Vicksburg (Oligocene) Smaller Foraminifera From Mississippi

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By RUTH TODD

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Descriptions and illustrations of smaller Foraminifera from five measured sections in western Mississippi

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VICKSBURG (OLIGOCENE) SMALLER FORAMINIFERA FROM MISSISSIPPI

By RUTH TODD

ABSTRACT

This paper describes and illustrates a fauna of 176 species and varieties of smaller Foraminifera from parts of the Vicksburg group, and charts the distribution of the species found in five measured sections in central and western Mississippi. The stratigraphic units involved are the Mint Spring marl member of the Marianna limestone, the Glendon limestone member, and the marl member of the Byram formation. Thirteen new species and three new varieties are described.

INTRODUCTION

A study of the smaller Foraminifera in samples collected by W. H. Monroe from five richly fossiliferous sections in the Vicksburg group (Oligocene) of Mississippi was made to see if definite correlation could be established from one section to another by means of these organisms. The results of the study are presented here. Additional material from other sections in the Vicksburg group would make a more complete and possibly somewhat altered picture. In present circumstances it seems advisable to complete the present work, which may be useful as a basis for more detailed studies of the smaller Foraminifera in the Vicksburg group.

The general stratigraphic section exposed in western Mississippi is as follows:

Middle Oligocene (Vicksburg group restricted)	Byram formation	Bucatunna clay member
		Marl member
		Glendon limestone member
	Marianna limestone	Limestone member
		Mint Spring marl member
Lower Oligocene	Forest Hill sand (equivalent of Red Bluff clay to eastward)	

The Forest Hill sand represents deltaic deposition with the landmass toward the northwest, and its equivalent Red Bluff clay to the eastward represents the marine beds offshore from the delta. At the beginning of Vicksburg deposition, the Forest Hill deltaic deposits were submerged, permitting marine waters to cover the area. The deposition of the Glendon limestone member was in deeper water with less clastic material.

The five sections from which Mr. Monroe collected are located as follows: (1) Mint Spring Bayou, near Vicksburg, Miss.; (2) Burke Creek; (3) Gulf and Ship Island Railroad cut 1.5 miles south of Plain; (4) Richland Creek; and (5) Robinson Quarry near Brandon, Rankin County, Miss. These sections include, from bottom to top, the Mint Spring marl member of the Marianna limestone, the Glendon limestone member, and the typical marl member of the Byram formation, although not all are present in a single section.

Fifty-seven samples were prepared and examined. In the first two sections studied, all the samples were prepared, but as the hard limestone beds yielded very few specimens or none, in the other three sections only the softer beds, marls or clays or sands, were prepared. About two ounces of material was washed through 40-, 80-, and 200-mesh silk screens and, after drying, the two finer portions were treated with carbon tetrachloride that floated off most of the smaller Foraminifera. The coarser portion was examined for large specimens and the sinkings of the other two portions were also examined for specimens which might not have floated. The picking was not done quantitatively, but an attempt was made to find all the recognizable forms present and a rough estimate made as to abundance, whether rare, common or abundant. One hundred seventy-six species and varieties were recognized, of which thirteen species and three varieties are described as new. Eight others may be undescribed, but available specimens do not warrant description. A few other forms were omitted because specimens were too few or poorly preserved.

The richest sections are those at Mint Spring Bayou and at Burke Creek: 149 species and varieties occur in the former and 148 in the latter, with 135 common to both. These two sections show the closest resemblance and differ from the other three sections in the relative abundance of Miliolidae, 21 species of which occur in these two sections in comparison with only a single species of this family, *Massilina decorata* Cushman, in each of the other three sections. These three eastern sections together have 136 species and varieties, 85 of which are common to all three. Eighty species and varieties are common to all five sections.

The distribution chart (p. 4), showing the occurence and relative abundance of all the species in each sample studied, indicates the close relationships of the five sections.

The foraminiferal fauna here described is a composite one drawn from parts of all five sections. The fauna of the lower part of the Vicksburg group would be expected to be one characteristic of nearshore and shallow water conditions, and the entire section of nearly 40 feet at Mint Spring Bayou and the lower part of the section at Burke Creek, the most westerly of those in Rankin County, does bear out this expectation. With the coming of deeper water in Glendon time, the foraminiferal fauna shows a corresponding change in certain of its species, chiefly those belonging to the Miliolidae. The foraminiferal fauna as a whole, however, appears to be a single fauna with no distinct changes, other than the ecologic change from shallow, nearshore deposition of the lower beds to deeper, offshore deposition of the upper beds. From the foraminiferal evidence it appears that the entire section at Mint Spring Bayou is equivalent to the lower parts of the sections in Rankin County.

From the study of the distribution and abundance of the Foraminifera in these sections, the following species and varieties appear to be of significance and may be found useful in local correlation work elsewhere in this part of the Vicksburg group.

Massilina decorata Cushman
Bulimina ovata D'Orbigny var. *primitiva* Todd, n. var.
Uvigerina vicksburgensis Cushman and Ellisor
Angulogerina byramensis (Cushman) var. *anfracta* Todd, n. var.
Angulogerina rugoplicata Cushman
Discorbis arcuato-costata Cushman
Discorbis subglobosa Cushman
Discorbis byramensis Cushman
Gyroidina vicksburgensis (Cushman)
Cancris vicksburgensis Todd, n. sp.
Baggina xenoula Hadley
Asterigerina bracteata Cushman
Alabamina mississippiensis Todd, n. sp.

No general, widely applicable statement could be made in regard to restricted ranges of any of these forms. In the four sections in Rankin County, the top occurrence of *Massilina decorata* Cushman appears to form a recognizable horizon within the Glendon limestone member of the Byram formation. As the species is generally abundant it should form a useful local marker.

The work of Mr. W. H. Monroe in collecting the material from these measured sections, and the invaluable help of Dr. Joseph A Cushman on many questions regarding determinations of species, are deeply appreciated.

STRATIGRAPHIC SECTIONS

The five sections are described below, with the stratigraphic zones numbered upward from the bottom.

Mint Spring Bayou, south of National Military Cemetery, Vicksburg, Miss.

	Thickness Ft.	In.
Byram formation.		
Marl facies.		
20. Yellow laminated marl to road	?	
19. "Ironstone"	Crust	
18. Harder blue and gray marl. Top ledge in creek. Overlain by ironstone (?)	2	
17. Blue marl	2	
16. Hard gray glauconitic marl	2	
15. Gray glauconitic marl	3	
14. Cream-colored marl, somewhat harder than bed 13	2	
13. Glauconitic marl	1	
12. Soft shaly limestone	2	
11b. Laminated marl and sand 11a. Laminated marl and sand	5	
10. Hard gray lime	1	
9. Soft yellow marl	-----	10
Glendon (?) limestone member.		
8. Hard blue-gray lime. Top of waterfall	2	
7. Hard gray marl	-----	10
6. Gray, brown, and light blue marl with hard break in middle	2	10
5. Hard gray lime	2	10
4. Soft gray fossiliferous calcareous marl or clay	-----	5
3. Hard gray lime	2	
Marianna limestone.		
Mint Spring marl member.		
2. Gray and brown sand and clay. Fossils. Gray, highly calcareous sand at top	10	
1. Blue-gray, carbonaceous sand and clay. Fossils	7+	

All the samples were prepared and examined and Foraminifera found in all except sample 1.

Section in Burke Creek, sec. 15, T. 4 N., R. 1 E., Rankin County, Miss.

	Thickness Ft.	In.
Byram formation.		
Glendon limestone member.		
757–16. Light gray and brown clay filled with calcareous concretions	2	0
757–15. Light brown marl	3±	
757–14. Slightly indurated yellow and white glauconitic marl	1±	
757–13. Hard ledge of glauconitic, slabby limestone	1	3
757–12. Light gray, soft, highly glauconitic marl	2	0
757–11. Light gray, glauconitic, medium hard, slabby limestone	1	3
757–10. Soft, light gray, glauconitic marl	1	7
757– 9. Hard glauconitic limestone	0	9
Marianna limestone.		
Limestone member.		
757– 8. Blue-gray marl	3	0
757– 7. Slightly indurated limestone	1	0
757– 6. Soft, cream-colored marl (no samples)	2	3
757– 5. Indurated marl		
757– 4. Blue-gray, coarsely glauconitic marl	3	0
757– 3. Coquina and concretionary limestone	0	11

	Thickness Ft.	In.
Marianna limestone—Continued		
Mint Spring marl member.		
757–2b. Blue-gray, ferruginous, coarsely glauconitic marl	5	6
757–2a. Very rich shell bed	1	0
Forest Hill sand.		
757– 1. Black, fossiliferous sand and clay	3±	
757– 0. Lignite		

All the samples were prepared and examined except 0, 5, 6, 7, 9, 11, and 13.

Gulf and Ship Island Railroad cut, 1.5 miles south of Plain, Rankin County, Miss.

Residual clay and colluvium

	Thickness Ft.	In.
Byram formation.		
Marl facies.		
521–22. White chalk, clay and calcareous concretions	2	3
521–20, 21. Ironstained calcareous clay overlain by very rich shell bed	1	3
521–19. Rich shell bed	0	7
521–18. Light yellow, soft marl	1	3
521–17. Very fossiliferous shell bed	0	6
521–16. Soft yellow glauconitic limestone	1	7
Glendon(?) limestone member.		
521–15. Hard white limestone	1	10
521–14. Soft white limestone or marl	1	6
521–13. Hard white glauconitic limestone	0	6
521–12. Medium hard, cream-colored, glauconitic, fossiliferous marl	1	7
521–11. Hard gray limestone	0	10
521–10. Soft yellow glauconitic marl	0	3
521– 9. Hard gray glauconitic limestone	0	9
521– 8. Soft, cream-colored, fossiliferous, glauconitic marl	0	6
521– 7. Hard, white to cream-colored, glauconitic limestone, fossils abundant	1	0
521– 6. Light blue-gray, highly glauconitic, calcareous clay, containing prolific shell bed 6″ above base; weathers yellow	1	8
521– 5. Hard, yellow, slabby, very fossiliferous, glauconitic limestone	0	11
521– 4. Cream-colored, glauconitic, fossiliferous marl	0	10
521– 3. Hard, white, fossiliferous limestone	0	10
521– 2. Soft, cream-colored marl, contains no glauconite, many soft shells	1	2
521– 1. Hard, cream-colored, fine grained, fossiliferous limestone	1	6+

All the samples were prepared and examined, except 22, and Foraminifera found in all except 7. The three groups of samples: 18 and 19, 13 to 15, and 9 to 11, were each prepared as composite samples.

Richland Creek, sec. 3, T. 4 N., R. 2 E., Rankin County, Miss.

	Thickness Ft.	In.
Byram formation.		
Glendon(?) limestone member.		
545–8. Hard, cream-colored limestone	1	0
545–7. Hard marl, blue at base, cream-colored and flaky in middle, cream-colored and massive at top. The middle layer may be limestone	4	6
545–6. Very hard, white and cream-colored, finely glauconitic limestone	1	1
545–5. Grayish, cream-colored, soft marl. Very rich shell bed at base	2	5
545–4. Hard white limestone	1	2
545–3. Hard, light blue, flaky marl	1	8
545–2. Hard, light blue, glauconitic marl that weathers to cream color	1	8
545–1. Light blue, glauconitic, medium-hard limestone	?	

All the samples were prepared and examined except 1, 4, and 6.

Robinson Quarry, near Brandon, sec. 19, T. 5 N., R. 4 E., Rankin County, Miss.

Residual clay

	Thickness Ft.	In.
Byram formation.		
Glendon(?) limestone member.		
662–15. Hard limestone from high bed. Exact relation not shown.		
Residual clay.		
662–14. Hard ledge of limestone	2	2
662–13. Soft marl. Many Lepidocyclinas at base	2	3
662–12. Hard yellow limestone	0	10
662–11. Soft yellow clay or marl	0	10
662–10. Massive overhanging ledge of limestone	2	3
662– 9. Soft, gray marl, passing upward into light brown marl	1	2
662– 8. Hard ledge of white limestone full of fossils	1	0
662– 7. Highly fossiliferous gray soft marl. Upper part full of large Lepidocyclinas	1	6
662– 6. Gray limestone	1	4
662– 5. Dark gray clay passing upward into soft yellow marl, both fossiliferous	1	6
662– 4. Very fossiliferous soft marl	0	5
662– 3. Hard blue-gray limestone	1	6
662– 2. Soft blue-gray marl	1	0
662– 1. Hard ledge of blue-gray limestone	?	
Concealed from bottom of quarry	5	0

Only samples 2, 4, 5, 7, 9, 11, and 13 were prepared and examined.

SYSTEMATIC DESCRIPTIONS

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

Spiroplectammina mississippiensis (Cushman) Cushman and Todd

Plate 1, figure 1

Textularia mississippiensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 90, pl. 14, fig. 4, 1922; Prof. Paper 129–F, p. 125, 1922; Prof. Paper 133, p. 17, 1923.

Cushman and Applin, Am. Assoc. Petrol. Geologists Bull., vol. 10, p. 166, pl. 6, figs. 10, 11, 1926.

Cushman and G. D. Hanna, California Acad. Sci. Proc., 4th ser., vol. 16, p. 211, pl. 13, fig. 5, 1927.

Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 79, pl. 12, fig. 5, 1929.

Cole and Ponton, Florida Geol. Survey Bull. 5, p. 27, pl. 10, fig. 3, 1930.

Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 19, pl. 1, fig. 7, 1932.

Cushman, U. S. Geol. Survey Prof. Paper 181, p. 7, pl. 1, figs. 3, 4, 1935.

Davis, Jour. Paleontology, vol. 15, p. 150, pl. 24, figs. 15–17; pl. 25, figs. 5, 6, 1941.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 14, pl. 1, figs. 2, 4, 1942.

Cushman and Siegfus, San Diego Soc. Nat. History Trans., vol. 9, no. 34, p. 401, pl. 15, fig. 6, 1942.

Goudkoff and Porter, Am. Assoc. Petrol. Geologists Bull., vol. 26, p. 1653 (list), 1942.

Kelley, idem. vol. 27, pp. 8, 11 (lists), 1943.

Spiroplectammina mississippiensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 80, pl. 13, fig. 1, 1945; vol. 22, p. 76, pl. 13, fig. 10, 1946.

Stuckey, Jour. Paleontology, vol. 20, p. 163, pl. 29, figs. 6, 7, 11, 1946.

Cushman and Stone, Cushman Lab. Foram. Research Special Pub. 20, p. 3, pl. 1, fig. 7, 1947.

Cushman and Renz, idem, Special Pub. 22, p. 4, pl. 1, fig. 5, 1947.

Test elongate, fairly broad, thickest in the middle, thence thinning toward the periphery, in end view biconvex, central portion curved; chambers rather low and broad, especially in the early stages, becoming higher in the adult and often less broad so that the later chambers in the adult make a test less wide than at earlier stages; sutures covered by a coarsely arenaceous layer meeting in the center and at the periphery, leaving the central portion of each chamber uncovered, periphery irregular, not definitely or regularly spinose; chamber walls smooth and finely perforate. Length 0.40 to 0.55 millimeter.—Cushman.

The chamber walls are apparently not "finely perforate" but are very smoothly finished and may appear so.

This species, described from the Byram formation, is present and generally abundant nearly throughout all the sections.

Spiroplectammina mississippiensis (Cushman) Cushman and Todd var. alabamensis (Cushman) Cushman and Herrick

Plate 1, figure 2

Textularia mississippiensis Cushman var. *alabamensis* Cushman, U. S. Geol. Survey Prof. Paper 133, p. 17, pl. 1, fig. 4, 1923.

Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 1, fig. 6, 1933.

Cushman, U. S. Geol. Survey Prof. Paper 181, p. 7, pl. 1, figs. 5, 6, 1935.

Davis, Jour. Paleontology, vol. 15, p. 150, pl. 25, figs. 2, 3, 1941.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 15, 1942.

Cushman and MacGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 66, 1942.

Howe, Jour. Paleontology, vol. 16, p. 268 (list), 1942.

Spiroplectammina mississippiensis (Cushman) var. *alabamensis* Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 56, pl. 9, figs. 1–3, 1945.

Cushman and Todd, idem, vol. 21, p. 80, pl. 13, fig. 2, 1945; vol. 22, p. 76, pl. 13, fig. 11, 1946.

Cushman, idem, Special Pub. 16, p. 4, pl. 1, fig. 3, 1946.

Cushman and Todd, idem, Contr., vol. 24, p. 10 (list), 1948.

Spiroplectammina alabamensis Stuckey, Jour. Paleontology, vol. 20, p. 164, pl. 29, figs. 4, 5, 1946.

Variety differing from the typical species in the more elongate form, somewhat thicker test, especially in the center, the less well-defined peripheral carina, and the sutures excavated instead of being covered by an arenaceous layer.—Cushman.

This variety, described from the Glendon limestone member of the Byram formation in Alabama, is widely distributed in all the sections but is less abundant than the typical form. Specimens are somewhat larger, adult specimens ranging from 0.55 to 0.75 mm in length.

Spiroplectammina howei Stuckey

Plate 1, figures 3, 4

Spiroplectammina howei Stuckey, Jour. Paleontology, vol. 20, p. 164, pl. 29, figs. 8–10, 1946.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 77, pl. 13, fig. 12, 1946; vol. 24, p. 5 (list), 1948.

Test elongate, about twice as long as broad, flattened, thickest in the middle, early coiled initial portion comprising about one-fifth of the test, sides nearly parallel in rectilinear portion which generally consists of a series of eight biserial chambers; chamber walls smooth, sutures depressed yet filled with arenaceous cementation material; median line broad, thickened and limbate; aperture an elliptical opening in the base of the last-formed chamber.—Stuckey.

Length 0.70 to 1.25 mm, breadth 0.40 to 0.50 mm, thickness 0.17 to 0.25 mm.

Genus TEXTULARIA Defrance, 1824

Textularia tumidula Cushman

Textularia tumidulum Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 89, pl. 15, figs. 1, 2, 1922; Prof. Paper 129–F, p. 125, 1922; Prof. Paper 133, p. 15, 1923.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 1, fig. 3, 1933.

Davis, Jour. Paleontology, vol. 15, p. 152, pl. 25, fig. 10, 1941.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 65, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 77, pl. 13, fig. 13, 1946.

Test large, elongate, compressed, thickest in the central region, thence thinning toward the periphery, initial end rapidly broadening in the adult, the sides nearly parallel to a point near the apertural end, where the breadth of the test is reduced; chambers numerous, in the adult about three times as wide as high, and the last-formed chamber in many old-age specimens somewhat distinctly set off from the others, the inner portion of each chamber much thicker than the other portions and in the rapid decrease in thickness often leaving a channel running lengthwise of the test between this central tumid area and the gradually sloping outer portion, usually very well marked in adult specimens; sutures not very distinct; wall arenaceous but smoothly finished. Largest specimen 2.5 millimeters in length.—Cushman.

Rare and fragmentary specimens from the Mint Spring Bayou and Burke Creek sections belong to this large species, described from the Byram formation.

Textularia subhauerii Cushman

Plate 1, figure 5

Textularia subhauerii Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 89, pl. 14, fig. 2, 1922; Prof. Paper 129–F, p. 126, 1922; Prof. Paper 133, p. 16, 1923; Jour. Paleontology, vol. 1, p. 148, pl. 23, fig. 2, 1927.

Cole and Gillespie, Bull. Am. Paleontology, vol. 15, no. 57b, p. 6, 1930.

Cushman, U. S. Geol. Survey Prof. Paper 181, p. 8, pl. 1, fig. 10, 1935.

Cushman and McGlamery, idem, Prof. Paper 189–D, p. 103, 1938.

Davis, Jour. Paleontology, vol. 15, p. 152, pl. 25, fig. 15, 1941.

Howe, idem, vol. 16, p. 268 (list), 1942.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 17, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 77, pl. 13, fig. 14, 1946.

Test large, stout, elongate, early portion rapidly increasing in width with each newly added chamber, later adult portion with the sides nearly parallel, slightly lobulated; periphery rounded but the median portion nearly flat; chambers eighteen to twenty, increasing in height as added, those of the later portion nearly as high as broad, sutures usually rather indistinct; wall coarsely arenaceous but smoothly finish on the exterior; aperture at the base of the inner margin of the chamber. Length 2 mm. or less.—Cushman.

This species, known from the upper Eocene and the Oligocene, occurs in scattered samples throughout all five sections. The surface of the test is much rougher than in *Textularia adalta* or *T. tumidula.*

Textularia adalta Cushman

Plate 1, figure 6

Textularia adalta Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 2, p. 29, pl. 4, fig. 2, 1926; U. S. Geol. Survey Prof. Paper 181, p. 8, pl. 1, figs. 11, 12, 1935.

Davis, Jour. Paleontology, vol. 15, p. 147, pl. 24, figs. 1, 2, 1941.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 11, pl. 1, figs. 7, 9, 1942.

Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 57, 1945.

Cushman and Todd, idem, vol. 21, p. 80, pl. 13, figs. 3, 4, 1945.

Test elongate, slender, early portion tapering and compressed, adult portion thicker and with the sides nearly parallel, periphery subacute except in the last few chambers which are rounded; chambers numerous, the last 5 or 6 making up half the test, earlier ones indistinct, low and broad, later ones more inflated, higher; sutures distinct especially in the later portion where they are somewhat depressed, usually oblique; wall finely arenaceous, only slightly roughened; aperture a high arched opening in the central part of the base of the apertural face. Maximum length 2 mm.—Cushman.

Specimens widely distributed in all the sections seem identical, upon comparison with the types, with this species, known from the upper Eocene of Alabama, Mississippi, Georgia, and Texas.

Family VERNEUILINIDAE

Genus Gaudryina D'Orbigny, 1839

Gaudryina (Siphogaudryina) youngi Howe

Plate 1, figure 7

Gaudryina youngi Howe, Jour. Paleontology, vol. 4, p. 328, pl. 27, fig. 1, 1930.

Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 77, pl. 11, figs. 15, 16, 1937.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Cushman, Cushman Lab. Foram. Research Special Pub. 7A, p. 21, 1946.

Cushman and Todd, idem, Contr., vol. 22, p. 77, pl. 13, fig. 15, 1946; vol. 24, p. 5 (list), 1948.

Textularia (nearest to *siphonifera*) Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.

Test elongate, tapering, greatest width near the apertural end, early portion triserial and tricarinate, later portion biserial and subquadrate; the angles distinct, the broader faces of the test flattened, the angles of each chamber marked by fistulose processes which are usually broken at the tip showing the hollow within. Sutures distinct and depressed. Wall finely arenaceous. Aperture an arched opening on the inner margin of the last formed chamber. Length 0.65 mm; breadth 0.22 mm; thickness 0.125 mm.—Howe.

This distinctive small species occurs in scattered samples in all the sections. It was described from the Byram formation and has been recorded from the Red Bluff clay of Mississippi and the Glendon limestone member of the Byram of Alabama.

Gaudryina (Siphogaudryina) glabrata (Cushman) Cushman

Plate 1, figure 8

Ehrenbergina glabrata Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 93, pl. 17, fig. 4, 1922; Prof. Paper 133, p. 24, 1923.

P. Applin, Am. Assoc. Petroleum Geologists Bull., vol. 9, p. 24, 1925.

Gaudryina (Siphogaudryina) glabrata Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 77, pl. 11, figs. 17, 18, 1937.

