

FLORIDA STATE GEOLOGICAL SURVEY

HERMAN GUNTER, *State Geologist*

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BULLETIN No. 4

THE FORAMINIFERA OF THE CHOCTAWHATCHEE FORMATION OF FLORIDA

By

JOSEPH A. CUSHMAN
SHARON, MASS.

TALLAHASSEE, FLORIDA
1930

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LETTER OF TRANSMITTAL

*To His Excellency, Hon. Doyle E. Carlton,
Governor of Florida.*

SIR:

I have the honor to submit herewith for publication as Bulletin No. 4, of the Florida State Geological Survey, a report entitled "The Foraminifera of the Choctawhatchee Formation of Florida" by Dr. Joseph A. Cushman, of Sharon, Mass. The importance of these microscopic fossils is becoming more appreciated, especially by oil geologists, and it is the intention of the Survey to issue from time to time reports similar to this dealing with the other formations of the State.

Respectfully,

HERMAN GUNTER,
State Geologist.

Tallahassee, Florida,
January 1, 1930.

9181- from Dept. of State 6/4/37

THE FORAMINIFERA OF THE CHOCTAWHATCHEE FORMATION OF FLORIDA

JOSEPH A. CUSHMAN

The Choctawhatchee formation has numerous foraminifera, and in some parts a rich fauna. For general information in regard to the formation as it occurs in Florida, one should consult the report by Cooke and Mossom (Florida Geological Survey, 20th Annual Report, pp. 138-149). Dr. W. C. Mansfield who collected much of the material used in the present report, recognizes three faunal zones in the Choctawhatchee. Of these, the lowest, known from the vicinity of Red Bay, Walton County, carries a very characteristic foraminiferal fauna. The middle and upper zones are characterized by numerous species of foraminifera not found in the lowest zone, but there are very few species that can be used to separate the two, and these are very rare species, so that it is to be suspected that their occurrence in one or the other zone is due to lack of material rather than a real distinction in the fauna. The relative abundance of certain species which are recorded from all three zones is very striking in one or the other of the zones, and may be used for distinctions not indicated in our table of occurrence.

The two lower zones are characterized by cold or cool water species as is the case with the Mollusca, although the basal zone which carries but few species of Mollusca is one of the richest in foraminifera. The upper zone carries a somewhat warmer water fauna characterized particularly by the development in large numbers at some stations of *Amphistegina lessonii* d'Orbigny, a species of warm shallow waters. These are from Leon and Washington Counties.

One point in regard to the material from Bay County should be noted. There are two lots used in the present paper. That from the R. L. Gainer farm on Econfinia River, about one mile below Econfinia bridge is reported by Mansfield as belonging to the upper zone. The foraminifera of which only twelve species were noted seem to agree with this determination. The other locality in Bay County is from

Bryant Scott's farm, one-quarter mile above mouth of branch entering Econfinia Creek, near bridge at Econfinia. This yielded a richer foraminiferal fauna of eighteen species and varieties, of which but two are common to the two localities, and these both occur in all three zones. The fauna of the second locality is much more closely related to the lowest zone of Walton County than to either of the others.

LOWEST ZONE

This zone exposed in Walton County east of Red Bay and, as noted above, possibly in Bay County, has numerous species and varieties of foraminifera peculiar to it. The following species are not known from the middle and upper zones:

Proteonina difflugiformis (H. B. Brady)	Dentalina, various species
Robulus americanus (Cushman)	Elphidium sagrum (d'Orbigny)
R. americanus, var. spinosus (Cushman)	Bulimina gracilis Cushman, n. sp.
R. catenulatus (Cushman)	Nonion pizarrensis Berry
Saracenaria acutauricularis (d'Orbigny)	Loxostomum gunteri Cushman, n. sp.
	Siphogenerina lamellata Cushman

The following additional species are rarely found in the other zones:

Bolivina marginata Cushman	Bolivina floridana Cushman
----------------------------	----------------------------

Altogether there are more than sixty species and varieties of foraminifera recorded from the lowest bed, all of which are characteristic of cool waters and waters of some considerable depth.

MIDDLE AND UPPER ZONES

As already noted, there are very few species of foraminifera to distinguish these two zones except *Amphistegina lessonii* d'Orbigny which seems to occur only in the upper zone. There are however a number of species which will distinguish the middle and upper zones from the lowest one. Some of the most characteristic of these are given here:

Textularia agglutinans d'Orbigny	Bolivina plicatella Cushman, n. sp.
*T. mayori Cushman	*B. pulchella (d'Orbigny), var.
Quinqueloculina, various species	primitiva Cushman, n. var.
Pseudopolymorphina rutila (Cushman)	*Discorbis mira Cushman
*Nonion grateloupi (d'Orbigny)	D. vilardeboana (d'Orbigny)
Virgulina fusiformis Cushman, n. sp.	D. consobrina (d'Orbigny)
	*D. valvulata (d'Orbigny)

Some of these species indicated by an asterisk are found in fairly warm waters off the coast of Florida today. All these are most common in the upper zone.

RELATIONSHIPS OF THE FAUNA

The relationships of the fauna are interesting. There are numerous species not known elsewhere or at least only in the Miocene of adjoining regions of the Gulf Coastal Plain of the United States, although they have closely allied species elsewhere. Some of these such as *Pseudarcella arenata* and *Virgulina gunteri* have their nearest relatives in the Miocene or Uppermost Oligocene of Europe. There are other species which seem identical with species found in the Miocene of the Gatun formation of the Panama Canal Zone, the Miocene of Cuba, and of Santo Domingo. Other species are identical or closely allied to species of the Miocene or Pliocene of the California region.

Of the species which are still living, those of the upper bed particularly, are represented in the waters of the present coast of Florida or the West Indies. There are other species which are known at the present time only from the Western coast of South America or extending up the Southern coast of North America. These species apparently died out in the Miocene in the Western Atlantic, and have persisted only in the Pacific or else migrated to the Pacific at that time.

A table is given showing the distribution by stations, numbered to correspond with the list which follows (pp. 13-14). Nearly all the species and varieties are figured to make the work of the most possible use to those working with the fauna. My thanks are due to Miss Margaret S. Moore for her care in the drawing of the specimens for the plates, and to Miss Alice E. Cushman for painstaking work with the manuscript.

References are given to other works where complete references to the literature of the species may be found and only references to such works as may be needful are given here. The Choctawhatchee fauna was described in an earlier report (Cushman, Bull. 676, U. S. Geol. Survey, 1918), but the known fauna has been greatly enlarged by the study of this later material, and the newer classification is here used. References to the earlier work are given so that material named from the previous paper may be brought up to date.

My thanks are due to Mr. Herman Gunter, State Geologist of Florida, for his aid and co-operation in the preparation of this work, and to Dr. W. C. Mansfield of the U. S. National Museum for supplying most of the material on which the present paper is based. The holotypes are to be deposited in the collection of the U. S. National Museum, and paratypes of new species and duplicates of other species in the collections of the Cushman Laboratory at Sharon, Massachusetts and the Florida State Geological Survey at Tallahassee, Florida.

DISTRIBUTION OF THE FORAMINIFERA OF THE CHOCTAWHATCHEE FORMATION

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FLORIDA GEOLOGICAL SURVEY—BULLETIN FOUR.

SPECIES OF FORAMINIFERA	Bay County		Calhoun County		Leon County					Liberty County					Walton County					Washington County		
	953	682	954	960	946	964	965	966	967	670	956	958	961	962	671	673	947	948	950	422	706	955
<i>Proteonina difflugiformis</i>															+	+						
<i>Urnulina compressa</i>					+																	
<i>Pseudarcella arenata</i>	+							+							+	+						
<i>Textularia agglutinans</i>			+	+			+		+		+	+	+									
<i>Textularia gramen</i>							+	+	+				+	+	+	+	+	+	+			
<i>Textularia mayori</i>	+				+				+			+	+									
<i>Textularia floridana</i>																						
<i>Bigenerina nodosaria</i> , var. <i>textularioidea</i>					+																	
<i>Quinqueloculina</i> cf. <i>fusca</i>						+								+								
<i>Quinqueloculina</i> <i>seminula</i>								+	+				+	+								+
<i>Quinqueloculina</i> <i>lamareckiana</i>									+													
<i>Quinqueloculina</i> <i>contorta</i>														+								
<i>Quinqueloculina</i> <i>subpoezana</i>																						+
<i>Spiroloculina</i> <i>planulata</i>									+													
<i>Sigmoilina</i> <i>tenuis</i>				+			+										+					
<i>Sigmoilina</i> sp (?)																						+
<i>Cornuspira involvens</i>									+													
<i>Robulus americanus</i>																+	+	+	+			
<i>Robulus americanus</i> , var. <i>spinosisus</i>																		+	+			
<i>Robulus</i> <i>iotus</i>																					+	
<i>Robulus</i> <i>catenulatus</i>																+		+				

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DISTRIBUTION OF THE FORAMINIFERA OF THE CHOCTAWHATCHEE FORMATION—*Continued*

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FLORIDA GEOLOGICAL SURVEY—BULLETIN FOUR.

SPECIES OF FORAMINIFERA	Bay County		Calhoun County		Leon County					Liberty County					Walton County					Washington County		
	953	682	954	960	946	964	965	966	967	670	956	958	961	962	671	673	947	948	950	422	706	955
<i>Nonion grateloupi</i>				+	+	+	+	+	+	+		+	+			+	+	+				+
<i>Nonion pizarrensis</i>					+							+	+			+	+	+				+
<i>Nonion glabella</i>					+							+	+									+
<i>Nonionella auris</i>	+	+	+								+		+	+		+			+			
<i>Elphidium poeyanum</i>					+	+		+				+	+				+		+			
<i>Elphidium incertum</i>			+	+		+	+			+	+	+	+	+					+			
<i>Elphidium sagrum</i>															+		+	+	+			
<i>Elphidium advenum</i>	+			+		+				+		+	+				+	+	+			
<i>Elphidium</i> sp (?)		+																				
<i>Pavonina</i> sp (?)						+																
<i>Plectofrondicularia floridana</i>				+		+											+	+	+			
<i>Buliminella elegantissima</i>		+	+	+	+	+	+			+		+		+		+	+		+			+
<i>Buliminella curta</i>		+														+	+	+				
<i>Bulimina gracilis</i>																+	+	+	+			
<i>Bulimina inflata</i>						+					+						+	+	+			
<i>Virgulina gunteri</i>		+		+			+									+	+	+	+			
<i>Virgulina punctata</i>		+		+						+		+	+				+		+			+
<i>Virgulina fusiformis</i>							+				+											
<i>Bolivina marginata</i>		+		+													+	+	+			
<i>Bolivina marginata</i> , var. <i>multicostata</i>		+														+	+	+	+			
<i>Bolivina floridana</i>		+														+	+	+	+			

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FLORIDA GEOLOGICAL SURVEY—BULLETIN FOUR.

FORAMINIFERAL MATERIAL FROM THE CHOCTAWHATCHEE
FORMATION OF FLORIDA

BAY COUNTY

1/953. On R. L. Gainer farm on Econfinia River, about 1 mile below Econfinia Bridge, sec. 4, T. 1 S., R. 13 W., Bay County, Fla. W. C. Mansfield, collector, Oct. 30, 1925.

1/682. Bryant Scott's farm, $\frac{1}{4}$ mile above mouth of branch entering Econfinia Creek, near bridge at Econfinia, Bay County, Fla. Julia A. Gardner, collector, Nov. 14, 1923.

CALHOUN COUNTY

1/954. Four-mile Creek, half a mile NW. of Clarksville, from lowest bed exposed in the Creek, Calhoun County, Fla. W. C. Mansfield, collector, Nov. 2, 1925.

1/960. Darlings Slide, about $2\frac{1}{2}$ miles, airline, SE. from Clarksville, Calhoun County, Fla. W. C. Mansfield, collector, Nov. 2, 1925.

LEON COUNTY

1/946. SW. $\frac{1}{4}$ sec. 9, T. 1 S., R. 3 W., on Harveys Creek about $1\frac{1}{2}$ miles SE. of road from Tallahassee to Bloxham, Leon County, Fla. W. C. Mansfield, collector, Nov. 14, 1925.

1/964. Sec. 8, T. 1 S., R. 3 W., highest bed exposed in a small stream entering Harveys Creek at an abandoned mill, Leon County, Fla. W. C. Mansfield, collector, Nov. 16, 1925.

1/965. Sec. 8, T. 1 S., R. 3 W., Harveys Creek at abandoned mill, about half a mile above road leading to Bloxham, lowest bed of the Choctawhatchee, overlying Alum Bluff formation, Leon County, Fla. W. C. Mansfield, collector, Oct. 17 and Nov. 15, 1925.

1/966. Double Branch, about 6 miles E. of Jackson? Bridge, sec. 8, T. 1 S., R. 3 W., just above the bridge on road to bridge, Leon County, Fla. W. C. Mansfield, collector, Oct. 17, 1925.

1/967. Lower upper Miocene bed at Jackson Bluff, left bank Ocklocknee River, just above the bridge, Leon County, Fla. W. C. Mansfield, collector, Oct. 16, 1925.

LIBERTY COUNTY

1/670. Alum Bluff, upper bed, Liberty County, Fla. Julia A. Gardner, collector, Dec. 23, 1923.

1/956. Apalachicola River, Alum Bluff, from the *Ecphora* bed of Dall, or lower Choctawhatchee (marl) bed, Liberty County, Fla. W. C. Mansfield and E. C. Bracewell, collectors, Nov. 5, 1925.

1/958. Old Coes Mill, an abandoned mill about $1\frac{1}{2}$ miles NW. of Hosford, Liberty County, Fla. W. C. Mansfield and E. C. Bracewell, collectors, Nov. 6, 1925.

1/961. On Mr. S. D. Johnson's place near Woods, sec. 26, T. 1 S., R. 8 W., Liberty County, Fla. W. C. Mansfield and E. C. Bracewell, collectors, Nov. 7, 1925.

1/962. Cut in road leading to Watson's Landing, Liberty County, Fla. Choctawhatchee marl. W. C. Mansfield and E. C. Bracewell, collectors, Nov. 10, 1925.

WALTON COUNTY

1/671. Red Bay, Jim Kennedy Branch, Walton County, Fla. Julia A. Gardner, collector, Oct. 26, 1923.

1/673. E. Gomillion's place, Red Bay, Walton County, Fla. Julia A. Gardner, collector, Oct. 26, 1923.

1/947. Jim Kennedy Branch, about 1 mile east of Red Bay, from the lowest fossiliferous bed, Walton County, Fla. W. C. Mansfield, collector, Oct. 24, 1925.

1/948. John Anderson farm, $\frac{3}{4}$ miles east of Red Bay, Walton County, Fla. W. C. Mansfield, collector, Oct. 20, 1925.

1/950. From E. Gomillion's place about $\frac{1}{2}$ mile east of Red Bay and about $\frac{1}{5}$ mile from the Gomillion residence, Walton County, Fla. W. C. Mansfield, collector, Oct. 20, 1925.

WASHINGTON COUNTY

1/422. Hamlin Pond, near range line between T. 1 N., R. 13 and 14 W., about 10 miles south of Wausau, Washington County, Fla. C. W. Cooke and Julia A. Gardner, collectors, June 25, 1921.

1/706. Sink at Gully Pond, probably in sec. 14, T. 1 N., R. 14 W., about 10 miles south of Wausau, Washington County, Fla. C. W. Cooke and Julia A. Gardner, collectors, June 25, 1921.

1/955. Gully Sink, T. 2 N., R. 14 (?) W., Washington County, Fla. W. C. Mansfield, collector, Oct. 29, 1925.

The numbers given are those of the U. S. Geological Survey.

DESCRIPTIONS OF SPECIES

Family SACCAMMINIDAE

Subfamily Saccammininae

Genus *PROTEONINA* Williamson, 1858*PROTEONINA DIFFLUGIFORMIS* (H. B. Brady) (?)

Plate 1, figures 1 a, b

Test free, consisting of a single, elongate oval or pyriform chamber with a more or less distinct, tubular neck, usually tapering gradually from the body of the chamber, which is undivided; wall fairly thick, of sand grains of variable size, firmly cemented or in small specimens with an excess of cement and fairly smooth; aperture circular, simple, terminal.

Length of figured specimen 0.25 mm.; breadth 0.15 mm.; thickness 0.10 mm.

This species seems to be rare in the material examined although it is easily overlooked on account of its small size and indistinct appearance in the general material. The specimen is compressed, but as the apertural end is broken the compression may be secondary.

The only specimens are from E. Gomillion's place, Red Bay, Walton County, and from Jim Kennedy Branch, also near Red Bay.

Genus *URNULINA* Gruber, 1884*URNULINA COMPRESSA* Cushman, n. sp.

Plate 1, figures 2 a, b

Test free, small, compressed, slightly longer than broad, greatest width at about the middle, basal end somewhat angular, apertural end broadly rounded; wall of a single layer of sand grains firmly cemented; aperture large, rounded, slightly at one side of the axis of the test.

Length 0.25 mm.; breadth 0.20 mm.; thickness 0.12 mm.

Holotype—(Cat. No. 371068, U.S.N.M.). From Choctawhatchee marl, on Harveys Creek about 1½ miles S. E. of road from Tallahassee to Bloxham, Leon County, Florida, collected by W. C. Mansfield.

This seems to be the first record of this genus as a fossil. The very large aperture, compressed test and acute basal end in side view should distinguish this species. It is rare in the collection, but is easily overlooked on account of its small size and its color. The only other species of the genus is recorded from the coast of Europe.

Genus *PSEUDARCELLA* Spandel, 1909*PSEUDARCELLA ARENATA* Cushman, n. sp.

Plate 1, figures 3 a, b

Test free, about twice as broad as high, plano-convex in side view, dorsal side strongly convex, ventral side flattened and slightly con-

cave in the middle, circular in outline; wall very thin, composed of distinct sand grains firmly cemented, somewhat chitinous; aperture circular with a simple flattened tooth.

Diameter 0.25-0.30 mm.; height 0.15-0.18 mm.

Holotype—(Cat. No. 371069, U.S.N.M.). From Choctawhatchee marl, of E. Gomillion's place, Red Bay, Walton County, collected by Julia A. Gardner.

Besides the type locality, the species was found in material from Jim Kennedy Branch, Red Bay, Walton County; Double Branch, about 6 miles east of Jackson Bridge, Leon County, and on R. L. Gainer's farm, on Econfinia River, Bay County.

This is a very distinct species of small size and constant in its characters. Specimens are fairly numerous when the material is carefully searched, but it is easily overlooked on a hasty examination.

The genus is known from the Upper Oligocene of Europe at rather widely separated localities of Germany, France and northern Italy. This is the first record for it in the Western Hemisphere, and it should be found in the Miocene to the northward of Florida.

Family TEXTULARIIDAE

Subfamily Textulariinae

Genus TEXTULARIA DeFrance, 1824

TEXTULARIA AGGLUTINANS d'Orbigny

Plate 1, figures 4 *a*, *b*

Textularia agglutinans d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 136, pl. 1, figs. 17, 18, 32, 34.—CUSHMAN, U. S. Geol. Survey, Bull. 676, 1918, p. 46, pl. 9, fig. 6; Bull. 103, U. S. Nat. Mus., 1918, p. 52, pl. 19, fig. 3; Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 7, pl. 1, figs. 4, 5.

Test elongate, tapering, somewhat compressed, the periphery rounded; chambers inflated, increasing in height toward the apertural end; sutures distinct, depressed; wall rather coarsely arenaceous, but smoothly finished on the exterior; aperture an elongate slit in a well-marked depression of the inner border of the chamber.

Length usually less than 1 mm.; breadth 0.25-0.35 mm.; thickness 0.15-0.25 mm.

This species was not noted in the material from about Red Bay, but occurs as noted in the table from several stations in Leon, Liberty, and Calhoun Counties. I have recorded it from the Miocene of Virginia and Maryland, and from the Uppermost Culebra formation of the Panama Canal zone, as well as elsewhere in the Oligocene.

It is a common species in the West Indies in comparatively shallow water.

TEXTULARIA GRAMEN d'Orbigny

Plate 1, figures 5 *a*, *b*

Textularia gramen D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 248, pl. 15, figs. 4, 6.—CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, pp. 8, 45, pl. 9, fig. 5 (not 2, 3 = *T. mayori*).

Test slightly longer than broad, compressed, periphery subacute, sides strongly divergent; chambers distinct, comparatively few, fairly high, the earlier ones strongly overlapping; sutures distinct, slightly depressed; wall finely arenaceous, smoothly finished; aperture elongate, in a definite groove at the base of the inner margin of the last-formed chamber.

Length 0.60-0.75 mm.; breadth 0.35-0.45 mm.; thickness 0.22-0.25 mm.

I have previously recorded this species from the Miocene of Florida in the above reference. Some of the specimens are evidently *Textularia mayori* which in its young stages sometimes resembles *T. gramen*. It is the most common species of the genus in the Florida Miocene, and occurs in Walton, Leon, Liberty and Washington Counties.

TEXTULARIA MAYORI Cushman

Plate 1, figures 6-8

Textularia mayori CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 23, pl. 2, fig. 3; Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 7.

Textularia gramen (in part) CUSHMAN (not d'Orbigny), Bull. 676, U. S. Geol. Survey, 1918, pl. 9, figs. 2, 3 (not fig. 5).

Test compressed, increasing rapidly in breadth, especially in the microspheric form, initial end rounded, apertural end obliquely truncate; chambers often indistinct, periphery of the later chambers each with an elongate, conical, hollow, spinose projection, often broken at the tip, those of the early portion directed backward, the later ones extending outward; sutures only slightly depressed, curved; wall arenaceous, of angular sand-grains with much fine cement, surface smoothly finished; aperture low, elongate, at the inner border of the last-formed chamber, in a reentrant of the border, with a thin lip above.

Length up to 1 mm.; breadth 0.35 mm.; thickness 0.12-0.15 mm.

This species was originally described from recent material collected about the Tortugas. It occurs also along the east coast of Florida. The Miocene specimens are very similar to the living ones but are less accelerated, the early chambers usually being without spines, some of them not developing the spines at all in immature specimens but they can be distinguished by the form and association with mature specimens.

This species is rather common in the Choctawhatchee marl, and I have specimens from Leon, Liberty, Bay and Washington Counties.

TEXTULARIA FLORIDANA Cushman

Plate 1, figures 9 *a*, *b*

Textularia transversaria FLINT (not H. B. Brady), Rep. U. S. Nat. Mus., 1897 (1899), p. 283, pl. 28, fig. 4.

