

Family PENEROPLIDAE

Genus PENEROPLIS Montfort, 1808

***Peneroplis bradyi* Cushman**

Plate 2, figure 12

Peneroplis bradyi Cushman, 1930, p. 40, pl. 14, figs. 8-10.

This small, delicate species was described from Montego Bay, Jamaica, and occurs only rarely in our Bahama material. It is very thin and translucent and is easily distinguishable from the more common *Peneroplis proteus* d'Orbigny.

***Peneroplis proteus* d'Orbigny**

Plate 1, figure 10

Peneroplis proteus d'Orbigny. Cushman, 1930, p. 37, pl. 13, figs. 1-17.

Described from Cuba and Jamaica, this species is common and fairly well distributed over the Bahama

Banks, as it is throughout the West Indies. It also occurs at Saipan in the Mariana Islands but less abundantly.

Genus SPIROLINA Lamarck, 1804

***Spirolina arietina* (Batsch)**

Spirolina arietinus (Batsch). Cushman, 1930, p. 43, pl. 15, figs. 4, 5.

This is the rarest of the peneroplids in our Bahama Bank samples. It has a worldwide distribution in warm shallow waters.

Genus MARGINOPORA Quoy and Gaimard, 1830

***Marginopora vertebralis* Quoy and Gaimard**

Marginopora vertebralis Blainville. Cushman, Todd and Post, 1954, p. 348, pl. 82, figs. 5, 6.

Most of the recorded occurrences for this species are from the tropical Pacific, but it is also known off Brazil. The Bahama specimens are typical but rare.

Genus ARCHAIAS Montfort, 1808

***Archaias angulatus* (Fichtel and Moll)**

Plate 1, figure 5

Nautilus angulatus Fichtel and Moll, 1803, p. 113, pl. 22, figs. a-e.

Archaias angulatus (Fichtel and Moll). Cushman, 1930, p. 46, pl. 16, figs. 1-3; pl. 17, figs. 3-5.

Orbiculina adunca Lamarck, d'Orbigny, 1839a, p. 64, pl. 8, figs. 8-16.

In our material this species is dominant from the reef edge up to but not in the nearshore areas. *Archaias angulatus* was described from the Arabian Sea (a doubtful record) and is widespread around the West Indies where it occurs also in Tertiary sediments. In the Pacific it seems to occur only as a Tertiary fossil.

Genus CYCLORBICULINA Silvestri, 1937

***Cyclorbiculina compressa* (d'Orbigny)**

Plate 1, figure 8

Orbiculina compressa d'Orbigny, 1839a, p. 66, pl. 8, figs. 4-7.

Brady, 1884, p. 209, pl. 14, fig. 9.

Archaias compressus (d'Orbigny). Cushman, 1930, p. 48, pl. 17, figs. 1, 2.

Cyclorbiculina compressa (d'Orbigny). Loeblich and Tappan, 1964, p. C495, figs. 383, 1-3.

This species resembles *Sorites marginalis* (Lamarck) but is thick or raised in the initial stage. *Sorites* is common in the Dry Tortugas and might be expected in the Bahamas, but we found none. Wayne Bock has suggested its absence here to be attributable to the nature of the bottom west of Andros Island. He finds *Sorites*

to be almost entirely restricted to a vegetative substrate (written commun., Mar. 23, 1970).

Cyclorbiculina compressa was described from the West Indies and is known mostly from that area. It occurs with *Archaias angulatus* (Fichtel and Moll) but is less abundant than that species in the Bahama Banks sediments.

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1839

***Guttulina* cf. *G. spicaeformis australis* (d'Orbigny)**

We have some rare polymorphinids from scattered samples on the Bank, most of which are indeterminable with certainty. Among them are occasional specimens having faint striae suggesting the subspecies *australis*. For comparison see *Guttulina spicaeformis* (Roemer) var. *australis* (d'Orbigny) as cited by Cushman and Ozawa (1930, p. 32, pl. 5, fig. 3). Some of the indeterminable specimens may be immature.

Family BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

***Buliminella milletti* Cushman**

Plate 2, figure 13

Buliminella milletti Cushman. Cushman and Parker, 1947, p. 69, pl. 17, figs. 20, 21.

This species was described from Fiji and has been reported from the West Indian region. It is more tapering than the more widely recorded and longer ranging *Buliminella madagascariensis* (d'Orbigny). Although it occurs rarely in our material, it is fairly well distributed.