Cushman and Todd, idem, Contr., vol. 22, p. 78, pl. 13, figs. 16, 17, 1946.

This minute species was found in only two samples. It is distinctive in its thin and very smooth wall and low, broad chambers separated by deeply incised sutures.

Family VALVULINIDAE

Genus Karreriella Cushman, 1933

Karreriella advena (Cushman) Cushman

Plate 1, figure 9

Gaudryina advena Cushman, U. S. Geol. Survey Prof. Paper 133, p. 22, pl. 3, fig. 1, 1923.
Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.
Karreriella advena Cushman, Cushman Lab. Foram. Research Special Pub. 8, p. 130, pl. 15, fig. 10, 1937.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Cushman, Cushman Lab. Foram. Research Special Pub. 8A, p. 43, 1947.
Cushman and Todd, idem, Contr., vol. 24, p. 8 (list), 1948.

Test elongate, tapering, slightly compressed, greatest breadth near the apertural end, earliest whorl apparently with more than three chambers, later triserial, and in the adult biserial, rounded in transverse section; chambers rather indistinct; sutures very slightly depressed, mostly indistinct; wall arenaceous, with larger angular fragments and a finer ground mass, firmly cemented; aperture in the adult elongate horizontally, above the base of the chamber, with a distinct lip. Length up to 1.50 mm; breadth 0.40–0.60 mm; thickness 0.30–0.50 mm.—Cushman, 1937.

This species, described from the Byram formation, is rather common in the Mint Spring Bayou section, rare in three sections, and absent from the fifth. Superficially it resembles *Textularia adalta*, but, even where the terminal aperture is not preserved, it may be distinguished by its more cylindrical test and higher chambers.

Genus Liebusella Cushman, 1933

Liebusella byramensis (Cushman) Cushman var. turgida (Cushman) Cushman

Plate 1, figure 10

Clavulina byramensis Cushman var. *turgida* Cushman, U. S. Geol. Survey Prof. Paper 133, p. 22, pl. 2, figs. 4, 5, 1923.
Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.
Liebusella byramensis (Cushman) var. *turgida* Cushman, U. S. Geol. Survey Prof. Paper 181, p. 11, pl. 2, fig. 9, 1935; Cushman Lab. Foram. Research Special Pub. 8, p. 165, pl. 19, figs. 20, 21, 1937.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 19, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Applin and Jordan, idem, vol. 19, p. 130 (list), 1945.
Cushman and Ellisor, idem, vol. 19, p. 549, pl. 71, fig. 16, 1945.
Cushman, Cushman Lab. Foram. Research Special Pub. 16, p. 5, pl. 1, figs. 8–10, 1946; Special Pub. 8A, p. 58, 1947.
Cushman and Todd, idem, Contr., vol. 24, p. 8 (list), 1948.

This form is rare in the present material, being represented mainly by immature forms that resemble globular strutureless masses of glassy and white opaque grains, firmly cemented. However, a few adult specimens show the same type of selection of grains in color and size and indicate the relationship of the small globular masses. Broken specimens show a very smoothly finished interior.

Family MILIOLIDAE

Genus Quinqueloculina D'Orbigny, 1826

Quinqueloculina cookei Cushman

Plate 1, figures 11, 12

Quinqueloculina cookei Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 141, pl. 33, figs. 2, 3, 1922; Prof. Paper 133, p. 54, 1923.

Test three to four times as long as broad, apertural end extended in a conspicuous cylindrical neck, periphery of the test carinate, in early stages with a single carina, in later stages with two carinae and concave between; chambers rapidly increasing in size, broadest at the basal end, slightly twisted; sutures distinct but not depressed; wall thin, smooth, glossy in well-preserved specimens; aperture circular with a slight lip, tooth not observed. Length 0.70 to 0.85 mm, breadth 0.17 to 0.30 mm.

This species was described from the Mint Spring marl member of the Marianna limestone and has not been recorded elsewhere. Scattered specimens in the Mint Spring Bayou section and abundant specimens in sample 4 of the Burke Creek section appear to belong here although they are smaller than the original description indicates.

Quinqueloculina vicksburgensis Cushman

Plate 1, figure 13

Quinqueloculina vicksburgensis Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 141, pl. 34, fig. 6, 1922; Prof. Paper 133, p. 52, 1923.
Quinqueloculina venusta Karrer? var. Cushman, idem, Prof. Paper 129–E, p. 102, pl. 26, fig. 5, 1922.

Test much elongate, narrow; chambers distinct; basal end broadly rounded, projecting; apertural end also projecting, forming a cylindrical neck and rounded aperture; periphery of the test subacute; surface smooth, dull. Length nearly 2 mm, width 0.5 mm.—Cushman.

A very few specimens from the Mint Spring Bayou and Burke Creek sections seem to belong to this species, known from the Glendon limestone member of the Byram formation and Mint Spring marl member of the Marianna limestone of Mississippi.

Quinqueloculina byramensis Cushman

Plate 1, figure 14

Quinqueloculina byramensis Cushman, U. S. Geol. Survey Prof. Paper 133, p. 54, pl. 8, fig. 5, 1923.

Test slightly longer than broad, equally rounded at initial and apertural ends, sharply triangular in end view, periphery acute; chambers not inflated, last two of nearly equal size; sutures indistinct; wall ornamented by a reticulate pattern made up of strong longitudinal costae between which are weaker transverse ridges; surface shiny where well preserved; aperture

triangular, not projecting, apparently without a lip or tooth. Length 0.30 to 0.43 mm, breadth 0.25 to 0.30 mm.

A few specimens of this distinctive species, known only from the Byram formation, occur in two of the sections.

Quinqueloculina tessellata Cushman

Quinqueloculina tessellata Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 142, pl. 33, fig. 8; pl. 34, fig. 1, 1922; Prof. Paper 133, p. 54, 1923.

Dumble, Am. Assoc. Petrol. Geologists Bull., vol. 8, p. 444 (list), 1924.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 21, pl. 2, figs. 11, 14, 1942.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 66, pl. 4, fig. 1, 1942.

One broken specimen was found in the lowest sample of the Mint Spring Bayou section. This species differs from *Q. byramensis* in its more elongate form and much finer ornamentation.

Quinqueloculina crassa D'Orbigny var. macerata Cushman and Todd

Plate 1, figure 16

Quinqueloculina crassa D'Orbigny var. *macerata* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 79, pl. 14, figs. 3, 4, 1946.

Quinqueloculina crassa? Cushman (not D'Orbigny), U. S. Geol. Survey Prof. Paper 129–E, p. 102, pl. 27, figs. 1, 2, 1922; Prof. Paper 133, p. 52, 1923.

Cushman and McGlamery, idem, Prof. Paper 189–D, p. 104, pl. 24, fig. 4, 1938.

Quinqueloculina cf. *crassa* Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 550, pl. 72, fig. 4, 1945.

This finely costate variety, described from the Byram formation, differs from the typical form in its more elongate test and more angular chambers. It has been recorded also from Choctaw Bluff, Alabama, and from the subsurface Anahuac formation of Ellisor in Texas. Specimens occur rarely in three of the sections.

Quinqueloculina mcglameryae Cushman and Todd

Plate 1, figure 15

Quinqueloculina mcglameryae Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 80, pl. 13, figs. 22, 23, 1946.

Quinqueloculina sp. Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 66, pl. 4, fig. 2, 1942.

Test small, nearly as broad as long, nearly circular in front view, periphery angled but somewhat rounded; chambers distinct, increasing rather rapidly in size as added; sutures distinct but not depressed; wall with rather few, coarse costae, parallel to the periphery; aperture rounded, with the outer wall of the final chamber somewhat overhanging, usually without a definite apertural tooth. Maximum length 0.50 mm; breadth 0.40 mm.; thickness 0.30 mm.—Cushman and Todd.

This species resembles *Quinqueloculina crassa* D'Orbigny var. *macerata* Cushman and Todd in general form, but is much smaller. Specimens occur rarely in two of the sections.

Quinqueloculina monroei Cushman and Todd

Plate 1, figure 17

Quinqueloculina monroei Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 79, pl. 14, figs. 1, 2, 1946.

Quinqueloculina bicostata D'Orbigny var. Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 102, pl. 26, figs. 2–4, 1922; Prof. Paper 133, p. 52, 1923.

Quinqueloculina byramensis Hermes (not Cushman), Thesis Univ. Utrecht, p. 35, pl. 5, fig. 3, 1945.

Test elongate, nearly 2½ times as long as broad, much compressed, base and apertural end each somewhat projecting beyond the general outline of the test, periphery angled, in the earlier stages concave with two distinct costae somewhat rounded, the final chamber often with three or more distinctly raised costae with deep depressions between; chambers distinct, rather narrow; sutures distinct, slightly depressed; wall smooth except for the strongly developed costae; aperture rounded, at the end of the projecting apertural end of the chamber. Maximum length 1.50 mm; breadth 0.60 mm; thickness 0.40 mm.—Cushman and Todd.

Young specimens have only a single carina on a periphery that is more acute than that of specimens in later stages.

This species occurs in some numbers in the Mint Spring Bayou and Burke Creek sections. It was described from the Glendon limestone member of the Byram formation and has been recorded from the Mint Spring marl member of the Marianna limestone in Mississippi, the Marianna limestone of Alabama, and the "Oligo-Miocene" of Cuba.

Quinqueloculina fulgida Todd, n. sp.

Plate 1, figure 18

Quinqueloculina contorta Cushman (not D'Orbigny), U. S. Geol. Survey Prof. Paper 129–F, p. 142, pl. 34, figs. 2, 3, 1922; Prof. Paper 133, p. 53, 1923.

Test oval, length about 1¾ times breadth, periphery subacute in early stages, smoothly rounded in later stages; chambers of even size from initial to apertural end, evenly curved; sutures distinct, depressed; wall smooth, polished; aperture slightly projecting, large, rounded, with a short, bifid tooth. Length 0.50 to 0.85 mm., breadth 0.22 to 0.50 mm.

Holotype (Cushman Coll. No. 47517) from the middle Oligocene, Mint Spring marl member of the Marianna limestone (sample 2), Mint Spring Bayou, south of National Military Cemetery, Vicksburg, Miss.

This species differs from *Quinqueloculina contorta* D'Orbigny in its smoothly rounded, not flat, periphery and its more projecting apertural end. It differs from *Q. monroei* Cushman and Todd in its broader form and smoothly rounded periphery.

Specimens are not common and were found in only four samples of the Mint Spring Bayou section. The references above are to specimens from the Mint Spring marl member of the Marianna limestone.

Quinqueloculina glabrata Cushman

Plate 1, figures 19, 20

Quinqueloculina glabrata Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 141, pl. 34, fig. 8, 1922; Prof. Paper 133, p. 52, 1923.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 549, pl. 72, figs. 1, 2, 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 78, pl. 13, fig. 19, 1946.

Quinqueloculina vicksburgensis Cushman and Todd (not Cushman), idem, vol. 22, p. 78, pl. 13, fig. 21, 1946.

Test elongate, compressed, basal end rounded, apertural end extended into a slender neck, periphery acute, carinate; chambers compressed, sides may be slightly concave; sutures distinct, depressed; wall smooth; aperture circular, at the end of a prominent neck, surrounded by a slight lip, and with a slender bifid tooth. Length 0.70 to 1.00 mm or more, breadth 0.25 to 0.45 mm.

The considerable series of specimens available for study seems to show that two forms are present: one, long, slender, and compressed; and the other, more broadly oval and thicker. This species differs from *Quinqueloculina cookei* Cushman in having a single, not double, carina, even in its fully adult stages. The carina is made serrate in many specimens by the breaking of its thin edge.

This is a fairly abundant species in the two sections where Miliolidae occur in any numbers: Mint Spring Bayou and Burke Creek. It has been recorded from the Byram formation of Mississippi and the subsurface Anahuac formation of Ellisor in Texas.

Genus Massilina Schlumberger, 1893

Massilina decorata Cushman

Plate 1, figure 21

Massilina decorata Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 143, pl. 23, fig. 7, 1922; Prof. Paper 133, p. 55, 1923.

Cushman and G. D. Hanna, California Acad. Sci. Proc., 4th ser., vol. 16, p. 224, 1927.

Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.

Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 40, pl. 7, fig. 1, 1929.

Cole and Ponton, Florida Geol. Survey Bull. 5, p. 29, pl. 10, fig. 5, 1930.

Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 20, pl. 2, fig. 6, 1932.

Cushman and McMasters, Jour. Paleontology, vol. 10, p. 510, pl. 74, fig. 8, 1936.

Cushman, U. S. Geol. Survey Prof. Paper 181, p. 13, pl. 3, figs. 14–16, 1935; Cushman Lab. Foram. Research Contr., vol. 15, p. 52, pl. 9, fig. 13, 1939.

Galloway and Heminway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Is., vol. 3, pt. 4, p. 314, pl. 5, fig. 1, 1941.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 22, pl. 1, fig. 26, 1942.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 66, pl. 4, fig. 3, 1942.

Franklin, Jour. Paleontology, vol. 18, p. 308, pl. 45, fig. 7, 1944.

Cushman, Cushman Lab. Foram. Research Special Pub. 16, p. 5, pl. 1, fig. 11, 1946.

Cushman and Todd, idem, Contr., vol. 24, p. 8 (list), 1948.

Massilina cf. *decorata* Cushman and Renz, idem, Special Pub. 22, p. 9, pl. 2, fig. 14, 1947.

Test much flattened, elliptical or oval, slightly longer than wide, basal and apertural ends projecting, the apertural end narrowed to a small cylindrical neck, nearly in the longitudinal axis of the test; sutures rather indistinct; surface dull white; periphery rounded, the sides ornamented by very fine pits, giving a finely granular appearance to the test. Length 1 mm or less.—Cushman.

This species has been recorded from middle Eocene to lower Miocene strata from the Gulf Coastal region, California, a core taken off the east coast of the United States, Porto Rico, Venezuela, and Trinidad.

In the five sections here studied it seems to be one of the most important species. It is the only miliolid form that occurs in all of the sections and is abundant in all. Furthermore, in the four sections in Rankin County it occurs only in the lower parts of the sections and the upper limit of its occurrence seems to form a recognizable horizon within the Glendon limestone member of the Byram formation.

Genus Spiroloculina D'Orbigny, 1826

Spiroloculina occlusa (Cushman) Cushman and Todd

Plate 1, figure 23

Massilina occlusa Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 104, pl. 28, fig. 2, 1922; Prof. Paper 133, p. 55, 1923.

Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928; vol. 16, p. 267 (list), 1942.

Spiroloculina occlusa Cushman and Todd, Cushman Lab. Foram. Research Special Pub. 11, p. 15, pl. 3, fig. 12, 1944; idem, Contr., vol. 22, p. 80, pl. 14, fig. 7, 1946; vol. 24, p. 8 (list), 1948.

Test small, elongate, elliptical, flat, periphery slightly concave with limbate margins; chambers involute, only the last two visible, quadrangular in section, projecting into a narrow neck at the apertural end; sutures indistinct, depressed, irregular, due to the last chamber irregularly overlapping the previous one; wall smooth, polished; aperture quadrangular, without a lip, with a short simple tooth on the inner margin. Length 0.45–0.65 mm; breadth 0.25–0.30 mm; thickness 0.12–0.15 mm.—Cushman and Todd.

This species, described from the Red Bluff clay and Glendon limestone member of the Byram formation, occurs in scattered samples in two of the sections.

Spiroloculina spissa Cushman and Todd

Plate 1, figure 22

Spiroloculina spissa Cushman and Todd, Cushman Lab. Foram. Research Special Pub. 11, p. 19, pl. 3, figs. 18–21, 1944; idem, Contr., vol. 22, p. 81, pl. 14, fig. 6, 1946; vol. 24, p. 8 (list), 1948.

Spiroloculina grateloupi Cushman (not D'Orbigny), U. S. Geol. Survey Prof. Paper 129–E, p. 101, pl. 25, fig. 2, 1922; Prof. Paper 133, p. 50, 1923.

Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.

Test elongate, oval, about 2½ times as long as broad, deeply excavated in the central portion, periphery broad, slightly convex, distinctly angled at the margins; chambers few, rapidly increasing in size and thickness as added, strongly projecting and broadest at the base, thence tapering to the slender, elongate neck at the apertural end, peripheral margins of earlier chambers evident as raised ridges in the early portion of the test; sutures distinct, deeply depressed; wall smooth, polished; aperture flattened-oval with longest diameter at right angles to breadth of test, with a short tooth on the inner margin of the aperture, and a short, sometimes bifid, one on the opposite margin. Length 0.50–0.55 mm; breadth 0.22–0.25 mm; thickness 0.18–0.20 mm.—Cushman and Todd.

This species occurs rarely in two of the sections. It is known only from the Byram formation, Red Bluff clay, and Vicksburg group in Mississippi.

Genus Articulina D'Orbigny, 1826

Articulina byramensis Cushman

Plate 1, figure 28

Articulina byramensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 103, pl. 27; figs. 5, 6, 1922; Prof. Paper 129–F, p. 143, 1922; Prof. Paper 133, p. 56, 1923.

Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.

Cushman, Cushman Lab. Foram. Research Special Pub. 10, p. 7, pl. 1, figs. 18, 19, 1944.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 552, pl. 72, fig. 10, 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 82, pl. 14, figs. 10, 11, 1946; vol. 24, p. 8 (list), 1948.

Test of two portions, a basal triloculine portion followed by a single linear chamber, the earlier portion with the lip of the antepenultimate chamber standing out free at the base, that of the penultimate chamber covered by the base of the last-formed one, last chamber rounded in transverse section or slightly compressed, with a broadly flaring, slightly downward-curved lip; aperture rounded, slightly longer than wide; surface of the test with numerous longitudinal costae, sharp, sometimes, especially in the final chamber, anastomosing. Length 1.25 mm.—Cushman.

A few scattered specimens, but none showing the uniserial chamber, occur in the Mint Spring Bayou and Burke Creek sections. They are recognizable by their high, sharp, anastomosing costae.

Articulina advena (Cushman) Cushman

Plate 1, figure 27

Vertebralina advena Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 102, pl. 25, figs. 5, 6, 1922; Prof. Paper 133, p. 51, 1923.

Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 66, pl. 4, fig. 5, 1942.

Articulina advena Cushman, Cushman Lab. Foram. Research Special Pub. 10, p. 8, pl. 1, figs. 20, 21, 1944.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 552, pl. 72, fig. 9, 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 81, pl. 14, figs. 8, 9, 1946; vol. 24, p. 8 (list), 1948.

Test of medium size, quinqueloculine or triloculine in the earlier stages; chambers distinct; sutures very slightly depressed; wall ornamented with fine, longitudinal costae mostly parallel to the periphery, not anastomosing; aperture with a distinct lip, thickened at the margin, and little if at all flaring. Length 0.55–0.70 mm; diameter 0.40–1.00 mm.—Cushman, 1944.

This species, which is much broader than *Articulina byramensis* and has the costae less prominent, occurs rarely.

Genus Triloculina D'Orbigny, 1826

Triloculina byramensis Cushman and Todd

Plate 1, figure 25

Triloculina byramensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 83, pl. 14, figs. 16, 17, 1946.

Triloculina sp. Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 104, pl. 24, fig. 5, 1938.

Test small, somewhat longer than broad, periphery broadly rounded, tending to become slightly angular at the base; chambers distinct, inflated; sutures distinct, but only slightly depressed; wall smooth, polished; aperture nearly circular, with a distinctly thickened lip and a short, broad tooth with slight expansions at the outer angles. Maximum length 0.40 mm; breadth 0.30 mm; thickness 0.22 mm.—Cushman and Todd.

Re-examination of paratypes of this species from the Byram formation of Mississippi shows the presence of faint longitudinal costae, which apparently may or may not be present.

The species occurs fairly frequently in the Mint Spring Bayou and Burke Creek sections.

Triloculina sculpturata Cushman

Plate 1, figure 24

Triloculina sculpturata Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 143, pl. 33, figs. 4, 5, 1922; Prof. Paper 133, p. 57, 1923; Cushman Lab. Foram. Research Contr., vol. 5, p. 40, pl. 7, fig. 2, 1929.

Cushman and Todd, idem, vol. 22, p. 83, pl. 14, fig. 14, 1946.

Test about twice as long as wide; periphery rounded or truncate; sutures indistinct; surface peculiarly sculptured, in general formed of longitudinal costae with broad surfaces, together with irregular connections, forming areolae; aperture rounded, with a simple tooth. Length 0.5 millimeter.—Cushman.

This beautifully ornamented species occurs commonly in the Mint Spring Bayou and Burke Creek sections. It is known only from the Mint Spring marl member of the Marianna limestone and Byram formation and should make a good index fossil for the shallower-water facies of these formations.

Triloculina peroblonga Cushman

Plate 1, figure 26

Triloculina peroblonga Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 143, pl. 34, figs. 4, 5, 1922; Prof. Paper 133, p. 56, 1923.

Test much elongate, periphery rounded; chambers rounded at the base; the apertural end coming to or extending slightly beyond the base of the previous chamber; aperture rounded

with a simple tooth and a slightly thickened lip; sutures distinct; wall dull white, smooth. Length 1.5 millimeters or less.—Cushman.

A few scattered specimens seem to belong to this species, described and known only from Mint Spring Bayou. They are, however, much smaller, none exceeding 0.48 mm in length.

Triloculina architectura Todd, n. sp.

Plate 1, figure 33

Test large, oval, about 1¾ times as long as broad, flat and angled on the periphery; chambers rapidly increasing in size, curved longitudinally, angular in section, sides slightly concave; sutures distinct, incised; wall dull, matte, sometimes very faintly and finely costate in part; aperture very slightly projecting, oval, without a lip, with a long, slender tooth that is bifid at the tip. Length 0.65 to 1.00 mm, breadth 0.35 to 0.60 mm.

Holotype (Cushman Coll. No. 47618) from the middle Oligocene, limestone member of the Marianna limestone (sample 757–4), section in Burke Creek, sec. 15, T. 4 N., R. 1 E., Rankin County, Miss.

This species resembles topotypes of *Quinqueloculina contorta* D'Orbigny from the Miocene of the Vienna Basin but differs in being triloculine and in being proportionally shorter.

It was found in only one sample but abundantly in it.

Genus Pyrgo Defrance, 1824

Pyrgo byramensis Cushman and Todd

Plate 1, figure 29

Pyrgo byramensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 83, pl. 14, figs. 18, 19, 1946; vol. 24, p. 8(list), 1948.

Test small, slightly longer than broad, broadly rounded in transverse section, base broadly rounded, apertural end somewhat tapering; chambers distinct, strongly inflated; sutures distinct but only slightly depressed; wall smooth and polished; aperture circular, without a distinct lip, the apertural tooth with a peculiar trilobate form in end view and somewhat rounded in front view. Maximum length 0.60 mm; breadth 0.45 mm; thickness 0.35 mm.—Cushman and Todd.

This species, described from the Byram formation and recorded in the Red Bluff clay, occurs commonly in the Burke Creek section and less frequently in the Mint Spring Bayou section.

Pyrgo monroei Cushman and Todd

Plate 1, figure 30

Pyrgo monroei Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 84, pl. 14, figs. 20, 21, 1946.