Textularia floridana CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 24, pl. 1, fig. 7; Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 18, pl. 2, figs. 11, 12.

Test elongate, two or three times as long as wide, much compressed, periphery entire or broken, in the adult with the sides nearly parallel, initial end rather sharply pointed, apertural end broadly rounded or truncate; chambers numerous, thickest near the center, increasing somewhat in height toward the apertural end, the peripheral portions thin walled and often broken away; sutures nearly at right angles to the periphery, slightly if at all depressed; wall finely arenaceous, smooth; aperture small, rounded, at the base of the inner margin of the last-formed chamber.

Length of recent specimens nearly 1 mm. Figured specimen 0.40 mm.; breadth 0.20 mm.; thickness 0.10 mm.

While there are numerous records for this species from along the Florida coast and the West Indies, it is very rare in the Miocene. The only specimen is from Gully Sink, Washington County, Florida, collected by W. C. Mansfield.

The specimen has the periphery entire and the peculiar form of the initial end suggests that possibly this species belongs to the group of biserial forms derived from *Gaudryina* by acceleration of development.

Genus BIGENERINA d'Orbigny, 1826

BIGENERINA NODOSARIA d'Orbigny, var. TEXTULARIOIDEA (Goës)

Plate 1, figure 10

Textularia sagittula DEFRANCE, forma *Bigenerina* GOËS, Kongl. Svensk. Vet. Akad. Handl., vol. 19, pt. 4, 1882, p. 78, pl. 5, figs. 159, 160.

Clavulina textularioidea GOËS, l. c., vol. 25, 1894, p. 42, pl. 8, figs. 387-399; Bull. Mus. Comp. Zool., vol. 29, 1896, p. 37, pl. 4, figs. 26-38.

Bigenerina nodosaria FLINT, Rep. U. S. Nat. Mus., 1897 (1899), p. 286, pl. 31, fig. 4.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 51; Publ. 311, Carnegie Instit. Washington, 1922, p. 25, pl. 2, figs. 5, 6.

Bigenerina nodosaria D'ORBIGNY, var. *textularioidea* CUSHMAN, Bull. 103, U. S. Nat. Mus., pt. 3, 1922, p. 25, pl. 5, figs. 8, 9.

Variety differing from the typical form in the larger size and much greater proportion of the uniserial stage and reduction of the biserial portion as well as in the relation of the two, the last-formed chambers of the test often being greater in size than the entire biserial portion.

Length of the fossil specimens slightly less than 1 mm.; diameter 0.20 mm.

Specimens are rare in the Choctawhatchee marl, a few specimens being found on Harveys Creek about 1½ miles S. E. of road from Tallahassee to Bloxham, Leon County, and a single specimen from Gully Sink, Washington County, all collected by W. C. Mansfield.

The few fossil specimens are not as well as developed as the recent ones of the Florida coast and the West Indies, and apparently the greater development of this form in the West Indian region has taken place since the Miocene.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

QUINQUELOCULINA cf. FUSCA H. B. Brady

Plate 1, figures 11, 12

There are a very few small arenaceous specimens which seem best referred to Brady's species. In the waters adjacent to Florida at the present time, *Quinqueloculina fusca* seems to be absent and the common species are *Q. agglutinans* d'Orbigny and *Q. bidentata* d'Orbigny. However, *Q. fusca* occurs on the Pacific coast of America with a fauna related closely to the Choctawhatchee marl of Florida.

QUINQUELOCULINA SEMINULA (Linné)

Plate 2, figures 1, 2

"Conchula minima arcte in se contorta, etc." Plancus, De Conchis min. not., 1739, p. 19, pl. 11, fig. 1 *A, B, C*.

"Tubulus marinus irregulariter intortus vermicularis" Gualtieri, Index Test., 1742, pl. 10, fig. S.

Serpula seminulum LINNAEUS, Syst. Nat., ed. 12, 1767, p. 1264.

Quinqueloculina seminulum d'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 303.—CUSHMAN, Bull. 103, U. S. Nat. Mus., 1918, p. 78, pl. 27, figs. 4 *a, b*; pl. 28, figs. 1-3; pl. 29, figs. 1 *a-e*; Bull. 676, U. S. Geol. Survey, 1918, pp. 22, 70, pl. 1, fig. 8; pl. 28, figs. 2, 4, 5; pl. 29, fig. 1; Bull. 104, U. S. Nat. Mus., 1929, p. 24, pl. 2, figs. 1, 2.

Miliolina seminulum WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 85, pl. 7, figs. 183-185.—H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 157, pl. 5, fig. 6.

Test longer than wide, greatest width near the middle; chambers distinct, of nearly uniform diameter, periphery rounded, sutures distinct, very slightly depressed; wall smooth, polished; aperture large, with a simple tooth.

This species is rare in the Choctawhatchee marl, specimens occurring in very small numbers at but a few stations.

QUINQUELOCULINA LAMARCKIANA d'Orbigny

Plate 2, figures 3-5

Quinqueloculina lamarckiana d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 189, pl. 11, figs. 14, 15.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 65, pl. 15, figs. 13, 14; Publ. 311, Carnegie Inst. Washington, 1922, p. 64; Publ. 342, 1924, p. 63; Publ. 344, 1926, p. 81; Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 26, pl. 2, figs. 6 *a-c*.

Quinqueloculina auberiana d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 193, pl. 12, figs. 1-3.—CUSHMAN, Bull. 103, U. S. Nat. Mus., 1918, p. 79, pl. 29, figs. 3 *a-c*; Bull. 676, U. S. Geol. Survey, 1918, pp. 23, 71, pl. 5, fig. 3; pl. 30, fig. 1.

Quinqueloculina cuvieriana H. B. BRADY (not d'Orbigny), Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 162, pl. 5, figs. 12 *a-c*.

Test nearly as broad as long; chambers distinct, generally triangular in transverse section, the angles subacute but not carinate; sutures slightly depressed; wall smooth and polished; apertural end of chamber slightly extended, forming an elliptical neck without a definite lip, but with a narrow, elongate tooth.

Fossil specimens, length 0.80 mm.; breadth 0.50 mm.; thickness 0.40 mm.

Specimens of this species are rare in the Choctawhatchee marl as are all members of the family.

QUINQUELOCULINA CONTORTA d'Orbigny

Plate 2, figures 6 *a-c*

Quinqueloculina contorta d'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 298, pl. 20, figs. 4-6.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 29, pl. 3, figs. 6 *a-c*.

Miliolina contorta H. B. BRADY, Journ. Roy. Micr. Soc., 1887, p. 881.—HERON-ALLEN and EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 30; Trans. Linn. Soc. London, Zool., vol. 11, 1916, p. 213.

Test somewhat longer than broad; chambers polygonal in transverse section, periphery and sides flattened or slightly concave, angles subacute; sutures distinct, slightly depressed; wall smooth; aperture rounded, slightly projecting, with a simple tooth.

Length of fossil specimens 0.30 mm.; breadth 0.20 mm.; thickness 0.10 mm.

This is a rare species in the Choctawhatchee marl. The species was described by d'Orbigny from the Miocene of the Vienna Basin, and it seems to be still living on the coasts of Europe but not in the West Indian region.

QUINQUELOCULINA SUBPOEYANA Cushman

Plate 2, figures 7 *a*, *b*

Quinqueloculina subpoeyana CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 66; Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 31, pl. 5, figs. 3 *a-c*.

Test elongate, about two and a half times as long as wide; chambers distinct, peripheral border rounded, apertural end projecting; sutures somewhat obscured; wall ornamented by numerous longitudinal costae which, instead of being uniform, are usually irregularly toothed throughout, giving a peculiar roughened appearance to the test; aperture with a thin lip and a single tooth.

Length of figured specimen 0.35 mm.; breadth 0.18 mm.; thickness 0.12 mm.

This is a fairly common species in shallow water in the Florida and general West Indian region, but has not been previously recorded as a fossil. It is very rare in the Choctawhatchee marl.

Genus SPIROLOCULINA d'Orbigny, 1826

SPIROLOCULINA PLANULATA (Lamarck)

Plate 3, figures 1 *a*, *b*

[For complete references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 41.]

Test irregularly elliptical, periphery in the young convex, in the adult becoming flattened or concave; chambers distinct, the initial end projecting considerably beyond the aperture of the previously formed one, the apertural end very slightly, if at all, projecting, side view concave; sutures distinct; surface matt; aperture with a slight lip and an elongate tooth, often slightly bifid at the tip.

Length of figured specimen 0.43 mm.; breadth 0.30 mm.; thickness 0.10 mm.

This is a very rare species in the Florida Miocene, but is found living off the coast.

SPIROLOCULINA DEPRESSA d'Orbigny

Plate 3, figures 2 *a*, *b*

In the earlier Report (Bull. 676, U. S. Geol. Survey, 1918, p. 72, pl. 31, figs. 2 *a*, *b*), this species was recorded from the Choctawhatchee marl at Jackson Bluff as *Spiroloculina limbata* d'Orbigny. A study of topotype material from Castel Arquato, Italy with the original figures of d'Orbigny shows that later authors have greatly mixed these two species.

No further specimens were found from the Florida Miocene.

SPIROLOCULINA sp?

Plate 3, figure 3

There is a single specimen of a peculiarly ornamented species of *Spiroloculina* figured here. It is from the Choctawhatchee marl, Gully Sink, Washington County, Florida. The later chambers are marked by sharp costae.

Genus SIGMOILINA Schlumberger, 1887

SIGMOILINA TENUIS (Czjzek)

Plate 2, figures 8 a-c

Quinqueloculina tenuis CZJZEK, Haidinger's Nat. Abhandl., vol. 2, 1847, p. 149, pl. 13, figs. 31-34.

Sigmoilina tenuis CHASTER, First Rept. Southport Soc. Nat. Sci., 1890-91 (1892), p. 56.—JONES, Foram. Crag, pt. 2, 1895, p. 125, pl. 7, fig. 2.—CUSHMAN, Bull. 103, U. S. Nat. Mus., 1913, p. 81, pl. 31, figs. 4 a-c; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 139.

Sigmoilina elliptica GALLOWAY and WISSLER, Journ. Pal., vol. 1, 1927, p. 39, pl. 7, fig. 2.

Test sigmoid, longer than broad, compressed; chambers narrow, rounded in transverse section, five or six visible on either side; sutures distinct, curved; wall smooth; aperture with a slight neck, rounded.

Length 0.40 mm.; breadth 0.20 mm.; thickness 0.08 mm.

This species is very rare in the Choctawhatchee marl. Bagge has recorded it from the Miocene, Choptank formation, of Pawpaw Point, Maryland as "*Spiroloculina tenuis*." It occurs also in the Miocene, Gatun formation, of the Panama Canal Zone. Czjzek's specimens were from the Miocene of the Vienna Basin, and a study of my own specimens from that area show that our specimens are identical. The original figure is not well drawn although in the adult of some specimens of the Vienna Basin and elsewhere there is a tendency for the last two or three chambers to be formed almost in a single plane. The more normal form is that figured here.

Sigmoilina elliptica described by Galloway and Wissler from the Pleistocene of California is the same, as shown by a comparison of topotype material with the series from the Vienna Basin.

Genus TRILOCULINA d'Orbigny, 1826

TRILOCULINA SCHREIBERIANA d'Orbigny

Plate 3, figures 4 a-c

In the earlier Report (Bull. 676, U. S. Geol. Survey, 1918, p. 71, pl. 30, fig. 4), this species was recorded from Coes Mill, Liberty County. It must be very rare, as no further specimens have been found. A copy of the figure of the specimen from Coes Mill is given here.

TRILOCULINA ASPERULA Cushman

Plate 1, figure 13

Triloculina asperula CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 72, pl. 30, fig. 3.

Test subcircular in side view, chambers tapering toward either end, irregularly roughened, sutures distinct; aperture with a simple tooth. Diameter, 0.25 millimeter.

This species was described from the Choctawhatchee marl at Coes Mill, Liberty County, but no further specimens have been found.

Genus PYRGO Defrance, 1824

PYRGO SUBSPHAERICA (d'Orbigny)

Plate 3, figures 5 a-c

Biloculina subsphaerica D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 162, pl. 8, figs. 25-27.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 73; Publ. 311, Carnegie Instit. Washington, 1922, p. 77; Publ. 344, 1926, p. 83.

Pyrgo subsphaerica CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 68, pl. 18, figs. 1, 2.

Test small, rotund, slightly longer than broad, somewhat broader than thick, chambers rounded, periphery rounded; suture distinct, depressed, in side view showing a sinuous line concave toward the last-formed chamber near the aperture and concave toward the preceding chamber at the opposite end; wall smooth and polished; aperture broadly oval with a somewhat flattened tooth with short lateral extensions at the tip only partially filling the aperture.

Length 0.50 mm.; breadth 0.40 mm.; thickness 0.35 mm.

This species was recorded (Bull. 676, U. S. Geol. Survey, 1918, p. 72, pl. 31, fig. 1), as "*Biloculina bulloides*" from the Choctawhatchee marl of Jackson Bluff, Leon County. It must be very rare, as no further specimens were found.

Family OPTHALMIDIIDAE

Subfamily Cornuspirinae

Genus CORNUSPIRA Schultze, 1854

CORNUSPIRA INVOLVENS (Reuss)

Plate 3, figure 6

Operculina involvens REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 370, pl. 46, fig. 30.

Cornuspira involvens REUSS, Sitz. Akad. Wiss. Wien, vol. 48, Abt. 1, 1863, p. 39, pl. 1, fig. 2. [For complete references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 80.]

Test nearly circular in side view, consisting of a proloculum and a long, closely coiled, planispiral, second chamber of nearly equal diameter throughout, slightly involute; suture distinct, somewhat

depressed; wall smooth and polished, occasionally showing slight lines of growth; aperture nearly the size of the open end of the tube.

The single specimen found is evidently a young stage. It is from the lower Upper Miocene bed at Jackson Bluff, left bank of Ocklocknee River, just above the bridge, Leon County, collected by W. C. Mansfield.

The species is a common one in warm shallow water.

Family LAGENIDAE

Subfamily Nodosariinae

Genus ROBULUS Montfort, 1808

ROBULUS AMERICANUS (Cushman)

Plate 3, figures 7 a, b

Cristellaria americana CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 50, pl. 10, figs. 5, 6.

Test closely coiled, biconvex, slightly keeled, composed of but six or seven chambers in the last-formed whorl; sutures raised and ending in a raised umbonal area, surface otherwise smooth; aperture radiate with the median ventral slit enlarged and prolonged into the apertural face.

Diameter up to 1.50 mm.; thickness up to 0.75 mm.

This species was previously recorded from the Choctawhatchee marl, 1 mile south of Red Bay, Walton County. In the later collections, it has been found on John Anderson's farm, $\frac{3}{4}$ mile east of Red Bay; Jim Kennedy Branch, 1 mile east of Red Bay and E. Gomillion's place, $\frac{1}{2}$ mile east of Red Bay, all in Walton County. It seems to be confined in Florida to this particular phase of the Choctawhatchee marl where it is often frequent.

The species may be distinguished by its closely coiled form with comparatively few chambers, the raised costae, and the raised umbonal area.

ROBULUS AMERICANUS (Cushman), var. SPINOSUS (Cushman)

Plate 3, figures 8 a, b

Cristellaria americana CUSHMAN, var. *spinosa* CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 51, pl. 10, fig. 7.

Variety differing from the typical form by the addition of species on the peripheral margin opposite the ends of the sutures.

The type specimens of this variety are from the Choctawhatchee marl, 1 mile south of Red Bay, Walton County. The variety has been found with the typical form on the John Anderson farm, $\frac{3}{4}$ mile east of Red Bay and E. Gomillion's place $\frac{1}{2}$ mile east of Red Bay,

Walton County, but not in the other counties from which material was obtained. This variety with the typical form should be good markers for this phase of the Choctawhatchee marl.

ROBULUS IOTUS (Cushman)

Plate 4, figures 1 a, b

Cristellaria cultrata H. B. BRADY (not Montfort), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 550, pl. 70, figs. 4-6.

Cristellaria iota CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 111, pl. 29, fig. 2; pl. 30, fig. 1.

Test close-coiled, compressed, umbonate, the periphery with a thin, broad keel, nearly transparent, ten to fifteen chambers in the last-formed coil in the adult, narrow; sutures slightly curved, slightly limbate, but not raised above the general surface, umbonal region occupied by a large, thickened, transparent knob; wall smooth, thin; aperture radiate, at the peripheral angle of the test with the ventral slit continued in to the apertural face.

Diameter of Florida specimens up to 1.5 mm.

The only specimens are from Sink at Gully Pond, about 10 miles south of Wausau, Washington County, collected by C. W. Cooke and Julia A. Gardner.

The keel is not as strongly developed as in many recent specimens, but this character is a variable one.

ROBULUS FLORIDANUS (Cushman)

Plate 4, figures 2 a, b

Cristellaria floridana CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 51, pl. 11, fig. 1.

Test elongate, crosier-form, early portion closely coiled, later chambers becoming uncoiled and more elongate, test comparatively thick in front view, peripheral margin rounded; wall smooth, except for slight raised areas above the sutures, which are otherwise indistinct; aperture peripheral.

Length 2 mm.; breadth 1.20 mm.; thickness 0.50 mm.

The type of this species is from the Choctawhatchee marl, 1 mile south of Red Bay, Walton County.

No additional specimens were found in the further search of material from this area showing that it is a very rare form.

ROBULUS CATENULATUS (Cushman)

Plate 4, figures 3 a, b

Cristellaria catenulata CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 51, pl. 11, fig. 2.

Test comparatively large, compressed, oval, composed of numerous chambers, ten or more in the last-formed coil, peripheral margin

narrowed but rounded, the area above the sutures with broad, raised ribs curving toward the umbilical region, the inner ends often terminating in rounded knobs or the whole suture with a row of bead-like prominences; aperture radiate, slightly projecting.

Diameter of type 2 mm.

This species was described from the Choctawhatchee marl from 1 mile south of Red Bay, Walton County. There are a few specimens, one of which is figured, and which may be this same species from E. Gomillion's place, Red Bay, Walton County, collected by Julia A. Gardner. This, like other related species, is probably very variable in its surface characters. It strongly resembles *Robulus vaughani* Cushman from the Miocene of the Panama Canal Zone and the two may be found to be one species.

Genus PLANULARIA DeFrance, 1824

PLANULARIA sp?

Plate 4, figures 6 a, b

This species is represented by too few specimens to be sure of its full characters. It has the sutures raised and is tricarinate at the periphery but is not the same in side view as *P. tricarinella* H. B. Brady.

The specimens are from the John Anderson farm, $\frac{3}{4}$ mile east of Red Bay, Walton County, collected by W. C. Mansfield.

PLANULARIA sp?

Plate 4, figures 4 a, b, 5

The two megalospheric specimens figured are evidently very young stages of a species different from the above. There is so little material that any specific determination must await the finding of additional and especially adult specimens.

The figured specimens are from Gully Sink, Wasington County.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA sp?

Plate 4, figures 7 a, b

Owing to the variability of different species of *Marginulina*, it seems very unwise to assign specific names to this and the following species which are represented by only one or two specimens each.

This figured specimen is from a cut in the road leading to Watson's Landing, Liberty County, collected by W. C. Mansfield and E. C. Bracewell.

MARGINULINA sp?

Plate 4, figures 8 *a, b*

The figured specimen is from the lower bed at Alum Bluff, Apalachicola River, Liberty County, collected by W. C. Mansfield and E. C. Bracewell.

MARGINULINA sp?

Plate 4, figures 9 *a, b*

The figured specimen is from the lowest fossiliferous bed on Jim Kennedy Branch, about 1 mile east of Red Bay, Walton County, collected by W. C. Mansfield.

Genus SARACENARIA DeFrance, 1824

SARACENARIA ACUTAURICULARIS (Fichtel and Moll)

Plate 4, figures 10 *a, b*

"*Hammoniae subrotundae*" SOLDANI, Testaceographia, vol. 1, pt. 1, 1789, p. 61, pl. 49, fig. X.

Nautilus acutauricularis FITCHELL and MOLL, Test. Micr., 1803, p. 102, pl. 18, figs. *g-i*.

Cristellaria acutauricularis PARKER and JONES, Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 114.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 543, pl. 114, figs. 17 *a, b*.

Test elongate, the adult triangular in transverse section, somewhat uncoiling, periphery acute, apertural face broad, slightly convex; chambers few, distinct; sutures distinct, very slightly depressed; wall smooth; aperture radiate.

Length of figured specimen 0.70 mm.

The only specimen is from the lowest fossiliferous bed on Jim Kennedy Branch, about 1 mile east of Red Bay, Walton County.

Genus DENTALINA d'Orbigny, 1826

DENTALINA COMMUNIS d'Orbigny

Plate 5, figure 1

Nodosaria (Dentalina) communis D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 254, No. 35.

Nodosaria communis REUSS, Verstein, Böhm. Kreide, pt. 1, 1845, p. 28, pl. 12, fig. 21. [For further references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 75.]

Test elongate, slender, slightly tapering, slightly curved, composed of several chambers, those toward the apertural end inflated; sutures depressed, those toward the initial end less distinct, more or less oblique; wall smooth; aperture radiate, excentric.

Length up to 3 mm.

I have already recorded this species from the Choctawhatchee marl from 1 mile south of Red Bay, Walton County (Bull. 676, U. S. Geol. Survey, 1918, p. 50, pl. 10, fig. 8). In the more recent collections, it has occurred in some numbers at the following localities: Jim Kennedy Branch, 1 mile east of Red Bay; John Anderson's farm, $\frac{3}{4}$ mile east of Red Bay; and E. Gomillion's place, $\frac{1}{2}$ mile east of Red Bay. Like *Robulus americanus*, it is a good marker for this particular portion of the Miocene, as it was not found elsewhere in other counties of Florida. It occurs in the Miocene, Gatun formation, of the Panama Canal Zone.

DENTALINA CONSOBRINA d'Orbigny, var. EMACIATA Reuss

Plate 5, figure 2

Dentalina emaciata REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 63, pl. 3, fig. 9.

Nodosaria (Dentalina) consobrina, var. *emaciata* REUSS, Denkschr. Akad. Wiss. Wien, vol. 25, 1865, p. 132, pl. 2, figs. 12, 13.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 502, pl. 62, figs. 25, 26.—FLINT, Rep. U. S. Nat. Mus., 1897 (1899), p. 310, pl. 56, fig. 1.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 56, pl. 27, fig. 9; Bull. 104, pt. 4, 1923, p. 78, pl. 13, figs. 3-5.