Genus VIRGULINA d'Orbigny, 1826

***Virgulina punctata* d'Orbigny**

Virgulina punctata d'Orbigny, 1839a, p. 139, pl. 1, figs. 35, 36.

Virgulina punctata was described from the shore sands of Cuba and Jamaica. Our two specimens are slightly twisted and have a distinctive punctate wall. Recorded occurrences include the Gulf of Mexico, Gulf of Paria, and the Atlantic Ocean off South America.

Genus BOLIVINA d'Orbigny, 1839

***Bolivina compacta* Sidebottom**

Bolivina compacta Sidebottom. Cushman, 1937b, p. 135, pl. 17, figs. 22-24.

Bolivina subexcavata Cushman and Wickenden, 1929, p. 9, pl. 4, fig. 4.

Bolivina compacta was described from the Mediterranean but has a cosmopolitan distribution. It has a simple test with a surface that is coarsely perforate, crinkled, and pitted. We have only very few specimens from scattered samples.

Bolivina pulchella (d'Orbigny)

Sagrina pulchella d'Orbigny, 1839a, p. 150, pl. 1, figs. 23, 24.
Bolivina pulchella (d'Orbigny). Cushman, 1937b, p. 151, pl. 15, figs. 9-11.

This species appears to occur only in the West Indies, along the Atlantic shore of South America, and in the North Atlantic. It was described from Cuba, St. Thomas, and Jamaica. Distinctive in having costae overhanging its sutures, *Bolivina pulchella* is scattered in our samples and never found more than rarely.

Bolivina rhomboidalis (Millett)

Bolivina rhomboidalis (Millett). Cushman, 1937b, p. 138, pl. 18, fig. 7.

This well-known cosmopolitan bolivinid is characterized by its rhomboid shape in cross section. It is scattered and rare in our Bahama samples.

Bolivina striatula Cushman

Bolivina striatula Cushman, 1937b, p. 154, pl. 18, figs. 30, 31.

Described from the Dry Tortugas off Florida, this cosmopolitan species is scattered and rare on the Bahama Banks.

Subgenus LOXOSTOMUM Ehrenberg, 1854***Bolivina (Loxostomum) limbata costulata* Cushman**

Loxostoma limbatum (H. B. Brady) var. *costulatum* (Cushman). Cushman, 1937b, p. 187, pl. 21, figs. 30, 31.

Only two specimens were found of this subspecies described from the Dry Tortugas, off Florida. Recorded occurrences indicate it is probably cosmopolitan.

Genus RECTOBOLIVINA Cushman, 1927***Rectobolivina advena* (Cushman)**

Siphogenerina advena Cushman, 1922a, p. 35, pl. 5, fig. 2.

This species has been recorded from a number of localities around the West Indies and Gulf of Mexico but always rarely. It was described from the Dry Tortugas, off Florida. We have a single specimen from 169.5-170 cm deep in core *D7*.

Genus HOPKINSINA Howe and Wallace, 1932***Hopkinsina pacifica* Cushman**

Hopkinsina pacifica Cushman, 1933, p. 86, pl. 8, fig. 16.

This species was described from Vavau Anchorage, Tonga. It has been reported from off New England, off Rio de la Plata, and in the Gulf of Paria. The specimens reported from the Atlantic localities have been called the variety or subspecies *atlantica*.

We have only a single immature specimen. It does not show the biserial stage, but the wall is smooth and finely perforate.

Genus ANGULOGERINA Cushman, 1927***Angulogerina occidentalis* (Cushman)**

Angulogerina occidentalis (Cushman). Todd and Bronnimann, 1957, p. 36, pl. 9, figs. 5, 6.

Three single specimens were found of this species originally described from the Dry Tortugas. It seems to be a widely distributed species. It is costate with its chambers being less compact and more separated than those of *Angulogerina angulosa* (Williamson).

Genus FISSURINA Reuss, 1850***Fissurina lucida* (Williamson)**

Fissurina lucida (Williamson). Todd and Low, 1967, p. 28, pl. 3, fig. 31.

Typical, but smaller than normal, specimens are rare and scattered in our material. The species seems to be widely reported but never abundant. It is characteristic of shallow water with many records of cold-water occurrences.

Family SPIRILLINIDAE**Genus SPIRILLINA Ehrenberg, 1843*****Spirillina vivipara* Ehrenberg**

Spirillina vivipara Ehrenberg. Brady, 1884, p. 630, pl. 85, figs. 1-5.
 Todd, 1965, p. 6.