Test somewhat longer than broad, in front view nearly rectangular, in side view biconvex; chambers distinct, the outer side gently convex, the other two sides flattened or somewhat concave, with the peripheral angles slightly keeled; sutures rather obscure, slightly depressed; wall smooth, except for the peripheral angles, polished; aperture nearly circular, with a slightly thickened border and a tooth with a narrow base and two lateral projections. Maximum length 0.55 mm; breadth 0.35 mm; thickness 0.35 mm.—Cushman and Todd.

Single specimens were found in three samples. The species was described from the Byram formation.

Genus Flintia Schubert, 1911

Flintia laticoncava Cushman

Plate 1, figure 31

Flintia laticoncava Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 26, pl. 4, fig. 3, 1935.

Test in the early stages quinqueloculine, later becoming involute and planispiral, two chambers making up the final whorl, and in the later stages tending somewhat to become evolute, periphery broadly rounded, sides concave; chambers distinct, in the adult three-sided in transverse section, the periphery convex, and the two sides concave, the angles somewhat rounded; sutures distinct, somewhat irregularly crenulate; wall smooth; aperture semicircular with a distinct, rounded lip and a broad tooth. Length 0.50 mm; breadth 0.40 mm; thickness 0.40 mm.—Cushman.

Numerous specimens in various stages of development represent this species in the Mint Spring Bayou and Burke Creek sections. It was described from a zone 6 feet above ledge under suspension bridge on Pearl River, Byram, Miss.

Family OPHTHALMIDIIDAE

Genus Cornuspira Schultze, 1854

Cornuspira byramensis Cushman

Plate 1, figure 32

Cornuspira byramensis Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 27, pl. 4, fig. 4, 1935.

Cushman and Frizzell, idem, vol. 19, p. 83, pl. 14, fig. 4, 1943.

Cushman and Todd, idem, vol. 22, p. 84, pl. 14, fig. 22, 1946; vol. 24, p. 8(list), 1948.

Test planispiral, the early coils with the diameter about equal, later adult 1 or 2 coils very rapidly expanding and slightly compressed; suture distinct, depressed; wall smooth; aperture elliptical, somewhat smaller than the section of the tubular chamber. Diameter 0.50 mm; thickness 0.10 mm.—Cushman.

This species occurs in some numbers in the Burke Creek section. Most of the specimens have the thin central portion broken out.

The species has been found in the Byram formation and Red Bluff clay of Mississippi and the Oligocene Lincoln formation of Washington.

Family LAGENIDAE

Genus Robulus Montfort, 1808

Robulus vicksburgensis (Cushman) Ellisor

Plate 2, figures 1, 2

Cristellaria vicksburgensis U. S. Geol. Survey Prof. Paper 129–F, p. 130, pl. 31, figs. 6, 7, 1922; Prof. Paper 133, p. 29, 1923.

P. Applin, Am. Assoc. Petrol. Geologists Bull., vol. 9, pp. 24, 25, 1925.

Lenticulina vicksburgensis Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.
Cole and Ponton, Florida Geol. Survey Bull. 5, p. 31, pl. 10, fig. 7, 1930.
Robulus vicksburgensis Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 2, fig. 2, 1933.
Howe, Jour. Paleontology, vol. 16, p. 268 (list), 1942.
Applin and Jordan, idem, vol. 19, p. 130 (list), 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 84, pl. 14, fig. 23, 1946.
Cushman and Renz, idem, Special Pub. 22, p. 12, pl. 3, fig. 6, 1947.
Cushman and Todd, idem, Contr., vol. 24, p. 8 (list), 1948.
Cristellaria sp. Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 93, 1922.

Test composed of few chambers, seven to eight in the visible coil; surface generally smooth, except on the sutures, which are marked by rather broad, curved, raised ridges, those near the earlier part of the coil broken into rounded knobs, especially near the umbilical area, the later ones more continuous; periphery angled, the early portion carinate; apertural face smooth and somewhat concave with acute projecting angles; aperture radiate at the angle of the chamber. Length 0.65 to 1 mm.

It seems to be very constant in its characters and can be distinguished by the peculiar ornamentation, the uncoiling of the later portion of the test, and the concave apertural face.—Cushman.

Many of the present specimens show a slight ornamentation on the wall between the sutures in the form of short, discontinuous costae parallel to the periphery.

This species is one of the most abundant and widely distributed in all the sections. It was described from the Mint Spring marl member of the Marianna limestone and has been recorded from the Byram formation and Red Bluff clay of Mississippi, the Glendon limestone member of the Byram formation of Mississippi and Alabama, the Marianna limestone of Alabama and Florida, subsurface Vicksburg formation in Texas, and the upper Oligocene Ste. Croix formation of Trinidad.

It is probable that the specimens from the Marianna limestone and Red Bluff clay at St. Stephens, Ala., called "*Cristellaria submamilligera* Cushman" (U. S. Geol. Survey Prof. Paper 133, p. 30, pl. 4, figs. 5, 6, 1923) belong to *Robulus vicksburgensis*, as they are quite distinct in ornamentation from the Recent types of *C. submamilligera* from the Philippine region.

Robulus vicksburgensis (Cushman) Ellisor var. aperta (Cushman) Todd

Plate 2, figure 3

Cristellaria vicksburgensis Cushman var. *aperta* Cushman, U. S. Geol. Survey Prof. Paper 133, p. 29, pl. 4, fig. 4, 1923.
Lenticulina vicksburgensis var. *aperta* Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.
Cole and Ponton, Florida Geol. Survey Bull. 5, p. 31, 1930.

Variety differing from the typical form in the character of the sutures, which are broadly limbate, of clear shell material, and either not otherwise ornamented or with a single knob at the inner end; test otherwise smooth, often with a thin keel.—Cushman.

Discrimination of this variety is difficult as there seem to be all gradations from more completely beaded sutures to smooth, limbate sutures. Furthermore, the degree of ornamentation may be a function of degree of megalo- or microspheric form, as the available specimens seem to suggest that the extremely megalospheric specimens with large proloculum and few chambers are in general the less strongly ornamented.

The two forms, as here distinguished, commonly occur together with the variety less abundant.

Robulus cf. R. alato-limbatus (Gümbel) Howe and Wallace

Plate 2, figure 4

Robulus alato-limbata (Gümbel) Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 37, pl. 3, fig. 2, 1932.
Cushman, U. S. Geol. Survey Prof. Paper 181, p. 15, pl. 6, fig. 2, 1935.
Coryell and Embich, Jour. Paleontology, vol. 11, p. 299, pl. 41, fig. 16, 1937.
Howe, Louisiana Dept. Cons. Geol. Bull. 14, p. 40, pl. 4, fig. 18, 1939.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 26, pl. 3, fig. 7, 1942.
?Cushman and Siegfus, San Diego Soc. Nat. History Trans., vol. 9, p. 404, pl. 15, figs. 19–21, 1942.
Cushman and Applin, Cushman Lab. Foram. Research Contr., vol. 19, p. 33, pl. 7, fig. 11, 1943.
Colom. Instit. Invest. Geol. No. 2 Estudios Geológicos, p. 61, pl. 2, figs. 28, 29, 1945.
Robulus cf. *alato-limbatus* Cushman and Simonson, Jour. Paleontology, vol. 18, p. 194, pl. 30, fig. 8, 1944.
Cushman and Stainforth, Cushman Lab. Foram. Research Special Pub. 14, p. 22, pl. 2, fig. 24, 1945.
Cushman and Todd, idem, Contr., vol. 21, p. 85, pl. 13, fig. 25, 1945.

Test small, closely coiled, compressed, umbones large and prominent, periphery smooth, acute, narrowly keeled; chambers 5 to 7 in the last whorl, not inflated; sutures distinct, limbate, tangential, slightly curved; wall smooth, translucent, earlier whorls visible in the umbones and previous apertures appearing as radiate patterns along the periphery; aperture large but not protruding. Diameter 0.45 to 0.60 mm, thickness 0.20 to 0.30 mm.

This species, like *Robulus vicksburgensis*, is very common and occurs throughout all five sections. It is probably not specifically identical with *R. alato-limbatus* from the Eocene of Bavaria but resembles it, especially in its tangential sutures.

The references above are to records which very probably are of the same species. They are from the Eocene (Jackson and Claiborne age) of the Gulf Coastal region, Panama, and California, and the Oligocene of California, Trinidad, and Spain.

Genus Marginulina D'Orbigny, 1826

Marginulina sp.

Plate 2, figure 5

Test small, strongly compressed, periphery subacute, smooth; chambers rapidly uncoiling, very rapidly

increasing in size, very slightly if at all inflated; sutures distinct, limbate, slightly curved, strongly oblique in uncoiled portion, very slightly depressed; wall smooth, finely perforate; aperture radiate, protruding, at the outer peripheral angle. Breadth 0.12 to 0.18 mm, length of uncoiled specimens up to 0.42 mm, thickness 0.08 to 0.10 mm.

A very few, mostly immature specimens from all the sections may represent an undescribed species but are inadequate for description. They somewhat resemble rare specimens from the Chickasawhay limestone near Millry, Alabama (Cushman and McGlamery, 1942, p. 67, pl. 4, figs. 6, 7) but do not have as many chambers.

Genus Dentalina D'Orbigny, 1826

Dentalina mesonensis Cole and Gillespie

Plate 2, figure 10

Dentalina mesonensis Cole and Gillespie, Bull. Am. Paleontology, vol. 15, no. 57b, p. 8, pl. 4, fig. 7, 1930.
Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 555, pl. 74, fig. 1, 1945.

Very rare specimens from all the sections are referred to this species, described from the Oligocene Meson formation of Mexico and recorded from the subsurface Anahuac formation of Ellisor in Texas. The test is curved, with oblique sutures and indistinct chambers that are very low and broad in the early portion of the test.

Dentalina monroei Todd, n. sp.

Plate 2, figure 6

Test small for the genus, slightly compressed, slightly curved, periphery smooth in the early portion, later slightly indented; chambers few (6 to 10) with very gradual increase in height, almost no increase in breadth, later chambers slightly inflated; sutures distinct, limbate, slightly oblique in the earlier portion and horizontal in the later portion; wall smooth, polished, finely perforate, translucent; aperture radiate, protruding from the inner peripheral angle, without a neck. Length up to 1.4 mm, commonly 0.65 to 0.75 mm; breadth 0.15 to 0.18 mm; thickness 0.12 to 0.16 mm.

Holotype (Cushman Coll. no. 47540) from the middle Oligocene marl member of the Byram formation (sample 13), Mint Spring Bayou, south of National Military Cemetery, Vicksburg, Miss.

This species differs from *Dentalina jamaicensis* Cushman and Todd, from the Miocene of Buff Bay, Jamaica, in its fewer chambers, more even breadth throughout, and less strongly protruding aperture.

This species is the most common of the Dentalinas, occurring throughout all five sections. It should form a good index fossil for this part of the Oligocene.

Dentalina hantkeni Cushman

Plate 2, figure 7

Dentalina hantkeni Cushman, Cushman Lab. Foram. Research Contr. vol. 9, p. 9, pl. 1, figs. 18, 19, 1933; U. S. Geol. Survey Prof. Paper 181, p. 20, pl. 8, figs. 5, 6, 1935.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 42, 1942.

Test elongate, arcuate, somewhat compressed, composed of a few chambers, initial end rounded; chambers distinct, increasing in length as added, outer curve sinuate, inner curve nearly uniform; sutures fairly distinct, somewhat oblique; aperture near the inner curve with a slightly produced neck. Length 1.25 mm; greatest diameter 0.15 mm.—Cushman.

A few scattered specimens from three of the sections in Rankin County appear to be this species, described from the Ocala limestone of Alabama and recorded also from the Yazoo clay of Mississippi. The fragmentary specimen figured shows the general form.

Dentalina badenensis D'Orbigny

Plate 2, figure 8

Dentalina badenensis D'Orbigny, Foraminifères fossiles du bassin tertiaire de Vienne, p. 44, pl. 1, figs. 48, 49, 1846.

Fragmentary specimens of a rather large slender species are referred to *Dentalina badenensis* D'Orbigny, described from the Miocene of the Vienna Basin. They have been compared with a topotype and seem to be very close. The chambers are 1½ to 2 times as high as broad, moderately inflated, and the sutures are distinct, limbate, and slightly oblique.

Dentalina emaciata Reuss

Plate 2, figures 11, 12

Dentalina emaciata Reuss, Deutsch. geol. Gesell. Zeitschr., vol. 3, p. 63, pl. 3, fig. 9, 1851.
Bornemann, idem, vol. 7, p. 324, 1855.
Reuss, Akad. Wiss. Wien Math.-naturwiss. Kl., Sitzungsber., vol. 48, pt. 1, p. 45, 1863.
Asano, Tohoku Imp. Univ. Sci. Repts., ser. 2 (Geol.), vol. 19, no. 2, p. 213 (35), pl. 25 (2), figs. 13, 20, 21, 23; pl. 27 (4), figs. 17, 19, 48; pl. 28 (5), figs. 21, 24, 28; pl. 29 (6), figs. 14, 24, 1938.
ten Dam and Reinhold, Geol. Stichting Mededeel., ser. C–V, no. 2, p. 59, 1942.
Nodosaria emaciata Galloway and Morrey, Bull. Am. Paleontology, vol. 15, no. 55, p. 15, pl. 1, fig. 14, 1929.

Test slender, curved, inner periphery smooth, at least in the early part, outer periphery slightly indented; chambers gradually increasing in size, height, and inflation as added; sutures distinct, limbate, very slightly oblique, tending to become horizontal, not depressed in the early portion, slightly depressed in the later portion; wall smooth, finely perforate; aperture radiate, protruding, at the inner peripheral angle. Length up to 1.60 mm, diameter 0.15 to 0.22 mm.

Fairly frequent specimens from four of the sections seem to be close to this species, described from the Oligocene of Germany. They have been compared with a topotype.

Dentalina soluta Reuss

Plate 2, figure 9

Dentalina soluta Reuss, Deutsch. geol. Gesell. Zeitschr., vol. 3, p. 60, pl. 3, fig. 4, 1851.
Bornemann, idem, vol 7, p. 322, 1855.
Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 48, pt. 1, pp. 43, 65, 1863.
Stache, *Novara*-Exped., Geol. Theil, vol. 1, pt. 2, p. 203, pl. 22, fig. 29, 1864.
Hantken, Jahrb. K. Ungar. geol. Anstalt Mitth., vol. 4, p. 29, pl. 3, figs. 2, 14, 1875 (1881); Math. Naturwiss. Ber. Ungarn, vol. 2, p. 127, 1884.
Franke, Mus. Natur.-Heimatkunde Naturw. Ver. Abhandl Ber., vol. 4, pt. 2, p. 167, pl. 5, fig. 28, 1925; Danmarks geol. Undersogelse, vol. 2, Raekke, no. 46, p. 13, pl. 1, fig. 12, 1927.
Asano, Tohoku Imp. Univ. Sci. Repts., ser. 2 (Geol.), vol. 19, no. 2, p. 213 (35), pl. 25 (2), fig. 31; pl. 27 (4), fig. 24, 1938.
Staesche and Hiltermann, Reichs. Bodenforschung Abhandl., n. ser., no. 201, pl. 15, fig. 10; pl. 19, fig. 4; pl. 22, fig. 14; pl. 24, fig. 5; pl. 25, fig. 3; pl. 26, fig. 9; pl. 35, fig. 9, 1940.
Toulmin, Jour. Paleontology, vol. 15, p. 587, pl. 79, figs. 23, 24, 1941.
ten Dam and Reinhold, Geol. Stichting Mededeel., ser. C-V, no. 2, p. 59, pl. 4, fig. 4, 1942.
Franklin, Jour. Paleontology, vol. 18, p. 310, pl. 46, fig. 12, 1944.
Cushman and Stainforth, Cushman Lab. Foram. Research Special Pub. 14, p. 24, pl. 3, fig. 18, 1945.
Colom, Instit. Invest. Geol. No. 3 Estudios Geologicos, p. 144, pl. 9, fig. 133, 1946.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 85, pl. 14, fig. 26, 1946.
Dentalina cf. *soluta* Cushman, idem, vol. 15, p. 56, pl. 10, fig. 1, 1939.

Test arcuate, periphery strongly indented throughout, initial end rounded, apertural end acute; chambers few, strongly inflated, greatest diameter below the middle of each chamber; sutures much depressed; wall smooth, finely perforate, slightly hispid around the base of each chamber; aperture at the end of a prominent neck, eccentric. Length up to 1.00 mm or more; average diameter 0.20 mm.

This is a very distinctive form and fragments were obtained from all five sections. *Dentalina soluta* was described from the Oligocene of Germany. A very similar form is *D. guttifera* D'Orbigny, described from the Miocene of the Vienna Basin, but from the figure it appears to be a more slender and fragile species.

Dentalina pseudoinvolvens Cushman and McGlamery

Plate 2, figure 27

Dentalina pseudoinvolvens Cushman and McGlamery, Cushman Lab. Foram. Research Contr., vol. 15, p. 45, pl. 9, figs. 1, 2, 1939; U. S. Geol. Survey Prof. Paper 197–B, p. 67, pl. 4, figs. 8, 9, 1942.
Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 556, pl. 74, fig. 3, 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 85, pl. 14, figs. 24, 25, 1946.
Dentalina sp. Cushman and Ponton, Florida Geol. Survey Bull. 9, p. 61, pl. 9, figs. 3, 4, 1932.

Test elongate, slender, slightly arcuate, very gently tapering, with the greatest diameter at the last-formed chamber, initial end with a short spine; chambers few, about six in the adult, inflated, somewhat pyriform, proloculum fusiform, later chambers increasing very gradually in size as added, more inflated on one side; sutures distinct, depressed, strongly limbate; wall ornamented with distinct, low, longitudinal costae, sometimes tending to become slightly spiral; aperture radiate, at the end of a slightly prolonged, tapering neck. Length up to 1.25 mm; diameter 0.15–0.18 mm.—Cushman and McGlamery.

A few poorly preserved specimens are referred to this species, described from the Chickasawhay limestone near Millry, Alabama, and recorded from the subsurface Anahuac formation of Ellisor in Texas, the Byram formation of Mississippi, and the lower Miocene Chipola formation of Florida. The figured specimen is considerably larger than the types and the costae are faint or missing on the central part of the chambers.

Dentalina praecatesbyi (Cushman and Todd) Cushman and Todd

Plate 2, figure 26

Nodosaria praecatesbyi Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 85, pl. 14, figs. 28, 29, 1946.
Dentalina praecatesbyi Cushman and Todd, idem, vol. 24, p. 8(list), 1948.
Nodosaria sp. Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 130, pl. 30, fig. 5, 1922.

Test with 3 to 5 chambers, increasing in diameter as added, initial end usually with a single, short spine, the final chamber often slightly longer than the earlier ones; sutures distinct, depressed; wall ornamented with coarse, rounded, longitudinal costae, usually somewhat thickened at the outer end, frequently irregular and sometimes fused in part; aperture terminal, radiate, usually ending in a distinct point. Maximum length 1.50 mm; breadth 0.48 mm.—Cushman and Todd.

This species, described from the Byram formation and known from the Mint Spring marl member of the Marianna limestone and Red Bluff clay of Mississippi, occurs in typical form in all the sections. It is a more robust, thicker-walled species than *D. pseudoinvolvens*, and the chambers are more inflated.

Genus Chrysalogonium Schubert, 1907

Chrysalogonium vicksburgense Todd, n. sp.

Plate 2, figures 13–15

Nodosaria longiscata Cole and Ponton (not D'Orbigny), Florida Geol. Survey Bull. 5, p. 33, pl. 6, fig. 4, 1930.
Cole and Gillespie, Bull. Am. Paleontology, vol. 15, no. 57b, p. 8, pl. 4, fig. 1; pl. 3, fig. 9, 1930.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 46, pl. 4, fig. 26, 1942.
Cushman and Renz, Cushman Lab. Foram. Research Special Pub. 22, p. 15, pl. 4, figs. 17, 18, 1947.
Nodosaria ewaldi? Cushman and Todd (not Reuss), idem, Contr., vol. 21, p. 87, pl. 14, fig. 6, 1945.
Chrysalogonium sp. Cushman and Todd, idem, vol. 22, p. 86, pl. 15, figs. 1, 2, 1946.

Test slender, elongate, slightly arcuate; initial end rounded, with or without a short spine; apertural end acutely conical; chambers 2 to 3½ times as long as

broad, evenly shaped, chamber walls parallel for most of their length; sutures distinct, slightly constricted, horizontal throughout the test; wall smooth, thick, very finely perforate; aperture a finely porous conical tip on the narrowed end of the last-formed chamber. Length unknown, as no complete adult specimens were found; undoubtedly exceeding 3 mm, diameter 0.10 to 0.30 mm.

Holotype (Cushman Coll. no. 47658) from the middle Oligocene Glendon(?) limestone member of the Byram formation (sample 662–5), Robinson Quarry near Brandon, sec. 19, T. 5 N., R. 4 E., Rankin County, Miss.

Chrysalogonium granti (Plummer), from the Midway group of Texas, is smaller, the chambers are less elongate and usually slightly tapering with the greatest diameter near the basal end of the chamber, and the sutures are less distinct and less strongly constricted.

This form has been recorded under various names, as indicated in the synonymy above, from the Oligocene Marianna limestone of Florida, Byram formation of Mississippi, Meson formation of Mexico and Ste. Croix formation of Trinidad, and the Eocene Yazoo clay and Moodys Branch formation of Mississippi. In the present material the species occurs sparsely in all the sections.

Genus Pseudoglandulina Cushman, 1929

Pseudoglandulina sp.

Plate 2, figure 16

The specimen figured was the only one of this genus found. It is incomplete at the apertural end but apparently represents an undescribed species, rather elongate, with incised sutures, and smooth, thin wall.

Genus Saracenaria Defrance, 1824

Saracenaria moresiana Howe and Wallace

Plate 2, figure 17

Saracenaria moresiana Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 42, pl. 2, fig. 8, 1932.

Berquist, Mississippi Geol. Survey Bull. 49, p. 48, pl. 3, fig. 14, 1942.

Test elongate, roughly triangular, periphery well rounded, apertural face flaring; chambers few, about six usually visible, each succeeding chamber becoming more elongate and broader; sutures distinct, slightly depressed, slightly curved; wall calcareous, glassy; aperture radiate. Length 0.5 mm.—Howe and Wallace.

A few specimens, from three of the sections, seem upon comparison with a paratype to belong to this species, described from the upper Eocene of Louisiana and recorded from the Jackson group of Scott County, Miss. They differ from *S. hantkeni* Cushman in having a more flaring apertural face and in not being uncoiled.

Genus Frondicularia Defrance, 1824

Frondicularia garretti Cushman

Plate 2, figure 18

Frondicularia garretti Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 28, pl. 4, fig. 8, 1935; Special Pub. 16, p. 15, pl. 4, fig. 5, 1946.

Test elongate, compressed, the sides nearly parallel for most of the length, periphery truncate, slightly concave, angles slightly keeled, bluntly rounded; chambers few in number, somewhat variable in size, but of fairly uniform shape, the sides extending backward over the previous chamber at the sides; sutures distinct, somewhat limbate, raised, curved inward toward the elongate axis of the test; wall smooth; aperture rounded, terminal. Length 0.50–0.60 mm; breadth 0.15 mm; thickness 0.05 mm.—Cushman.

A young specimen, consisting of the proloculum and second chamber, represents this species, described from the Byram formation at Byram, Miss., and recorded from the Cocoa sand member of the Yazoo clay at Cocoa Post Office, Ala.