Test elongate, tapering, often with a spine at the apical end, slightly curved; composed of numerous chambers, short and cylindrical in the early portion but becoming longer and more inflated in the later portion; sutures not depressed in the early portion, more so later; wall smooth; aperture radiate, slightly excentric.

The only specimen in the collection is that figured. It is somewhat broken but seems best placed under this variety. It is from the lowest fossiliferous bed on Jim Kennedy Branch, about 1 mile east of Red Bay, Walton County, collected by W. C. Mansfield.

DENTALINA sp. (?)

Plate 5, figure 3

The figured fragment was found with the above specimen, and may possibly represent the adult chambers or may belong to some other species. It is figured for the record.

Genus NODOSARIA Lamarck, 1812

NODOSARIA CATESBYI d'Orbigny

Plate 5, figure 4

Nodosaria Catesbyi d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 16, pl. 11, figs. 8-10.

Test composed of two chambers, the proloculum subglobular, with a short basal spine, the second chamber more pyriform, apertural end somewhat prolonged; suture distinct and depressed; wall ornamented

with numerous, very distinct costae which extend the entire length of the two chambers to the aperture.

Length 0.45 mm.; diameter 0.17 mm.

A number of specimens of this species very close indeed to the original figured by d'Orbigny from the West Indies were found in the material from Calhoun, Liberty and Leon Counties. None of the specimens have more than two chambers, and all the characters are identical with those figured by d'Orbigny. They are from Darlings Slide, about $2\frac{1}{2}$ miles, airline, southeast from Clarksville, Calhoun County; from Mr. S. D. Johnson's place near Woods, Sec. 26, T. 1 S., R. 8 W., Liberty County, and from lowest bed, Harvey's Creek, at abandoned mill, Sec. 8, T. 1 S., R. 3 W., Leon County.

Subfamily Lageninae

Genus LAGENA Walker and Jacob, 1798

LAGENA PERLUCIDA (Montagu)

Plate 5, figure 5

Vermiculum perlucidum MONTAGU, Test. Brit., 1803, p. 525, pl. 14, fig. 3.

Lagena perlucida BROWN, Illust. Conch. Great Britain, 1827, fly leaf, pl. 1, fig. 29; ed. 2, 1844, p. 3, pl. 56, fig. 29.—SCHLUMBERGER, Feuille des Jeunes Nat., ann. 13, 1882, pl. 1, fig. 2.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 46, pl. 8, figs. 12, 13.

Lagena vulgaris WILLIAMSON, var. *perlucida* WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 5, pl. 1, figs. 7, 8.

Test somewhat pyriform, elongate, broadest near the base, the apertural end continued into an elongate, cylindrical, slender neck, often with a slight lip, the opposite portion of the test with a few, fine, longitudinal costae, extending part way up the body of the test; surface otherwise smooth.

Length up to 0.35 mm.; diameter 0.10 mm.

Specimens occurred in collections from Walton, Liberty, Leon, Bay, and Washington Counties. There is a considerable amount of variation in the shape of the test which may be regularly and symmetrically pyriform, or of the shape figured here or even with the basal end flattened instead of rounded.

LAGENA CLAVATA (d'Orbigny)

Plate 5, figures 6 a, b

Oolina clavata d'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 24, pl. 1, fig. 2.

Lagena clavata MACKIE, Recreative Science, vol. 1, 1859, p. 148, fig. 13. [For complete references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 10.]

Test elongate, clavate or fusiform with a long neck at the oral end and basal end rounded, usually with a spinose projection, transverse

section circular; wall smooth, thin and transparent; aperture with a definite phialine lip.

Length of figured specimen 0.30 mm.; diameter 0.15 mm.

There are rare specimens showing almost no variation from Walton, Liberty and Calhoun Counties. It has recently been recorded from the Pliocene of California (Contr. Cushman Lab. Foram. Res., vol. 5, pt. 3, 1929, p. 68, pl. 11, fig. 3).

LAGENA HEXAGONA (Williamson)

Plate 5, figures 11 *a*, *b*

Entosolenia squamosa MONTAGU, var. *hexagona* WILLIAMSON, Ann. Mag. Nat. Hist., ser. 2, vol. 1, 1848, p. 20, pl. 2, fig. 23; Rec. Foram. Great Britain, 1858, p. 13, pl. 1, fig. 31.

Lagena hexagona SIDDALL, Cat. Brit. Rec. Foram., 1879, p. 6. [For complete references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 24.]

Test pyriform, base semicircular, apertural end somewhat drawn out, with a short neck; surface ornamented by rather regular, hexagonal reticulations.

Length up to 0.30 mm.

This species is very rare in the collections, while the following variety is common. Single specimens occur at Jim Kennedy Branch, 1 mile east of Red Bay, Walton County and Gully Sink, T. 2 N., R. 14 W., Washington County.

The reticulations are not in lines, and are smaller than those of the variety.

LAGENA HEXAGONA (Williamson), var. SCALARIFORMIS (Williamson)

Plate 5, figures 7 *a*, *b*

Entosolenia squamosa (MONTAGU), var. *scalariformis* WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 13, pl. 1, fig. 30.

Lagena scalariformis REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), p. 333, pl. 5, figs. 69-71.

Lagena hexagona (WILLIAMSON), var. *scalariformis* CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 17, pl. 6, fig. 4; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 145; Contr. Cushman Lab. Foram. Res., vol. 5, pt. 3, 1929, p. 72, pl. 11, fig. 17.

Test subglobular, surface ornamentation of a generally reticulate pattern, the sides of the reticulations often thickened, forming costae, the top and bottom borders usually less conspicuous; aperture without a neck or lip, slightly protruding.

Length 0.25 mm.; diameter 0.18 mm.

This is one of the commonest forms of the genus in the Choctawhatchee marl occurring in material from Bay, Calhoun, Leon, Liberty, and Washington Counties, but strangely there are no specimens from Walton County, where the typical form occurs.

LAGENA SULCATA (Walker and Jacob)

Plate 5, figure 10

"*Serpula* (*Lagena*) *striata sulcata rotundata*" WALKER and BOYS, Test. Min., 1784, p. 2, pl. 1, fig. 6.

Serpula (*Lagena*) *sulcata* WALKER and JACOB, Adams' Essays, Kanmacher's ed., 1798, p. 634, pl. 14, fig. 5.

Lagena sulcata PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 351.

Test typically subglobose, slightly longer than broad; wall with numerous, rather coarse, longitudinal costae, neck elongate with a definite, phialine lip.

Length of figured specimen 0.27 mm.; diameter 0.18 mm.

This species is rare in the Choctawhatchee marl. Single specimens are from Darlings Slide about $2\frac{1}{2}$ miles, airline, southeast from Clarksville, Calhoun County, and from the lower bed at Alum Bluff, Apalachicola River, Liberty County.

LAGENA SUBSTRIATA Williamson

Plate 5, figure 14

Lagena substriata WILLIAMSON, Ann. Mag. Nat. Hist., ser. 2, vol. 1, 1848, p. 15, pl. 1, fig. 12.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 56, pl. 10, fig. 11; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 145; Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 68, pl. 11, fig. 4.

Lagena vulgaris WILLIAMSON, var. *substriata* WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 7, pl. 1, fig. 14.

Test elongate, body of the test longer than broad, basal end rounded, apertural end tapering into an elongate neck; wall ornamented with numerous, fine, longitudinal costae, continuous from the base of the chamber to the neck, sometimes a few on the neck itself.

Length 0.50 mm.; diameter 0.25-0.30 mm.

There are fine large specimens of this species showing but little variation from Walton, Liberty, Leon and Calhoun Counties.

LAGENA COSTATA (Williamson), var. AMPHORA Reuss

Plate 5, figure 8

Lagena amphora REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), p. 330, pl. 4, fig. 57.

Lagena costata (WILLIAMSON), var. *amphora* CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 21, pl. 10, figs. 2, 3; pl. 12, fig. 2; Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 70, pl. 11, figs. 11, 12.

Test elongate, pyriform, with a long, tapering neck; surface with comparatively few, prominent costae, running up onto the elongate tapering neck; aperture small, without a lip.

Length of figured specimen 0.27 mm.; diameter 0.12 mm.

The only complete specimens are from the lower marl bed, Alum Bluff on the Apalachicola River, Liberty County, collected by W. C.

Mansfield and E. C. Bracewell. There is a single broken specimen from Coes Mill, Liberty County, which may also belong here.

LAGENA cf. STRIATO-PUNCTATA Parker and Jones

Plate 5, figure 9

There are several specimens from the lower bed at Alum Bluff, Apalachicola River, Liberty County, which are elongate pyriform in shape, finely costate with the peculiar pitted appearance usually found in this species.

LAGENA ORBIGNYANA (Seguenza), var. LACUNATA Burrows and Holland

Plate 5, figure 13 a, b

Lagena castrensis H. B. BRADY (not Schwager), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 485, pl. 60, figs. 1, 2.—BALKWILL and WRIGHT, Trans. Roy. Irish Acad., vol. 28 (Sci.), 1885, p. 341, pl. 12, figs. 20, 21.—EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 333, pl. 10, figs. 71, 72.—FLINT, Rep. U. S. Nat. Mus., 1897 (1899), p. 308, pl. 54, fig. 5.

Lagena lacunata BURROWS and HOLLAND, in JONES, Paleont. Soc., 1895, p. 205, pl. 7, fig. 12.

Lagena orbignyana, var. *castrensis* MILLETT, Journ. Roy. Micr. Soc., 1901, p. 626, pl. 14, fig. 20.

Lagena orbignyana, var. *lacunata* SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, No. 16, 1910, p. 19, pl. 2, fig. 14; Journ. Quekett Micr. Club, vol. 11, 1912, p. 416, pl. 19, figs. 16-18.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 43, pl. 20, fig. 1.

Test rounded or ovate, much compressed, whole test surrounded by a peripheral keel inside of which on either side is a complete raised rim about the body proper; neck somewhat elongate; wall with the body portion ornamented by a network of lacunae or pitted areas of varying size usually with an outlining ring about each pit.

Length up to 0.30 mm.; breadth 0.25 mm.; thickness 0.15 mm.

Specimens occurred in material from Leon, Liberty and Washington Counties. The form is especially abundant at Gully Sink, Washington County, Florida.

LAGENA cf. MARGINATO-PERFORATA (Seguenza)

Plate 5, figure 12

There are specimens from Liberty and Leon Counties which may be referred to this species. The test is much compressed, usually of the form figured, the keel very variable, and the surface coarsely perforate.

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1826

GUTTULINA IRREGULARIS (d'Orbigny)

Globulina irregularis d'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 226, pl. 13, figs. 9, 10.—CUSHMAN and THOMAS, Journ. Pal., vol. 3, 1929, p. 177, pl. 23, figs. 2 a-c. [For further references, see Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930.]

Test oval to subdeltoidal, equilaterally triangular with rounded sides and angles, excepting the acute apertural end; chambers more or less angular, elongated, arranged in a clockwise, quinqueloculine series, each succeeding chamber excepting the last one or two chambers in full grown specimens coming down to the base; sutures depressed, distinct; wall smooth, but in full grown specimens often having the last small chamber with spines or covered with fistulose tubes; aperture radiate.

Under this species is placed "*Polymorphina byramensis* Cushman" and a number of other species. It is very widely distributed in the Tertiary.

The only specimen in the collection is from the John Anderson farm, $\frac{3}{4}$ mile east of Red Bay, Walton County.

GUTTULINA COSTATULA Galloway and Wissler

Plate 5, figure 15

Polymorphina (*Guttulina*) *costatula* GALLOWAY and WISSLER, Journ. Pal., vol. 1, 1927, p. 57, pl. 9, figs. 10 a, b.

Guttulina costatula CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930, pl. 6, figs. 3 a, b.

Test short, somewhat fusiform, acute at both ends; chambers inflated, rounded, not much embracing, arranged in a contra-clockwise, quinqueloculine series, each succeeding chamber removed much farther from the base; sutures depressed, distinct; wall ornamented with numerous distinct, rounded costae, of which there are five more strongly developed at the base, radiating from the acute initial end independent of the sutures and taking positions in accord with the quinqueloculine arrangement of the early chambers; aperture produced, radiate.

This species was described from the Pleistocene of California and apparently occurs also in the Late Tertiary of Australia.

Single specimens occurred at three stations in Liberty and Calhoun Counties.

GUTTULINA LACTEA (Montagu), var. EARLANDI Cushman and Ozawa

Plate 5, figure 19

Polymorphina concava JONES (not Williamson), Foram. Crag., pt. 3, 1896, p. 264, pl. 5, fig. 22.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1909, p. 431, pl. 17, fig. 6.

Polymorphina lactea, var. *concava* SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 51, No. 9, 1907, p. 14, pl. 3, figs. 8, 9.

Guttulina lactea (MONTAGU), var. *earlandi* CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930, pl. 10, fig. 5.

This variety differs from the typical form of the species in its attached character and in holding to the short form seen in the early stages of the typical form.

The single specimen which undoubtedly belongs to this variety is from Gully Sink, T. 2 N., R. 14 (?) W., Washington County.

Other records for the variety are from the Late Tertiary and Recent seas of western and southern Europe.

Genus PYRULINA d'Orbigny, 1826

PYRULINA ALBATROSSI Cushman and Ozawa

Plate 5, figures 17, 18

Pyrulina albatrossi CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930, pl. 15, figs. 1-3.

Test elongate, fusiform to cylindrical, acute at both ends; chambers elongated, much embracing, arranged in a triserial series, becoming biserial later, but often one extra, rounded chamber added at the top of the test, each succeeding chamber slightly removed from the base; sutures but little depressed, nearly vertical, generally distinct; wall smooth, thin, almost transparent; aperture radiate.

This species is recorded at numerous *Albatross* stations in the western Atlantic.

There are two typical specimens.

Genus GLOBULINA d'Orbigny, 1826

GLOBULINA GIBBA d'Orbigny

Plate 5, figure 21

Globulina gibba d'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 277, No. 10, Modèles No. 63; Foram. Foss. Bass. Tert. Vienne, 1846, p. 227, pl. 13, figs. 13, 14. [For further references, see Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930.]

Test globular to subglobular, transverse section almost circular; chambers few, inflated, rounded, arranged in a nearly triserial series; sutures not depressed, generally clear; wall smooth, translucent, often with fistulose tubes, especially at the apertural end; aperture radiate.

This is a widely distributed species, especially in the Miocene and earlier Tertiary. The specimens are mostly from Walton County, but it occurs rarely in Leon and Calhoun Counties.

FORAMINIFERA CHOCTAWHATCHEE FORMATION OF FLORIDA. 35

GLOBULINA INAEQUALIS Reuss

Plate 5, figure 22

Globulina inaequalis REUSS, Denkschr. K. Akad. Wiss. Wien, vol. 1, 1850, p. 377, pl. 48, fig. 9. [For further references to this species, see Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930.]

Test ovate, more or less compressed, broadly rounded at the base, tapering toward the apex; chambers few, inflated, much overlapping, arranged in a nearly triserial series; sutures very slightly if at all depressed, distinct; wall smooth, translucent; aperture radiate.

This is a widely distributed species, especially in the earlier Tertiary. There are rare specimens from Leon, Walton and Washington Counties.

GLOBULINA ROTUNDATA (Bornemann)

Plate 5, figure 16

Guttulina rotundata BORNEMANN, Zeitschr. deutsch. geol. Gesell., vol. 7, 1855, p. 346, pl. 18, fig. 3. [For further references to this species, see Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930.]

Test ellipsoidal or ovoid to cylindrical, rounded at the base, slightly produced at the apertural end; chambers rounded, almost as long as broad, arranged in a nearly triserial series, each succeeding chamber removed much farther from the base, rarely becoming almost uniserial in the last chamber; sutures but little depressed, generally distinct; wall smooth, thick, often with fistulose tubes; aperture radiate.

This species occurs at several stations in the Choctawhatchee marl, all in Walton County.

Genus PSEUDOPOLYMORPHINA Cushman and Ozawa, 1928

PSEUDOPOLYMORPHINA DUMBLEI (Cushman and Applin)

Plate 6, figure 5

Polymorphina compressa D'ORBIGNY, var. *dumblei* CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 173, pl. 9, figs. 4, 5.

Pseudopolymorphina dumblei CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930, pl. 25, figs. 1 a, b.

Test compressed, elongated, obtuse at the base, more or less acute at the apertural end; chambers slightly longer than wide, more or less compressed, much embracing, arranged at first in a nearly triserial series becoming biserial later; sutures but little depressed, distinct; wall smooth; aperture radiate.

Most of the records for this species are from the American Eocene, but specimens seemingly identical occur in the Choctawhatchee marl of Calhoun, Liberty and Walton Counties, Florida.

PSEUDOPOLYMORPHINA RUTILA (Cushman)

Plate 5, figure 20

Polymorphina regina H. B. BRADY, PARKER and JONES, var. *rutila* CUSHMAN, U. S. Geol. Survey, Prof. Paper 133, 1923, p. 34, pl. 5, figs. 7, 8.

Pseudopolymorphina rutila CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930, pl. 26, figs. 3 a, b.

Test compressed, elongate, fusiform, with a strong spine at the base; chambers more or less elongated, not much embracing, alternating; sutures more or less depressed, distinct; wall marked with a few strong, longitudinal costae; aperture radiate.

This species has previously been known from the Lower Oligocene of Mississippi. It occurs in the Choctawhatchee marl of Calhoun, Leon and Washington Counties. The costae are somewhat variable in number, but the general characters of the test are fairly constant.

Genus SIGMOMORPHINA Cushman and Ozawa, 1928

SIGMOMORPHINA WILLIAMSONI (Terquem)

Plate 6, figure 4

Polymorphina williamsoni TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 1, 1878, p. 37.

Sigmomorphina williamsoni CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, art. 6, 1930, pl. 38, figs. 3, 4.

Polymorphina lactea WALKER and JABOB, var. *oblonga* WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 71, pl. 6, figs. 149, 149a.

Test ovate to oblong, compressed, of nearly equal thickness, sides nearly parallel, rounded at both ends; chambers elongated, embracing, arranged in a contra-clockwise, sigmoid series, each succeeding chamber extending down to the base; sutures scarcely depressed, but distinct; wall smooth, thin, nearly transparent; aperture long, radiate, furnished with an entosolenian tube.

This species occurs especially as a recent form in the waters off Western Europe. The only specimen is from the Choctawhatchee marl on S. D. Johnson's place, near Woods, Liberty County, Florida.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION GRATELOUPI (d'Orbigny)

Plate 6, figures 1-3

Nonionina grateloupi d'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 294, No. 19; in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 46, pl. 6, figs. 5, 7.—FORNASINI, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 1, 1904, p. 12, pl. 3, fig. 5.—CUSHMAN, Publ. 291, Carnegie Instit. Washington, 1919, p. 48; Proc. U. S. Nat. Mus., vol. 59, 1921, p. 61, pl. 14, figs. 9-11; Publ. 311, Carnegie Instit. Washington, 1922, p. 55, pl. 9, figs. 7, 8; Publ. 344, 1926, p. 79; Bull. 104, U. S. Nat. Mus., pt. 7, 1929, p. 10, pl. 3, figs. 9-11; pl. 4, figs. 1-4.

Nonionina scapha CUSHMAN (not Fichtel and Moll), Bull. 103, U. S. Nat. Mus., 1918, p. 73, pl. 25, figs. 6 *a*, *b*; Bull. 676, U. S. Geol. Survey, 1918, p. 68, pl. 25, fig. 2; pl. 26, figs. 2, 3.

Test typically planispiral and bilaterally symmetrical but often becoming somewhat trochoid, mostly involute, in peripheral view the sides nearly parallel, periphery rounded; chambers numerous, usually ten to twelve in the last-formed coil in adults, chambers increasing rapidly in length, especially in the last few chambers; sutures distinct, slightly depressed; wall smooth, finely perforate; aperture small, at the base of the last-formed chamber, narrow.

Length up to 0.60 mm.; breadth 0.35 mm.; thickness 0.20 mm.

This species was originally noted by d'Orbigny from the Miocene of France, and afterward figured from the West Indian region where it is common. I have recorded it from the Miocene of Cuba, Santo Domingo, Panama and the Coastal Plain of the United States. It occurs in the Choctawhatchee marl in Calhoun, Leon, Liberty, and Washington Counties.

There is a tendency for the specimens to become asymmetrical like *Nonionella*.

NONION PIZARRENSIS Berry

Plate 6, figures 7, 8

Nonion pizarrensis BERRY, Journ. Pal., vol. 1, 1927-1928 (1928), p. 269, figs. 1-3 (in text).—CUSHMAN and KELLETT, Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 4, pl. 1, figs. 10 *a*, *b*; pl. 2, figs. 1 *a*, *b*.

Nonionina depressula CUSHMAN (not Walker and Jacob), Bull. 103, U. S. Nat. Mus., 1918, p. 72, pl. 25, figs. 5 *a*, *b*.

Nonionina boueana CUSHMAN (not d'Orbigny), Bull. 676, U. S. Geol. Survey, 1918, p. 68, pl. 25, fig. 3.

Test nearly bilaterally symmetrical, slightly longer than broad in side view; periphery broadly rounded, umbilici depressed but not usually open; chambers twelve to fifteen in the last-formed coil, elongate, curved, the apertural face convex; sutures distinct, strongly depressed at the inner end, becoming less so toward the periphery, gently curved; wall smooth, polished, very finely perforate, often roughened about the umbilicus; aperture elongate, at the base of the apertural face, often slightly more extended on one side than the other.

Length up to 0.60 mm.; breadth 0.45-0.50 mm.; thickness 0.22-0.25 mm.

This species is very common on the West coast of South America on the coast of Peru, occurs in the Miocene, Gatun formation, of Panama, and is abundant in the Choctawhatchee marl of Walton County.

This and the preceding species will serve as good markers for the division of these two areas.

NONION GLABRELLA Cushman, n. sp.

Plate 6, figures 6 a, b

Test planispiral, bilaterally symmetrical, periphery rounded, tending to become slightly uncoiled in the adult; chambers six or seven in the coil, increasing rather rapidly in size in the adult, the slightly uncoiled chambers much the largest; sutures distinct, later ones somewhat open and limbate, very slightly curved; wall smooth and highly polished, very finely perforate; aperture narrow, at the base of the apertural face.

Length of holotype 0.30 mm.; breadth 0.20 mm.; thickness 0.10 mm.

Holotype—(Cat. No. 371070, U.S.N.M.). From Choctawhatchee marl, from Old Coes Mill, about 1½ miles northwest of Hosford, Liberty County. There are rare specimens also from Leon and Washington Counties.