A single specimen of *Spirillina vivipara* was found in the nearshore station *B1*. The long synonymy in the Todd reference given above attests to its worldwide distribution.

***Spirillina vivipara revertens* Rhumbler**

Spirillina vivipara Ehrenberg var. *revertens* Rhumbler. Todd, 1957, p. 290 (table 4), pl. 90, fig. 2.
 Todd, 1965, p. 6.

This subspecies is also well known from shallow waters. It is rare in two of our nearshore samples, *E9* and *F1*.

Genus CONICOSPIRILLINA Cushman, 1927***Conicospirillina atlantica* Cushman**

Conicospirillina atlantica Cushman, 1947, p. 91, pl. 20, fig. 8.

This species was described from 35 meters in Onslow Bay, North Carolina, and no subsequent records have been noted. The single small specimen obtained from near the bottom of the core taken at station *E8* may be immature.

Family DISCORBIDAE
Genus ROSALINA d'Orbigny, 1826

Rosalina bahamaensis Todd and Low, n. sp.

Plate 3, figure 2

Rosalina candeiana d'Orbigny, 1839a, p. 97, pl. 4, figs. 2-4.

Test biconvex, umbilicate, periphery rounded, lobulate; 5 to 7 chambers comprising the adult whorl, slightly inflated; sutures distinct, slightly limbate between the early chambers, ventral sutures deeply indented; wall milky white, roughened by coarse and dense perforations except over the free flaps of the chambers in the umbilicus, initial spire light orange in color; aperture under the ventral edge of the final chamber and extending under the free flaps of previous chambers in the umbilicus. Diameter 0.32 mm; thickness 0.18 mm.

Holotype (USNM 688523) from 109.5-110 cm in core taken at station A2 on the Bahama Banks, west of Andros Island: lat 25°11'30" N.; long 79°02'30" W.

It has been recommended that the name *Rosalina candeiana* be considered a nomen dubium and be abandoned (Banner and Blow, 1960, p. 37; Todd, 1965, p. 11). This species described by d'Orbigny from shore sands of Cuba is easily recognizable, however, and is well represented in our Bahama material. Because of the unfortunate circumstance, reported by Banner and Blow (1960, p. 37), that the only two syntypes of *Rosalina candeiana* in existence are a bolivianid and a polymorphinid, a neotype cannot be erected. Hence a new species is erected.

This species is quite distinctive in its coarse and dense perforations and the star pattern in the umbilicus which results from the unattached inner ends of previous chambers that converge into the open umbilicus.

Rosalina bahamaensis, n. sp., is the commonest species of this genus in our samples and occurs fairly consistently over the entire area.

Rosalina floridana (Cushman)

Discorbis floridana Cushman, 1922a, p. 39, pl. 5, figs. 11, 12.

Rosalina floridana (Cushman). Todd, 1965, p. 10, pl. 3, figs. 1, 3; pl. 4, fig. 5.

Described from the Dry Tortugas, off Florida, *Rosalina floridana* has been widely reported in both the Atlantic and Pacific. It occurs in scattered samples in the Bahamas. It consists of a low, flat test that is finely perforate and has knobs around the umbilicus.

Rosalina rugosa d'Orbigny

Rosalina rugosa d'Orbigny, 1839b, p. 42, pl. 2, figs. 12-14.

Todd, 1965, p. 12, pl. 4, fig. 1.

Our rare Bahama specimens seem typical of this species described from off Patagonia but otherwise reported

mostly from the Pacific. Its coarse perforations look white on a clear dark wall.

Genus NEOCONORBINA Hofker, 1951

Neoconorbina terquemi (Rzehak)

Neoconorbina terquemi (Rzehak). Todd, 1965, p. 16, pl. 5, fig. 6.

Neoconorbina terquemi is a high conical species having 3 to 4 arcuate chambers visible around the periphery. It is a variable cosmopolitan species and occurs rarely in scattered Bahama samples.

Genus DISCORBIS Lamarek, 1804

Discorbis aguayoi Bermudez

Discorbis aguayoi Bermudez, 1935, p. 204, pl. 15, figs. 10-14.

Discorbis aguayoi was described from the north coast of Cuba and has been reported from the Gulf of Paria, the coast of Texas, off southern Brazil, and the tropical Pacific. Distinctive in having a spongy mass on the ventral surface, it is well represented in the nearshore samples only.