Genus Palmula Lea, 1833

Palmula caelata (Cushman) Israelsky

Plate 2, figure 19

Bolivina caelata Cushman, U. S. Geol. Survey Prof. Paper 133. pl. 2, fig. 2, 1923.

Palmula caelata Israelsky, Sixth Pacific Sci. Congress Proc., pl. 4, fig. 8, 1939.

Howe, Jour. Paleontology, vol. 16, p. 268 (list), 1942.

Flabellina vicksburgensis Howe, idem, vol. 4, p. 327, pl. 27, fig. 2, 1930.

Test roughly diamond-shaped, much compressed, apertural end extended; coiled in early part of test, followed by a linear series of chambers shaped as in *Frondicularia*. Surface strongly punctate; ornamentation consisting of irregular polygonal areas bounded by raised lines between raised sutures. Sutures in the early part of test slightly modified by the reticulate pattern, but transparent and with transmitted convergent light clearly showing the early coiled portion which is characteristic of the genus. Aperture terminal, radiate; the apertural face of the last chamber being flattened and smooth. Maximum length observed 1.01 mm; maximum width 0.63 mm. Length of figured specimen 0.74 mm; width 0.53 mm.—Howe's description of *Flabellina vicksburgensis* from the Byram marl.

The taxonomy of this species, which was originally described from the Red Bluff clay in Alabama, is complicated. It was not until 1937, when Cushman (p. 70), stated that "a study of the type of '*Bolivina caelata* Cushman,' in liquid by transmitted light, shows that this species is really a *Flabellina* with a peculiar reticulate ornamentation, and much the general shape of *Bolivina*," that *caelata* was recognized as "*Flabellina*," or more properly, *Palmula*. In the meantime, "*Flabellina vicksburgensis*" had been erected for the reticulate flabelline form known in the Vicksburg. Later, in 1939 and 1942, Israelsky and Howe both recorded it under its proper name.

A single specimen, incomplete but showing the characteristic surface ornamentation, was found in the Burke Creek section.

The species is quite close to "*Flabellina henbesti* Bermúdez" from the Eocene of Cuba but that species has a thin and ruffled keel around the periphery and the reticulations decrease noticably in strength until the last-formed chamber is nearly unornamented.

Genus Lagena Walker and Jacob, 1798

Lagena costata (Williamson) Reuss

Plate 2, figure 23

Entosolenia costata Williamson, Recent Foraminifera of Great Britain, p. 9, pl. 1, fig. 18, 1858.

Lagena costata Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 46, pt. 1, p. 329, pl. 4, fig. 54, 1862.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 105, pl. 24, fig. 12, 1938.

Cushman, Cushman Lab. Foram. Research Special Pub. 16, p. 15, pl. 4, figs. 6, 7, 1946.

Cushman and Todd, idem, Contr., vol. 22, p. 86, 1946; vol. 24, p. 11 (list), 1948.

Test subglobular, circular in section, slightly elongate, apertural end pointed; wall ornamented with 8 to 14 or more high, sharp, longitudinal costae, the number depending on the size of the test, the wall between the costae commonly translucent and appearing dark, the costae joined irregularly on the base of the test but becoming faint and disappearing toward the apertural end; aperture small, circular, at the end of a very short tube which seems to extend partly inside and partly outside the test wall. Length 0.20 to 0.32 mm, diameter 0.17 to 0.23 mm.

This is by far the commonest of all the Lagenas in these samples from the Vicksburg group. The specimens seem very close to the type specimen of this species, as figured from off the British Isles. A few other records of specimens that seem to be the same as those from the section of the Vicksburg are included in the synonymy given above. They are from the Oligocene of Choctaw Bluff, Ala., the Byram formation and Red Bluff clay of Mississippi and the Eocene Yazoo clay of Mississippi and Cocoa sand member of the Yazoo clay of Alabama. The species occurs commonly throughout all the sections.

Lagena substriata Williamson

Plate 2, figure 21

Lagena substriata Williamson, Annals and Mag. Nat History, 2d ser., vol. 1, p. 15, pl. 2, fig. 12, 1848.

Schlumberger, Soc. zool. France Mém., vol. 7, p. 253, 1894.

Cushman, U. S. Nat. Mus. Bull. 104, pt. 4, p. 56, pl. 10, fig. 11, 1923; Scripps Inst. Oceanography Bull., Tech. ser., vol. 1, p. 145, 1927; Cushman Lab. Foram. Research Contr., vol. 5, p. 68, pl. 11, fig. 4, 1929; Florida Geol. Survey Bull. 4, p. 31, pl. 5, fig. 14, 1930.

Cushman, Stewart, and Stewart, San Diego Soc. Nat. History Trans., vol. 6, no. 2, p. 57, pl. 3, fig. 9, 1930.

Cushman and Laiming, Jour. Paleontology, vol. 5, p. 100, pl. 11, fig. 1, 1931.

Cushman, Tennessee Div. Geology Bull. 41, p. 37, pl. 5, fig. 7, 1931.

Hada, Tohoku Imp. Univ. Sci. Repts., 4th ser., Biol., vol. 6, p. 108, text fig. 64, 1931.

Cushman and Ponton, Florida Geol. Survey Bull. 9, p. 63, 1932.

Cushman and Cahill, U. S. Geol. Survey Prof. Paper 175–A, p. 16, pl. 5, fig. 11, 1933.

Blake, Biol. Survey Mt. Desert Region, pt. 5, p. 75, 1933.

Palmer and Bermudez, Soc. cubana hist. nat. Mem., vol. 10, p. 280, 1936.

Asano, Tohoku Imp. Univ. Sci. Repts., 2d ser. (Geol.), vol. 19, p. 216 (38), pl. 27 (4), fig. 35, 1938.

Cushman and LeRoy, Jour. Paleontology, vol. 12, p. 125, pl. 22, fig. 12, 1938.

Kleinpell, Miocene stratigraphy of California, p. 226, Tulsa, 1938.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 52, pl. 5, fig. 10, 1942.

Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 336, pl. 52, fig. 15, 1944.

Cushman, Cushman Lab. Foram. Research Special Pub. 12, p. 21, pl. 3, fig. 8, 1944.

Cushman and Todd, idem, Special Pub. 15, p. 33, pl. 5, fig. 15, 1945.

Cushman, U. S. Geol. Survey Prof. Paper 206, p. 95, pl. 39, fig. 22, 1946.

Lagena cf. *substriata* Beck, Jour. Paleontology, vol. 17, p. 602, pl. 107, fig. 30, 1943.

Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 9, pl. 2, fig. 14, 1944.

Cushman and Todd, idem, vol. 21, p. 13, pl. 3, fig. 15, 1945.

Lagena vulgaris Williamson var. *substriata* Williamson, Recent Foraminifera of Great Britain, p. 7, pl. 1, fig. 14, 1858.

Lagena striata (D'Orbigny) var. *substriata* Williamson, Cushman, U. S. Nat. Museum Bull. 71, pt. 3, p. 20, pl. 8, figs. 1–3, 1913; U. S. Geol. Survey Prof. Paper 129–F, p. 128, pl. 29, fig. 10, 1922; Prof. Paper 133, p. 26, 1923.

Cushman and McGlamery, idem, Prof. Paper 197–B, p. 67, pl. 4, fig. 23, 1942.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 558, 1945.

Test subglobular or elongate, with a long, slender neck, the neck comprising about one-third the length of the test; wall thin, translucent, ornamented with numerous (20 to 30) faint, low, longitudinal costae, evenly spaced over the body of the test by the intercalation of additional costae at the widest part, costae coming together at a point or, commonly, at a small raised ring at the base of the test, costae extending up to the base of the neck that is in some specimens ornamented by irregular horizontal rings; aperture small, circular, surrounded by a very slight lip in well-preserved specimens. Length 0.35 to 0.55 mm, diameter 0.12 to 0.22 mm.

This species, like *L. costata*, occurs in all the sections but is less abundant. It closely resembles the typical Recent species, described from off the British Isles, and similar specimens have been widely recorded from Cretaceous to Recent.

Lagena hexagona (Williamson) Siddall

Plate 2, figure 20

Entosolenia squamosa var. *hexagona* Williamson, Annals and Mag. Nat. History, 2d ser., vol. 1, p. 20, pl. 2, fig. 23, 1848; Recent Foraminifera of Great Britain, p. 13, pl. 1, fig. 32, 1858.

Lagena hexagona Siddall, Catalogue of Recent British Foraminifera, p. 6, 1879.

Jones, Foraminifera of the Crag, pt. 2, p. 193, pl. 6, fig. 7, 1895.

Silvestri, Pont. accad. Nuovi Lincei Mem., vol. 12, p. 117, pl. 2, fig. 19; pl. 3, figs. 1, 2, 1896.

Reade, Geol. Mag., dec. 4, vol. 7, pl. 5, fig. 15, 1900.

Cushman, U. S. Nat. Museum Bull. 71, pt. 3, p. 17, pl. 6, figs. 2, 3, 1913; U. S. Geol. Survey Prof. Paper 129–F, p. 129, pl. 29, fig. 12, 1922; Prof. Paper 133, p. 26, 1923; U. S. Nat. Museum Bull. 104, pt. 4, p. 24, pl. 4, fig. 6, 1923; Cushman Lab. Foram. Research Contr., vol. 5, p. 72, pl. 11, fig. 18, 1929.

Cushman, Stewart, and Stewart, San Diego Soc. Nat. History Trans., vol. 6, p. 57, pl. 3, fig. 7, 1930.

Cushman, Tennessee Div. Geol. Bull. 41, p. 38, pl. 5, fig. 12, 1931.

Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 28, pl. 6, fig. 14, 1932.

Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 21, fig. 20, 1933; U. S. Geol. Survey Prof. Paper 181, p. 23, pl. 9, fig. 10, 1935.

Howe, Louisiana Dept. Cons. Geol. Bull. 14, p. 50, pl. 6, fig. 16, 1939.

Cushman, Foraminifera, 3d Ed., Key, pl. 21, fig. 20, Cambridge, 1940.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 50, pl. 5, fig. 24, 1942.

Frizzell, Jour. Paleontology, vol. 17, p. 348, pl. 56, fig. 26, 1943.

Beck, idem. vol. 17, p. 602, pl. 107, fig. 23, 1943.

Cushman, Cushman Lab. Foram. Research Contr., vol. 21, p. 3, pl. 1, fig. 7, 1945.

Cushman and Todd, idem, vol. 22, p. 86, 1946.

Cushman, U. S. Geol. Survey Prof. Paper 206, p. 95, pl. 39, fig. 16, 1946.

Test nearly spherical, except for the low, conical apertural region; wall covered by a network of high, sharp, strongly raised lines in a crudely hexagonal pattern, the cells appearing dark due to the translucent wall; aperture small, circular, at the end of a short tube which extends partly inside and partly outside the test, without a lip. Length 0.22 to 0.28 mm, diameter 0.20 to 0.24 mm.

This species, like *L. substriata*, was described from off the British Isles and has been recorded widely from Upper Cretaceous to Recent. It occurs in all five sections studied.

Lagena acuticosta Reuss

Plate 2, figure 22

Lagena acuticosta Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, p. 305, pl. 1, fig. 4, 1861 (1862).

A very few specimens in two of the sections are referred to this species, which was described from the Upper Cretaceous of Europe and has been recorded widely from Cretaceous to Recent. These specimens differ from those referred to *L. costata* (Williamson) in being more spherical with a distinctly projecting neck and in having fewer and less prominent costae.

Lagena cookei Cushman

Plate 2, figure 24

Lagena cookei Cushman, U. S. Geol. Survey Prof. Paper 133, p. 25, pl. 3, figs. 9, 10, 1923.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Test broader than long, base broadly truncate; apertural end tapering to a short cylindrical neck; surface smooth except for a slight granulation, dull. Length usually not exceeding 0.2 mm.—Cushman.

Two specimens were found in the Glendon (?) limestone member in the railroad cut.

Lagena striatopunctata Parker and Jones

Plate 2, figure 25

Lagena sulcata Walker and Jacob var. *striatopunctata* Parker and Jones, Philosophical Trans., vol. 155, p. 350, pl. 13, figs. 25–27, 1865.

Lagena striatopunctata Parker and Jones, H. B. Brady, Annals and Mag. Nat. History, 5th ser., vol. 1, p. 434, pl. 20, fig. 3, 1878.

Balkwill and Wright, Royal Irish Acad. Trans., vol. 28, Sci., p. 339, pl. 14, fig. 20, 1885.

Chapman, Royal Micr. Soc. Jour., 1893, p. 584, pl. 8, fig. 15.

Goës, K. svenska vetensk. akad. Handl., vol. 25, no. 9, p. 83, pl. 13, fig. 753, 1894.

Sidebottom, Quekett Micr. Club Jour., vol. 11, p. 392, pl. 16, figs. 7–10, 1912.

Cushman, U. S. Nat. Mus. Bull. 71, pt. 3, p. 30, pl. 14, fig. 10, 1913; Bull. 104, pt. 4, p. 55, pl. 10, fig. 10, 1923.

Cushman and Todd, Cushman Lab. Foram. Research Special Pub. 15, p. 33, pl. 5, fig. 13, 1945.

Test very small, circular in section, elongate, tapering toward the apertural end; wall thin, translucent, ornamented with 8 high, sharp costae that appear transversely striated owing to their conspicuous perforations; aperture at the end of a very long, slender neck. Length of body of test 0.17 mm, diameter 0.09 to 0.10 mm.

Two very typical specimens were found in sample 757–2a of the Burke Creek section.

Originally described from the Arctic and recorded from the Eocene of France, this species has been widely recorded from Lower Cretaceous to Recent. Only those records accompanied by figures have been included in the synonymy.

Family POLYMORPHINIDAE

Genus Guttulina D'Orbigny, 1839

Guttulina byramensis (Cushman) Howe

Plate 3, figure 1

Polymorphina byramensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 94, pl. 17, fig. 2, 1922; Prof. Paper 129–F, p. 131, 1922; Prof. Paper 133, p. 31, pl. 5, figs. 1–5, 1923.

P. Applin, Am. Assoc. Petrol. Geologists Bull., vol. 9, p. 25, 1925.

Nuttall, Quart. Jour. Geol. Soc., vol. 84, p. 92, pl. 6, fig. 12, 1928.

Guttulina byramensis Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.

Cushman and Schenck, California Univ., Dept. Geol. Sci. Bull., vol. 17, p. 309, pl. 43, figs. 6–8, 1928.

Condit, Jour. Paleontology, vol. 4, p. 262 (list), 1930.

Cushman and Stainforth, Cushman Lab. Foram. Research Special Pub. 14, p. 32, pl. 4, figs. 25, 26, 1945.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 558, pl. 74, fig. 15, 1945.

Weaver, Washington Univ. [Seattle] Pub. in Geology, vol. 6, no. 2, p. 49 (list), 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 86, pl. 15, fig. 3, 1946.

Detling, Jour. Paleontology, vol. 20, p. 354, pl. 48, fig. 10, 1946.

Cushman and Renz, Cushman Lab. Foram. Research Special Pub. 22, p. 20, 1947.

Cushman and Todd, idem, Contr., vol. 24, p. 8 (list), 1948.

Guttulina irregularis Cushman and Ozawa (part) (not D'Orbigny), U. S. Nat. Museum Proc., vol. 77, art. 6, p. 25, 1930.

Test short and broad, triangular, composed of a few chambers, usually only four, all except a final fifth chamber extending back to the base of the proloculum, forming a truncate test; chambers inflated, sutures deep and distinct; surface smooth; aperture radiate, only slightly produced. Length 0.75 mm or less.—Cushman.

Guttulina byramensis is one of the most abundant species in this material from the Vicksburg group, occurring commonly to abundantly throughout all the sections. Its short, broad shape and the last chamber's usually failing to extend back to the base of the test serve to distinguish it.

Guttulina problema D'Orbigny

Plate 3, figure 2

Guttulina problema D'Orbigny, Foraminifères fossiles du bassin tertiaire de Vienne, p. 224, pl. 12, figs. 26–28, 1846.

Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 19, pl. 2, figs. 1–6; pl. 3, figs. 1a–c, 1930.

Test broadly fusiform, acute at the apertural end, more or less rounded at the initial end in the megalospheric form, rather rounded at the base in the microspheric form; chambers elongated, more or less inflated, arranged in a clockwise, quinqueloculine series, each succeeding chamber slightly removed from the base; sutures depressed, very distinct; wall rather thick, smooth; aperture radiate. Length, 0.50–1.25 mm; breadth, 0.40–1.25 mm; thickness, 0.28–0.70 mm.—Cushman and Ozawa, 1930.

Fairly abundant specimens in all five sections are referred to this common species, known from Cretaceous to Recent. They are a little smaller than average for this species, and the sutures are very little if at all depressed, resulting in a smooth, not indented, periphery.

Guttulina spicaeformis (Roemer) Cushman and Ozawa var. australis (D'Orbigny) Cushman and Ozawa

Plate 3, figure 3

Globulina australis D'Orbigny, Voyage dans l'Amérique meridionale, vol. 5, Foraminifères, p. 60, pl. 1, figs. 1–4, 1839.

Polymorphina australis H. B. Brady, Parker and Jones, Linnean Soc. London Trans., vol. 27, p. 239, pl. 41, fig. 27, 1870.

Guttulina spicaeformis (Roemer) var. *australis* Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 32, pl. 5, fig. 3, 1930.

Bermúdez, Soc. cubana hist. nat. Mem., vol. 9, p. 183, 1935.

Hadley, Elisha Mitchell Sci. Soc. Jour., vol. 52, p. 35, 1936.

Howchin, Royal Soc. South Australia Trans., vol. 60, pp. 22, 23, 1936.

van Bellen, Geol. Stichting Mededeel., ser. C–V, no. 4, p. 36, pl. 2, fig. 30, 1946.

Polymorphina regina Cushman (not H. B. Brady, Parker and Jones), Carnegie Inst. Washington Pub. 311, p. 33, pl. 4, figs. 5, 6, 1922; U. S. Geol. Survey Prof. Paper 129–E, p. 94, pl. 18, fig. 4, 1922; Prof. Paper 129–F, p. 131, pl. 30, fig. 8, 1922; Prof. Paper 133, p. 33, 1923.

Test fusiform, periphery indented, initial end rounded, apertural end acute with slightly concave sides; chambers moderately inflated in their lower parts, not much embracing; wall ornamented with very fine, longitudinal costae, generally well developed over the lower part of the test, obscure in some specimens; aperture radiate, protruding. Length 0.65 to 0.75 mm, breadth 0.32 to 0.42 mm.

This species was found in all the sections but is not common. It is known from Recent material of the West Indies, the Byram formation and Mint Spring marl member of the Marianna limestone of Mississippi, the Tertiary of Australia, and the Eocene of the Netherlands and England.

Genus Globulina D'Orbigny, 1839

Globulina gibba D'Orbigny

Plate 3, figure 4

Globulina gibba D'Orbigny, Foraminifères fossiles du bassin tertiaire de Vienne, p. 227, pl. 13, figs. 13, 14, 1846.

Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 60, pl. 16, figs. 1–4, 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 apertural end; aperture radiate. Length 0.45–1.10 mm; breadth 0.40–0.90 mm; thickness 0.40–0.90 mm—Cushman and Ozawa, 1930.

This very common and widespread species was found frequently to abundantly in nearly every sample.

Globulina gibba D'Orbigny var. punctata D'Orbigny

Plate 3, figure 5

Globulina punctata D'Orbigny, Foraminifères fossiles du bassin tertiaire de Vienne, p. 229, pl. 13, figs. 17, 18, 1846.

Globulina gibba d'Orbigny var. *punctata* Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 69, pl. 17, figs. 4, 5, 1930.

ten Dam and Reinhold, Geol. Stichting Mededeel., ser. C–V, no. 1, p. 50, pl. 2, fig. 15, 1941; no. 2, p. 73, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 88, pl. 14, fig. 14, 1945.

van Bellen, Geol. Stichting Mededeel., ser. C–V, no. 4, p. 38, pl. 3, fig. 6, 1946.

Colom, Instit. Invest. Geol. No. 3, Estudios Geolôgicos, p. 153, pl. 13, fig. 269, 1946.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 8 (list), 1948.

Polymorphina hirsuta H. B. Brady, Parker and Jones, Linnean Soc. London Trans., vol. 27, p. 243, pl. 42, fig. 37, 1870.
Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 62, pt. 1, p. 486, 1870; in von Schlicht, Foram. Septar. Pietzpuhl, pl. 34, figs. 1–3, 1870.
Jones and Chapman, Linnean Soc. Jour., Zoology, vol. 25, p. 511, text fig. 21, 1896.
Jones, Foraminifera of the Crag, pt. 3, p. 273, pl. 6, fig. 14, 1896.
Heron-Allen and Earland, Royal Micr. Soc. Jour., 1909, p. 435, pl. 17, fig. 7.
Franke, Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 78, pl. 6, fig. 22, 1925.
Globulina rugosa D'Orbigny, Foraminifères fossiles du bassin tertiaire de Vienne, p. 229, pl. 13, figs. 19, 20, 1846.
Terquem, Essai sur le classement des animaux qui vivent sur la plage et dans les environs de Dunkerque, pt. 2, p. 77, pl. 10, fig. 1, 1876.
Polymorphina rugosa Cushman, U. S. Nat. Museum Bull. 104, pt. 4, p. 157, pl. 41, fig. 6, 1923.
Polymorphina globosa Karrer (not von Münster), Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 52, pt. 1, p. 497, pl., fig. 12, 1865.

This finely spinose variety occurs with the typical form but is much less abundant. Like the species it has a broad range, and is known from Cretaceous to Recent.

Globulina gibba D'Orbigny var. striata Egger

Plate 3, figure 6

Polymorphina (Globulina) striata Egger, Neues Jahrb. für Min., Jahrg. 1857, p. 291, pl. 14, figs. 3, 4.
Globulina gibba d'Orbigny var. *striata* Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 65, pl. 16, figs. 5–7, 1930.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 22, fig. 10, 1933; Foraminifera, 3rd ed., Key, pl. 22, fig. 10, Cambridge, 1940.
Polymorphina (Globulina) costata Egger, Neues Jahrb. für Min., Jahrg. 1857, p. 291, pl. 14, figs. 5, 6.
Polymorphina costata H. B. Brady, Parker and Jones, Linnean Soc. London Trans., vol. 27, p. 240, pl. 41, fig. 31, 1870.

Variety with the test not compressed, often somewhat longer than broad, wall thick, translucent, ornamentation of the surface consisting of longitudinal, platelike costae, independent of the sutures, each broken into numerous irregular, jagged portions; apertural end usually broadly rounded. Length 0.30–0.40 mm; breadth 0.20–0.33 mm; thickness 0.18–0.30 mm.—Cushman and Ozawa, 1930.

Only two specimens showing the very distinctive surface ornamentation of this variety were found in the Mint Spring Bayou and Burke Creek sections. It was described from the Miocene of Germany.

Globulina alabamensis Cushman and McGlamery

Plate 3, figure 7

Globulina alabamensis Cushman and McGlamery, Cushman Lab. Foram. Research Contr., vol. 15, p. 46, pl. 9, fig. 3, 1939; U. S. Geol. Survey Prof. Paper 197–B, p. 68, pl. 5, figs. 1–4, 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 87, pl. 15, fig. 4, 1946; vol. 24, p. 8 (list), 1948.
Polymorphina spinosa Cushman (not D'Orbigny), U. S. Geol. Survey Prof. Paper 129–F, p. 133, pl. 31, fig. 5, 1922; Prof. Paper 133, p. 34, 1923.