With its tendency to uncoil, its highly polished surface and peculiar sutures, this is a striking species.

Genus NONIONELLA Cushman, 1926

NONIONELLA AURIS (d'Orbigny)

Plate 7, figures 1 a-c

Valvulina auris d'ORBIGNY, Voy. Amér. Mérid., 1839, vol. 5, pt. 5, "Foraminifères," p. 47, pl. 2, figs. 15-17.

Nonionella auris CUSHMAN and KELLETT, Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 5, pl. 1, fig. 9; pl. 2, figs. 2, 3.

Test asymmetrical, slightly trochoid, the spire not raised, periphery in the adult broadly rounded; chambers nine to eleven in the adult, low and broad, very distinct, slightly inflated, in the adult with the last-formed chamber having an enlarged portion extending over the umbilicus on the ventral side; sutures distinct, depressed, gently curved; wall smooth, polished, very finely perforate; aperture at the base of the last-formed chamber extending from the periphery ventrally, low and broad.

Maximum length, 0.40 mm.; breadth, 0.30 mm.; thickness 0.18 mm.

This is a common species on the west coast of South America, and is common in the Choctawhatchee marl of Bay, Calhoun, Liberty and Walton Counties.

It has more chambers than *Nonionella miocenica* Cushman of the Miocene of California.

Genus *ELPHIDIUM* Montfort, 1808*ELPHIDIUM POEYANUM* (d'Orbigny)

Plate 7, figures 3, 4

Polystomella poeyana d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 55, pl. 6, figs. 25, 26.—CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 55, pl. 9, figs. 9, 10; Publ. 344, 1926, p. 79.

Elphidium poeyanum CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 7, 1929, p. 25, pl. 10, figs. 4, 5.

Polystomella striato-punctata CUSHMAN (not Fichtel and Moll), Bull. 103, U. S. Nat. Mus., 1918, p. 74, pl. 26, figs. 3, 4; Bull. 676, U. S. Geol. Survey, 1918, pp. 19, 69, pl. 8, fig. 4; pl. 26, fig. 4 (?) ; pl. 27, fig. 2.—Prof. Paper 128B, U. S. Geol. Survey, 1920, p. 71, pl. 11, fig. 17.

Test of small size for the genus, strongly compressed, periphery broadly rounded, margin slightly lobulate, sides nearly parallel in peripheral view, umbilical regions slightly depressed; chambers averaging ten to twelve in number in the last-formed coil but variable, very slightly inflated, very distinct; sutures slightly depressed, marked by the very short, broad retral processes, averaging about fifteen in number in recent specimens and less in the fossil ones; wall thin, translucent, smooth, conspicuously but finely perforate; aperture composed of a series of small, rounded openings at the base of the apertural face.

Diameter up to 0.50 mm.; thickness 0.20 mm.

This is a common species in the West Indian region where it was described by d'Orbigny. It has been confused with *E. striato-punctata* which is a very different species.

E. poeyanum occurs in the Pliocene and Miocene of the coastal plain of the United States, of the Panama Canal zone, and the West Indies. There are specimens from Leon, Liberty, Walton and Washington Counties.

ELPHIDIUM INCERTUM (Williamson)

Plate 7, figures 2 a, b

Polystomella umbilicatulula, var. *incerta* WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 44, pl. 3, figs. 82, 82a.

Elphidium incertum CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 7, 1929, p. 18, pl. 7, figs. 4-9.

Test of small size for the genus, compressed, periphery broadly rounded, margin entire or with the last two or three chambers lobulated, umbilical regions slightly depressed, often with a slight knob or irregularly arranged slits at the base of the sutures; chambers few, usually less than ten in the last-formed coil, slightly inflated, distinct; sutures distinct, mainly marked by the openings, retral processes few, usually not more than five to seven; wall thick, usually

opaque; aperture composed of several small, rounded openings at the base of the apertural face.

Diameter 0.50 mm.; thickness 0.23 mm.

This is a common Atlantic species in cool waters.

Specimens are common in the Choctawhatchee marl occurring in Calhoun, Leon, Liberty and Walton Counties, rare in the last.

ELPHIDIUM SAGRUM (d'Orbigny)

Plate 7, figures 6 *a*, *b*

Polystomella sagra d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 55, pl. 6, figs. 19, 20.—CUSHMAN, Bull. 103, U. S. Nat. Mus., 1918, p. 75, pl. 26, figs. 5 *a*, *b*; Publ. 291, Carnegie Instit. Washington, 1919, p. 49; U. S. Geol. Survey, Prof. Paper 128B, 1920, p. 71, pl. 11, figs. 20, 21.

Polystomella lanieri CUSHMAN (not d'Orbigny), U. S. Geol. Survey, Prof. Paper 128B, 1920, p. 72, pl. 11, fig. 22.

Elphidium sagram CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 7, 1929, p. 24, pl. 9, figs. 5-6.

Test of small size for the genus, periphery broadly rounded, margin entire, not lobulate, sides convex in peripheral view, the last-formed portion wider than the earlier portions, umbilical regions somewhat depressed; last-formed chambers slightly inflated, twelve to fifteen in the last-formed coil; sutures usually not depressed, marked by the retral processes which are continuous over the earlier portion of the test to form ridges slightly oblique to the periphery; wall fairly thick, perforate; aperture composed of a series of small, rounded openings at the base of the apertural face.

Diameter 0.50 mm.; thickness 0.30-0.35 mm.

This species was described by d'Orbigny from shore sands of Cuba as rare. It is a widely distributed species in the West Indian region, but apparently never occurs in any considerable numbers. It occurs in the Miocene of Cuba and Santo Domingo, and the Pleistocene of the Panama Canal zone. It is rare in the Choctawhatchee marl, occurring as rare specimens in Walton County only.

ELPHIDIUM ADVENUM (Cushman)

Plate 7, figures 7 *a*, *b*

Polystomella subnodosa H. B. BRADY (not v. Münster), Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 734, pl. 110, figs. 1 *a*, *b*.—CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 70, pl. 27, figs. 6 *a*, *b*; Prof. Paper 128B, 1920, p. 71, pl. 11, fig. 18.

Polystomella advena CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 56, pl. 9, figs. 11, 12; Publ. 342, 1924, p. 48; Publ. 344, 1926, p. 80.

Elphidium advenum CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 7, 1929, p. 25, pl. 10, figs. 1, 2.

Polystomella crisa CUSHMAN (not Linné), Bull. 676, U. S. Geol. Survey, 1918, p. 69, pl. 27, figs. 1, 4, 5; Prof. Paper 128B, 1920, p. 71, pl. 11, fig. 19.

Test of medium size for the genus, strongly compressed, periphery acute, with a narrow carina, often somewhat lobulate, sides nearly parallel in peripheral view, umbilical regions depressed, often with a small, central, clear boss; chambers distinct, ten to fifteen in the last-formed coil, slightly inflated, especially the later ones; sutures usually depressed and the chamber wall between them raised; wall distinctly perforate; aperture composed of a few pores at the base of the apertural face.

Diameter up to 0.50 mm. or more; thickness 0.15 mm.

This is a common species in the West Indian region both recent and fossil. There is considerable variation in the inflation of the chambers and in the relative width of the chambers and the area occupied by the retral processes. In the Choctawhatchee marl, it occurs in Bay, Calhoun, Leon, Liberty and Walton Counties, often abundant in the latter about Red Bay.

ELPHIDIUM sp?

Plate 7, figures 5 a, b

There are numerous specimens like that figured, from the marl at E. Gomillion's place near Red Bay, Walton County. There are traces of retral processes in the last few chambers but they seem never to be well developed.

Family HETEROHELICIDAE

Subfamily Pavonininae

Genus PAVONINA d'Orbigny, 1826

PAVONINA sp?

There is a single incomplete specimen in the collection which probably represents a very beautiful new species of this genus, but no further specimens have been found. There is not enough of this specimen to give the complete specific characters.

Subfamily Plectofrondiculariinae

Genus PLECTOFRONDICULARIA Liebus, 1903

PLECTOFRONDICULARIA FLORIDANA Cushman, n. sp.

Plate 8, figure 1

Test elongate, tapering, greatest width toward the apertural end, strongly compressed, sides keeled, tricarinate, early portion of the flattened sides with a single median costa; chambers numerous, very distinct, increasing in height toward the apertural end; sutures very distinct, slightly depressed, each half somewhat sigmoidally curved,

slightly limbate; wall smooth except for the median costa; aperture elliptical, terminal.

Length of holotype 0.80 mm.; breadth 0.25 mm.; thickness 0.08 mm.

Holotype—(Cat. No. 371071, U.S.N.M.). From Choctawhatchee marl, E. Gomillion's place, $\frac{1}{2}$ mile east of Red Bay, Walton County, collected by W. C. Mansfield. It also occurs on the John Anderson farm, $\frac{3}{4}$ mile east of Red Bay, and in the lowest fossiliferous bed on Jim Kennedy Branch, 1 mile east of Red Bay, both in Walton County, and at Darling's Slide, about $2\frac{1}{2}$ miles, airline, southeast of Clarksville, Calhoun County.

This species is closely related to *P. californica* Cushman and Stewart from the Pliocene of California. That species has broader and less oblique sutures in the adult, and its early stages in this respect are much like the Florida species. When they are seen together, it is very easy to separate the two.

Family BULIMINIDAE

Subfamily Turritininae

Genus BULIMINELLA Cushman, 1911

BULIMINELLA ELEGANTISSIMA (d'Orbigny)

Plate 8, figures 2, 3

Bulimina elegantissima d'ORBIGNY, Voy. Amér. Mérid., 1839, vol. 5. No. 5, "Foraminifères," p. 51, pl. 7, figs. 13, 14.—SCHLUMBERGER, Feuille Jeun. Nat., vol. 12, 1882, p. 8, pl. 1, fig. 14.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 402, pl. 50, figs. 20-22.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 49, No. 5, 1905, p. 11, pl. 2, fig. 6.

Buliminella elegantissima CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 89; Proc. U. S. Nat. Mus., vol. 56, 1919, p. 606; Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 40, pl. 6, figs. 5 *a*, *b*.—CUSHMAN and KELLETT, Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 6, pl. 3, figs. 1-3.

Test elongate, spiral, making about three volutions, initial end pointed, much more so in the microspheric form; chambers numerous, seven to ten in the last-formed whorl, narrow, slightly inflated; sutures distinct, slightly curved, very slightly depressed; wall smooth, finely perforate; aperture elongate, narrow, somewhat enlarged toward the middle of the apertural face.

Length up to 0.40 mm.; diameter 0.12-0.15 mm.

Specimens are very abundant in some of the collections and very rare or wanting in others. There are specimens from Bay, Calhoun, Leon, Liberty, Walton and Washington Counties.

BULIMINELLA CURTA Cushman

Plate 8, figure 4

Buliminella curta CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 33, pl. 5, fig. 13.

Test an elongate spiral, tapering or fusiform, initial end rounded thence rapidly increasing in diameter until well toward the apertural end, periphery slightly lobulate, spiral suture well marked; chambers numerous, five or six making up a whorl in the adult, distinct, inflated; sutures distinct, slightly depressed; wall smooth, very finely perforate; aperture comma-shaped in a slightly concave depression of the last-formed chamber.

Length up to 0.55 mm.; diameter 0.20 mm.

This species was originally described from the Miocene, Monterey shale of California. Most of the Florida specimens are like the original figure with the greatest width toward the apertural end, but there are a few evidently old age specimens in both regions like that figured here in which the later chambers fail to increase the diameter of the test. All the specimens are from near Red Bay, Walton County.

Genus BULIMINA d'Orbigny, 1826

BULIMINA GRACILIS Cushman, n. sp.

Plate 8, figures 5 *a*, *b*

Test elongate, slender, of nearly uniform diameter for most of its length, about $3\frac{1}{2}$ times as long as wide in the adult; chambers generally triserial, inflated; sutures distinct, depressed; wall smooth, polished; aperture elongate, narrow.

Length 0.60 mm.; diameter 0.18-0.20 mm.

Holotype—(Cat. No. 371072 U.S.N.M.). From Choctawhatchee marl, E. Gomillion's place, $\frac{1}{2}$ mile east of Red Bay, Walton County. It is very abundant at other stations east of Red Bay, but does not occur in the other counties so far as observed.

This is an unusual form of *Bulimina*, in that there is a tendency to become somewhat biserial and to have the aperture drawn away from the periphery toward the center of the face, but it does not become truly terminal.

BULIMINA INFLATA Seguenza

Plate 8, figures 6 *a*, *b*

Bulimina inflata SEGUENZA, Atti Accad. Gioenia Sci. Nat., ser. 2, vol. 18, 1862, p. 109, pl. 1, fig. 10. [For further references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 93, pl. 21, fig. 1.]

Test short, broadest usually above the middle; sutures much depressed; chambers overhanging at the basal edge; upper portion of the test smooth, lower portion with distinct costae growing in thick-

ness toward the basal margin and there ending in stout spines; apical end usually with a stout acicular spine; wall thick.

Length 0.50 mm.; breadth 0.25-0.30 mm.

Scattered specimens occur in material from Leon, Liberty and Walton Counties.

Genus VIRGULINA d'Orbigny, 1826

VIRGULINA GUNTERI Cushman

Plate 9, figures 1, 2

Virgulina floridana CUSHMAN, Contr. Cushman, Lab. Foram. Res., vol. 5, 1929, p. 54, pl. 9, figs. 7-10 (not *V. floridana* Cushman, 1920).

Virgulina gunteri CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 105.

Test two or three times as long as broad, early portion triserial, later chambers irregularly biserial, sides in the adult nearly parallel, greatest width typically at or below the middle; later chambers not greatly inflated; sutures distinct, marked by a row of depressions between the processes that extend backward from the margins of the later-formed chamber; wall smooth, finely perforate; aperture elongate, narrow, extending from the inner margin of the chamber well toward the apex.

Length up to 0.60 mm.; breadth 0.20 mm.; thickness 0.18 mm.

The types of this species are from the Choctawhatchee marl of Walton County. It is abundant at the stations in Walton and Bay Counties, and very rare in Calhoun and Leon Counties.

The species is close to *V. pertusa* Reuss from the Miocene and Pliocene of western Europe. The Florida species is much smaller and more slender.

VIRGULINA PUNCTATA d'Orbigny

Plate 8, figures 7 a, b

Virgulina punctata d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 139, pl. 1, figs. 35, 36.—CUSHMAN, Publ. 291, Carnegie Instit. Washington, 1919, p. 35; Proc. U. S. Nat. Mus., vol. 59, 1921, p. 52, pl. 11, fig. 15; Publ. 311, Carnegie Instit. Washington, 1922, p. 31, pl. 3, fig. 9; Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 117.

Virgulina squamosa CUSHMAN (not d'Orbigny), Bull. 103, U. S. Nat. Mus., 1918, p. 58, pl. 21, fig. 6.

Test elongate, compressed, fusiform, broadest near the middle, initial end bluntly pointed; chambers numerous, earliest ones triserial, later ones biserial, inflated; sutures distinct, slightly depressed; wall smooth, punctate; aperture elongate.

Length 0.60 mm.; breadth 0.20 mm.; thickness 0.10 mm.

Specimens are rare in the Choctawhatchee marl, but occur at scattered stations in Bay, Calhoun, Liberty, Walton and Washington Counties.

The species is a common one in the general West Indian region, and is known from the Miocene of the gorge of the Yumuri River, Matanzas, Cuba, and from the Miocene, Gatun formation of the Panama Canal zone.

VIRGULINA FUSIFORMIS Cushman, n. sp.

Plate 8, figures 8 *a, b*

Test small, somewhat compressed, fusiform, greatest breadth at about the middle, ends bluntly pointed; chambers distinct, earliest ones triserial, later ones biserial, inflated; sutures very slightly depressed; wall smooth, very finely perforate; aperture elliptical, very small at the upper end of the test, reaching the inner margin of the chamber.

Length 0.30 mm.; breadth 0.12 mm.; thickness 0.08 mm.

Holotype—(Cat. No. 371073, U.S.N.M.). From Choctawhatchee marl of lower bed at Alum Bluff on the Apalachicola River, Liberty County. The species is common at this locality and occurs also on Harveys Creek, Leon County.

This is a peculiar little species, but with its characters held very constantly in the large series of specimens. The fusiform shape with pointed ends, and very small aperture are characteristic.

Genus *BOLIVINA* d'Orbigny, 1839

BOLIVINA MARGINATA Cushman

Plate 8, figures 9 *a, b*

Bolivina marginata CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 48, pl. 10, fig. 1; Contr. Cushman Lab. Foram. Res., vol. 1, 1925, p. 30, pl. 5, figs. 5 *a, b*.

Test much compressed, of medium size for the genus, periphery acute, keeled throughout or sometimes obsolete at the apertural end; sutures usually distinctly limbate, oblique; chambers numerous, distinct, seven or eight chambers making up the last half of the test, earlier ones long and narrow, later ones much higher; wall thin, rather coarsely perforate, surface smooth; aperture elongate, narrow.

Length usually less than 1 mm.; breadth 0.25-0.30 mm.; thickness 0.12-0.15 mm.

The species was originally described from the Choctawhatchee marl from 1 mile south of Red Bay. It occurs at the various stations in Walton County about Red Bay and also on Bryant Scott's farm near bridge at Econfinia, Bay County. The species occurs also in the Miocene, Monterey shale, of California.

BOLIVINA MARGINATA Cushman, var. MULTICOSTATA Cushman

Plate 8, figures 13, 14

Bolivina aenariensis (COSTA), var. *multicostata* CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 48, pl. 10, fig. 2.

Variety differing from the typical in the ornamentation of the test which consists of a series of longitudinal costae of varying lengths.

This was originally described as a variety of *Bolivina aenariensis*, but the variety occurs with the typical smooth form at almost every station where it occurs. The figures show extremes of variation in the costae.

BOLIVINA FLORIDANA Cushman

Plate 8, figures 15 *a*, *b*

Bolivina floridana CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 49, pl. 10, fig. 4.

Test elongate, slightly compressed, gradually tapering with the greatest width near the apertural end, periphery broadly rounded; chambers numerous, somewhat inflated; sutures indistinct except near the apertural end; the base of each chamber prolonged into lobular processes across the sutures, the intermediate areas deeply excavated; wall coarsely perforate; aperture elongate.

Length up to 0.70 mm.; breadth 0.20-0.25 mm.; breadth 0.10-0.12 mm.

This species was originally described from the Choctawhatchee marl of Red Bay. It is abundant in the phase of the marl developed about Red Bay in Walton County, and there are specimens from Bryant Scott's farm, near the bridge at Econfina, Bay County. It has therefore almost the same distribution at *B. marginata*.

BOLIVINA PLICATELLA Cushman, n. sp.

Plate 8, figures 10 *a*, *b*

Test small, short and broad, compressed, greatest width near the apertural end, periphery subacute; chambers except the last two obscured by the ornamentation which also obscures the sutures; wall ornamented by two distinct longitudinal ridges, rounded or sharp, connected between with transverse ridges, coinciding partially with the chambers, leaving the whole surface broken into series of irregular depressions, coarsely perforate; aperture elongate.

Length 0.25-0.30 mm.; breadth 0.12-0.15 mm.; thickness 0.06-0.08 mm.

Holotype—(Cat. No. 371074, U.S.N.M.). From Choctawhatchee marl, from cut in road leading to Watson's Landing, Apalachicola River, Liberty County.

The species also occurs rarely in Calhoun, Leon and Liberty Counties. This is very close to if not identical with the species now living off the coasts of Australia which has been referred to *Bolivina plicata* d'Orbigny, but is very different from that. A similar form occurs also on the coasts of Europe.

BOLIVINA PULCHELLA d'Orbigny, var. *PRIMITIVA* Cushman, n. var.

Plate 8, figures 12 *a, b*

Variety differing from the typical in the few biserial chambers, averaging two to four and the large number of triserial chambers which make up half of the test; wall coarsely perforate.

Length of figured specimen 0.35 mm.; breadth 0.20 mm.; thickness 0.10 mm.

Holotype of variety—(Cat. No. 371075, U.S.N.M.). From Choctawhatchee marl, collected on S. D. Johnson's place near Woods, Liberty County. The variety also occurs rarely in Leon and Washington Counties.

There are a few single specimens of *Bolivina* of which we need more material before referring them to definite species.

Genus *LOXOSTOMUM* Ehrenberg, 1854

LOXOSTOMUM GUNTERI Cushman, n. sp.

Plate 8, figures 11 *a, b*

Test elongate, tapering, greatest breadth near the apertural end, only slightly compressed, periphery rounded; chambers and sutures somewhat obscured by the ornamentation of the surface consisting of fine longitudinal costae often somewhat broken; aperture narrow elliptical, terminal in the adult.

Length up to 0.50 mm.; breadth 0.20 mm.; thickness 0.10-0.12 mm.

Holotype—(Cat. No. 371076, U.S.N.M.). From Choctawhatchee marl of E. Gomillion's place, ½ mile east of Red Bay, Walton County. There are specimens also from Jim Kennedy Branch, 1 mile east of Red Bay, but it was not found in the collections from the remainder of the area represented.

The shape, ornamentation and position of the aperture will distinguish the species which is named for Mr. Herman Gunter, State Geologist of Florida.

Subfamily Reussiinae

Genus REUSSIA Schwager, 1877

REUSSIA SPINULOSA (Reuss)

Plate 8, figures 17 *a*, *b*

Verneuilina spinulosa REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 374, pl. 47, fig. 12. [For references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 60.]

Reussia spinulosa SCHWAGER, Boll. Com. Geol. Ital., vol. 8, 1877, p. 26, pl., fig. 66.—CUSHMAN and KELLETT, Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 9, pl. 3, figs. 10 *a*, *b*.

Test pyramidal, three sided, triangular in transverse section, the sides flat or slightly concave, the initial end acutely pointed; initial end and angles of chambers often with sharp spines; walls of medium thickness, hyaline, or in some cases thickened and rough, perforate, smooth or granular; apertural end of test bluntly angled, the edges of the chambers thickened; aperture a curved slit at the base of the inner edge of the chamber.

Length up to 0.75 mm.; diameter 0.40 mm.

Specimens are not usually common, but were obtained in the collections from Bay, Leon, Liberty, Walton and Washington Counties. The final chamber is usually thin and most of the fossil specimens are broken at the tip.