Genus ROTORBINELLA Bandy, 1944

Rotorbinella mira (Cushman)

Plate 2, figure 16

Rotorbinella mira (Cushman). Todd, 1965, p. 18, pl. 8, fig. 2.

Rotorbinella mira was described from the West Indies and has a cosmopolitan distribution in warm shallow water. It is scattered and rare in the Bahamas.

Genus GLABRATELLA Dorreen, 1948

Glabratella brasiliensis Boltovskoy

Glabratella brasiliensis Boltovskoy, 1959, p. 90, pl. 14, figs. 8-11.

Glabratella brasiliensis was described from beach sands of Cabo Frio, southern Brazil, and has been reported from the Falklands and the north coast of Cuba. Our single specimen from the southwest corner of the Bank has the typical widely open aperture and radial striations. It measures 0.21 mm in diameter.

Genus EOEPONIDELLA Wickenden, 1947

Eoeponidella nitidula (Chaster)

Pulvinulina nitidula Chaster, 1892, p. 66, pl. 1, fig. 17.

Eoeponidella delicatula Seiglie, 1964, p. 511, pl. 5, fig. 11.

This species was described from shore mud and shallow water off Southport, England. It has since been reported from Delos, Clare Island, Kerimba Archipelago, west of Scotland, off Antarctica, Iceland, off Belgium, and Los Testigos Reefs, Venezuela. It is a widely distributed species but very rare. We found a single specimen from the top of core A4.

The periphery is angled, and the lower plates on the ventral side reach out to the periphery.

Genus HELENINA Saunders, 1961

***Helena anderseni* (Warren)**

Plate 3, figure 1

Pseudocponides anderseni Warren, 1957, p. 39, pl. 4, figs. 12-15.

Parker and Athearn, 1959, p. 341, pl. 50, figs. 28-31.

Helena anderseni (Warren). Saunders, 1957, p. 374, figs. 1, 2.

Todd and Low, 1961, p. 18, text fig. 2, fig. 2.

Described from marshland off the Louisiana coast, *Helena anderseni* is known only from brackish waters: Trinidad, Cape Cod, and Martha's Vineyard. It is well represented in the nearshore samples at the Bahamas.

Superficially it resembles the genus *Ammonia* but has supplementary apertures along the dorsal sutures.

Genus LAMARCKINA Berthelin, 1881

***Lamarckina* sp.**

A single specimen, probably a juvenile, was found in the bottom of the core taken at station D8. It has six chambers and a flat dorsal surface with concave edges.

Family ROTALIIDAE

Genus AMMONIA Brönnich, 1771

***Ammonia beccarii* (Linné)**

Ammonia beccarii (Linné). Albani, 1968, p. 110, pl. 9, figs. 7, 9, 10.

Although scattered and rare, *Ammonia beccarii* is not restricted to any one area in the Bahamas.

***Ammonia beccarii tepida* (Cushman)**

Rotalia beccarii (Linnaeus) var. *tepida* Cushman, 1931b, p. 61, pl. 13, fig. 3.

The subspecies *tepida* was described from present-day waters off Puerto Rico and has been widely reported along the Atlantic coast as well as in the Pacific. Our only occurrence consists of three specimens from near the northwest edge of the bank, at station A3.

Genus ROTALIA Lamarck, 1804

***Rotalia rosea* d'Orbigny**

Rotalia rosea d'Orbigny, 1826, p. 272, no. 7; Modèles no. 35.

Parker, Jones and Brady, 1865, p. 24, pl. 3, fig. 79.

Rotalina rosea d'Orbigny, 1839a, p. 72, pl. 3, figs. 9-11.

Truncatulina rosea (d'Orbigny). Brady, 1884, p. 667, pl. 96, fig. 1.

Described from Martinique, *Rotalia rosea* was later reported by M. Illing (1952, p. 282, fig. 2) to be largely restricted to the exposed coasts in the Bahamas. Our

only occurrence of it is in an unnumbered sample taken south-southwest of South Riding Rock on the outer edge of the bank. Specimens are common and typical and are dark pink in color. It is well known in the West Indies and along the Pacific coast of South America. Wayne Bock reports it to be abundant on exposed reefs and rocky shores where the substrate is hard and wave action is vigorous (written commun., Mar. 23, 1970).