Test slightly longer than broad, both ends broadly rounded, periphery broadly rounded, thickness slightly less than the breadth; chambers few, only slightly inflated, increasing rapidly in size as added, last-formed chamber making up at least half the surface in the adult; sutures distinct, sigmoid in the adult, little if at all depressed, very slightly limbate; wall ornamented with numerous short spines, rather evenly scattered over the whole surface; aperture terminal, radiate. Length 0.60–1.25 mm; breadth 0.40–1.00 mm; thickness 0.35–0.85 mm.—Cushman and McGlamery.

This species occurs in all five sections. It is easily distinguished from *G. gibba* D'Orbigny var. *punctata* D'Orbigny by its ornamentation, which is much coarser, with rather widely spaced, blunt, stalk-like projections rather than true spines, and with the wall between the spines smooth and translucent in well-preserved specimens.

Globulina fimbriata Cushman and McGlamery

Plate 3, figure 8

Globulina fimbriata Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 105, pl. 24, fig. 20, 1938.

Test planoconvex, periphery keeled, the edge frilled; chambers somewhat obscure on the convex side, several visible on the flattened side, the last-formed chamber making up all but a small elongate area at one side; sutures somewhat indistinct, not depressed; wall smooth, perforate; aperture obscure, apparently peripheral in the adult. Diameter 0.30 mm, height 0.10 mm.—Cushman and McGlamery.

This is apparently an attached form. It was described from the Oligocene at Choctaw Bluff, Alabama River, Ala., but not previously recorded elsewhere. Specimens were found in a few samples from three of the sections in Rankin County.

Genus Pyrulina D'Orbigny, 1839

Pyrulina albatrossi Cushman and Ozawa

Plate 3, figure 9

Pyrulina albatrossi Cushman and Ozawa, U. S. Nat. Museum, Proc., vol. 77, art. 6, p. 58, pl. 15, figs. 1–3, 1930.
Cushman, Florida Geol. Survey Bull. 4, p. 34, pl. 5, figs. 17, 18, 1930.
Cushman and Ponton, idem, Bull. 9, p. 66, 1932.
Cushman and Cahill, U. S. Geol. Survey Prof. Paper 175–A, p. 18, pl. 6, fig. 5, 1933.
Cushman, idem, Prof. Paper 210–A, p. 5, 1946.

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. Holotype, length 1.85 mm; breadth 0.65 mm; thickness 0.40 mm.—Cushman and Ozawa.

Single specimens were found in four samples. This species was described from off Cuba and has been recorded from the Miocene of Florida, North Carolina, Maryland, and wall samples from the Virgin Islands.

Pyrulina aequalis Todd, n. sp.

Plate 3, figure 10

Test broadly fusiform, circular in section, about equally acute at both ends, periphery smooth; chambers rapidly increasing in size, last two comprising most of the test, very little if at all inflated; sutures indistinct, not depressed; wall smooth, finely perforate, translucent in well-preserved specimens; aperture comparatively large, radiate, not greatly protruding. Length as much as 0.60 mm, breath as much as 0.22 mm.

Holotype (Cushman Coll. no. 47663) from the middle Oligocene, Glendon (?) limestone member of the Byram formation (sample 662–5), Robinson Quarry near Brandon, sec. 19, T. 5 N., R. 4 E., Rankin County, Miss.

This species differs from *P. vicksburgensis* (Cushman) in its broadly fusiform shape and smooth wall throughout.

It occurs, but is rare, in all but the Richland Creek section.

Genus Pseudopolymorphina Cushman and Ozawa, 1928

Pseudopolymorphina rutila (Cushman) Cushman and Ozawa

Plate 3, figure 16

Polymorphina regina H. B. Brady, Parker and Jones var. *rutila* Cushman, U. S. Geol. Survey Prof. Paper 133, p. 34, pl. 5, figs. 7, 8, 1923.

Pseudopolymorphina rutila Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 100, pl. 26, fig. 3, 1930.

Cushman, Florida Geol. Survey Bull. 4, p. 36, pl. 5, fig. 20, 1930.

Cole, idem, Bull. 6, p. 30, pl. 4, fig. 13, 1931.

Cushman and Ponton, idem, Bull. 9, p. 67, 1932.

Cushman and Cahill, U. S. Geol. Survey Prof. Paper 175–A, p. 19, pl. 6, fig. 11, 1933.

Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 22, fig. 15, 1933; Foraminifera, 3d ed., Key, pl. 22, fig. 15, Cambridge, 1940.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 87, pl. 15, fig. 5, 1946.

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. Maximum length 1.30 mm; breadth 0.22 mm; thickness 0.14 mm.—Cushman and Ozawa, 1930.

A few specimens of this species, described from the Byram formation of Mississippi and recorded also from the Miocene and Pliocene of Florida, were found in three of the sections.

Genus Sigmomorphina Cushman and Ozawa, 1928

Sigmomorphina semitecta (Reuss) Cushman and Ozawa var. terquemiana (Fornasini) Cushman and Ozawa

Plate 3, figure 11

Polymorphina amygdaloides Reuss var. *terquemiana* Fornasini, Accad. sci. Ist. Bologna Mem., ser. 5, vol 9, 1900–1902, p. 72, text fig. 25, 1902.

Sigmomorphina semitecta (Reuss) var. *terquemiana* (Fornasini) Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 129, pl. 33, figs. 4, 5; pl. 34, figs. 2, 3; pl. 35, fig. 1, 1930.

Cushman, Tennessee Div. Geology Bull. 41, p. 42, pl. 6, fig. 12, 1931; U. S. Nat. Museum Bull. 161, pt. 2, p. 40, pl. 9, figs. 6–9, 1933; Cushman Lab. Foram. Research Special Pub. 5, pl. 22, fig. 16, 1933; U. S. Geol. Survey Prof. Paper 181, p. 28, 1935.

Howe, Louisiana Dept. Cons. Geol. Bull. 14, p. 55, pl. 7, figs. 11, 12, 1939.

Cushman, Foraminifera, 3d ed., Key, pl. 22, fig. 16, Cambridge, 1940.

Cushman and Applin, Cushman Lab. Foram. Research Contr., vol. 19, p. 37, pl. 7, fig. 23, 1943.

Cushman, idem, vol. 20, p. 24, pl. 4, fig. 15; p. 41, pl. 7, fig. 3, 1944.

Cushman and Todd, idem, vol. 21, p. 15; p. 90, pl. 14, fig. 11, 1945.

Cushman and Herrick, idem, vol. 21, p. 61, pl. 10, fig. 4, 1945.

Cushman and Todd, idem, vol. 22, pp. 57, 87, 1946.

van Bellen, Geol. Stichting Mededeel., ser. C–V, no. 4, p. 42, pl. 3, fig. 20, 1946.

Cushman, U. S. Geol. Survey Prof. Paper 206, p. 98, pl. 41, fig. 13, 1946; Cushman Lab. Foram. Research Special Pub. 16, p. 20, pl. 4, fig. 18, 1946.

Cushman and Renz, idem, Special Pub. 18, p. 35, pl. 5, fig. 26, 1946; idem, Contr., vol. 23, p. 44, 1947.

Sigmomorphina cf. *semitecta* (Reuss) var. *trequemiana* (Fornasini) Cushman and Todd, idem, vol. 18, p. 35, pl. 6, figs. 16, 17, 1942.

Polymorphina amygdaloides Terquem (not Reuss), Soc. géol. France Mém., 3rd sér., vol. 2, p. 141, pl. 14 (22), figs. 30, 31, 1882.

Polymorphina pauperata Terquem, idem, vol. 1, p. 38, pl. 3 (8), figs. 11–19, 1878.

Globulina varians Terquem, idem, vol. 2, p. 128, pl. 13 (21), figs. 9–16, 1882.

Test rather small for the genus, compressed, smoothly pyriform; chambers elongate, rapidly enlarging, all extending down to the base of the test, not inflated, strongly embracing; sutures distinct, generally not depressed; wall smooth, very finely perforate, translucent; aperture radiate, slightly protruding. Length 0.35 to 0.70 mm, breadth 0.22 to 0.33 mm.

This form, which is widely recorded from Upper Cretaceous to Recent, occurs very frequently throughout all the sections.

Sigmomorphina undulosa (Terquem) Cushman and Ozawa

Plate 3, figure 12

Polymorphina undulosa Terquem, Soc. Géol. France Mém., 3rd. sér., vol. 1, p. 41, pl. 3 (8), fig. 35 (not fig. 36), 1878.

Sigmomorphina undulosa (Terquem) Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 131, pl. 34, figs. 4, 5, 1930.

Cole, Florida Geol. Survey Bull. 6, p. 31, text figs. 1–3, 1931.

Cushman and Ponton, idem, Bull. 9, p. 68, pl. 10, fig. 6, 1932.

Polymorphina amygdaloides Terquem (not Reuss), Soc. géol. France Mém., 3rd sér., vol. 1, p. 39, pl. 3 (8), figs. 22, 25 (not figs. 23, 24, 26–30), 1878.

Test oval to ovate, compressed; chambers elongated, embracing, arranged in a contraclockwise sigmoid series, each succeeding chamber not much removed from the base; sutures depressed, distinct; wall smooth, rather thin, often covered

with fistulose tubes; aperture radiate. Maximum length 0.60 mm; breadth 0.30 mm; thickness 0.15 mm.—Cushman and Ozawa, 1930.

Four specimens from the Burke Creek and Robinson Quarry sections seem to belong to this species. They are all extremely glassy and clearly show the internal arrangement of the chambers. The species has been reported from the Miocene and Pliocene of Florida, the Pliocene of England, and Recent material from the Atlantic.

Sigmomorphina cf. S. williamsoni (Terquem) Cushman and Ozawa

Plate 3, figure 14

A single very small specimen from sample 757–8 of the Burke Creek section seems to be very close to this species as described by Cushman and Ozawa (U. S. Nat. Museum Proc., vol. 77, art. 6, p. 138, pl. 38, figs. 3, 4, 1930). It is only 0.25 mm long and 0.13 mm wide.

Sigmomorphina pulchra Todd, n. sp.

Plate 3, figure 13

Test elongate oval, greatest breadth about the middle, slightly compressed, periphery smooth, initial and apertural ends about equally acute; chambers sigmoid, rapidly increasing in size as added, not strongly embracing, last one or two chambers not reaching back to the base; sutures very distinct, slightly depressed; wall smooth, very finely perforate; aperture comparatively large, oval, radiate, protruding. Length 0.65 to 0.83 mm, breadth 0.25 to 0.30 mm.

Holotype (Cushman Coll. no. 47664) from the middle Oligocene Glendon (?) limestone member of the Byram formation (sample 662–5), Robinson Quarry near Brandon, sec. 19, T. 5 N., R. 4 E., Rankin County, Miss.

This species differs from *S. trilocularis* (Bagg), from the Pleistocene of California, in the slenderer form and smooth periphery. It occurs rarely in all the sections studied.

Genus Polymorphina D'Orbigny, 1826

Polymorphina advena Cushman

Plate 3, figure 17

Polymorphina advena Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 132, pl. 31, fig. 4, 1922; Cushman Lab. Foram. Research Contr., vol. 5, p. 41, pl. 7, fig. 5, 1929.
Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 118, pl. 30, fig. 10, 1930.
Cushman and Ponton, Florida Geol. Survey Bull. 9, p. 67, pl. 10, fig. 4, 1932.
Cushman, U. S. Geol. Survey Prof. Paper 181, p. 29, pl. 10, fig. 8, 1935.
Cushman and McGlamery, idem, Prof. Paper 189–D, p. 106, pl. 24, fig. 21, 1938.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 58, pl. 6, figs. 14, 15, 1942.
Howe, Jour. Paleontology, vol. 16, p. 268 (list), 1942.
Cushman and Ellisor, idem, vol. 19, p. 559, pl. 74, fig. 20, 1945.
Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 61, pl. 10, fig. 5, 1945.
Cushman and Todd, idem, Special Pub. 15, p. 35, pl. 5, fig. 22, 1945; Contr., vol. 22, p. 87, pl. 15, figs. 6, 7, 1946; vol. 24, p. 8 (list), 1948.

Test much compressed, broadly ovate; chambers numerous, elongate, alternating, much the broadest near the peripheral end; sutures slightly depressed; surface ornamented with numerous fine longitudinal costae, except the last-formed one or two chambers, which are smooth, at least at the apertural end; aperture radiate. Length 1 mm.—Cushman.

This species occurs nearly throughout all the sections. It was described from Mint Spring Bayou and has been recorded from the upper Eocene to the Miocene.

Polymorphina frondea (Cushman) Cushman

Plate 3, figure 15

Bolivina frondea Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 126, pl. 29, fig. 3, 1922; Prof. Paper 133, p. 20, 1923.
Polymorphina frondea Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 41, 1929.
Cushman and Ozawa, U. S. Nat. Museum Proc., vol. 77, art. 6, p. 118, pl. 30, fig. 11, 1930.
Bermúdez, Soc. cubana hist. nat. Mem., vol. 12, p. 20, 1938.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 68, pl. 5, figs. 5–7, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 41, pl. 4, fig. 7, 1943.
Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 559, pl. 74, fig. 19, 1945.
Cushman, Cushman Lab Foram. Research Contr., vol. 21, p. 4, pl. 1, fig. 13, 1945.
Cushman and Todd, idem, vol. 21, p. 91, pl. 14, fig. 20, 1945; vol. 22, p. 88, 1946.

Test compressed, of uniform thickness, the broad sides nearly parallel, oblong, broadest above the middle, acuminate toward the initial end, margins with a raised rim; chambers compressed, elongated, alternating; sutures depressed, distinct; wall smooth, often with obscure fine costae; aperture radiate. Length 0.50–0.65 mm; breadth 0.30–0.40 mm; thickness 0.04–0.05 mm—Cushman and Ozawa, 1930.

This species also occurs nearly throughout all the sections. It was described from the Mint Spring marl member of the Marianna limestone and has been recorded from the Glendon limestone member of the Byram formation, Marianna limestone, Red Bluff clay, Chickasawhay limestone, subsurface Anahuac formation of Ellisor in Texas, Jackson group of Mississippi and Georgia, Eocene of Cuba, and Paleocene of Mississippi.

At first glance the two strongly compressed species of *Polymorphina*, *advena* and *frondea*, might be confused, but close examination shows several reliable points of distinction: (1) the periphery is rounded in *P. advena* and sharply truncate in *P. frondea*; (2) the sutures are limbate and more distinct in *P. frondea;* and (3) the initial end in *P. frondea* is more sharply acute with the test rapidly broadening, whereas in *P. advena* the initial end is blunt with the sides gradually tapering outward from it.

Genus Ramulina Rupert Jones, 1875

Ramulina globulifera H. B. Brady

Plate 3, figure 18

Ramulina globulifera H. B. Brady, Quart. Jour. Micr. Sci., vol. 19, p. 58, pl. 8, figs. 32, 33, 1879; *Challenger* Rept., Zoology, vol. 9, p. 587, pl. 76, figs. 22–28, 1884.
Amicis, Nat. Sicil., vol. 14, p. 112, pl. 1, fig. 14, 1895.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, pt. 1, p. 135, pl. 2, fig. 2; pl. 22, fig. 33, 1899.
Flint, U. S. Nat. Museum Rept. for 1897, p. 321, pl. 68, fig. 6, 1899.
Cushman, U. S. Nat. Museum Bull. 71, pt. 3, p. 110, pl. 39, fig. 1, 1913.
Chapman and Parr, Linnean Soc. Jour., Zoology, vol. 36, p. 394, pl. 21, fig. 86, 1926.
Plummer, Texas Univ. Bull. 3101, p. 174, pl. 11, fig. 15, 1931.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 22, fig. 23, 1933.
Toulmin, Jour. Paleontology, vol. 15, p. 596, pl. 80, fig. 21, 1941.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 59, pl. 6, fig. 21, 1942.
Kline, idem, Bull. 53, p. 42, pl. 4, figs. 10, 15, 1943.
Colom, Instit. Invest. Geol. No. 3 Estudios Geológicos, p. 154, pl. 13, figs. 268, 271, 272, 1946.

Fragmentary specimens occur in scattered samples throughout all the sections studied. They consist of irregularly globular central chambers from which four to six short arms radiate outward toward other globular chambers. The walls of the chambers and radiating arms are thin, sometimes translucent, and rather thinly covered by sharp spines.

This species was described from Recent material and has been widely recorded from Cretaceous to Recent.

Family NONIONIDAE

Genus Nonion Montfort, 1808

Nonion decoratum Cushman and McGlamery

Plate 3, figure 19

Nonion decoratum Cushman and McGlamery, Cushman Lab. Foram. Research Contr., vol. 15, p. 46, pl. 9, fig. 4, 1939; U. S. Geol. Survey Prof. Paper 197–B, p. 69, pl. 5, fig. 9, 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 88, 1946.
Nonion advenum Cushman and McGlamery (part) (not Cushman), U. S. Geol. Survey Prof. Paper 189–D, p. 106, pl. 24, fig. 23 (not fig. 24), 1938.

Test planispiral, involute, periphery rounded, lobulate, umbilical area somewhat depressed but with a central boss; chambers very distinct, eight to ten in the adult whorl, slightly inflated, increasing rather evenly in size as added; sutures very distinct, deeply excavated, limbate, very slightly curved in the earlier stages, nearly straight and radial in the last-formed portion; wall mostly smooth, finely perforate, the inner portion of the sutures toward the umbilical region, and the central boss, ornamented with fine, granular projections; aperture low, elongate, at the base of the last-formed chamber. Length 0.40–0.45 mm; breadth 0.30–0.40 mm; thickness 0.20 mm.—Cushman and McGlamery.

This species was described from the Chickasawhay limestone near Millry, Ala., and has been recorded from Choctaw Bluff, Ala., and from the Byram formation at its type locality. It occurs commonly to abundantly nearly throughout all five sections.

Nonion advenum (Cushman) Howe

Plate 3, figure 20

Nonionina advena Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 139, pl. 32, fig. 8, 1922; Prof. Paper 133, p. 50, 1923.
Dumble, Am. Assoc. Petrol. Geologists Bull., vol. 8, p. 444 (list), 1924.
Cushman and Applin, idem, vol. 10, p. 181, pl. 10, figs. 16, 17, 1926.
Nonion advena (Cushman) Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.
Nonion advenus Cole and Gillespie, Bull. Am. Paleontology, vol. 15, no. 57b, p. 10, pl. 2, fig. 15, 1930.
Nonion advenum Cushman, U. S. Geol. Survey Prof. Paper 181, p. 30, pl. 11, figs. 1–4, 1935; Prof. Paper 191, p. 9, pl. 20, figs. 3, 4, 1939.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 59, pl. 6, fig. 20, 1942.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 69, pl. 5, fig. 8, 1942.
Applin and Jordan, Jour. Paleontology, vol. 19, pp. 129, 130 (lists), 1945.
Cushman and Ellisor, idem, vol. 19, p. 560, pl. 75, fig. 1, 1945.
Cushman, Cushman Lab. Foram. Research Contr. vol. 21, p. 5, pl. 1, fig. 15, 1945.
Cushman and Herrick, idem, vol. 21, p. 61, pl. 10, fig. 9, 1945.
Cushman and Todd, idem, vol. 21, p. 91, pl. 15, fig. 1, 1945; vol. 22, p. 88, 1946.

Test small, circular in side view, biconvex; periphery rounded, nine to eleven chambers in the last-formed coil, inflated; sutures curved, slightly sigmoid, the inner portion excavated and broadened; umbilical region at each side of the test occupied by a large projecting knob of clear shell material; aperture at the base of the last-formed chamber. Diameter 0.75 mm or less.—Cushman.

This species was described from the Mint Spring marl member of the Marianna limestone of Mississippi and has been widely recorded in the lower and middle Oligocene and upper Eocene of the Gulf Coastal area. It was found to be much less abundant than *N. decoratum* in the present samples. The two species are close in appearance but differ in the following respects: (1) the periphery of *N. decoratum* is lobulated in side view and broadly rounded in edge view whereas the periphery of *N. advenum* is smooth in side view and subacute in edge view; (2) the average number of chambers in *N. advenum* is about two more than in *N. decoratum*; and (3) the umbilical area is depressed in *N. decoratum*, but is raised and with the umbilical boss generally higher in *N. advenum*.

Nonion vickburgense Todd, n. sp.

Plate 3, figure 21

Nonion affine Cushman and Ellisor (not Reuss), Jour. Paleontology, vol. 19, p. 560, pl. 75, fig. 2, 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 88, pl. 15, fig. 8, 1946.

Test planispiral, much compressed, deeply biumbilicate; umbilici irregularly shaped with inward-projecting flaps; periphery entire, broadly rounded; chambers indistinct, 8 to 10 in the adult whorl, of uniform shape, not inflated except the last one or two, very gradually increasing in size as added, each chamber ending at the umbilical region in a slightly thickened limbate flap which overhangs the open umbilicus; sutures indistinct except when the test is moistened, slightly curved near the periphery, last one or two slightly depressed, not limbate; wall smooth, coarsely perforate, translucent in well-preserved specimens with the sutures appearing limbate due to the chamber wall visible within; aperture a low, elongate opening at the base of the apertural face, protected by a delicate, overhanging rim on the last-formed chamber. Diameter 0.40 to 0.50 mm, thickness 0.20 mm.

Holotype (Cushman Coll. no. 47652) from the middle Oligocene Glendon (?) limestone member of the Byram formation (sample 662–4), Robinson Quarry near Brandon, sec. 19, T. 5 N., R. 4 E., Rankin County, Miss.

This species differs from *N. affine* (Reuss) in the less compressed test, the slightly fewer and less distinct chambers, and the irregular, broken appearance of the umbilici as compared to the smoothly finished umbilici in *N. affine*. It differs from *N. planatum* Cushman and Thomas in its larger size and irregular umbilici, and its slightly inflated later chambers.

This is one of the most abundant species in this Vicksburg material, being found in every sample studied.

Specimens referred to *N. affine* from the type locality of the Byram formation in Mississippi and the subsurface Anahuac formation of Ellisor in Texas seem to belong to this species.

Nonion danvillense Howe and Wallace

Nonion danvillensis Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 51, pl. 9, fig. 3, 1932.
Cushman, U. S. Geol. Survey Prof. Paper 191, p. 5, pl. 1, fig. 19, 1939.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 60, pl. 6, fig. 25, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267(list), 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 92, pl. 15, fig. 4, 1945.
Cushman, idem, Special Pub. 16, p. 21, pl. 4, fig. 25, 1946.
Cushman and Todd, idem, Contr., vol. 24, p. 11(list), 1948.

Specimens from the Mint Spring Bayou and Burke Creek sections seem to be identical with this species, described from the upper Eocene of Louisiana and recorded from the upper Eocene of Mississippi and Alabama and the Oligocene Red Bluff clay of Mississippi and Glendon limestone member of the Byram formation of Alabama.

Nonion alabamense Cushman and Todd

Plate 3, figure 22

Nonion alabamense Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 88, pl. 15, figs. 9, 10, 1946.