Genus CHRYSALIDINELLA Schubert, 1907

CHRYSALIDINELLA PULCHELLA (Cushman)

Plate 8, figures 16 *a*, *b*

Chrysalidina pulchella CUSHMAN, Bull. 103, U. S. Nat. Mus., 1918, p. 54, pl. 20, figs. 2 *a-c*.

Test elongate, gently tapering, broadest at the apical end, triangular in transverse section, early portion triserial, later uniserial; chambers distinct, not inflated; sutures distinct, slightly raised and limbate, curved; wall smooth but coarsely perforate; aperture formed of numerous rounded openings on the terminal face, each at the end of a small papilla.

Length of figured specimen 0.40 mm.; diameter 0.25 mm.

This species was previously described from the Miocene, Gatun formation, of the Panama Canal zone. It occurs in the Choctawhatchee marl of Jim Kennedy Branch, 1 mile east of Red Bay, Walton County, and from S. D. Johnson's place, near Woods, Liberty County.

In this species, the chambers are much higher than in the recent species, *C. dimorpha* (H. B. Brady), and the sutures are much more prominent.

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Subfamily Uvigerininae

Genus UVIGERINA d'Orbigny, 1826

UVIGERINA cf. PIGMEA d'Orbigny

Plate 9, figures 3-6

The four specimens figured show somewhat of the range of variation in the species of the Choctawhatchee marl which may be referred tentatively to this species of d'Orbigny. It is unlike any of the recent material now living off the coast. The Uvigerinas are so variable and in such a state of chaos that reference to type material with large series must be made before very intelligent work can be done in straightening out this group.

UVIGERINA AUBERIANA d'Orbigny

Plate 9, figure 7

Uvigerina auberiana d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 106, pl. 2, figs. 23, 24.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 163, pl. 42, figs. 3, 4.

Test elongate, rapidly tapering from the narrow base to the greatest breadth somewhat above the middle, periphery lobulate; chambers inflated, sutures depressed, distinct; wall ornamented with closely-set, fine, spinose projections, the last-formed chamber often smoother; apertural end in the adult tapering, with an elongate, cylindrical neck and phialine lip.

Length up to 0.75 mm.; diameter 0.30-0.40 mm.

Specimens are rare and were only found from Walton County, lowest fossiliferous bed on Jim Kennedy Branch about 1 mile east of Red Bay and from John Anderson's farm, $\frac{3}{4}$ mile east of Red Bay. The species was described by d'Orbigny from the West Indian region, but is not common.

Genus SIPHOGENERINA Schlumberger, 1883

SIPHOGENERINA LAMELLATA Cushman

Plate 9, figure 10

Siphogenerina lamellata CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 55, pl. 12, fig. 3; Proc. U. S. Nat. Mus., vol. 67, art. 25, 1926, p. 10, pl. 1, fig. 13.

Test elongate, tapering gradually from the initial end, broadly rounded at the apertural end; chambers comparatively few, somewhat indistinct, surface ornamentation consisting of several equidistant, longitudinal lamellae extending the length of the test and fusing at the initial end; aperture with a tubular neck and phialine lip.

Length up to 1 mm.; diameter 0.45 mm.

This species was described from the Choctawhatchee marl, from 1 mile south of Red Bay. It has occurred in some numbers in the more recent collections from Walton County, but was not found in material from the other counties, and should be a good marker for this phase of the marl.

The type specimen is an extreme one, and the costae are not always as high as our present figure shows.

Genus *ANGULGERINA* Cushman, 1927

ANGULGERINA OCCIDENTALIS (Cushman)

Plate 9, figures 8, 9

Uvigerina angulosa CUSHMAN (not Williamson), Publ. 311, Carnegie Inst. Washington, 1922, p. 34, pl. 5, figs. 3, 4.

Uvigerina occidentalis CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 169.

Test minute, elongate, triangular in transverse section, the periphery somewhat lobulate; chambers distinct, those of the last-formed portion becoming more distinct and remote; sutures distinct and depressed; wall ornamented with longitudinal costae on all but the last-formed chambers in the adult; apertural end drawn out into a short tubular neck and slight phialine lip.

Length usually less than 0.50 mm.; diameter 0.15-0.20 mm.

This species is common in the West Indian region at the present time, and probably derived from *Angulogerina byramensis* Cushman of the Lower Oligocene of the Coastal Plain region. It shows much variation in its ornamentation from heavily costate specimens to nearly smooth ones as shown in the figures.

Specimens are fairly common in the Choctawhatchee marl of Calhoun, Leon, Walton and Washington Counties.

Family ELLIPSOIDINIDAE

Genus *ELLIPSOLAGENA* A. Silvestri, 1923

ELLIPSOLAGENA BIDENS Cushman, n. sp.

Plate 9, figures 11 a, b

Test slightly longer than broad, body of the test somewhat ovate, apertural end produced but broadly rounded, basal end typically with two short rounded projections near together in the median line, test in end view broadly elliptical; wall smooth; aperture an elongate slit, slightly more open on one side than the other.

Length up to 0.28 mm.; breadth 0.18 mm.; thickness 0.15 mm.

Holotype—(Cat. No. 371077, U.S.N.M.). From Choctawhatchee marl of Bryant Scott's Farm, $\frac{1}{4}$ mile above mouth of branch entering Econfinia Creek, near the bridge at Econfinia, Bay County, collected

by Julia A. Gardner. It is common in Bay and Walton Counties, and rare in Liberty County.

There is considerable variation in the base which may lack the projections in some specimens, otherwise the characters are constant.

Family ROTALIIDAE

Subfamily Spirillininae

Genus *SPIRILLINA* Ehrenberg, 1841

SPIRILLINA ORBICULARIS Bagg

Plate 9, figures 12 *a, b*

Spirillina orbicularis BAGG, Bull. Amer. Pal., vol. 2, No. 10, 1898, p. 33 (327), pl. 2 (22), figs. 2 *a-c*.—CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 58, pl. 14, fig. 1.

Test planispirally coiled, the coils increasing in diameter as added, periphery broadly rounded, ventral side with rows of beads more or less following the coils, dorsal side with a row of pits along the sutures; aperture arched, comparatively narrow.

Diameter about 0.50 mm.

Bagg described this species from the Miocene, Yorktown formation, of Yorktown, Va., and I recorded a specimen from the Miocene, Duplin marl of Mayesville, S. C.

The figured specimens are from Jim Kennedy Branch, about 1 mile east of Red Bay, Walton County, and there is a single specimen from Jackson Bluff, left bank of Ocklocknee River, Leon County.

Subfamily Discorbisinae

Genus *DISCORBIS* Lamarck, 1804

DISCORBIS ROSACEA (d'Orbigny)

Plate 9, figures 13 *a-c*

Rotalia rosacea d'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 273, No. 15.

Discorbina rosacea JONES, PARKER and H. B. BRADY, Foram. Crag., 1866, pl. 4, fig. 17.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 644, pl. 89, figs. 1, 4.

Discorbis rosacea CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 13, fig. 13 (in text); Bull. 676, U. S. Geol. Survey, 1918, p. 59, pl. 14, fig. 4.

Test plano-convex, dorsal side convex, ventral side flattened or slightly concave; chambers numerous, but five forming the last adult whorl, much elongated in the adult; sutures very obliquely curved, in the early stages on the dorsal side slightly limbate; wall smooth, finely perforate; aperture ventral, elongate.

Diameter up to 1.10 mm.

There are specimens from Leon, Liberty and Walton Counties. The figured specimen is an especially large fine one, the usual run of specimens being not more than half this size.

DISCORBIS SUBARAUCANA Cushman

Plate 10, figures 1 a-c

Discorbis subarauca CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 41, pl. 7, figs. 1, 2.

Discorbis bertheloti CUSHMAN (not d'Orbigny), Bull. 676, U. S. Geol. Survey, 1918, p. 58, pl. 15, figs. 1-3.

Test unequally biconvex, dorsal side somewhat arched, the ventral side slightly convex, flattened or even somewhat concave, periphery not lobulated, composed of about two and a half whorls; chambers distinct, six to eight in the adult whorl, slightly inflated; sutures oblique, curved, earlier ones on the dorsal side, limbate, less so on the ventral side; wall perforate, smooth; aperture at the base of the ventral side of the last-formed chamber, narrow.

Diameter up to 0.40 mm.; thickness 0.12-0.15 mm.

This species is widely distributed in the present waters of the West Indian region, and is the most common species of the genus in the Choctawhatchee marl of Florida, and occurs in the Miocene of the Coastal Plain northward.

There are specimens from Calhoun, Leon, Liberty, Walton and Washington Counties.

DISCORBIS MIRA Cushman

Plate 10, figures 2 a-c

Discorbis mira CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 39, pl. 6, figs. 10, 11.

Test trochoid, plano-convex, dorsal side forming a low cone, ventral side flattened and very slightly convex, periphery subacute; chambers distinct, not inflated; sutures on the dorsal side limbate, strongly oblique, curved, ventrally somewhat depressed, nearly radial; wall coarsely perforate, smooth; aperture an elongate, slightly arched slit at the ventral margin.

Diameter up to 0.65 mm.

Specimens of this species which is so common in the present waters off Florida are rare in the Choctawhatchee marl. The only specimens are from Leon and Liberty Counties. This species with its neat, flaring cone, strongly curved, limbate sutures and coarse perforations is distinct from any other species of the genus in the collection. It is probable that the specimen referred to *D. vilardeboana* (Cushman, Bull. 676, U. S. Geol. Survey, 1918, p. 14, pl. 3, fig. 1) is this species.

DISCORBIS VILARDEBOANA (d'Orbigny)

Plate 10, figures 3 a-c

Rosalina vilardeboana D'ORBIGNY, Voy. Amér. Mérid., 1839, vol. 5, pt. 5, "Foraminifères," p. 44, pl. 6, figs. 13-15.

Discorbis vilardeboana CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1915, p. 14, pl. 9, fig. 2; pl. 15, fig. 4; fig. 14 (in text); Bull. 676, U. S. Geol. Survey, 1918, p. 58, pl. 14, figs. 3-5.

Test plano-convex, dorsal side rather evenly convex, ventral side flattened or slightly concave, umbilicate, periphery rounded; chambers distinct, inflated, five to seven in the adult whorl, the last chamber occupying nearly one-third of the ventral side; sutures distinct, slightly curved, only slightly depressed; wall distinctly perforate, smooth; aperture a narrow slit on the ventral side of the chamber.

Diameter up to 0.50 mm.

The rounded periphery and few chambers will distinguish this species in the present collections. Specimens were obtained in collections from Calhoun, Leon and Liberty Counties.

DISCORBIS CONSOBRINA (d'Orbigny)

Plate 10, figures 4 a-c

Rosalina consobrina d'ORBIGNY, Voy. Amér. Mérid., 1839, vol. 5, pt. 5, "Foraminifères," p. 46, pl. 7, figs. 4-6.

Discorbis consobrina CUSHMAN and KELLETT, Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 10, pl. 4, figs. 1, 2.

Test biconvex, the dorsal side more strongly so, ventral side depressed in the umbilical region, periphery rounded; chambers five to seven in the last-formed whorl, distinct, regularly increasing in size as added, slightly inflated, on the ventral side ending in distinct angles at the umbilical end; sutures distinct, on the dorsal side oblique, very slightly curved, very little if at all depressed, on the ventral side slightly curved, nearly radial, depressed; wall smooth, distinctly perforate; aperture below the distinct lip on the ventral side of the chamber and extending into the umbilical region.

Diaméter 0.30 mm.; height 0.22 mm.

This species was described from the west coast of South America where it is a common species. It occurs in very typical form in the Choctawhatchee marl in Calhoun, Leon and Liberty Counties.

DISCORBIS VALVULATA (d'Orbigny)

Plate 10, figures 5 a-c

Rosalina valvulata d'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 271, No. 4; in Barker, Webb and Berthelot, Hist. Nat. Isles Canaries, 1839, vol. 2, pt. 2, "Foraminifères," p. 136, pl. 2, figs. 19-21; in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 96, pl. 3, figs. 21-23.

Discorbis valvulata CUSHMAN, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 59, pl. 14, figs. 4, 5; Publ. 344, Carnegie Instit. Washington, 1926, p. 78.

Test trochoid, plano-convex, very slightly convex dorsally, on the ventral side flattened or slightly concave, periphery rounded and thickened into a blunt keel; chambers distinct, few, about five making up the adult whorl; sutures curved strongly on the dorsal side, limbate but not depressed, ventrally sinuous, not limbate; wall coarsely perforate, smooth; aperture low, at the base of the last-formed chamber.

Length about 0.50 mm.; breadth 0.45 mm.; thickness 0.12-0.15 mm.

This species is rare in the West Indies at the present time, and a single specimen was found from the lower bed at Alum Bluff, Apalachicola River, Liberty County.

The peculiar ventral side, rounded, keeled periphery and strictly limbate sutures will distinguish the species.

Genus VALVULINERIA Cushman, 1926

VALVULINERIA FLORIDANA Cushman, n. sp.

Plate 10, figures 6 *a-c*

Test biconvex, somewhat involute on the dorsal side, almost completely so on the ventral side, periphery rounded, earlier portion somewhat angled; chambers inflated, especially on the ventral side, very distinct; sutures distinct, nearly radial, only slightly curved, not limbate; wall smooth, polished; aperture below the distinct, plate-like extension of the umbilical end of the chamber.

Length 0.45 mm.; breadth 0.35 mm.; thickness 0.15 mm.

Holotype—(Cat. No. 371078, U.S.N.M.). From Choctawhatchee marl of Bryant Scott's Farm, $\frac{1}{4}$ mile above mouth of branch entering Econfinia Creek, near the bridge at Econfinia, Bay County, collected by Julia A. Gardner. The species is abundant at the type locality and also at the various stations in Walton County, but not elsewhere.

It has a highly polished test, strongly umbilicate with distinct flap-like extensions over the aperture.

Subfamily Rotaliinae

Genus EPONIDES Montfort, 1808

EPONIDES MANSFIELDI Cushman, n. sp.

Plate 11, figures 1 *a-c*

Test trochoid, biconvex, close-coiled throughout, all chambers visible from dorsal side, last whorl completely involute ventrally, periphery acute, bluntly keeled; chambers distinct, slightly inflated on the ventral side, about nine in the adult whorl; sutures distinct, on the dorsal side limbate and usually raised, confluent with the keel and spiral suture, oblique, ventrally depressed, nearly radial; wall on

the ventral side strongly papillate especially in the middle umbonate area and along the sutures, in some specimens with papillae entirely covering the ventral side; aperture ventral, between the periphery and ventral umbo at the base of the chamber.

Diameter up to 0.75 mm.; thickness 0.25 mm.

Holotype—(Cat. No. 371079, U.S.N.M.). From Choctawhatchee marl of John Anderson's farm, $\frac{3}{4}$ mile east of Red Bay, Walton County, collected by W. C. Mansfield for whom the species is named. Besides the type locality, it is abundant at other stations in Walton County as well as found in Bay, Calhoun, Leon and Liberty Counties. It is one of the most abundant and characteristic species. It was probably recorded as *Rotalia beccarii* (Cushman, Bull. 676, U. S. Geol. Survey, 1918, p. 66, pl. 24, fig. 2), and as *Pulvinulina repanda* (l. c., p. 66, pl. 23, fig. 2).

It is closely related to *Eponides peruviana* from the west coast of South America but has a much more ornamented test.

EPONIDES LATERALIS (Terquem)

Plate 10, figures 7 a-c

Rosalina lateralis TERQUEM, Mém. Soc. Géol. France, ser. 1, vol. 4, 1878, p. 25, pl. 2 (7), figs. 11 a-c.

Pulvinulina lateralis H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 689, pl. 106, figs. 2, 3.—CUSHMAN, Proc. Boston Soc. Nat. Hist., vol. 34, 1908, p. 30, pl. 5, figs. 11, 12.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 53, No. 21, 1909, p. 5, pl. 2, fig. 6; pl. 3, figs. 1, 2.—HERON-ALLEN and EARLAND, Trans. Zool. Soc., vol. 20, 1915, p. 714, pl. 53, figs. 6-11.—CUSHMAN, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 336, pl. 69, figs. 2 a-c.

Test usually somewhat ovate, biconvex, periphery subacute and keeled; chambers distinct, later ones rapidly enlarging and flaring, inflated somewhat on the ventral side; sutures limbate dorsally, oblique, raised, ventrally depressed, nearly radial; wall smooth except for the raised sutures and on the ventral side the last-formed chamber with numerous large perforations; aperture at the base of the ventral edge of the chamber, low.

Length up to 1.50 mm.

In the adult the chambers of this species often become very irregular. It may be confused in the young with *E. repanda* but in the adult the two are very different. It is widely distributed in the recent oceans but there are few records in the fossil state, none from formations older than the Miocene. There are a number of specimens from the Choctawhatchee marl from S. D. Johnson's place near Woods, Liberty County, and a very few from Gully Sink, Washington County.

Genus *ROTALIA* Lamarck, 1804*ROTALIA BECCARII* (Linné), var. *PARKINSONIANA* (d'Orbigny)

Plate 11, figures 3 a-c

Rosalina parkinsoniana D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 99, pl. 4, figs. 25-27.

Variety differing from the typical in the number of chambers which in the variety rarely have more than ten in full grown specimens, the shorter broader chambers on the ventral side, the almost entire lack of beading at the sides of the chambers, and the lack of thickening of the sutures on the dorsal side.

Diameter not exceeding 0.50 mm.

This is apparently the form described by d'Orbigny from the West Indies. It occurs commonly in the material from Calhoun, Leon and Liberty Counties, but is not apparently present in the rich collections from Walton and Bay Counties.

Subfamily Baggininae

Genus *CANCRIS* Montfort, 1808*CANCRIS SAGRA* (d'Orbigny)

Plate 11, figures 4 a-c

Rotalina sagra D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 77, pl. 5, figs. 13-15.

Pulvinulina sagra CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 65, pl. 22, fig. 3; pl. 23, fig. 1.

Test longer than broad, biconvex, the ventral side more strongly convex than the dorsal, periphery acute; chambers few, six to seven in the adult whorl, increasing rapidly in size as added; sutures slightly depressed on the dorsal side, strongly on the ventral, gently curved; wall smooth; an elliptical area of clearer thinner wall near the aperture which is below a slight lip on the ventral side.

Length up to 0.75 mm.; breadth 0.55-0.70 mm.; thickness 0.20-0.30 mm.

d'Orbigny described this species from the West Indian shore sands, and it is fairly common in the region and off the Florida coast. The species is abundant and well developed in Walton County, and less so in Bay, Calhoun, Leon and Liberty Counties. There is much variation in the relative length and breadth due to the expansion of some of the later chambers.

Family AMPHISTEGINIDAE

Genus AMPHISTEGINA d'Orbigny, 1826

AMPHISTEGINA LESSONII d'Orbigny

Plate 11, figures 5 *a-c*

Amphistegina lessonii d'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 304, No. 3, pl. 17, figs. 1-4; Modèles No. 98. [For further references to this species, see Cushman, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 35.]

Test lenticular or more convex on one side than the other, periphery subacute; chambers numerous, fairly distinct, on the dorsal side simple, with a decided angle forward, on the ventral side with supplementary lobes on the inner end; sutures distinct, limbate, not depressed; wall smooth except near the aperture on the ventral side where it is often papillate; aperture small, ventral.

This species is abundant at some of the stations in Washington County, and less so in Leon County. It is absent or very rare in the rest of the material examined.

Family CASSIDULINIDAE

Subfamily Ceratobuliminidae

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA PONTONI Cushman, n. sp.

Plate 11, figures 2 *a-c*

Test small, trochoid, biconvex, periphery rounded, very slightly if at all lobulate; chambers distinct, usually eight or nine in the last-formed whorl, not inflated; sutures distinct, on the dorsal side oblique, slightly limbate, ventrally radial; wall smooth; apertural face obliquely truncate; aperture narrow, parallel to the periphery of the test.

Diameter 0.20 mm.; thickness 0.08 mm.

Holotype—(Cat. No. 371080, U.S.N.M.). From Choctawhatchee marl of Bryant Scott's Farm, $\frac{1}{4}$ mile above mouth of branch entering Econfinia Creek near the bridge at Econfinia, Bay County, collected by Julia A. Gardner. It occurs also in Liberty and Walton Counties. This is a distinctive species, but may easily be overlooked on account of its small size. Specimens from the dorsal side resemble the young of *Eponides mansfieldi*, but the ventral and peripheral sides quickly show the differences. The species is named for Mr. Gerald M. Ponton of the State Geological Survey of Florida.

Subfamily Cassidulininae

Genus CASSIDULINA d'Orbigny, 1826

CASSIDULINA CRASSA d'Orbigny

Plate 11, figures 6 *a*, *b**Cassidulina crassa* d'ORBIGNY, Foram. Amér. Mérid., 1839, p. 56, pl. 7, figs. 18-20.

[For further references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 124.]

Test subcircular to oval in outline, biconvex, periphery broadly rounded; chambers comparatively few, short and inflated; sutures distinct, somewhat depressed; wall smooth; aperture elongate, with a flattened tooth partially filling the aperture.

Diameter 0.25 mm.; thickness 0.18 mm.

This species is small but easily distinguished from the following by the rounded periphery and thicker test. There are specimens in the collection from Calhoun, Liberty and Walton Counties.

CASSIDULINA LAEVIGATA d'Orbigny, var. CARINATA Cushman

Plate 11, figures 7 *a*, *b**Cassidulina laevigata* d'ORBIGNY, var. *carinata* CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 124, pl. 25, figs. 6, 7.

Variety differing from the typical in the thinner, more compressed test, with a very distinct, thin carina forming the periphery of the test.

This variety was described from Recent material from off the coast of Florida and so it is not surprising to find it in the Miocene of the same region. It occurs in material from Calhoun, Liberty and Walton Counties.

Genus CASSIDULINOIDES Cushman, 1927

CASSIDULINOIDES BRADYI (Norman)

Plate 11, figures 8 *a*, *b**Cassidulina bradyi* (Norman ms.) J. WRIGHT, Proc. Belfast Nat. Field Club, App., 1880, p. 152. [For further references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 128.]

Test elongate, somewhat compressed, the early portion spirally coiled, later chambers forming an uncoiled, biserial series, lateral faces convex, peripheral border thin, usually somewhat rounded; chambers fairly distinct, but the sutures not depressed; wall smooth and polished; aperture somewhat longer than broad.

Length less than 0.50 mm.

The only locality for this species is the Lower Choctawhatchee marl at Alum Bluff, Apalachicola River, Liberty County, where it occurs in some numbers.