Specimens are conical dorsally, have eight or more chambers per whorl, are knobbed or rugose in the center of the dorsal surface, are flat to slightly raised ventrally, and have an umbilical plug. The pink color is diagnostic, darkest in the first-formed chambers and rarely faded to nearly white.

Family AMPHISTEGINIDAE

Genus ASTERIGERINA d'Orbigny, 1839

***Asterigerina carinata* d'Orbigny**

Plate 3, figure 3

Asterigerina carinata d'Orbigny, 1839a, p. 118, pl. 5, fig. 25; pl. 6, figs. 1, 2.

Described from sands of Cuba and Jamaica, *Asterigerina carinata* has been commonly reported in the West Indies and Gulf of Mexico. At the Bahamas it is common only near the reef edge.

Genus AMPHISTEGINA d'Orbigny, 1826

***Amphistegina lessonii* d'Orbigny**

Amphistegina lessonii d'Orbigny. Phleger and Parker, 1951, p. 26, pl. 13, figs. 13, 14; pl. 14, fig. 1.

This widely distributed species is represented by only a few worn specimens at South Riding Rock. It has been reported from many localities in the West Indies but appears not to live on the Bank itself but only along the exposed edge of it.

Family ELPHIDIIDAE

Genus ELPHIDIUM Montfort, 1808

***Elphidium advena* (Cushman)**

Plate 3, figure 5

Elphidium advenum (Cushman). Cushman, 1939, p. 60, pl. 16, figs. 31-35.

Elphidium advena was described from the Dry Tortugas, off Florida, and is a cosmopolitan species indigenous to warm shallow water in both the Atlantic and Pacific. It is biconvex and faintly keeled on the periphery with an inconspicuous knob over the umbilicus. It is not very common in our Bahama material.

Elphidium discoidale (d'Orbigny)

Plate 3, figure 9

Elphidium discoidale (d'Orbigny). Cushman, 1939, p. 56, pl. 15, figs. 5-7.

Described from the shore sands of Cuba and Jamaica, *Elphidium discoidale* is known mostly from the West Indies, Gulf of Mexico, and the Atlantic coast of South America. It is not recorded from the Pacific area or European waters and is not known as far north as New England in this hemisphere. It is a large species with a raised umbilical area; its robust test has a glassy surface with distinct pores. This is the most abundant species of *Elphidium* on the Bahama Bank.

Elphidium mexicanum Kornfeld

Plate 3, figure 4

Elphidium incertum (Williamson) var. *mexicanum* Kornfeld, 1931, p. 89, pl. 16, figs. 1, 2.

This species is recorded mostly from the Gulf of Mexico where it was described from coastal sediments of Texas and Louisiana. It is also known from the Atlantic coast of southeastern United States. The test is small and flat, has a rounded periphery and consists of 10-11 chambers. It has a milky wall with very fine pores, and there is a small, but distinct, umbilical knob.

Elphidium mexicanum is fairly well distributed on the Bahama Banks but is not abundant.

Elphidium morenoi Bermudez

Plate 3, figure 6

Elphidium morenoi Bermudez, 1935, p. 188, pl. 13, figs. 7-9.

Elphidium morenoi was described from the north coast of Cuba. In our Bahama material it is restricted to the nearshore samples where it occurs commonly. Its raised and beaded sutures give the test a rugged appearance. It consists of 10-12 chambers and has a rounded periphery.

Elphidium poeyanum (d'Orbigny)

Plate 3, figure 8

Elphidium poeyanum (d'Orbigny). Cushman, 1939, p. 54, pl. 14, figs. 25, 26.

Elphidium poeyanum was described from shore sands of Cuba and Jamaica. It has been widely reported in the West Indian region but only rarely elsewhere.

E. translucens Natland from off California is similar and may possibly be the same, but it has a more exca-

vated and depressed umbilicus and the wall is more nearly transparent. Both species have inconspicuous pores. *E. poeyanum* has about 11 chambers and is flat and only slightly lobulated. It is larger than *E. mexicanum* and *E. advena* and lacks any knobs.

It occurs commonly to abundantly at the Bahamas.

Elphidium sagra (d'Orbigny)

Plate 3, figure 7

Elphidium sagram (d'Orbigny). Cushman, 1939, p. 55, pl. 15, figs. 1-3.

This species was also described from the shore sands of Cuba and has been recorded elsewhere in the West Indies and off South America.