Test involute, bilaterally symmetrical, somewhat longer than broad, periphery subacute, sides slightly umbilicate; chambers about 12 in number, later ones distinct, slightly inflated, the inner end projecting slightly into the central depression, broadly triangular in apertural view; sutures distinct, later ones slightly depressed; wall smooth; aperture broad and very low, extending along the base of the final chamber. Length 0.55–0.65 mm; breadth 0.40–0.45 mm; thickness 0.30–0.32 mm.—Cushman and Todd.

Specimens occur in samples scattered throughout all the sections. This species was described from the Byram formation at Byram, Miss. It resembles *Nonionella hantkeni* (Cushman and Applin) var. *byramensis* Cushman and Todd, but is bilaterally symmetrical and proportionally shorter and thicker.

Genus Nonionella Cushman, 1926

Nonionella hantkeni (Cushman and Applin) Cushman var. spissa Cushman

Plate 3, figure 23

Nonionella hantkeni (Cushman and Applin) var. *spissa* Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 58, pl. 7, fig. 13, 1931.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 2, figs. 10, 12, 1933.
Cushman, U. S. Geol. Survey Prof. Paper 181, p. 31, pl. 12, fig. 6, 1935.
Cushman and McGlamery, Prof. Paper 189–D, p. 106, pl. 25, fig. 2, 1938.
Cushman, Prof. Paper 191, p. 30, pl. 8, fig. 5, 1939.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 61, pl. 6, fig. 22, 1942.
Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 560, pl. 75, fig. 5, 1945.
Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 63, pl. 10, fig. 12, 1945.
Cushman and Todd, idem, vol. 21, p. 92, pl. 15, fig. 5, 1945; vol. 22, p. 89, 1946.

Test large for the genus, robust, nearly involute but showing part of the earlier whorl on the dorsal side, slightly planoconvex with the dorsal side the flatter one; periphery subacute, indented at the last few chambers only; chambers distinct, curved, 9 to 11 in the last whorl, slightly inflated, gradually increasing in size as added; sutures distinct, curved, strongly incised, especially at the umbilicus, less so toward the periphery; wall thick, very finely perforate, smooth except for the areas of the umbilici on both sides which are slightly hispid; aperture a very low arched opening between the base of the apertural face and the previous whorl. Length 0.40 to 0.55 mm, thickness 0.25 to 0.30 mm.

This variety is very abundant in these samples. It was described from the upper Eocene Cooper marl of South Carolina and has been recorded from the upper Eocene of the Gulf Coastal region and the Oligocene of Choctaw Bluff, Ala., the Byram formation of Mississippi, and the subsurface Anahuac formation of Ellisor in Texas.

Nonionella hantkeni (Cushman and Applin) Cushman var. byramensis Cushman and Todd

Plate 3, figure 24

Nonionella hantkeni (Cushman and Applin) var. *byramensis* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 89, pl. 15, figs. 11, 12, 1946.

Test large for the genus, nearly involute but showing part of the earlier whorl on the dorsal side, compressed; periphery subacute, smooth, not indented; chambers distinct, 10 to 12 in the last whorl, not inflated, gradually increasing in size but more rapidly in length; sutures distinct, nearly radial but a little curved backward toward the periphery, slightly depressed toward the umbilicus; wall thick, very finely perforate, slightly hispid around the umbilici; aperture an inconspicuous, low, elongate opening between the base of the apertural face and the previous whorl. Length 0.50 to 0.75 mm, thickness 0.22 to 0.28 mm.

This variety was found in all the sections but is slightly less abundant than var. *spissa*.

Nonionella jacksonensis Cushman

Plate 3, figure 25

Nonionella jacksonensis Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 10, pl. 1, fig. 23, 1933; U. S. Geol. Survey Prof. Paper 181, p. 31, pl. 12, figs. 3, 4, 1935; Prof. Paper 191, p. 29, pl. 8, fig. 2, 1939.

Howe, Louisiana Dept. Cons. Geol. Bull. 14, p. 59, pl. 8, figs. 5–7, 1939.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 62, pl. 6, fig. 23, 1942.

Martin, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 11 (list), 1943.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 93, pl. 15, fig. 8, 1945.

Cushman, idem, Special Pub. 16, p. 22, pl. 4, fig. 26, 1946.

Cushman and Todd, idem, Contr., vol. 24, p. 10 (list), 1948.

Cushman and R. E. and K. C. Stewart, Oregon Dept. Geol. and Min. Ind., Bull. 36, pt. 3, p. 61, pl. 8, fig. 1; pt. 5, p. 100, pl. 13, fig. 5, 1947 (1948).

Nonionella cf. *jacksonensis* Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 560, pl. 75, fig. 6, 1945.

Nonionella crassipunctata Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 31, pl. 4, fig. 11, 1935.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 560, pl. 75, fig. 3, 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 90, pl. 15, fig. 16, 1946.

Nonionella cf. *mrassipunctata* Palmer, Soc. cubana hist. nat. Mem., vol. 14, p. 289, pl. 51, figs. 3, 4, 1940.

Test small for the genus, elongate planoconvex, nearly as thick as broad owing to the large expansion of the ventral lobe; periphery smooth, broadly rounded; chambers distinct, about eight in the last whorl, not inflated, very rapidly increasing in height as added, last chamber ending in a large, much inflated lobe over the umbilicus on the ventral side so that more than half the area of the ventral side is occupied by the last-formed chamber; sutures distinct but not depressed; wall thin, perforate, translucent; aperture inconspicuous, obscured by the ventral lobe. Length 0.30 to 0.38 mm, breadth 0.17 to 0.25 mm, thickness 0.15 to 0.20 mm.

This very striking species occurs in all the sections, quite commonly in the four sections in Rankin County.

This species was described from the Jackson group at Claiborne, Ala. A re-examination of the type specimen shows that the measurements as originally given are wrong and should read: "length 0.28 mm; breadth 0.20 mm; thickness 0.12 mm." Comparison of the type specimens of *N. jacksonensis* and *N. crassipunctata* indicates that they are indistinguishable and should be combined. As a result, the range of this species seems to be from middle Eocene to upper Oligocene and to include the southeastern United States, Texas, California, Oregon, and Cuba.

Nonionella jacksonensis Cushman var. compresa Cushman and Todd

Plate 3, figure 26

Nonionella jacksonensis Cushman var. *compressa* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 93, pl. 15, fig. 7, 1945; vol. 24, p. 8 (list), 1948.

Variety differing from the typical form in being strongly compressed and with the chambers more numerous and proportionally longer. A very few scattered specimens from three of the sections seem to be identical with this variety, previously known from the upper Eocene Moodys Branch formation and the lower Oligocene Red Bluff clay of Mississippi.

Nonionella pauciloba Cushman

Plate 3, figure 28

Nonionella pauciloba Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 32, pl. 4, fig. 12, 1935.

Cushman and Todd, idem, vol. 22, p. 89, pl. 15, fig. 17, 1946.

Nonionella cf. *pauciloba* Cushman and Renz, idem, Special Pub. 22, p. 21, pl. 5, fig. 12, 1947.

Test slightly longer than broad, only slightly inequilateral in peripheral view, dorsal side evolute, ventrally involute with the basal lobe very small, barely reaching and covering the umbilicus; chambers very distinct, above eight in the adult whorl, slightly inflated, pointed at the inner end, increasing gradually in length in the adult; sutures distinct, depressed, slightly curved, the earlier ones tending to become somewhat limbate; wall smooth, very finely perforate; aperture narrow, at the base and extending over slightly onto the ventral side. Length 0.30 mm; breadth 0.20 mm; thickness 0.15 mm.—Cushman.

This species occurs in all the sections. It is a smaller, more compact form than *N. oligocenica*.

Nonionella oligocenica Cushman and McGlamery

Plate 3, figure 27

Nonionella oligocenica Cushman and McGlamery, Cushman Lab. Foram. Research Contr., vol. 15, p. 47, pl. 9, fig. 5, 1939; U. S. Geol. Survey Prof. Paper 197–B, p. 69, pl. 5, figs. 10–12, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 89, pl. 15, fig. 15, 1946.

Nonionella danvillensis Cushman and McGlamery (not Howe and Wallace), U. S. Geol. Survey Prof. Paper 189–D, p. 106, pl. 25, fig. 1, 1938.

Test slightly longer than broad, slightly evolute, periphery broadly rounded, slightly lobulate in the last portion, ventral side slightly umbilicate, dorsal side slightly umbonate; chambers distinct, about ten in the adult whorl, somewhat inflated, more so in the last-formed portion of the adult whorl, increasing gradually and rather evenly in size as added; sutures distinct, earlier ones strongly limbate, curved, not depressed, later ones very slightly curved, depressed; wall smooth and polished, very finely perforate; aperture, a low opening at the base of the last-formed chamber, just ventral to the periphery, sometimes with a slight, overhanging lip. Length 0.45–0.50 mm; breadth 0.35–0.40 mm; thickness 0.20 mm.—Cushman and McGlamery.

This species is found fairly frequently throughout all the sections.

Nonionella tatumi Howe

Plate 3, figure 29

Nonionella tatumi Howe, Jour. Paleontology, vol. 4, p. 330, pl. 27, fig. 6, 1930.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 2, fig. 11, 1933.

Cushman, U. S. Geol. Survey Prof. Paper 191, p. 31, pl. 8, fig. 8, 1939.

Franklin, Jour. Paleontology, vol. 18, p. 313, pl. 46, fig. 23, 1944.

Cushman and Todd, Cushman Lab Foram. Research Contr., vol. 22, p. 90, pl. 15, figs. 13, 14, 1946; vol. 24, p. 8 (list), 1948.

Test subtrochoid, small, periphery broadly rounded, usually nine chambers in the last formed coil, distinct, dorsal side not completely involute. Sutures nearly straight. Ventral side involute with the last formed chamber having an extension the end of which is generally divided into three or more small lobes which completely cover the umbilical area. Aperture low, arched, at the base of the last formed chamber. Length 0.30 mm; breadth 0.25 mm; thickness 0.10 mm.—Howe.

The several finger-like extensions on the ventral lobe serve to distinguish this species from the somewhat similar *N. jacksonensis*. Although the type figure does not show these extensions, they are mentioned in the description and are conspicuous in the present specimens. The species occurs commonly throughout all the sections. It was described from the Mint Spring marl member of the Marianna limestone and has been recorded from the Byram formation and Red Bluff clay of Mississippi, subsurface Vicksburg formation in Texas, and the Carapita formation of Venezuela.

Nonionella minutissima Todd, n. sp.

Plate 3, figure 30

Test minute for the genus, compressed, dorsal side evolute with about two complete whorls visible, ventral side involute; periphery broadly rounded, slightly lobulated; chambers seven or eight in the last-formed whorl, gradually increasing in size and inflation as added, last formed one with an inconspicuous lobe over the umbilicus on the ventral side; sutures distinct, depressed, nearly radial; wall rather coarsely granular; aperture inconspicuous, at the base of the last-formed chamber. Diameter 0.20 to 0.25 mm, thickness 0.10 to 0.12 mm.

Holotype (Cushman Coll. no. 47612) from the middle Oligocene Mint Spring marl member of the Marianna limestone (sample 757–2b), section in Burke Creek, sec. 15, T. 4 N., R. 1 E., Rankin County, Miss.

This species somewhat resembles *Nonion danvillense* Howe and Wallace but is distinctly evolute on one side. In addition, the chambers are less rapidly enlarging and the periphery is broadly rounded in *Nonionella minutissima*.

This species was found commonly only in sample 757–2b of the Burke Creek section, but a few specimens were found in the other sections.

Family HETEROHELICIDAE

Genus Gümbelina Egger, 1899

Gümbelina cubensis Palmer

Plate 4, figure 1

Gümbelina cubensis Palmer, Soc. cubana hist. nat. Mem., vol. 8, p. 74, text figs. 1–6, 1934.

Palmer and Bermúdez, idem, vol. 10, p. 284, 1936.

Bermúdez, idem, vol. 12, p. 11, 1938.

Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 63, pl. 10, fig. 54, 1939.

Palmer, Soc. cubana hist. nat. Mem., vol. 14, p. 292, 1940.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 62, pl. 6, figs. 26, 27, 1942.

Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 63, pl. 10, fig. 14, 1945.

Cushman, idem, Special Pub. 16, p. 22, pl. 4, fig. 28, 1946.

Cushman and Todd, idem, Contr., vol. 22, p. 90, 1946; vol. 24, p. 11 (list), 1948.

Test minute. Comprising approximately 7 pairs of chambers biserially arranged throughout. Chambers inflated; increasing regularly but rapidly in width so that the last 2 pairs form half the length of the test. Maximum width at apertural extremity. Sutures depressed. In side view periphery only moderately lobulate. Aperture a very low opening at the base of the final chamber. Wall calcareous, very finely perforated, slightly roughened.

Dimensions: Length approximately .25 mm. There is considerable variation in the width. Average specimens have a width of .15 mm, but specimens .1 mm in width are not uncommon.—Palmer.

This species occurs commonly throughout all the sections. It is known from the Oligocene and upper Eocene of Cuba, the Eocene of submarine cores off the

east coast of the United States, the Eocene of Mississippi, Alabama, and Georgia, and the Oligocene Byram formation and Red Bluff clay of Mississippi.

Genus Bolivinella Cushman, 1927

Bolivinella subpectinata Cushman

Plate 4, figure 2

Bolivinella subpectinata Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 34, pl. 5, fig. 8, 1929.
Howe, Jour. Paleontology, vol. 4, p. 264, pl. 21, fig. 1, 1930.
Cushman and Ellisor, idem, vol. 19, p. 561, pl. 75, fig. 10, 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 91, 1946.
Textularia folium Cushman (not Parker and Jones), Washington Acad. Sci. Jour., vol. 10, p. 199, 1920; U. S. Geol. Survey Prof. Paper 129–E, p. 90, pl. 14, fig. 3, 1922; Prof. Paper 133, p. 18, 1923.

Test small, roughly rhomboid, widest at the base of the last-formed chambers, very much compressed, sides nearly flat; chambers numerous, strongly curved; sutures slightly limbate, strongly raised above the general surface of the test, confluent in a zig-zag line along the median line of the test, projecting somewhat at the peripheral margins forming a subpectinate edge; walls and sutures smooth. Length 0.50 mm; breath 0.40 mm.—Cushman.

This species occurs rarely in scattered samples in all but one of the sections. It is known from the Glendon limestone member of the Byram formation in Mississippi and the subsurface Anahuac formation of Ellisor in Texas.

Bolivinella vicksburgensis Howe

Plate 4, figure 3

Bolivinella vicksburgensis Howe, Jour. Paleontology, vol. 4, p. 266, pl. 21, fig. 5, 1930.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 8 (list), 1948.

Test small, elongate, widest at the outer edge of the last-formed chamber, compressed, but much thicker in the middle than at the edges; edges rounded and indented at or just above the suture lines; chambers smooth, gently curved down the middle of the test, the later ones slightly sigmoid; sutures confluent, limbate, forming a zig-zag line approximately flush with the surface of the chambers and ornamented with a regular series of raised beads. Length, 0.32 mm; width, 0.20 mm.—Howe.

Only single specimens of this slender species were found in several samples. It was described from the Glendon (?) limestone member of the Byram formation at the top of the falls at Mint Spring Bayou, Vicksburg, Miss., and has been recorded from the Red Bluff clay in Mississippi.

Genus Amphimorphina Neugeboren, 1850

Amphimorphina sp.

Plate 4, figure 4

Very rare specimens from the four sections in Rankin County seem to represent an undescribed species but they are inadequate for a complete description. They are small, strongly compressed, unornamented, and thin-walled and translucent. The available specimens show almost no variation in size and appearance. None has an unbroken apertural end.

Family BULIMINIDAE

Genus Buliminella Cushman, 1911

Buliminella obtusata Cushman

Plate 4, figure 5

Buliminella obtusata Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 42, pl. 7, fig. 8, 1929.
Cushman and Parker, idem, vol. 13, p. 39, pl. 4, figs. 8, 9, 1937.
Cushman and Todd, idem, vol. 22, p. 91, pl. 15, figs. 21, 22, 1946.
Cushman and Parker, U. S. Geol. Survey Prof. Paper 210–D, p. 63, pl. 16, figs. 16, 17, 1947.

Test elongate, between 2 and 3 times as long as broad, usually not more than 2 whorls; chambers numerous, 7 or more in the last whorl; sutures distinct, flush with the surface, except for the spiral suture, which may be depressed; wall smooth, polished, finely perforate; aperture in a slight depression of the apertural face, which is large and concave, gradually depressed to its deepest at the aperture. Length up to 0.46 mm; breadth up to 0.20 mm.—Cushman and Parker, 1937.

Very rare specimens of this distinctive species were found in three of the sections. In America it has been recorded only from the Vicksburg group and the Red Bluff clay of Mississippi. It differs from a somewhat similar form, *B. choctawensis* Cushman and McGlamery, in being larger and proportionally much stouter.

Buliminella madagascariensis (D'Orbigny) Cushman and Parker var. spicata Cushman and Parker

Plate 4, figure 6

Buliminella madagascariensis (d'Orbigny) var. *spicata* Cushman and Parker, in Cushman, U. S. Nat. Museum Bull. 161, pt. 3, p. 8, pl. 3, figs. 5, 6, 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 91, pl. 15, figs. 23, 24, 1946.
Cushman and Parker, U. S. Geol. Survey Prof. Paper 210–D, p. 64, pl. 16, fig. 20, 1947.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 9 (list), 1948.
Bulimina elegantissima D'Orbigny var. *apiculata* Chapman (not Egger), Linnean Soc. London Jour. Zoology, vol. 30, p. 31, pl. 4, fig. 77, 1907.
Sidebottom, Royal Micr. Soc. Jour. 1918, p. 23, pl. 3, fig. 11.
Buliminella elegantissima (D'Orbigny) var. *apiculata* Cushman, Carnegie Inst. Washington Pub. 342, p. 25, 1924.
Buliminella apiculata Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 44, pl. 7, figs. 6, 7, 1929.
Cushman and Parker, idem, vol. 13, p. 39, pl. 4, fig. 10, 1937.

Only two specimens of this small, compact form with a stout basal spine were found in the Mint Spring Bayou section. It is known from the Byram formation of Mississippi, the Oligocene, Miocene, and Recent of Australia, and the Recent of the Indo-Pacific region.

Buliminella robertsi (Howe and Ellis) Martin

Plate 4, figure 7

Bulimina robertsi Howe and Ellis, in Howe, Louisiana Dept. Cons. Geol. Bull. 14, p. 63, pl. 8, figs. 32, 33, 1939.

Buliminella robertsi Martin, Stanford Univ. Pub., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 9 (list), 1943.

Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 64, pl. 10, fig. 15, 1945.

Cushman and Todd, idem, vol. 21, p. 94, pl. 15, fig. 12, 1945.

Cushman and Parker, U. S. Geol. Survey Prof. Paper 210–D, p. 62, pl. 16, fig 8, 1947.

Bulimina guayabalensis Cushman and Thomas (not Cole), Jour. Paleontology, vol. 4, p. 38, pl. 3, fig. 6, 1930.

Two specimens of this minute species were found, one in the Mint Spring Bayou section and the other in the railroad cut. The species was described from the middle Eocene Cook Mountain formation, of Louisiana and has been recorded from the Cook Mountain formation of Texas, the Lodo formation of California, the McBean formation of Georgia, the Moodys Branch formation of Mississippi, and submarine cores off the east coast of the United States, all of Eocene age.

Comparison with specimens of *Turrilina alsatica* Andreae from the Oligocene of France shows that it very closely resembles this species, and a careful study may reveal that they are identical.

Genus Robertina D'Orbigny, 1846

Robertina angusta (Cushman) Cushman and Parker

Plate 4, figure 8

Buliminella subteres (H. B. Brady), var. *angusta* Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 127, pl. 29, figs. 8, 9, 1922; Prof. Paper 133, p. 24, 1923.

Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.

Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 42, pl. 7, fig. 4, 1929.

Robertina angusta Cushman and Parker, idem, vol. 12, p. 96, pl. 16, fig. 11, 1936.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 70, pl. 5, fig. 15, 1942.

Cushman and Frizzell, Cushman Lab. Foram. Research Contr., vol. 19, p. 85, pl. 14, fig. 15, 1943.

Cushman and Parker, U. S. Geol. Survey Prof. Paper 210–D, p. 73, pl. 18, fig. 6, 1947.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 9 (list), 1948.

Buliminella subteres Cushman and Ponton (not H. B. Brady), Florida Geol. Survey Bull. 9, p. 76, pl. 11, fig. 9, 1932.

Test usually more than twice as long as broad, irregularly fusiform, initial end somewhat more pointed than the apertural; chambers, about 7 pairs in the final whorl, increasing rather slowly in size as added, all of one series meeting the median line on the ventral side; sutures distinct, limbate, not depressed; wall smooth; aperture elongate, elliptical, almost closed near the base, more open toward the inner end, which reaches more than half way across the apertural face, supplementary aperture very small and low. Length 0.32–0.60 mm; diameter 0.22–0.34 mm.—Cushman and Parker, 1936.

This species was found rarely in three of the sections studied. It was described from the Mint Spring marl member of the Marianna limestone and is known from the Byram formation and Red Bluff clay of Mississippi, the Chickasawhay limestone of Alabama, and the Lincoln formation of Washington, all of Oligocene age, and the Duplin marl of Florida, of Miocene age.

Genus Bulimina D'Orbigny, 1826

Bulimina ovata D'Orbigny var. primitiva Todd, n. var.

Plate 4, figures 9–11

Bulimina ovata D'Orbigny? Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 92, pl. 16, fig. 4, 1922; Prof. Paper 133, p. 23, 1923.

Bulimina ovata Cushman (part) (not D'Orbigny), idem, Prof. Paper 181, p. 35, pl. 13, fig. 15 (not fig. 16), 1935; Cushman Lab Foram. Research Special Pub. 16, p. 23, pl. 5, fig. 2, 1946.

Variety differing from the typical form in the more slender, more elongate, and smaller test, the indented sutures, and the more pointed initial end. Length 0.40 to 0.50 mm, diameter 0.20 to 0.28 mm.

Holotype of variety (Cushman Coll. no. 47525) from the middle Oligocene Glendon (?) limestone member of the Byram formation (sample 4), Mint Spring Bayou, south of National Military Cemetery, Vicksburg, Miss.

Comparison with topotypes of the typical form of the species from the Miocene of the Vienna Basin reveals that this variety is quite distinct. It seems to be an important form in the present series of samples, as it occurs quite commonly in only the lower portions of all the sections studied and is very rare or absent in the upper portions of the sections.

A few records of *Bulimina ovata* D'Orbigny, as given in the above synonymy seem upon examination of the figured specimens to belong in this variety. They are from the upper Eocene Cooper marl[1] of Berkeley County, S. C., and Cocoa sand member of the Yazoo clay of Choctaw County, Ala., and the Oligocene Byram formation of Mississippi.

Bulimina byramensis Cushman and Todd

Plate 4, figure 12

Bulimina byramensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 91, pl. 15, figs. 25, 26, 1946.

Test small, initial end subacute, tapering from the greatest width near the apertural end, triangular in transverse section, the angles rounded, the sides flat or slightly concave; chambers distinct, not inflated, sutures distinct, not depressed; wall smooth, distinctly perforate; aperture elongate, narrow, extending from the base of the apertural face nearly to the apex of the test. Length 0.25–0.30 mm; breadth 0.15 mm.—Cushman and Todd.

A single specimen from sample 521–20, 21 is identical with this species, described from the Byram formation in Mississippi.