Family CHILOSTOMELLIDAE

Subfamily Chilostomellinae

Genus CHILOSTOMELLA Reuss, 1850

CHILOSTOMELLA OOLINA Schwager

Chilostomella oolina SCHWAGER, Boll. Com. Geol. Ital., vol. 9, 1878, p. 527, pl. 1, fig. 16.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 74, pl. 11, figs. 3-10; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 169.

Test elongate, about three times as long as wide, both ends broadly rounded, sides nearly parallel for most of their length; wall thin, distinctly punctate; aperture very narrow, curved.

There is a single broken specimen evidently of this species from Bryant Scott's farm, Econfina, Bay County.

Family GLOBIGERINIDAE

Subfamily Globigerininae

Genus GLOBIGERINA d'Orbigny, 1826

The various species of the genus *Globigerina* used in a restricted sense are in such a chaotic state that it is difficult to treat most of them intelligently. A study of the types with large series of topotype specimens is necessary to straighten out the confusion now existing. There is a very considerable difference in the early and adult stages in most of the species, and unless good series can be obtained, descriptions based on a few specimens are worth little. A number of the forms were figured in my earlier work (Bull. 676, U. S. Geol. Survey, 1918, pls. 12, 13), and while some of these were not named or only with a question, they must remain in this unsatisfactory condition until some one available to the types can make a species study of this genus.

Genus GLOBIGERINOIDES Cushman, 1927

The preceding remarks apply to this genus also as far as the fossil representatives are concerned.

Subfamily Orbulininae

Genus ORBULINA d'Orbigny, 1826

ORBULINA UNIVERSA d'Orbigny

Orbulina universa d'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 3, pl. 1, fig. 1. [For further references to this species, see Cushman, Bull. 104, U. S. Nat. Mus., pt. 5, 1924, p. 28.]

Specimens of this common species are present in material from Walton County, but not well represented in the other parts of the area.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA MENARDII (d'Orbigny)

Plate 12, figures 1 a-c

Rotalia menardii d'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 273; Modèles No. 10.
Pulvinulina menardii OWEN, Journ. Linn. Soc. (Zool.), vol. 9, 1867, p. 148, pl. 5,
 fig. 6. [For further references to this species, see Cushman, Bull. 71, U. S. Nat.
 Mus., pt. 5, 1915, p. 54.]

Globorotalia menardii CUSHMAN, Bull. Scripps Instit. Oceanography, Tech. Ser.,
 vol. 1, 1927, p. 175.

Test typically plano-convex, dorsal side slightly convex, ventral side less so or often somewhat concave, umbilicate; peripheral margin thin, slightly lobulated, carinate; chambers five or six in the adult whorl, slightly inflated ventrally; sutures limbate above, curved below, depressed, radial; wall smooth except granular about the aperture which is ventral.

Diameter of fossil specimens usually less than 0.50 mm.

There are a few specimens from Bay, Calhoun and Liberty Counties.

The few specimens show much more variation in convexity of the ventral side than do most recent specimens.

Family ANOMALINIDAE

Subfamily Anomaliniinae

Genus PLANULINA d'Orbigny, 1826

PLANULINA DEPRESSA (d'Orbigny)

Plate 12, figures 2 a-c

Truncatulina depressa d'ORBIGNY, Voy. Amér. Mérid., 1839, vol. 5, pt. 5, "Foraminifères," p. 39, pl. 6, figs. 4-6.

Test much compressed, not completely involute in the adult, earlier chambers showing on both sides of the test, periphery subacute; chambers numerous, later ones often somewhat irregular, eight to ten chambers in the final whorl; sutures distinct, somewhat limbate on the dorsal side, confluent with the keeled edge, on the ventral side depressed; wall very coarsely perforate; aperture at the peripheral margin.

Diameter 0.60-0.75 mm.; thickness 0.10-0.15 mm.

d'Orbigny described this species from the coast of South America. It is variable in the last chambers and in the amount of limbation of the sutures. It is not as regular and spread out as *P. ornata* (d'Orbigny). Specimens occurred in material from Bay, Calhoun, Liberty, Walton and Washington Counties.

This is not the same as Schwager's *Anomalina wuellerstorfi*.

Subfamily Cibicidinae

Genus CIBICIDES Montfort, 1808

CIBICIDES FLORIDANA (Cushman)

Plate 12, figures 3 a-c

Truncatulina floridana CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 62, pl. 19, fig. 2.

Truncatulina lobatula (WALKER and JACOB), var. *ornata* CUSHMAN, l. c., p. 61, pl. 18, figs. 1, 2.

Test trochoid, biconvex, dorsal side less convex than the ventral, periphery acute, keeled; chambers numerous, ten to twelve in the adult whorl; sutures distinct, limbate and raised on the ventral side, fused at the center into an umbonal mass; wall coarsely perforate; aperture extending along the dorsal side of the chamber margin.

Diameter up to 0.75 mm.

The types of this species were from 1 mile south of Red Bay. It is probably the same as the var. *ornata* noted above. The relation of these forms to those of *Planulina floridana* should be studied, as they may represent the megalospheric and microspheric forms of a single species.

CIBICIDES AMERICANA (Cushman)

Plate 12, figures 5 a-c

Truncatulina americana CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 63, pl. 20, figs. 2, 3; pl. 21, fig. 1.

Test plano-convex, dorsal side nearly flat, ventral side slightly convex, periphery subacute; chambers numerous, eight to ten in the adult whorl, rather rapidly increasing in size; sutures distinct, slightly limbate on the dorsal side especially in the earlier chambers, depressed on the ventral side; wall smooth, finely perforate; aperture peripheral and extending onto the dorsal side, with a slight lip.

Diameter up to 0.75 mm.

This is a common species in the Miocene and Oligocene of the Coastal Plain region. It is not common in the material, but was noted from Bay and Liberty Counties.

CIBICIDES CONCENTRICA (Cushman)

Plate 12, figures 4 a-c

Truncatulina concentrica CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 64, pl. 21, fig. 3.

Test nearly plano-convex, dorsal side nearly flat, ventral side convex, periphery subcarinate; chambers distinct, seven to nine in the adult whorl, the inner end on the dorsal side with a definite proximal portion, fusing with adjacent ones to form a concentric band about the middle and more or less separated by a series of depressions;

sutures deep on the ventral side, slightly limbate and flush on the dorsal side; wall smooth, finely perforate; aperture largely dorsal with a thin lip.

Diameter up to 1 mm.

This is one of the most common species in the Choctawhatchee marl of Florida occurring in material from Bay, Calhoun, Leon, Liberty, Walton and Washington Counties.

In its adult stage, this is a very well marked species, but the early stages are similar in some respects to *C. americana*.

CIBICIDES LOBATULA (Walker and Jacob), var. ORNATA (Cushman)

Truncatulina lobatula (WALKER and JACOB). var. *ornata* CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 61, pl. 18, figs. 1, 2.

Test differing from the typical form in the ornamentation, especially the well developed bands outlining the chambers on the dorsal side.

The type specimen of this variety is from Coes Mill, Liberty County, and a single additional typical specimen has occurred in the collections from Jim Kennedy Branch, 1 mile east of Red Bay, Walton County. More material of this form is necessary to be sure of its relationships.

CIBICIDES REFULGENS (Montfort) (?)

In the earlier paper (Bull. 676, U. S. Geol. Survey, 1918, p. 61, pl. 18, fig. 3), this species was recorded from Coes Mill. No additional material has been obtained.

CIBICIDES VARIOLATA (d'Orbigny)

This species was recorded in the earlier paper (l. c., p. 62, pl. 10, fig. 3) from Jackson Bluff. No other specimens were found in this later material.

Genus DYOCIBICIDES Cushman and Valentine, 1930

DYOCIBICIDES BISERIALIS Cushman and Valentine

Plate 12, figures 6 a, b

Dyocibicides biserialis CUSHMAN and VALENTINE. CONTR. DEPT. GEOL., STANFORD UNIVERSITY, vol. 1, 1930, p. 31, pl. 10, figs. 1, 2.

Test fairly large, the early portion close coiled, later in a spreading biserial series of plano-convex chambers, the dorsal, attached side, flattened; seven or eight chambers in the last whorl, chambers not inflated, but becoming inflated in the biserial portion and greatly enlarging; sutures in the early coiled part, limbate and not depressed, in the biserial portion continuing the limbate character on the dorsal side but becoming deeply depressed ventrally; wall distinctly per-

forate; aperture in the early coiled portion, peripheral or slightly dorsal, in the uncoiled portion, an elongate slit at the outer edge of the chamber at the line of attachment, often elliptical, with a slightly raised lip.

Length up to 1.25 mm.

This species has been recently described from material collected off the California coast. The Florida specimens seem identical. They occur in material from Calhoun, Leon, Liberty, Walton and Washington Counties.

The perforations are much finer than in most of the species of *Cibicides* noted above. The later chambers are often irregular, but in adult specimens usually becoming biserial.

Family PLANORBULINIDAE

Genus ACERVULINA Schultze, 1854

ACERVULINA cf. INHAERENS Schultze

There are a few attached specimens from Leon County that probably should be referred to this species. None of them are complete.

PLATES 1-12

PLATE 1

- FIGS. 1 *a, b.* *Proteonina difflugiiformis* (H. B. Brady). $\times$ 85. *a*, front view; *b*, apertural view. Locality 1/673.
- 2 *a, b.* *Urnulina compressa* Cushman, n. sp. $\times$ 85. *a*, front view; *b*, apertural view. Locality 1/946.
- 3 *a, b.* *Pseudarcella arenata* Cushman, n. sp. $\times$ 85. *a*, front view; *b*, apertural view. Locality 1/673.
- 4 *a, b.* *Textularia agglutinans* d'Orbigny. $\times$ 85. *a*, front view; *b*, apertural view. Locality 1/961.
- 5 *a, b.* *Textularia gramen* d'Orbigny. $\times$ 65. *a*, front view; *b*, apertural view. Locality 1/947.
- 6-8. *Textularia mayori* Cushman. $\times$ 65. *a*, front view; *b*, apertural view. Locality 1/961.
- 9 *a, b.* *Textularia floridana* Cushman. $\times$ 85. *a*, front view; *b*, apertural view. Locality 1/955.
10. *Bigenerina nodosaria* d'Orbigny, var. *textularioidea* (Goës). $\times$ 60. Locality 1/946.
- 11, 12. *Quinqueloculina* cf. *fusca* H. B. Brady. $\times$ 85. *a, b*, opposite sides.
13. *Triloculina asperula* Cushman. $\times$ 85. Coes Mill, Liberty County.

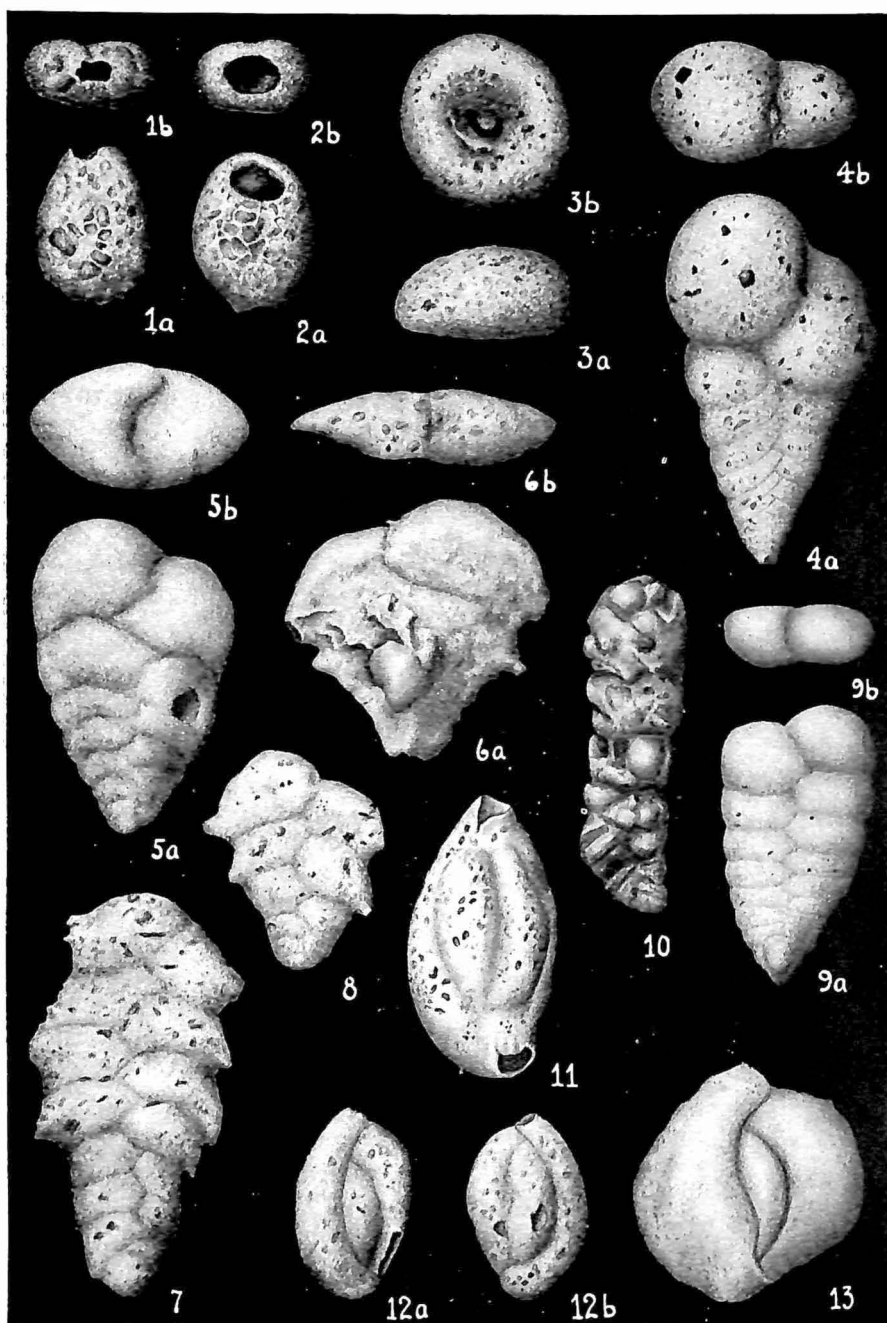


PLATE 2

- FIGS. 1 *a-c*. *Quinqueloculina seminula* (Linné). $\times$ 50. *a*, *b*, opposite sides; *c*, apertural view. Locality 1/961.
- 2 *a-c*. *Quinqueloculina seminula* (Linné), var. Locality 1/955.
- 3-5. *Quinqueloculina lamarckiana* d'Orbigny. $\times$ 50. *a*, *b*, opposite sides; *c*, apertural view. Locality 1/967.
- 6 *a-c*. *Quinqueloculina contorta* d'Orbigny. $\times$ 100. *a*, *b*, opposite sides; *c*, apertural view. Locality 1/962.
- 7 *a*, *b*. *Quinqueloculina subpoeyana* Cushman. $\times$ 85. *a*, *b*, opposite sides. Locality 1/955.
- 8 *a-c*. *Sigmoilina tenuis* (Czjzek). $\times$ 85 *a*, *b*, opposite sides; *c*, apertural view. Locality 1/947.

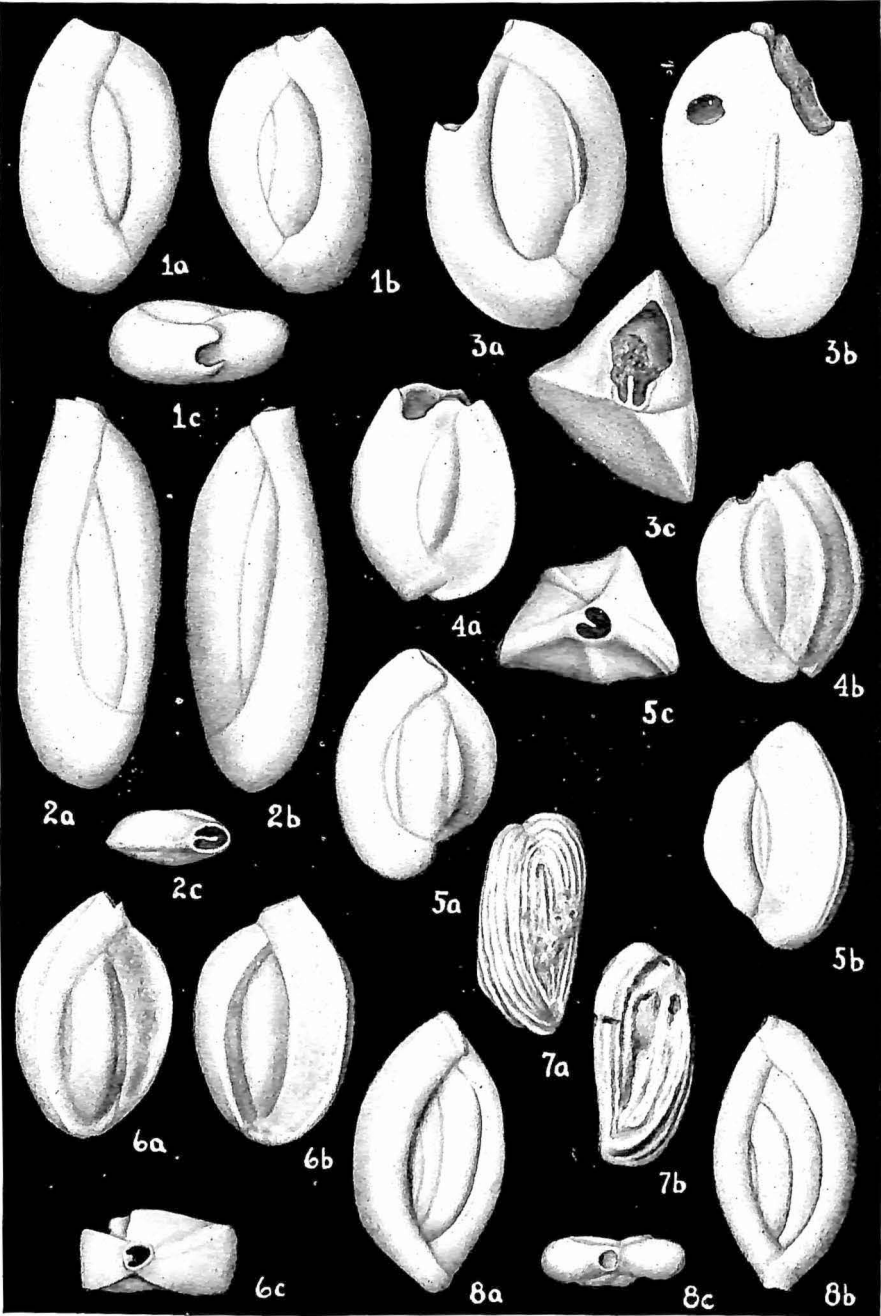


PLATE 3

- FIGS. 1 *a, b. Spiroloculina planulata* (Lamarck). $\times$ 85. *a*, front view; *b*, apertural view. Locality 1/967.
- 2 *a, b. Spiroloculina depressa* d'Orbigny. $\times$ 45. *a*, front view; *b*, apertural view. Jackson Bluff, Leon County.
3. *Spiroloculina* sp (?) $\times$ 85. Locality 1/955.
- 4 *a-c. Triloculina schreiberiana* d'Orbigny. $\times$ 45. *a, b*, opposite sides; *c*, apertural view. Coes Mill, Liberty County.
- 5 *a-c. Pyrgo subsphaerica* (d'Orbigny). $\times$ 40. *a*, front view; *b*, side view; *c*, apertural view. Jackson Bluff, Leon County.
6. *Cornuspira involvens* (Reuss). $\times$ 85. Locality 1/967.
- 7 *a, b. Robulus americanus* (Cushman). $\times$ 45. *a*, side view; *b*, apertural view. Locality 1/948.
- 8 *a, b. Robulus americanus* (Cushman), var. *spinosus* (Cushman). $\times$ 45. *a*, side view; *b*, apertural view. Locality 1/748.