It occurs rarely and is smaller than normal in the Bahamas. The test is thick through the center, angled on the periphery, and has an expanding apertural face. The prominent retral processes appear as spiral costae. *Elphidium sagra* is characterized by its bulging apertural face as contrasted with the low apertural face of *E. lanieri* (d'Orbigny).

Family CYMBALOPORIDAE**Genus CYMBALOPORETTA Cushman, 1928*****Cymbaloporetta bradyi* (Cushman)***Cymbaloporetta bradyi* (Cushman). Todd and Bronnimann, 1957, p. 37, pl. 11, fig. 9.

The Bahama specimens of this cosmopolitan species are all small, incipient forms, but they do have a cavernous ventral side. We have very few in scattered samples.

Genus TRETOMPHALUS Moebius, 1880***Tretomphalus bulloides* (d'Orbigny)***Tretomphalus bulloides* (d'Orbigny). Cushman, 1934, p. 86, pl. 11, figs. 1, 2; pl. 12, fig. 6.

We found a single typical specimen with a float chamber in the bottom of the core taken at station D8. The species was described from shore sands of Cuba and Haiti.

Family ANOMALINIDAE**Genus CIBICIDES Montfort, 1808*****Cibicides lobatulus* (Walker and Jacob)***Cibicides lobatula* (Walker and Jacob). Cushman, 1931b, p. 118, pl. 21, fig. 3.

This well-known cosmopolitan species is rare at the Bahamas, being found only in samples from the outer edge and at one central reef station.

Family **PLANORBULINIDAE**Genus **PLANORBULINA** d'Orbigny, 1826*Planorbulina acervalis* Brady*Planorbulina acervalis* Brady. Cushman, 1931b, p. 130, pl. 25, fig. 1.

This widely recorded species is rare in our Bahama material. With the closely related species *Acer vulina inhaerens* Schultze, it is restricted to two stations, A2 and D8, near the outer edge of the Bank.

Genus **ACERVULINA** Schultze, 1854*Acer vulina inhaerens* Schultze*Acer vulina inhaerens* Schultze. Cushman, Todd, and Post, 1954, p. 372, pl. 91, figs. 37, 38.

This is a cosmopolitan species in warm shallow water. It is rare at the Bahamas being found only at the two outermost stations.

Family **NONIONIDAE**Genus **FLORILUS** Montfort, 1808*Florilus* cf. *F. sloanii* (d'Orbigny)

Two single specimens were found which resemble the species cited as *Nonion sloanii* (d'Orbigny) by Cushman (1930, p. 9, pl. 3, figs. 6-8). Our specimens are not typical, being less elongate, flatter, and having only seven chambers. It was described from off Cuba and Jamaica.

Genus **PSEUDONONION** Asano, 1936*Pseudononion grateloupi* (d'Orbigny)

Nonionina grateloupi d'Orbigny, 1839a, p. 46, pl. 6, figs. 6, 7.
Nonion grateloupi (d'Orbigny). Cushman, 1930, p. 10, pl. 3, figs. 9-11; pl. 4, figs. 1-4.
Pseudononion grateloupi (d'Orbigny). Andersen, 1961, p. 84, pl. 18, fig. 3.

Pseudononion grateloupi was described from shore sands of Cuba, Jamaica, and Martinique and is a widespread species in the Atlantic and Pacific. It is a more flattened species than *P. atlanticum* (Cushman) and is also flatter than the specimens we are referring to *Florilus sloanii* (d'Orbigny). The rare occurrences are widely scattered on the Bahama Bank.

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| | | <i>rubrum</i> , <i>Homotrema</i> | 6 | <i>Spirillina</i> | 4, 6, 13 |

PLATES 1-3

Contact photographs of the plates in this report are available, at cost, from U.S. Geological
Survey Library, Federal Center, Denver, Colorado 80225

PLATE 1

[Fig. 8, $\times 25$; fig. 7, $\times 40$; all others, $\times 50$]