[1] Examination of the figured specimens shows that the localities given for the two figures on plate 13 of Prof. Paper 181 should be changed so that fig. 15 is from the Cooper marl and fig. 16 from a well sample in Texas.

Bulimina sp.

Plate 4, figure 13

Rare specimens, found in three of the sections, seem to represent an undescribed species but are inadequate for description. They are small, with somewhat inflated chambers rather rapidly increasing in size.

Genus Entosolenia Ehrenberg, 1848

Entosolenia mississippiensis Todd, n. sp.

Plate 4, figure 14

Test oval, about one and one-third times as long as broad; periphery acute, with a single prominent flange, moderately inflated, becoming compressed at the apertural end; wall thin, with a narrow opaque band around the periphery, leaving the central area translucent, finely perforate, slightly roughened; aperture narrow, elongate, with an entosolenian tube, flaring at the inner end, extending back into the chamber, closer to one wall of the chamber than the other so that the tube is visible from only one side of the specimen, apertural end not protruding. Length 0.20 to 0.30 mm, breadth 0.15 to 0.22 mm, thickness 0.10 to 0.13 mm.

Holotype (Cushman Coll. no. 47670) from the middle Oligocene Glendon (?) limestone member of the Byram formation (sample 662–5), Robinson Quarry near Brandon, sec. 19, T. 5 N., R. 4 E., Rankin County, Miss.

This species differs from *E. orbignyana* (Seguenza) in having a single peripheral flange and in its more smoothly curved, not truncate, apertural end.

This is the most abundant and widely occurring species of *Entosolenia* in these samples.

Entosolenia crumenata Cushman

Plate 4, figure 15

Entosolenia crumenata Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 31, pl. 4, fig. 9, 1935.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 109, pl. 26, fig. 11, 1938; Prof. Paper 197–B, p. 70, pl. 5, figs. 16–18, 1942.

Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 43, pl. 7, fig. 12, 1944.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 563, pl. 76, fig. 3, 1945.

Test single chambered, longer than broad, compressed, periphery truncate, with a single, broad keel in the median line and lesser ones at the angles, these forming a broadly elliptical or oval area in side view in the middle of each face, the sides continuing into the very distinct, compressed, tubular neck; wall clear; aperture terminal, narrowly elliptical. Length 0.40 mm; breadth 0.20 mm; thickness 0.12 mm.—Cushman.

Rare specimens were found in all the sections. The shape of the test seems to be highly varied, some specimens being nearly quadrangular.

The species was described from the lower Oligocene, 3 feet above a limestone ledge at the bottom of the hill on the road ascending from Waltersville, Mississippi, to National Cemetery, and has been recorded from the Oligocene from Choctaw Bluff and near Millry, Ala., the Oligocene subsurface Anahuac formation of Ellisor in Texas, and the Paleocene Coal Bluff marl member of the Naheola formation, from Wilcox County, Ala.

Entosolenia laevigata (Reuss) Cushman and McGlamery?

Plate 4, figure 16

Entosolenia laevigata (Reuss) Cushman and Todd, Cushman Lab. Foram. Research Special Pub. 15, p. 41, pl. 6, fig. 17, 1945.

Entosolenia cf. *laevigata* (Reuss) Cushman and Todd, idem, Contr., vol. 21, p. 95, pl. 15, fig. 28, 1945.

A few distinctive specimens from scattered samples in three of the sections are tentatively referred to this species. They are small, elongate, strongly compressed, with a distinct, narrow keel, the whole test tapering toward both ends but more sharply toward the narrow apertural neck; the wall of the main body of the test white and opaque, differing from the transparent keel.

These specimens are probably not identical with *E. laevigata*, described as "*Fissurina laevigata*" from the Miocene of Austria but do seem identical with two specimens from the Miocene of Buff Bay, Jamaica, and the upper Eocene Moodys Branch formation of Mississippi.

Entosolenia byramensis (Cushman) Todd

Plate 4, figure 17

Lagena byramensis Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 41, pl. 7, fig. 3, 1929.

Test nearly circular in front view, surrounded by a thin, broad keel of nearly transparent material, the body of the test strongly convex and marked by a series of raised costae, the outer ones nearly concentric, the inner ones gradually approaching the direction of the longitudinal axis of the test; apertural end squarely truncate. Diameter 0.25 mm.—Cushman.

This species was described from the Byram formation at Byram, Miss., and has not been recorded elsewhere. It is common or abundant nearly throughout all the sections studied.

A species subsequently described as *Entosolenia byramensis* (Cushman, 1935, p. 31, pl. 4, fig. 10) is entirely different and will require a new name. It somewhat resembles specimens referred to *Lagena hexagona* (Williamson) but differs in being bilaterally instead of radially symmetrical and in having a more prominent apertural neck. No specimens were found in the present material.

Entosolenia orbignyana (Seguenza) H. B. Brady var. flintii (Cushman) Howe

Plate 4, figures 18, 19

Lagena orbignyana (Seguenza) H. B. Brady var. *flintii* Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 129, pl. 29, fig. 11, 1922; Prof. Paper 133, p. 26, 1923.

Entosolenia orbignyana (Seguenza) var. *flintii* Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 9 (list), pl. 1, fig. 8, 1948.

Test of medium size for the genus, of varied shape in side view, from pyriform to nearly circular with a projecting apertural end, distinctly inflated, less inflated aperturally; keels of various widths, one median keel with a secondary keel on either side; wall ornamented with rather large, evenly spaced pits appearing white against the translucent chamber wall; aperture at the end of a prominent neck, compressed. Length 0.30 to 0.40 mm, breadth 0.22 to 0.30 mm, thickness 0.17 to 0.20 mm.

This very strikingly ornamented variety was described from the Mint Spring marl member of the Marianna limestone at Vicksburg, Miss., and has been recorded from the Byram formation and Red Bluff clay of Mississippi. It occurs commonly to abundantly nearly throughout all the sections studied.

Genus Virgulina D'Orbigny, 1826

Virgulina vicksburgensis Cushman

Plate 4, figures 20, 21

Virgulina vicksburgensis Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 48, pl. 7, fig. 6, 1936; Special Pub. 9, p. 12, pl. 2, figs. 7, 8, 1937.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 107, pl. 25, fig. 9, 1938; Prof. Paper 197–B, p. 70, pl. 5, fig. 22, 1942.

Howe, Jour. Paleontology, vol. 16, p. 268 (list), 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 92, pl. 15, fig. 28, 1946; vol. 24, p. 9 (list), 1948.

Virgulina sp. Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 92, pl. 16, figs. 2, 3, 1922.

Test elongate, distinctly compressed, gradually tapering from subacute initial end to greatest breadth formed by last two chambers, thence tapering to the rounded apertural end, periphery slightly lobulated, rounded; chambers distinct, numerous, increasing in relative length as added, slightly inflated; sutures distinct, depressed, strongly oblique in adult; wall smooth, finely perforate; aperture elongate, narrow, running from base of apertural face nearly to apex of chamber. Length 1.25 mm; breadth 0.30 mm; thickness 0.15–0.18 mm.—Cushman.

This is one of the most abundant species in this series of samples, and occurs throughout all the sections. It is known from the lower and middle Oligocene of Mississippi and Alabama.

Two specimens are figured to show variation; the more slender form with straight sutures (figure 20) is much more common.

Genus Bolivina D'Orbigny, 1839

Bolivina byramensis Cushman

Plate 4, figure 22

Bolivina caelata Cushman var. *byramensis* Cushman, U. S. Geol. Survey Prof. Paper 133, p. 19, pl. 1, fig. 9, 1923.

Bolivina byramensis Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 69, pl. 8, figs. 18–20, 1937.

Coryell and Rivero, Jour. Paleontology, vol. 14, p. 341, pl. 44, fig. 17, 1940.

Galloway and Heminway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Islands, vol. 3, pt. 4, p. 416, pl. 30, fig. 11, 1941.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 71, pl. 5, fig. 26, 1942.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Cushman and Todd, Cushman Lab. Foram. Research Special Pub. 15, p. 47, pl. 7, fig. 20, 1945; Contr., vol. 22, p. 92, pl. 15, fig. 29, 1946.

Cushman and Renz, idem, Special Pub. 22, p. 26, 1947.

Bolivina caelata Cushman (part), U. S. Geol. Survey Prof. Paper 133, p. 19 (not pl. 2, fig. 2), 1923.

Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.

Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 93, pl. 13, fig. 28, 1929.

Cole and Ponton, Florida Geol. Survey Bull. 5, p. 39, pl. 9, fig. 6, 1930.

Nuttall, Jour. Paleontology, vol. 6, p. 20, pl. 5, fig. 3, 1932.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 3, fig. 6, 1933.

Test somewhat rhomboid in front view, about 1½ times as long as broad, strongly compressed, periphery subacute or even sometimes slightly keeled; chambers obscured by the ornamentation, broader than high, the last ones sometimes slightly inflated; sutures oblique, curved, the earlier ones obscured by the ornamentation of the surface; wall finely perforate, the early portion, or nearly the entire test, covered by a reticulate pattern of raised ridges, becoming somewhat independent of the sutures themselves; aperture narrow, elongate, with a somewhat rounded rim. Length 0.50 mm; breadth 0.35 mm; thickness 0.10 mm.—Cushman, 1937.

This distinctively ornamented species occurs abundantly throughout all the sections.

Bolivina mississippiensis Cushman

Plate 4, figure 23

Bolivina mississippiensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 92, pl. 15, fig. 5, 1922; Prof. Paper 133, p. 20, 1923.

Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 69, pl. 8, fig. 16, 1937.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 71, pl. 5, figs. 24, 25, 1942.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 92, pl. 15, fig. 30, 1946.

Test elongate, tapering throughout, about 2½ times as long as broad, compressed, periphery subacute, greatest breadth toward the apertural end; chambers numerous, distinct, broader than high, somewhat overlapping, the base of the chamber in the adult with one or more distinct reëntrants; sutures distinct, very strongly limbate, somewhat crenulate, decidedly curved, strongly oblique; wall smooth, finely perforate; aperture a narrow, oval opening, extending to the base of the inner margin of the last-formed chamber, with a slightly rounded border. Length 0.40 mm; breadth 0.17 mm; thickness 0.08 mm.—Cushman, 1937.

This species was found in three of the sections. The irregular pattern of its sutures serves to distinguish it.

Bolivina costifera Cushman

Plate 4, figure 24

Bolivina mississippiensis Cushman var. *costifera* Cushman, Cushman Lab. Foram. Res. Special Pub. 6, p. 51, pl. 7, fig. 15; Special Pub. 9, p. 69, pl. 8, fig. 17, 1937.

Cushman and Todd, idem, Contr., vol. 22, p. 93, pl. 15, fig. 31, 1946; vol. 24, p. 9 (list), 1948.

Test very elongate, with parallel sides for most of its length, or very slightly broadening at apertural end, strongly compressed; periphery subacute, not indented; chambers numerous, distinct, about as high as broad, very rapidly increasing in height as added; sutures distinct, strongly limbate, especially toward their inner ends, evenly and strongly curved at their inner ends, becoming nearly parallel with the periphery at their outer ends, later sutures somewhat crenulate at their inner ends; wall thin, translucent, finely costate over the early chambers, smooth over the later chambers, distinctly perforate; aperture a narrow, oval opening, extending to the base of the inner margin of the last-formed chamber. Length 0.30 to 0.50 mm, breadth 0.12 to 0.17 mm.

This species occurs abundantly throughout all the sections. It was described from the Byram formation and occurs also in the Red Bluff clay of Mississippi. It is here raised to specific rank, as it seems distinct from *B. mississippiensis* Cushman in the following features in addition to the ornamentation: (1) narrower, less tapering form; (2) strongly curved and distinctly limbate sutures; and (3) thinner and more translucent wall. In many specimens the ornamentation is invisible except with cross-lighting and the most noticeable feature of this species is its distinct suture pattern.

Bolivina choctawensis Cushman and McGlamery

Plate 4, figure 25

Bolivina choctawensis Cushman and McGlamery, in Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 72, pl. 8, fig. 24, 1937.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 108, pl. 26, fig. 4, 1938; Prof. Paper 197–B, p. 71, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 93, pl. 15, fig. 32, 1946.

Test in the early half tapering, later half with the sides nearly parallel or even contracted, initial end pointed, apertural end obliquely truncate, periphery slightly truncate; chambers numerous, low and broad, of nearly uniform shape throughout, very gradually increasing in size as added, not inflated; sutures distinct, little if at all depressed, nearly at right angles to the long axis; wall ornamented with a few longitudinal costae, about four on a side, the outer pair parallel to the periphery, the inner pair nearly parallel to the long axis of the test; aperture narrow, elongate, in the median portion of the base of the apertural face. Length 0.30 mm; breadth 0.15 mm—Cushman and McGlamery.

This species occurs abundantly throughout all the sections. The three species, *B. byramensis*, *B. costifera*, and *B. choctawensis*, form the bulk of all the *Bolivina* specimens in these Vicksburg samples.

B. choctawensis was described from the Oligocene at Choctaw Bluff, Ala., and also occurs near Millry, Ala., and in the Byram formation at Byram, Miss. Examination of the type specimen shows it to have much less distinct sutures and costae than the type figure would indicate, and it is very coarsely perforate, giving it a rough-surfaced appearance.

Bolivina cookei Cushman

Plate 4, figure 26

Bolivina cookei Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 126, pl. 29, fig. 1, 1922; Prof. Paper 133, p. 20, 1923; Cushman Lab. Foram. Research Special Pub. 9, p. 68, pl. 8, fig. 15, 1937.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Test elongate, tapering, about 2½ to 3 times as long as broad, much compressed, periphery subacute; chambers distinct, much broader than high, of nearly uniform shape throughout, slightly if at all inflated; sutures distinct, slightly limbate, strongly oblique, making an angle of nearly 45°, very slightly curved; wall ornamented by numerous longitudinal costae, particularly on the base, but extending upward to varying degrees in different specimens; aperture narrow, elongate. Length up to 0.45 mm; breadth 0.15–0.18 mm.—Cushman, 1937.

This species, known from the Mint Spring marl member of the Marianna limestone of Mississippi and the Marianna limestone and Glendon limestone member of the Byram formation of Mississippi and Alabama, occurs rather rarely in these samples. It is somewhat like *B. costifera* in suture pattern, but is broader and more tapering.

Bolivina mexicana Cushman

Plate 4, figure 27

Bolivina mexicana Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 4, p. 81, pl. 12, fig. 2, 1926; Jour. Paleontology, vol. 1, p. 161, pl. 28, fig. 9, 1927; Cushman Lab. Foram. Research Special Pub. 9, p. 66, pl. 8, fig. 8, 1937.

Palmer, Soc. cubana hist. nat. Mem., vol. 14, p. 300, 1940.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 71, 1942.

Bolivina cf. *B. mexicana* Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 108, pl. 26, fig. 5, 1938; Prof. Paper 197–B, p. 71, pl. 5, fig. 27, 1942.

Test elongate, tapering, about 2½ times as long as broad, greatest breadth toward the apertural end, much compressed, the early portion with a slight keel, much more developed in the later portion; chambers numerous, those of the early portion low and broad, gradually increasing in height, until in the adult, the height is only slightly less than the breadth, later chambers slightly inflated; sutures distinct, somewhat limbate, in the early portion strongly oblique, slightly curved, later more strongly curved and less oblique, somewhat obscured by a slight imbrication of the chambers; wall smooth, finely perforate; aperture elongate, in the median line, with a slight lip. Length up to 1.20 mm; breadth 0.20–0.25 mm.—Cushman, 1937.

This species was found rarely but in all the sections. Specimens have been compared with the type and seem identical. The species was described from Alazan clays

of Mexico, and has been recorded from the Oligocene Chickasawhay limestone of Alabama, the upper Oligocene Cojimar formation of Cuba, and the upper Eocene of Scott County, Miss.

Bolivina tortuosa H. B. Brady

Plate 4, figure 35

Bolivina tortuosa H. B. Brady, Quart. Jour. Micr. Sci., vol. 21, p. 27, 1881; *Challenger* Rept., Zoology, vol. 9, p. 420, pl. 52, figs. 31–34, 1884.

Cushman, Carnegie Inst. Washington Pub. 342, p. 18, pl. 5, figs. 4, 5, 1924.

Cushman and Parker, U. S. Nat. Museum Proc., vol. 80, art. 3, p. 16, pl. 3, fig. 22, 1931.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 133, pl. 17, figs. 11–19, 1937.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 107, pl. 25, figs. 13, 21, 1938; Prof. Paper 197–B, p. 70, 1942.

Cushman, U. S. Nat. Mus. Bull. 161, pt. 3, p. 20, pl. 7, fig. 1, 1942.

Cushman and McCulloch, Allan Hancock Pacific Exped., vol. 6, no. 4, p. 220, pl. 27, fig. 12, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Special Pub. 15, p. 44, pl. 7, fig. 6, 1945.

A very few scattered specimens have tests strongly twisted about 90° from one end to the other and are referred to this species, which was described from Recent *Challenger* material and has been recorded widely from Tertiary strata. They vary considerably in length and breadth of the test. Similar specimens have been recorded from the Chickasawhay limestone of Alabama. The above synonymy includes only a few of the references to this species.

Bolivina quadricosta Cushman and McGlamery

Plate 4, figures 28, 29

Bolivina quadricosta Cushman and McGlamery, in Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 71, pl. 8, fig. 23, 1937.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 108, pl. 25, fig. 20, 1938; Prof. Paper 197–B, p. 71, 1942.

Test rapidly tapering from the subacute initial end to the greatest breadth formed by the last pair of chambers, somewhat roughly quadrate in end view, periphery of the early portion more strongly truncate, later more rounded; chambers distinct, somewhat inflated, especially the later ones, earlier ones broad and low, later ones rather rapidly increasing in height as added; sutures distinct, depressed, earlier ones slightly curved, later ones somewhat sinuate; wall coarsely perforate, the early portion ornamented with 4 oblique costae, 2 at each side nearly parallel to the periphery; aperture high and narrow, at the base of the inner margin. Length 0.35 millimeter, breadth 0.20 millimeter.—Cushman and McGlamery.

Rare specimens, probably belonging to this species, are smaller and do not show the inflation of the later chambers, but do have the costae paralleling the early periphery on both sides. The species has been known only from the Chickasawhay limestone of Alabama.

Bolivina mornhinvegi Cushman

Plate 4, figure 30

Bolivina mornhinvegi Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 32, pl. 5, fig. 1, 1935; Special Pub. 9, p. 70, pl. 8, fig. 21, 1937.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 108, pl. 25, fig. 17, 1938; Prof. Paper 197–B, p. 71, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 93, pl. 15, fig. 33, 1946.

Test 1½ to 2 times as long as broad, moderately compressed, periphery subacute, early portion rapidly expanding in breadth, later portion with the sides nearly parallel or very gradually widening; chambers distinct, comparatively few, early ones 2 or 3 times as broad as high, gradually increasing in height until in the adult the height and breadth are nearly equal, very slightly inflated in the adult; sutures very distinct, limbate, curved, forming an angle of 25°–35° with the horizontal, later ones very slightly depressed; wall very coarsely perforate, smooth; aperture narrow, elongate, with a thickened, rounded lip. Length 0.30–0.40 mm; breadth 0.15–0.20 mm; thickness 0.08 mm.—Cushman.

A few specimens are identical with the types of this species, described from the lower Oligocene, 24 ft. above limestone ledge, bottom of hill on road ascending from Waltersville, Miss., to National Cemetery, and recorded from the type Byram formation in Mississippi and the Chickasawhay limestone in Alabama.

Genus Loxostomum Ehrenberg, 1854

Loxostomum vicksburgense (Howe) Cushman

Plate 4, figure 31

Pleurostomella vicksburgensis Howe, Jour. Paleontology, vol. 4, p. 331, pl. 27, fig. 5, 1930.

Loxostoma vicksburgense Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 179, pl. 21, fig. 5, 1937.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 108, pl. 26, figs. 6–8, 1938; Prof. Paper 197–B, p. 71, pl. 5, fig. 28, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 93, pl. 15, fig. 34, 1946.

Test elongate, biserial, initial end acute, apertural end broadly rounded; chambers unornamented, distinct. Wall calcareous, smooth, coarsely perforate. Sutures depressed. Apertural face of the last formed chamber truncate, depressed; aperture elongate, narrow, terminal, with a lip-like thickening on the sides. Length 0.60 mm; width 0.20 mm.—Howe.

A single typical specimen was found in sample 521–18, 19.

Loxostomum hiwanneense Howe

Plate 4, figure 32

Loxostoma hiwanneense Howe, Jour. Paleontology, vol. 4, p. 329, pl. 27, fig. 7, 1930.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 3, fig. 7, 1933.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 178, pl. 21, figs. 3, 4, 1937.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Bolivina amygdalaeformis Howe (not H. B. Brady), idem, vol. 2, p. 174 (list), 1928.

Test small, elongate, only slightly compressed, tending to become uniserial, sides nearly parallel, periphery rounded, chambers comparatively few. Sutures hidden by the surface ornamentation, consisting of numerous delicate irregularly anastomosing costae. Surface finely punctate. Aperture terminal or nearly so. Length 0.40 mm; breadth 0.33 mm.—Howe.

This species occurs rarely in three of the sections. In its ornamentation it suggests *L. delicatum* but it is much more slender, and approaches a cylindrical shape.

The species was described from the Red Bluff clay at Hiwannee, Miss., and recorded from the Glendon limestone member of the Byram formation of Alabama and lower Oligocene well samples of Texas.

Loxostomum delicatum Cushman

Plate 4, figure 33

Loxostomum amygdalaeformis (H. B. Brady) var. *delicata* Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 44, pl. 8, fig. 2, 1929.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 3, fig. 8, 1933.

Loxostoma delicatum Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 175, pl. 20, fig. 29, 1937.

Bolivina amygdalaeformis Cushman (not H. B. Brady), Washington Acad. Sci. Jour., vol. 10, p. 199, 1920; U. S. Geol. Survey Prof. Paper 129–E, p. 91, pl. 15, fig. 3, 1922; Prof. Paper 133, p. 18, 1923.

Loxostomum hiwanneense Galloway and Heminway (not Howe), New York Acad. Sci., Sci. Survey Porto Rico and Virgin Is., vol. 3, pt. 4, p. 420, pl. 31, fig. 3, 1941.

Test about twice as long as broad, fusiform in front view, greatest breadth at or above the middle, slightly compressed, periphery broadly rounded; chambers largely obscured by the ornamentation of the surface except the last pair, which are slightly inflated; sutures almost completely obscured by the ornamentation, except in the later portion where they are very slightly depressed, curved, somewhat oblique; wall ornamented with numerous, fine, longitudinal costae, except the last two chambers, which are coarsely perforate; aperture an elliptical opening in the terminal face of the chamber. Length 0.60 mm; breadth 0.30 mm; thickness 0.15 mm.—Cushman, 1937.

This species occurs abundantly in three samples of the Mint Spring Bayou section and rarely in the Burke Creek section. Superficially it resembles *Bolivina byramensis* Cushman but differs in the ornamentation, that of *L. delicatum* consisting of fine, anastomosing, roughly longitudinal lines, whereas that of *B. byramensis* is irregularly reticulate.

The records of this species include the Byram formation of Mississippi, Oligocene well samples from Texas, and the upper Oligocene Cibao formation of Porto Rico (recorded as "*L. hiwanneense*").