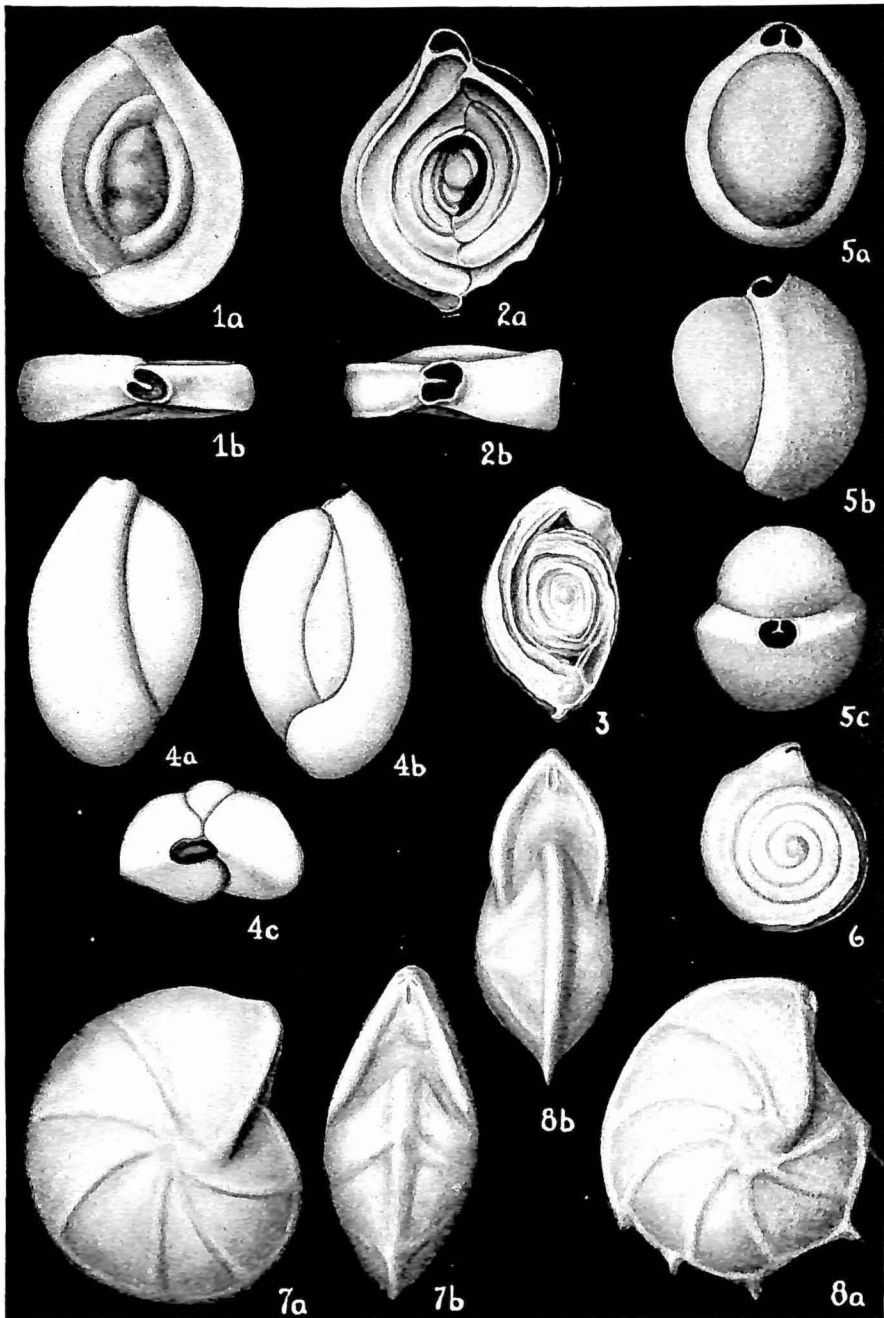
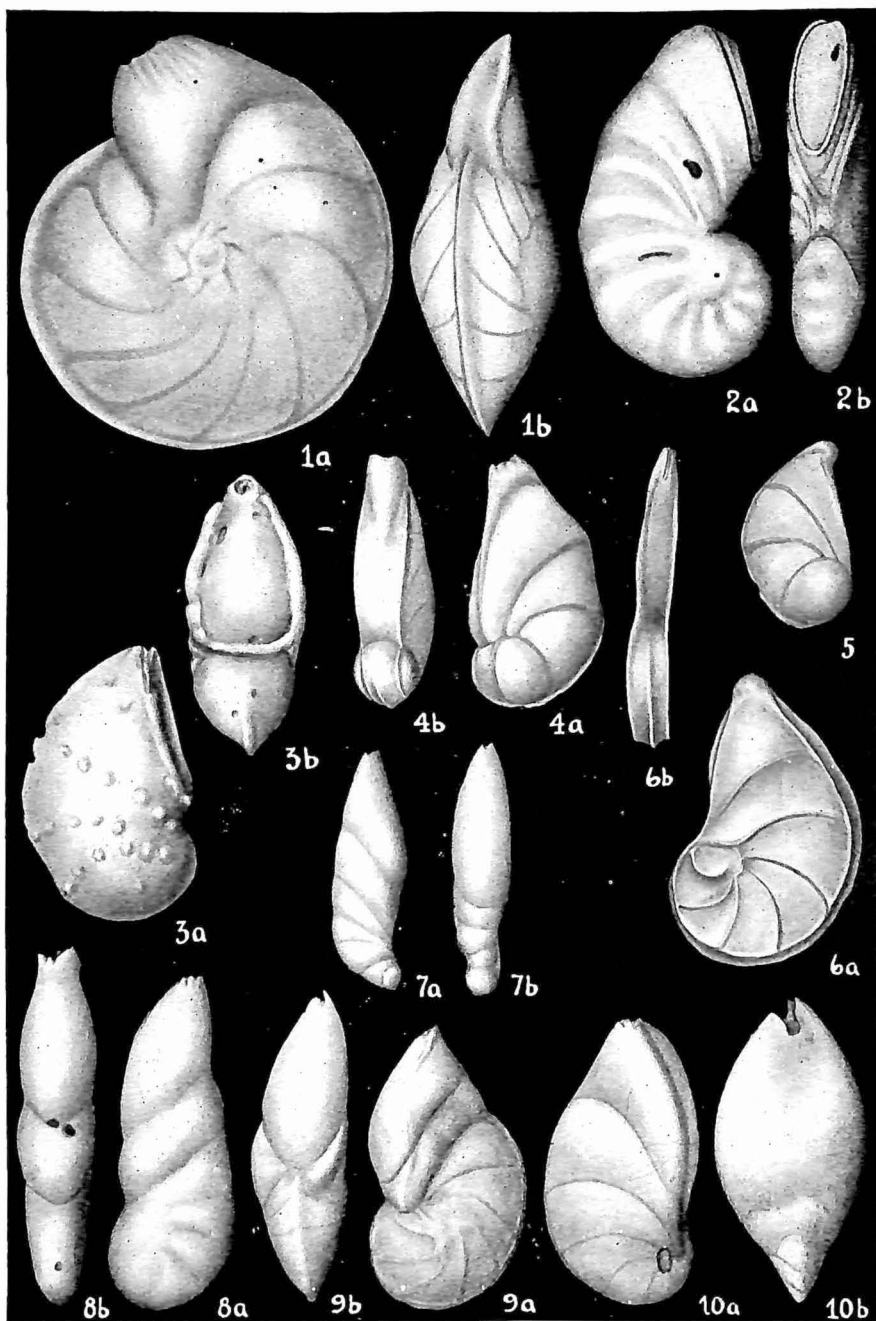


PLATE 4

- FIGS. 1 *a, b. Robulus iotus* (Cushman). $\times$ 35. *a*, side view; *b*, peripheral view. Locality 1/706.
- 2 *a, b. Robulus floridanus* (Cushman). $\times$ 40. *a*, side view; *b*, peripheral view. 1 mile south of Red Bay, Walton County.
- 3 *a, b. Robulus catenulatus* (Cushman). $\times$ 65. *a*, side view; *b*, peripheral view. Locality 1/673.
- 4 *a, b, 5. Planularia* sp (?) $\times$ 65. *a*, side view; *b*, peripheral view. Locality 1/655.
- 6 *a, b. Planularia* sp (?) $\times$ 65. *a*, side view; *b*, peripheral view. Locality 1/948.
- 7 *a, b. Marginulina* sp (?) $\times$ 65. *a*, side view; *b*, peripheral view. Locality 1/962.
- 8 *a, b. Marginulina* sp (?) $\times$ 50. *a*, side view; *b*, peripheral view. Locality 1/956.
- 9 *a, b. Marginulina* sp (?) $\times$ 50. *a*, side view; *b*, peripheral view. Locality 1/947.
- 10 *a, b. Saracenaria acutauricularis* (Fichtel and Moll). $\times$ 50. *a*, side view; *b*, peripheral view. Locality 1/947.



Family
Lagenidae

PLATE 5

- FIG. 1. *Dentalina communis* d'Orbigny. $\times$ 50. Locality 1/947.
2. *Dentalina consobrina* d'Orbigny, var. *emaciata* Reuss. $\times$ 50. Locality 1/947.
3. *Dentalina* sp (?) $\times$ 65. Locality 1/947.
4. *Nodosaria catesbyi* d'Orbigny. $\times$ 65. Locality 1/965.
5. *Lagena perlucida* (Montagu). $\times$ 100. Locality 1/958.
6 a, b. *Lagena clavata* (d'Orbigny). $\times$ 85. a, side view; b, apertural view. Locality 1/958.
7 a, b. *Lagena hexagona* (Williamson), var. *scalariformis* (Williamson). $\times$ 85. a, side view; b, apertural view. Locality 1/958.
8. *Lagena costata* (Williamson), var. *amphora* Reuss. $\times$ 85. Locality 1/956.
9. *Lagena* cf. *striato-punctata* Parker and Jones. $\times$ 85. Locality 1/956.
10. *Lagena sulcata* (Walker and Jacob). $\times$ 85. Locality 1/960.
11 a, b. *Lagena hexagona* (Williamson). $\times$ 100. a, side view; b, basal view. Locality 1/946.
12. *Lagena* cf. *marginato-perforata* (Seguenza). $\times$ 85. Locality 1/953.
13 a, b. *Lagena orbignyana* (Seguenza), var. *lacunata* (Burrows and Holland). $\times$ 85. a, side view; b, apertural view. Locality 1/958.
14. *Lagena substriata* Williamson. $\times$ 85. Locality 1/965.
15. *Guttulina costatula* Galloway and Wissler. $\times$ 65. Locality 1/962.
16. *Globulina rotundata* (Bornemann). $\times$ 65. Locality 1/947.
17, 18. *Pyrulina albatrossi* Cushman and Ozawa. $\times$ 65. Locality 1/961.
19. *Guttulina lactea* (Montagu), var. *earlandi* Cushman and Ozawa. $\times$ 85. Locality 1/955.
20. *Pseudopolymorphina rutila* (Cushman). $\times$ 50. Locality 1/954.
21. *Globulina gibba* d'Orbigny. $\times$ 65. Locality 1/947.
22. *Globulina inaequalis* Reuss. $\times$ 65. Locality 1/967.

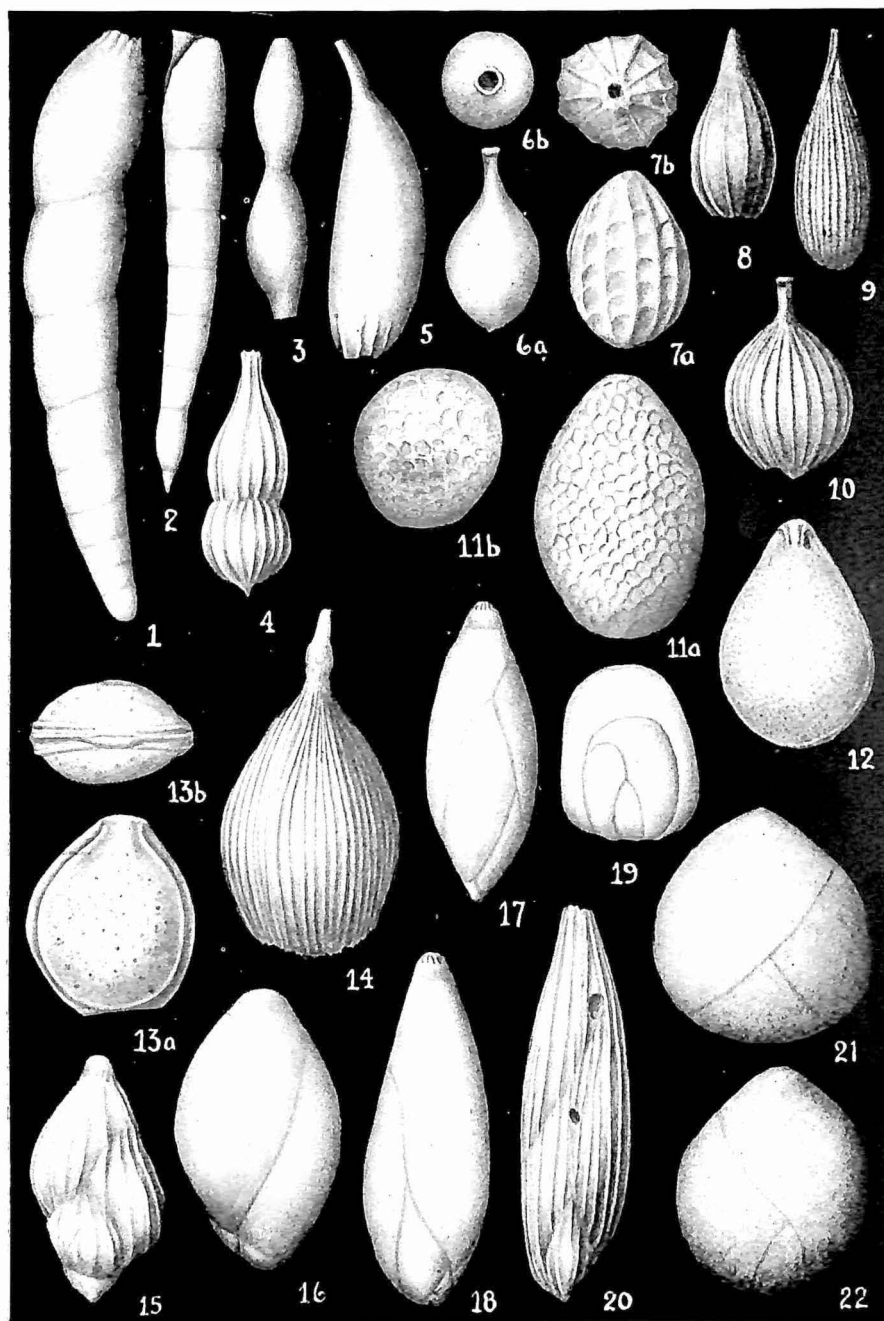


PLATE 6

- Figs.** 1-3. *Nonion grateloupi* (d'Orbigny). $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/958.
4. *Sigmomorphina williamsoni* (Terquem). $\times$ 65. Locality 1/961.
5. *Pseudopolymorphina dumblei* (Cushman and Applin). $\times$ 50. Locality 1/954.
- 6 *a, b*. *Nonion glabrella* Cushman, n. sp. $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/958.
- 7, 8. *Nonion pizarrensis* Berry. $\times$ 85. *a*, side view; *b*, peripheral view. Fig. 7, locality 1/948. Fig. 8, locality 1/947.

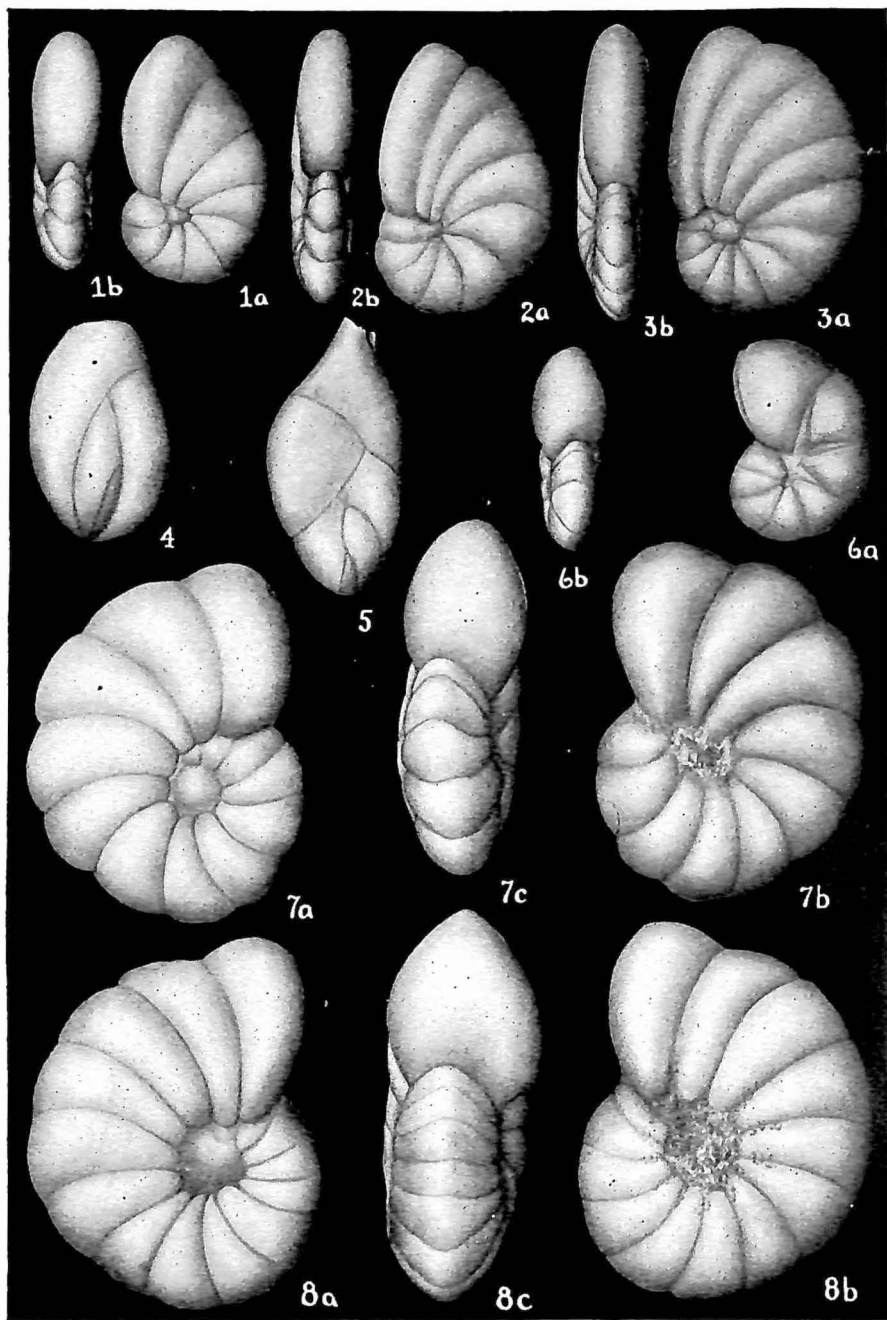
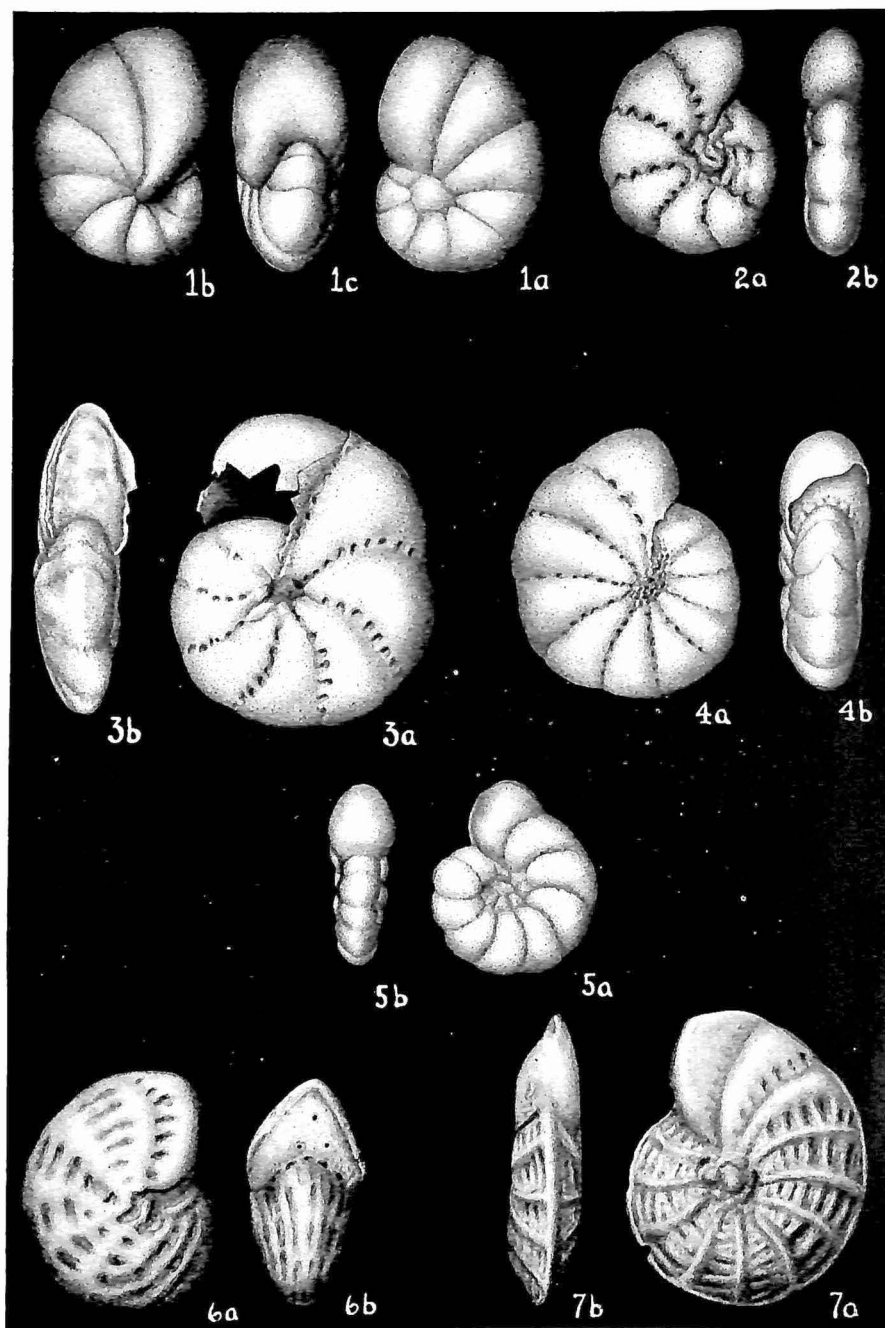


PLATE 7

- FIGS. 1 *a-c.* *Nonionella auris* (d'Orbigny). $\times$ 85. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/673.
- 2 *a, b.* *Elphidium incertum* (Williamson). $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/956.
- 3, 4. *Elphidium poeyanum* (d'Orbigny). $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/961.
- 5 *a, b.* *Elphidium* sp (?) $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/682.
- 6 *a, b.* *Elphidium sagrum* (d'Orbigny). $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/947.
- 7 *a, b.* *Elphidium advenum* (Cushman). $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/947.



Family Bulminidae

PLATE 8

- FIG. 1. *Plectofrondicularia floridana* Cushman, n. sp. $\times$ 55. Locality 1/950.
2. 3. *Buliminella elegantissima* (d'Orbigny). $\times$ 100. Locality 1/670.
4. *Buliminella curta* Cushman. $\times$ 65. Locality 1/682.
- 5 a, b. *Bulimina gracilis* Cushman, n. sp. $\times$ 85. a, side view; b, apertural view. Locality 1/950.
- 6 a, b. *Bulimina inflata* Seguenza. $\times$ 55. a, side view; b, apertural view. Locality 1/748.
- 7 a, b. *Virgulina punctata* d'Orbigny. $\times$ 65. a, side view; b, apertural view. Locality 1/682.
- 8 a, b. *Virgulina fusiformis* Cushman, n. sp. $\times$ 100. a, side view; b, apertural view. Locality 1/956.
- 9 a, b. *Bolivina marginata* Cushman. $\times$ 65. a, side view; b, apertural view. Locality 1/950.
- 10 a, b. *Bolivina plicatella* Cushman, n. sp. $\times$ 100. a, side view; b, apertural view. Locality 1/962.
- 11 a, b. *Loxostomum gunteri* Cushman, n. sp. $\times$ 65. a, side view; b, apertural view. Locality 1/950.
- 12 a, b. *Bolivina pulchella* d'Orbigny, var. *primitiva* Cushman, n. var. $\times$ 85. a, side view; b, apertural view. Locality 1/961.
- 13, 14. *Bolivina marginata* Cushman, var. *multicostata* Cushman. $\times$ 85. a, side view; b, apertural view. Fig. 13, locality 1/671; Fig. 14, locality 1/950.
- 15 a, b. *Bolivina floridana* Cushman. $\times$ 55. a, side view; b, apertural view. Locality 1/950.
- 16 a, b. *Chrysalidinella pulchella* (Cushman). $\times$ 85. a, side view; b, apertural view. Locality 1/947.
- 17 a, b. *Reussia spinulosa* (Reuss). $\times$ 65. a, side view; b, apertural view. Locality 1/947.