- FIGURE 1. *Articulina mucronata* (d'Orbigny) (p. C10).
USNM 688522; core A2, 49.5–50 cm.
2. *Articulina mexicana* Cushman (p. C10).
USNM 688521; core A2, 49.5–50 cm.
3. *Cribrbulimina polystoma* (Parker and Jones) (p. C8).
USNM 688554; core E9, about middle.
4. *Valvulina oviedoiana* d'Orbigny (p. C7).
USNM 688534; core B6, 9.5–10 cm; a, side view; b, top view.
5. *Archaias angulatus* (Fichtel and Moll) (p. C12).
USNM 688547; core D7, 9.5–10 cm.
6. *Clavulina angularis* d'Orbigny (p. C7).
USNM 688549; core E7, 9.5–10 cm.
7. *Quinqueloculina (Dentostomina) agglutinans* d'Orbigny (p. C9).
USNM 688530; core A11, 29.5–30 cm.
8. *Cyclorbiculina compressa* (d'Orbigny) (p. C12).
USNM 688546; core D7, 9.5–10 cm.
9. *Articulina sagra* d'Orbigny (p. C10).
USNM 688553; core E8, 9.5–10 cm.
10. *Peneroplis proteus* d'Orbigny (p. C11).
USNM 688545; core D7, 9.5–10 cm.



HOLOCENE BENTHONIC FORAMINIFERA FROM BAHAMA BANK

PLATE 2

[Figs. 2, 10, 11, 14, $\times 45$; all others, $\times 90$. Specimens illustrated in figs 1, 2, 4, 5, 7, 9, 10, 12, and 15 were stained green to facilitate photographing them]

- FIGURE 1. *Clavulina nodosaria* d'Orbigny (p. C7).
USNM 688529; core A11, 29.5–30 cm.
2. *Triloculina reticulata* d'Orbigny (p. C10).
USNM 688527; core A10, 9.5–10 cm.
3. *Quinqueloculina goesi* Todd and Bronnimann (p. C8).
USNM 688525; core A7, 9.5–10 cm.
4. *Quinqueloculina poeyana* d'Orbigny (p. C8).
USNM 688535; core B6, 89.5–90 cm.
5. *Quinqueloculina polygona* d'Orbigny (p. C8).
USNM 688548; core D8, 9.5–10 cm.
6. *Triloculina fiterrei meningoi* Acosta (p. C9).
USNM 688543; core D6, top.
7. *Biloculinella eburnea* (d'Orbigny) (p. C11).
USNM 688531; core A11, 109.5–110 cm.
8. *Triloculina bassensis* Parr (p. C9).
USNM 688544; core D6, top.
9. *Triloculina schreiberiana* d'Orbigny (p. C10).
USNM 688528; core A10, 9.5–10 cm.
10. *Quinqueloculina lamarckiana* d'Orbigny (p. C8).
USNM 688550; core E8, 9.5–10 cm.
11. *Quinqueloculina torrei* Acosta (p. C9).
USNM 688551; core E8, 9.5–10 cm; a, side view;
b, top view.
12. *Peneroplis bradyi* Cushman (p. C11).
USNM 688524; core A4, 79.5–80 cm.
13. *Buliminella milletti* Cushman (p. C12).
USNM 688526; core A9, 99.5–100 cm.
14. *Triloculina sidebottomi* (Martinotti) (p. C10).
USNM 688539; core C3, surface.
15. *Triloculina linneiana* d'Orbigny (p. C9).
USNM 688552; core E8, 9.5–10 cm.
16. *Rotorbinella mira* (Cushman) (p. C14).
USNM 688540; core C1, 9.5–10 cm; a, dorsal view;
b, ventral view; c, peripheral view.