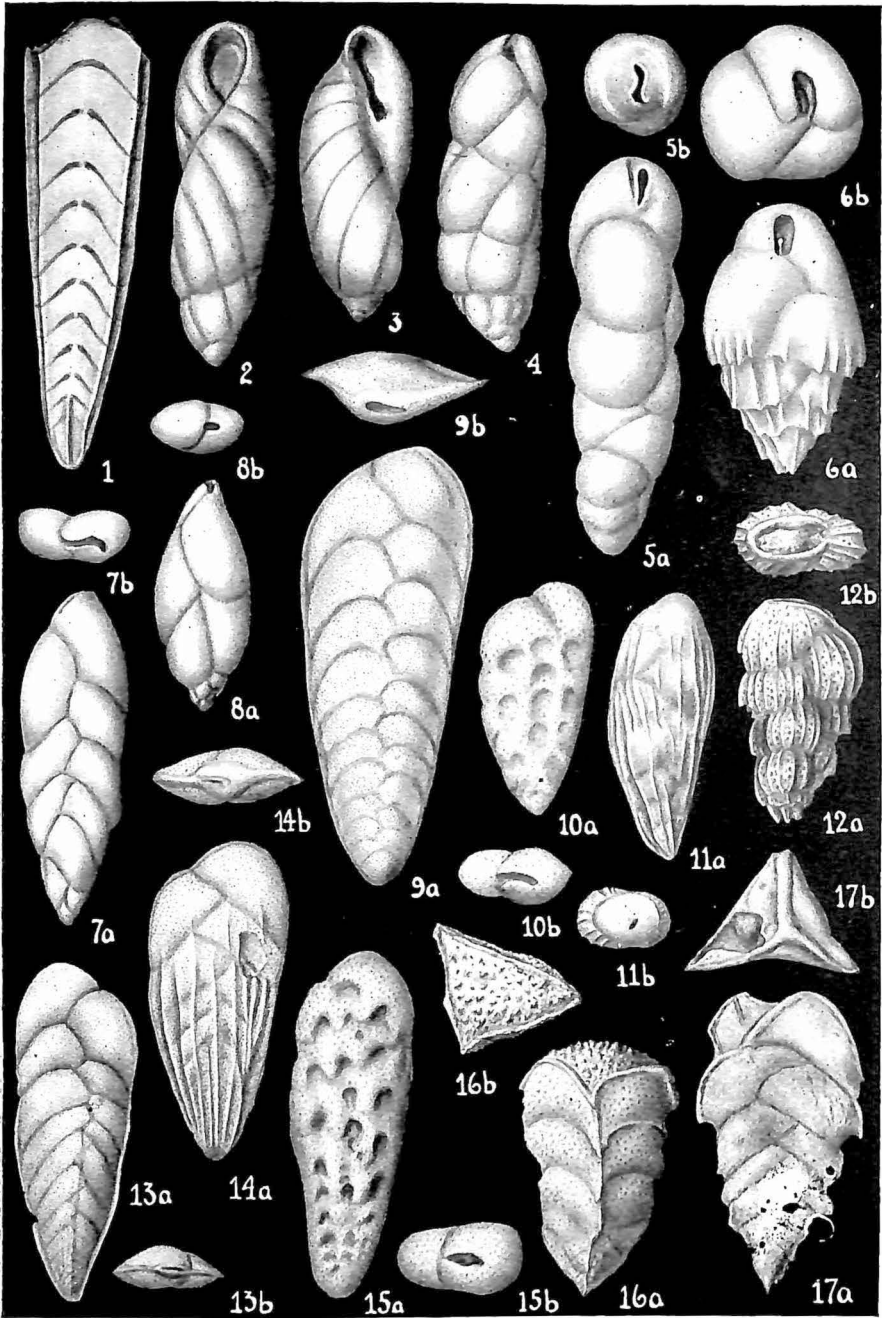


PLATE 9

- FIGS. 1, 2. *Virgulina gunteri* Cushman. $\times$ 45. Locality 1/963.
 3-6. *Uvigerina* cf. *pigmea* d'Orbigny. $\times$ 85. Figs. 3, 4, locality 1/950;
 Fig. 5, locality 1/948; Fig. 6, locality 1/671.
 7. *Uvigerina auberiana* d'Orbigny. $\times$ 85. Locality 1/947.
 8, 9. *Angulogerina occidentalis* (Cushman). $\times$ 85. Locality 1/947.
 10. *Siphogenerina lamellata* Cushman. $\times$ 45. Locality 1/948.
 11 *a, b.* *Ellipsolagena bidens* Cushman, n. sp. $\times$ 100. *a.* side view; *b.* aper-
 tural view. Locality 1/682.
 12 *a, b.* *Spirillina orbicularis* Bagg. $\times$ 85. *a.* dorsal view; *b.* ventral view.
 Locality 1/947.
 13 *a-c.* *Discorbis rosacea* (d'Orbigny). $\times$ 30. *a.* dorsal view; *b.* ventral
 view; *c.* peripheral view. Locality 1/953.

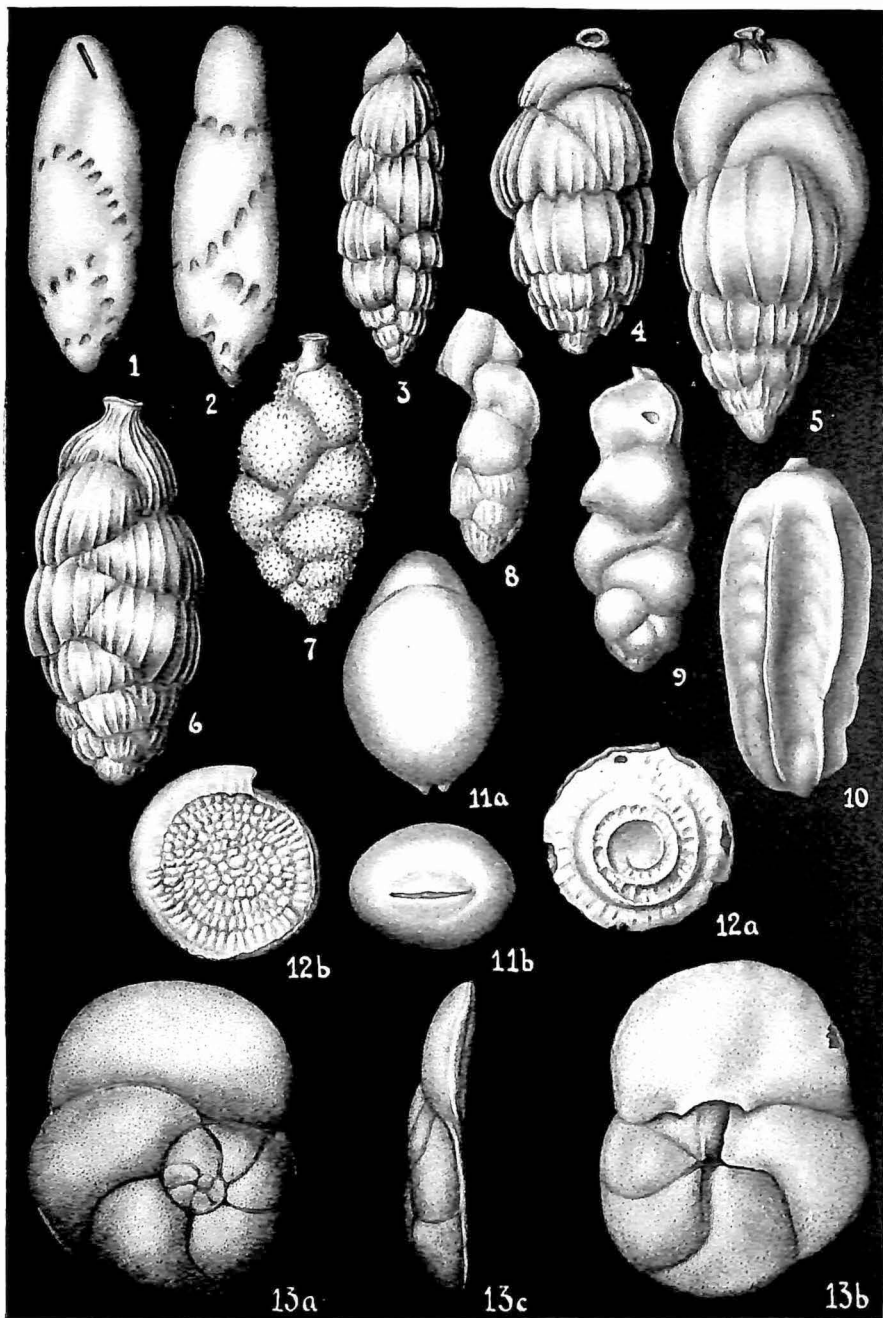


PLATE 10

- FIGS. 1 *a-c.* *Discorbis subaraucana* Cushman. $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/958.
- 2 *a-c.* *Discorbis mira* Cushman. $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/955.
- 3 *a-c.* *Discorbis vilardeboana* (d'Orbigny). $\times$ 85. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/961.
- 4 *a-c.* *Discorbis consobrina* (d'Orbigny). $\times$ 135. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/954.
- 5 *a-c.* *Discorbis valvulata* (d'Orbigny). $\times$ 85. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/956.
- 6 *a-c.* *Valvulineria floridana* Cushman, n. sp. $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/682.
- 7 *a-c.* *Eponides lateralis* (Terquem). $\times$ 55. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/961.

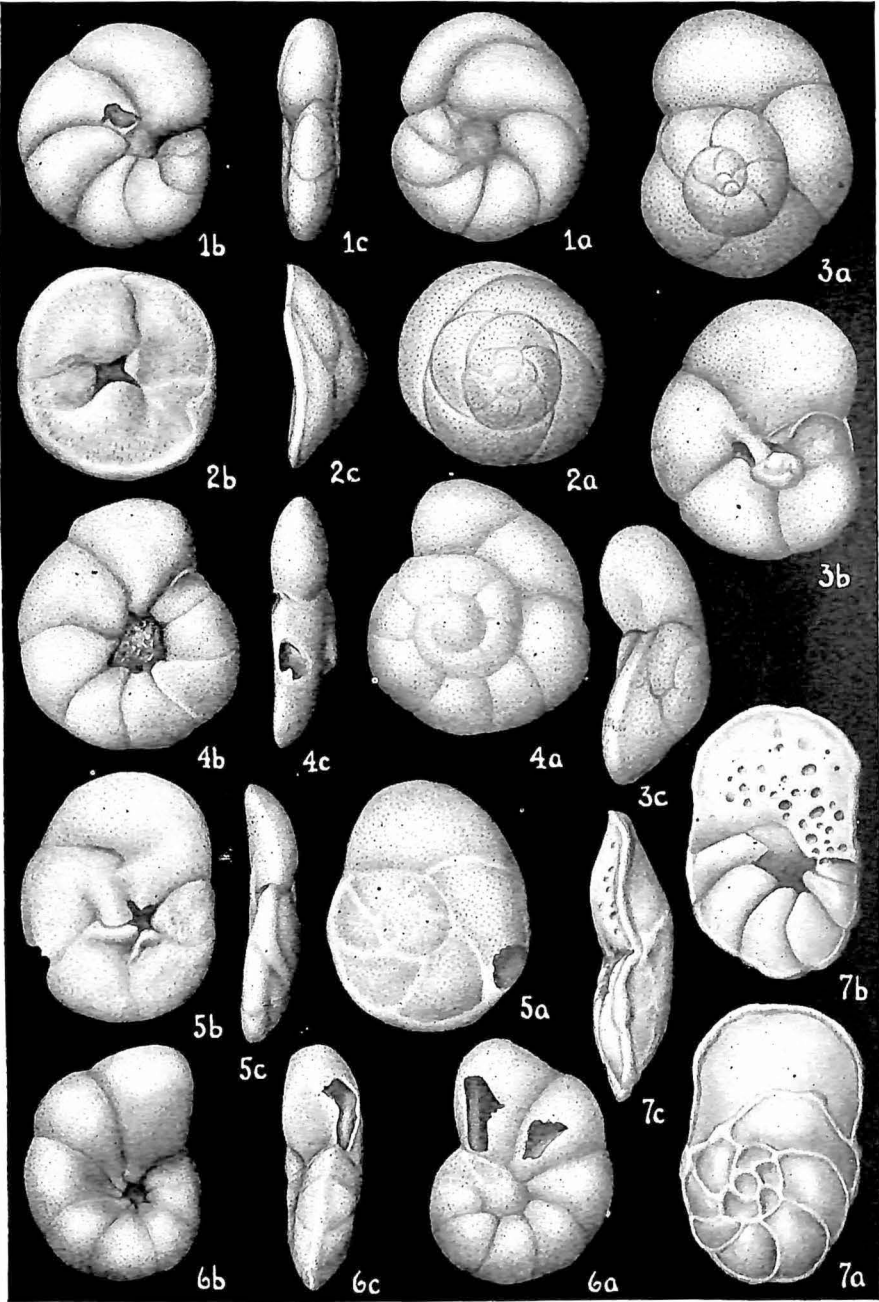


PLATE 11

- FIGS. 1 *a-c.* *Eponides mansfieldi* Cushman, n. sp. $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/948.
- 2 *a-c.* *Pulvinulinella pontoni* Cushman, n. sp. $\times$ 135. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/682.
- 3 *a-c.* *Rotalia beccarii* (Linné), var. *parkinsoniana* (d'Orbigny). $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/948.
- 4 *a-c.* *Cancris sagra* (d'Orbigny). $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/948.
- 5 *a-c.* *Amphistegina lessonii* d'Orbigny. $\times$ 45. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/706.
- 6 *a, b.* *Cassidulina crassa* d'Orbigny. $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/954.
- 7 *a, b.* *Cassidulina laevigata* d'Orbigny, var. *carinata* Cushman. $\times$ 135. *a*, side view; *b*, peripheral view. Locality 1/958.
- 8 *a, b.* *Cassidulinoides bradyi* (Norman). $\times$ 85. *a*, side view; *b*, peripheral view. Locality 1/954.

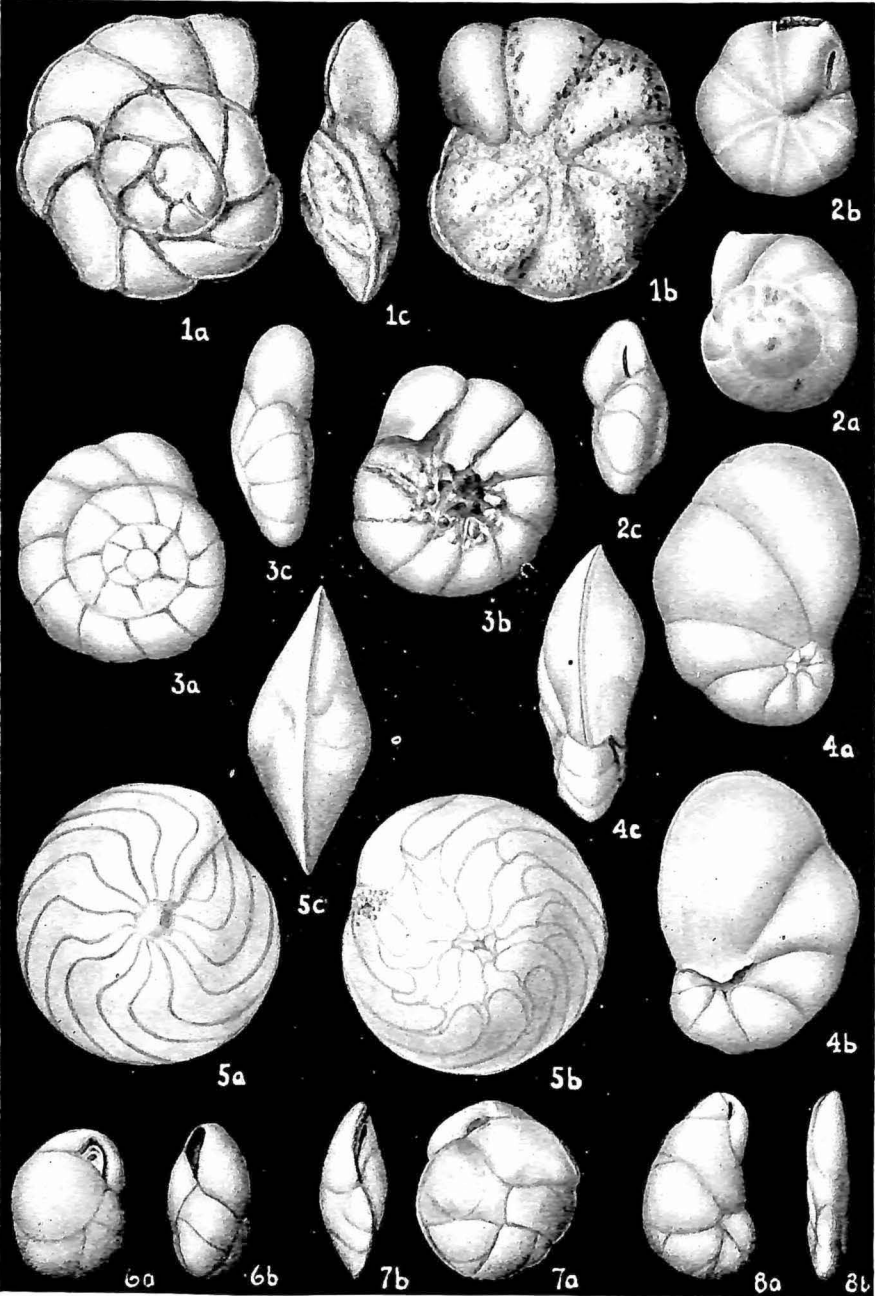
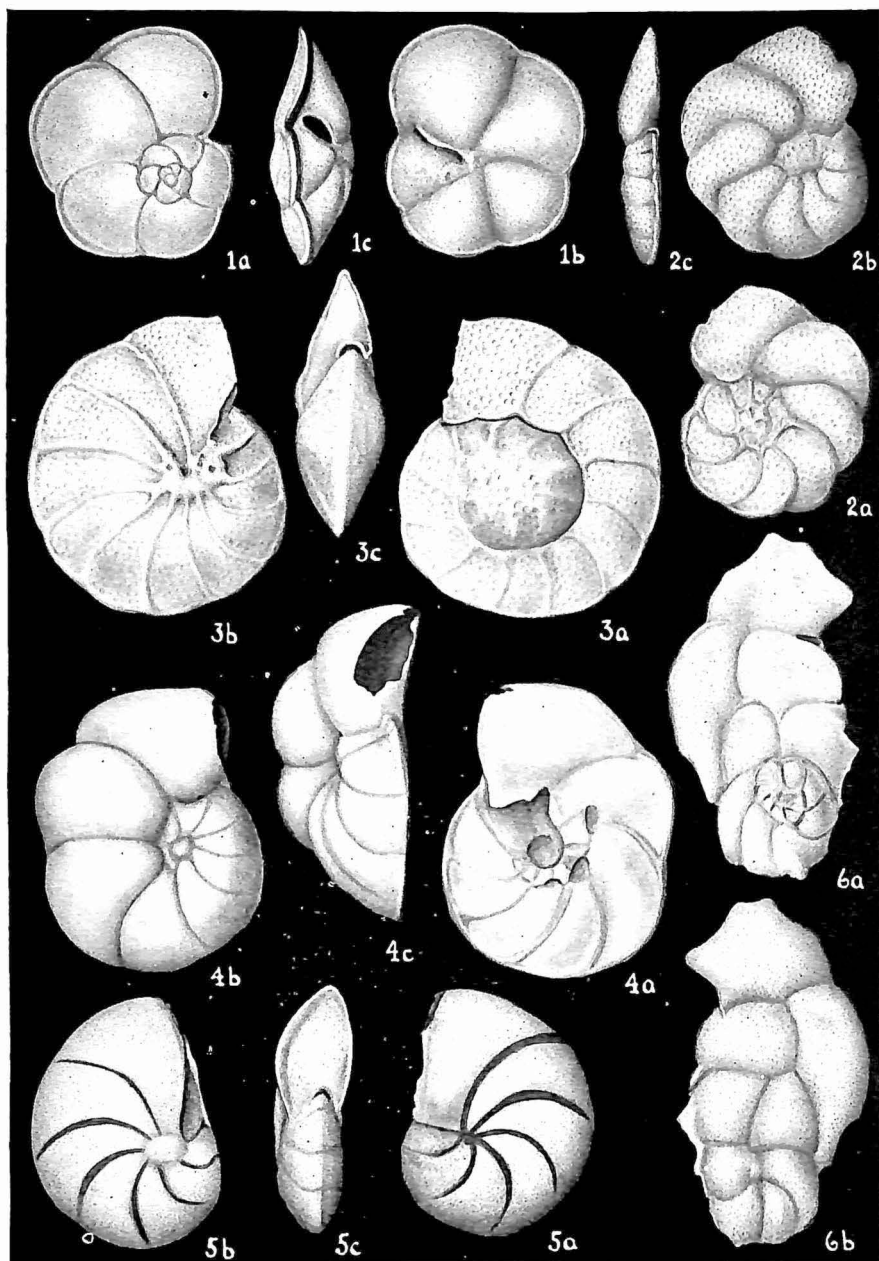


PLATE 12

- FIGS. 1 *a-c. Globorotalia menardii* (d'Orbigny). $\times$ 45. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/965.
- 2 *a-c. Planulina depressa* (d'Orbigny). $\times$ 45. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/953.
- 3 *a-c. Cibicides floridana* (Cushman). $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/948.
- 4 *a-c. Cibicides concentrica* (Cushman). $\times$ 45. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/748.
- 5 *a-c. Cibicides americana* (Cushman). $\times$ 65. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. Locality 1/953.
- 6 *a, b. Dyocibicides biserialis* Cushman and Valentine. $\times$ 45. *a*, dorsal view; *b*, ventral view. Locality 1/955.



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This index includes generic names only, for where there are two or more species of a genus they are usually treated on consecutive pages, and thus can be easily found. Names in italics are synonyms. Most species are treated in three different places, first in the distributional lists near the beginning, second in the catalogue proper, with descriptions and localities, and last in the illustrations.

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