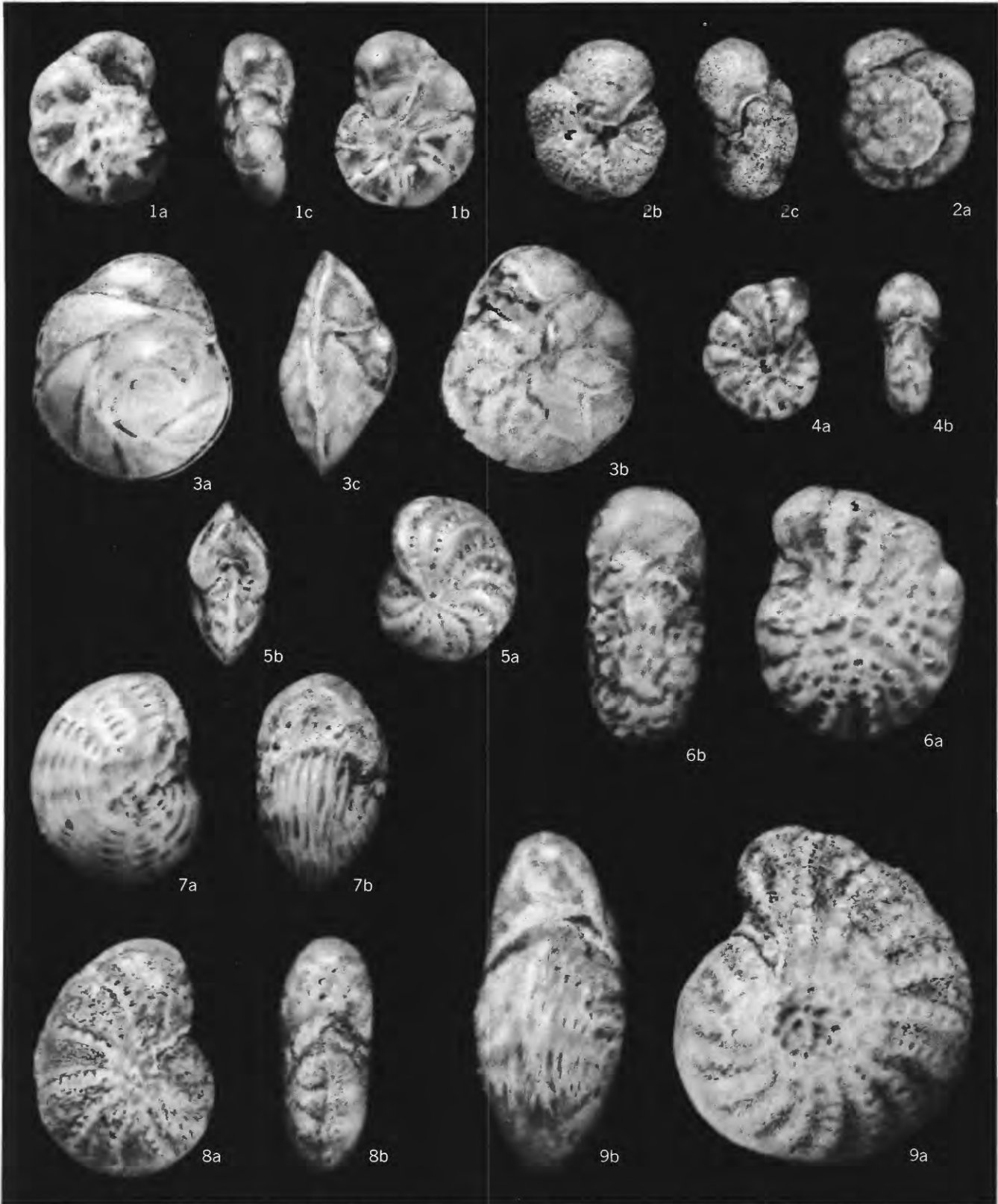


HOLOCENE BENTHONIC FORAMINIFERA FROM BAHAMA BANK

PLATE 3

[All figures $\times 90$. Specimens illustrated in figs. 4 and 5 were stained green to facilitate photographing them]

- FIGURE 1. *Helenina anderseni* (Warren) (p. C15).
USNM 688532; core A11, 109.5–110 cm; *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
2. *Rosalina bahamaensis* Todd and Low, n. sp (p. C14).
Holotype, USNM 688523; core A2, 109.5–110 cm; *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
3. *Asterigerina carinata* d'Orbigny (p. C15).
USNM 688520; core A2, 9.5–10 cm; *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
4. *Elphidium mexicanum* Kornfeld (p. C16).
USNM 688537; core B6, 89.5–90 cm; *a*, side view; *b*, peripheral view.
5. *Elphidium advena* (Cushman) (p. C15).
USNM 688536; core B6, 89.5–90 cm; *a*, side view; *b*, peripheral view.
6. *Elphidium morenoi* Bermudez (p. C16).
USNM 688533; core A11, 109.5–110 cm; *a*, side view; *b*, peripheral view.
7. *Elphidium sagra* (d'Orbigny) (p. C16).
USNM 688542; core D5, bottom; *a*, side view; *b*, peripheral view.
8. *Elphidium poeyanum* (d'Orbigny) (p. C16).
USNM 688541; core C1, 9.5–10 cm; *a*, side view; *b*, peripheral view.
9. *Elphidium discoidale* (d'Orbigny) (p. C16).
USNM 688538; core B7, 29.5–30 cm; *a*, side view; *b*, peripheral view.



HOLOCENE BENTHONIC FORAMINIFERA FROM BAHAMA BANK