Genus Bifarina Parker and Jones, 1872

Bifarina vicksburgensis (Cushman) Cushman

Plate 4, figure 34

Bolivina vicksburgensis Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 126, pl. 29, fig. 2, 1922; Prof. Paper 133, p. 20, 1923.

Bifarina vicksburgensis Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 45, pl. 8, figs. 3, 4, 1929.

Nuttall, Jour. Paleontology, vol. 6, p. 21, pl. 5, fig. 5, 1932.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 3, fig. 9, 1933.

Palmer and Bermúdez, Soc. cubana hist. nat. Mem., vol. 10, p. 291, 1936.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 198, pl. 22, figs. 29–33, 1937.

Cushman and Todd, idem, Contr., vol. 22, p. 94, pl. 16, fig. 1, 1946; vol. 24, p. 9 (list), 1948.

Test elongate, slender, five times as long as broad, somewhat compressed, particularly in the early portion, earliest portion biserial, in the adult with several distinctly uniserial chambers, periphery in the young serrate due to projections of the basal angle of each chamber, in the adult somewhat lobate; chambers distinct, those of the earliest portion somewhat broader than high, increasing gradually in height as added, in the adult with the height and breadth about equal, somewhat inflated, particularly in the later portion; sutures distinct, in early portion slightly depressed, in the adult strongly so, in earliest stages oblique, forming an angle of nearly 45° with the horizontal, gradually becoming less, in the adult horizontal; [wall with] the perforations often arranged in longitudinal lines, especially in the early portion; aperture in the adult becoming terminal, broadly elliptical, with a slightly raised lip. Length up to 0.70 mm; breadth 0.12 mm.—Cushman, 1937.

This species occurs commonly throughout all five sections. It was described from the Mint Spring marl member of the Marianna limestone and has been recorded from the Glendon limestone member of the Byram formation and Red Bluff clay of Mississippi, Alazan clays of Mexico, Oligocene well samples from Texas, and Oligocene of Cuba.

Genus Bitubulogenerina Howe, 1934

Bitubulogenerina aperta (Cushman) Howe

Plate 4, figure 37

Tubulogenerina aperta Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 45, pl. 8, fig. 1, 1929.

Bitubulogenerina aperta Howe, Jour. Paleontology, vol. 8, p. 418, pl. 51, fig. 3, 1934.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 212, pl. 24, fig. 13, 1937.

Cushman and Todd, idem, Contr., vol. 22, p. 94, pl. 16, fig. 2, 1946.

Test narrow, 2½ to 3 times as long as broad, early portion triserial, rapidly tapering, adult portion biserial, or tending to become uniserial, the sides nearly parallel, nearly circular in end view; chambers distinct, somewhat inflated, increasing gradually in size in the early stages, in the adult of rather uniform size tending to become somewhat higher in the later stages; sutures distinct, depressed, nearly horizontal; wall ornamented with spinose projections, in well-developed specimens elongate and apparently hollow, scattered over the entire surface of the test, especially well developed in the later chambers; aperture large, circular, terminal, with a raised lip. Length 0.35–0.40 mm; breadth 0.12–0.15 mm; thickness 0.08–0.12 mm.—Cushman, 1937.

Rare specimens were found in scattered samples. This very rough and irregular-appearing species was described from the Byram formation. No specimens

in the present material showed the hollow spinose projections.

Bitubulogenerina howei Cushman

Plate 4, figure 38

Bitubulogenerina howei Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 20, pl. 3, figs. 10–12, 1935; Special Pub. 9, p. 211, pl. 24, figs. 4–6, 1937.

Bergquist, Mississippi Geol. Survey Bull. 49, p. 72, pl. 7, fig. 25, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 9 (list), 1948.

Gaudryina sp. Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 127, pl. 29, fig. 6, 1922.

Bitubulogenerina sp. Howe, Jour. Paleontology, vol 8, pl. 51, fig. 4, 1934.

Test elongate, early portion tapering, triserial, later adult portion biserial, with the sides nearly parallel, very slightly compressed, periphery rounded, lobulate; chambers distinct, somewhat inflated, the earlier triserial ones increasing gradually in size, later ones very slightly increasing as added; sutures distinct, strongly depressed; wall calcareous, finely perforate, exterior covered with numerous small, bluntly spinose projections; aperture in the adult terminal, occupying a median position, large and rounded, with a distinct, raised lip. Length 0.28–0.33 mm; breadth 0.12–0.15 mm; thickness 0.10–0.12 mm.—Cushman.

Only two specimens in the present series of samples apear to be identical with this species, described from the Red Bluff clay and recorded from the Mint Spring marl member of the Marianna limestone and the upper Eocene Yazoo clay of Scott County, Miss.

Bitubulogenerina hiwanneensis Howe

Plate 4, figure 36

Bitubulogenerina hiwanneensis Howe, Jour. Paleontology, vol. 8, p. 421, pl. 51, fig. 2, 1934.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 211, pl. 24, figs. 7, 8, 1937.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 565, pl. 76, fig. 12, 1945.

Test elongate, free; first few chambers triserial, quickly becoming biserial and angular, the angulation being at or just above the middle of the chambers; wall calcareous and finely spinose; aperture siphonate with a short neck, subcircular lip and slightly crescentic opening. Length, 0.27 mm; width, 0.12 mm.—Howe.

A single specimen from sample 757–15 in the Burke Creek section seems identical with this species, described from the Red Bluff clay and recorded from the subsurface Anahuac formation of Ellisor in Texas.

Bitubulogenerina vioksburgensis Howe

Bitubulogenerina vicksburgensis Howe, Jour. Paleontology, vol. 8, p. 420, pl. 51, fig. 7, 1934.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 212, pl. 24, figs. 9, 10, 1937; Foraminifera, 3d ed., Key, pl. 47, fig. 3, Cambridge, 1940.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 94, pl. 16, fig. 3, 1946; vol. 24, p. 9 (list), 1948.

Test free, elongate; early chambers rounded, nodose, triserial in arrangement, quickly becoming biserial and angular, the chambers of the medial portion of the test carry two rows of tubular projections, later chambers carry only a fringe of nodose tubuli about the angular periphery; aperture terminal, siphonate, the lip being ovate in outline, but the apertural opening being subtriangular; aperture of preceding chamber usually visible as a distinct swelling, but filled with calcareous material. Length, 0.28 mm; width, 0.15 mm.—Howe.

A single specimen is referred to this species, described from Mint Spring Bayou, Vicksburg, Miss., and known from the Byram formation and Red Bluff clay in Mississippi.

Genus Tubulogenerina Cushman, 1927

Tubulogenerina vicksburgensis Howe

Plate 4, figure 39

Tubulogenerina vicksburgensis Howe, Jour. Paleontology, vol. 4, p. 331, pl. 27, fig. 3, 1930; vol. 8, pl. 51, fig. 1, 1934.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 216, pl. 24, figs. 17, 19, 20, 1937.

Test elongate, small, first few chambers biserial, rapidly becoming uniserial, chambers round or nearly so in transverse section. Wall calcareous, with a single row of tubuli extending around the median part of each chamber. Aperture elongate, narrow, in the middle of a flattened terminal apertural face. Length 0.40 mm; width 0.18 mm.—Howe.

Two specimens of this distinctive species were found in sample 521–17. It has been known only from the Byram formation.

Genus Reussella Galloway, 1933

Reussella byramensis Cushman and Todd

Plate 4, figure 40

Reussella byramensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 94, pl. 16, figs. 4, 5, 1946.

Cushman and Renz, idem, Special Pub. 22, p. 27, pl. 6, fig. 13, 1947.

Cushman and Todd, idem, Contr., vol. 24, p. 9 (list), 1948.

Test slightly longer than broad, tapering to a point at the initial end which occasionally has a slight spine, triangular in transverse section, sides flat or slightly concave, angles acute; chambers not inflated, distinct; sutures distinct, of clear shell material, not depressed; wall smooth; aperture slightly elongate, at the base of the last-formed chamber. Length 0.30–0.35 mm; breadth 0.20–0.25 mm.—Cushman and Todd.

This species is very abundant in the Mint Spring Bayou section but rare in the sections in Rankin County. It is known from the Byram formation and Red Bluff clay of Mississippi and the upper Oligocene Ste. Croix formation of Trinidad.

Reussella oligocenica Cushman and Todd

Plate 4, figure 41

Reussella oligocenica Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 94, pl. 16, figs. 6, 7, 1946.

Test small, elongate, 2 to 3 times as long as wide, sides nearly parallel except near the base which is bluntly pointed, apertural end rounded, triangular in transverse section, sides flat, angles subacute; chambers distinct, not inflated; sutures distinct, not depressed; wall smooth; aperture a small, semicircular opening at the base of the last-formed chamber. Length 0.25–0.38 mm; breadth 0.12 mm.—Cushman and Todd.

Specimens of this slender species of *Reussella*, described from the Byram formation, are rare in the samples studied.

Genus Uvigerina D'Orbigny, 1826

Uvigerina vicksburgensis Cushman and Ellisor

Plate 4, figures 47, 48

Uvigerina vicksburgensis Cushman and Ellisor, Cushman Lab. Foram. Research Contr., vol. 7, p. 54, pl. 7, fig. 7, 1931.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 3, fig. 10, 1933.
Cushman and Edwards, Cushman Lab. Foram. Research Contr., vol. 14, p. 76, pl. 13, figs. 10, 11, 1938.
Galloway and Heminway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Is., vol. 3, pt. 4, p. 432, pl. 33, fig. 12, 1941.
Howe, Jour. Paleontology, vol. 16, p. 268 (list), 1942.
Cushman and Simonson, idem, vol. 18, p. 200, pl. 33, fig. 5, 1944.
Applin and Jordan, idem, vol. 19, p. 130 (list), 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 9 (list), pl. 1, fig. 9, 1948.

Test elongate, 2 to 2½ times as long as broad, nearly circular in end view; chambers numerous, fairly distinct, only slightly inflated; sutures fairly distinct, slightly depressed; wall ornamented by numerous, slightly raised, longitudinal costae, usually broken at the sutures, but a few of them extending across adjacent chambers; aperture with a very short neck. Length 0.60–0.70 mm; diameter 0.30 mm.—Cushman and Ellisor.

Length of present specimens, up to 0.85 mm, diameter up to 0.38 mm.

This is an abundant and apparently a significant species in these samples—in three of the sections it is restricted to the upper part of the section. Specimens have been compared with the holotype, from a well sample of Vicksburg formation of Texas, and seem identical but generally better preserved and somewhat larger. The species has been recorded from many localities in the Oligocene of the Gulf Coastal Plain of the United States and Mexico, including the Glendon limestone member of the Byram formation of Alabama and the Red Bluff clay of Mississippi, and also from the Oligocene Tumey formation of Atwill in California, and the Ponce formation (upper Oligocene to lower Miocene) of Porto Rico.

Uvigerina sp.

Plate 4, figure 42

Rare specimens of a tiny *Uvigerina* or *Angulogerina* seem to be new but are too few to warrant description. They are slender, somewhat attenuated, tending to become triangular, with an acute initial end and distinct apertural neck, and have a very thin, spinose wall.

Genus Angulogerina Cushman, 1927

Angulogerina byramensis (Cushman) Ellisor

Plate 4, figures 43–46

Uvigerina byramensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 95, pl. 18, fig. 5, 1922; Prof. Paper 129–F, p. 133, 1922; Prof. Paper 133, p. 34, pl. 4, figs. 10, 11, 1923.
P. Applin, Am. Assoc. Petrol. Geologists Bull., vol. 9, p. 25, 1925.
Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.
Cole. Bull. Am. Paleontology, vol. 15, no. 57a, p. 4 (list), 1929.
Cole and Gillespie, idem, no. 57b, p. 11, pl. 2, fig. 6, 1930.
Cole and Ponton, Florida Geol. Survey Bull. 5, p. 39, pl. 9, fig. 7, 1930.
Franklin, Jour. Paleontology, vol. 18, p. 314, pl. 46, fig. 16, 1944.
Angulogerina byramensis Ellisor, Am. Assoc. Petroleum Geologists Bull., vol. 17, no. 11, pl. 3, fig. 16, 1933.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 109, pl. 26, figs. 9, 10, 1938.
Cushman and Edwards, Cushman Lab. Foram. Research Contr., vol. 14, p. 87, pl. 15, figs. 18, 19, 1938.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 24, no. 3, pl. 1, fig. 6, 1940.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 72, pl. 6, figs. 4–10, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 28, no. 9, pl. 7, fig. 6, 1944.
Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 567, pl. 76, fig. 11, 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 95, 1946.
Cushman and Renz, idem, Special Pub. 22, p. 29, pl. 6, fig. 20, 1947.
Cushman and Todd, idem, Contr., vol. 24, p. 9 (list), 1948.

Test elongate, slender, somewhat fusiform, earlier portion rounded in section, adult portion becoming triangular; chambers distinct, earlier ones closely set, rounded, slightly inflated, later ones becoming somewhat loosely arranged and more definitely triangular; wall in the early portion finely but distinctly longitudinally costate, the later chambers often becoming almost entirely smooth; aperture with a short, cylindrical or compressed neck with a distinct, phialine lip. Length 0.25–0.40 mm; diameter 0.12–0.18 mm.—Cushman and Edwards, 1938.

This is one of the most abundant species, and occurs in all but two of the samples studied. Its considerable variation in shape of test and degree of ornamentation are illustrated by the four specimens figured. The species seems to be distinct from *A. ocalana* Cushman, from the upper Eocene, to which it is closely related, in its stouter and more inflated test.

Angulogerina byramensis (Cushman) Ellisor var. fera Todd, n. var.

Plate 4, figure 49

Variety differing from the typical form in having the surface covered with rather coarse spines in addition to the costae. Length 0.40 to 0.48 mm, diameter 0.15 mm.

Holotype of variety (Cushman Coll. no. 47609) from the middle Oligocene Mint Spring marl member of the Marianna limestone (sample 757–2a), section in Burke Creek, sec. 15, T. 4 N., R. 1 E., Rankin County, Miss.

This form, which occurs rather rarely in the present material, seems to be a distinct variety.

Angulogerina byramensis (Cushman) Ellisor var. anfracta Todd, n. var.

Plate 4, figure 50

Variety differing from the typical form in having the chambers strongly undercut and thus the periphery much indented, and in having less conspicuous costae. Length up to 0.50 mm, diameter 0.15 to 0.18 mm.

Holotype of variety (Cushman Coll. no. 47584) from the middle Oligocene marl facies of the Byram formation (sample 521–17), Gulf and Ship Island Railroad cut, 1.5 miles south of Plain, Rankin County, Miss.

This variety seems to be an end form of a gradational series from the typical form, as nearly all degrees of undercutting may be found. Nevertheless, the variety is erected for the strongly undercut forms. The variety may be of value as a marker as it occurs commonly or abundantly in the upper portions of all but one of the sections.

Angulogerina hispidula Cushman and McGlamery

Plate 4, figure 51

Angulogerina hispidula Cushman and McGlamery, Cushman Lab. Foram. Research Contr. vol. 15, p. 47, pl. 9, fig. 6, 1939; U. S. Geol. Survey Prof. Paper 197–B, p. 72, pl. 6, fig. 12, 1942.

Test elongate, about twice as long as broad, tapering, greatest width formed by the last whorl, early portion triangular in section, angles in later portion broadly rounded; chambers distinct, later ones strongly inflated, increasing rapidly in size as added; sutures distinct, later ones strongly depressed; wall finely hispid, especially in the earlier portion; aperture terminal, elongate, with a distinct, collar-like lip. Length 0.35 mm; diameter 0.20 mm.—Cushman and McGlamery.

This species, previously known only from the Chickasawhay limestone near Millry, Ala., is fairly common in scattered samples in the present sections.

Angulogerina rugoplicata Cushman

Plate 4, figure 52

Angulogerina rugoplicata Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 33, pl. 5, fig. 5, 1935.
Cushman and Edwards, idem, vol. 14, p. 88, pl. 15, fig. 20, 1938.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 81, pl. 8, fig. 12, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 95, 1946.

Test about twice as long as broad, generally triangular in end view, the sides slightly concave, and the angles in the adult truncate, somewhat fusiform in side view, greatest diameter at about the middle; chambers distinct, strongly concave at the base, irregular, increasing in height toward the apertural end; sutures strongly depressed; wall distinctly perforate, with slight traces of longitudinal striae; aperture circular, terminal, with a very short, cylindrical neck and a very slight, rounded lip. Length 0.30 mm; diameter 0.15 mm.—Cushman.

This species occurs rarely in scattered samples in all the sections. It was described from the Oligocene, 41 ft. above limestone ledge, bottom of hill on road ascending from Waltersville, Miss., to National Cemetery, and has been recorded from the Byram formation at Byram, Miss., the Glendon limestone member of the Byram at Glendon, Ala., and the Eocene Yazoo clay of Scott County, Miss.

Angulogerina vicksburgensis Cushman

Plate 4, figure 53

Angulogerina vicksburgensis Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 33, pl. 5, figs. 3, 4, 1935.
Palmer and Bermúdez, Soc. cubana hist. nat. Mem, vol. 10 p. 293, 1936.
Bermúdez, idem, vol. 11, p. 339, 1937.
Cushman and Edwards, Cushman Lab. Foram. Research Contr., vol. 14, p. 88, pl. 15, figs. 21, 22, 1938.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 72, pl. 6, fig. 11, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 67, pl. 10, fig. 27, 1945.
Cushman and Todd, idem, vol. 22, p. 95, 1946; vol. 24, p. 9 (list), 1948.

Test elongate, 2½ to 3 times as long as broad, triangular in end view, sides somewhat convex, the angles rounded, early portion rapidly enlarging, adult portion with the sides nearly parallel; chambers numerous, distinct, generally triserial, slightly inflated, increasing in height in the adult; sutures distinct, slightly depressed; wall smooth, finely but distinctly perforate; aperture circular, terminal, with a distinct, cylindrical neck and prominent lip. Length 0.35–0.40 mm; diameter 0.12–0.15 mm.—Cushman.

This distinctive species is fairly common and well distributed throughout all the sections. It was described from the Byram formation and recorded from the Red Bluff clay of Mississippi, the Chickasawhay limestone and Glendon limestone member of the Byram formation of Alabama, the McBean formation of Georgia, and the Oligocene and Eocene of Cuba.

This species bears a strong resemblance to specimens of "*Uvigerina canariensis*, var. *australis* Heron-Allen and Earland" from the Miocene of "Filter Quarry," Batesford, Victoria, Australia, but no such attenuation of the later chambers as to result in a hole through the specimen, described by Heron-Allen, has been observed in these specimens.

Family ROTALIIDAE

Genus Spirillina Ehrenberg, 1843

Spirillina vicksburgensis Cushman

Plate 5, figure 1

Spirillina vicksburgensis Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 34, pl. 5, fig. 6, 1935.
Cushman and Todd, idem, vol. 22, p. 96, pl. 16, fig. 11, 1946; vol. 24, p. 9 (list), 1948.

Test planispiral, evolute, biconvex, periphery obliquely truncate, the dorsal side somewhat broader than the ventral; suture

distinct, slightly depressed in the ventral side; wall on the dorsal side with a single row of coarse pits, on the ventral side transversely and regularly plicate; aperture formed by the open end of the tubular chamber. Diameter 0.25 mm; thickness 0.07 mm.—Cushman.

Three typical specimens were found in the Mint Spring Bayou section. This species is known from the Byram formation and Red Bluff clay in Mississippi.

Spirillina subdecorata Cushman

Plate 5, figure 2

Spirillina subdecorata Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 95, pl. 19, figs. 4, 5, 1922; Prof. Paper 133, p. 37, 1923.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 95, pl. 16, fig. 10, 1946; vol. 24 p. 9 (list), 1948.

Test much compressed, thin, dorsal side slightly convex, ventral side strongly concave in the middle, periphery subacute; whorls comparatively few, early whorls narrow, about last two whorls much broader; suture distinct, slightly depressed; wall perforate, unornamented, thin, translucent; aperture very narrow, elongate, formed by the open end of the tube. Diameter 0.35 mm, thickness 0.06 mm.

Three specimens of this species, also know from the Byram formation and Red Bluff clay of Mississippi, were found in the Mint Spring Bayou and Burke Creek sections.

Genus Patellina Williamson, 1858

Patellina advena Cushman

Plate 5, figure 3

Patellina advena Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 135, pl. 31, fig. 9, 1922; Prof. Paper 133, p. 37, 1923; Carnegie Inst. Washington Pub. 342, p. 32, 1924.

Cushman and Wickenden, U. S. Nat. Museum Proc., vol. 75, art. 9, p. 11, pl. 4, fig. 10, 1929.

Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 16, pl. 3, fig. 2; p. 17, 1930.

Cushman and Parker, U. S. Nat. Museum Proc., vol. 80, art. 3, p. 18, pl. 4, fig. 3, 1931.

Cushman and Cahill, U. S. Geol. Survey Prof. Paper 175–A, p. 29, pl. 9, fig. 11, 1933.

Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 67, pl. 11, fig. 1, 1945.

Cushman and Todd, idem, vol. 24, p. 9 (list), 1948.

Test plano-convex, early portion composed of chambers spirally arranged, later ones elongate and becoming nearly annular; chambers partly divided by numerous longitudinal internal septa, visible from the exterior, forming what seems to be a radiating pattern; ventral side with numerous radiating lines. Diameter 0.4 millimeter.—Cushman.

This species was described from the Mint Spring marl member of the Marianna limestone at Mint Spring Bayou and is recorded from the Eocene McBean formation of Georgia, the lower Oligocene Red Bluff clay of Mississippi, the Miocene Yorktown formation of North Carolina, and Recent material from many localities in the Pacific. Three specimens were found in the Mint Spring Bayou section.

Genus Discorbis Lamarck, 1804

Discorbis tentoria Todd, n. sp.

Plate 5, figure 4

Test concavo-convex, periphery subacute with a narrow, blunt keel, and slightly lobulated; chambers few, four in the last whorl, very rapidly increasing in size as added, not inflated; sutures distinct, slightly limbate and not depressed on the dorsal side, curved and distinctly depressed ventrally, strongly oblique and gently curved on the dorsal side; wall smooth, finely perforate; aperture a small, nearly circular, arched opening at the edge of the last-formed chamber on the ventral side, about half way between the umbilicus and the periphery. Diameter 0.25 to 0.30 mm, thickness 0.10 mm.

Holotype (Cushman Coll. no. 47596) from the middle Oligocene marl member of the Byram formation (sample 521–18, 19), Gulf and Ship Island Railroad cut, 1.5 miles south of Plain, Rankin County, Miss.

This species differs from *D. alveata* Cushman, from the Jackson Eocene of Mississippi, in the definitely concave ventral side and the lack of ornamentation.

This species occurs in all the sections but nowhere abundantly.

Discorbis arcuato-costata Cushman

Plate 5, figure 6

Discorbis arcuato-costata Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 38, pl. 5, fig. 9, 1935.

Cushman and Todd, idem, vol. 22, p. 96, pl. 16, fig. 15, 1946; vol. 24, p. 9 (list), 1948.

Test plano-convex, ventral side flattened, dorsal side slightly convex, periphery acute, slightly keeled; chambers distinct, on the dorsal side increasing gradually in size, shape rather uniform, on the ventral side in the adult with the later chambers having distinct lobes on the inner margin; sutures very distinct, limbate, strongly but evenly curved on the dorsal side, sigmoid on the ventral side; wall distinctly perforate, on the dorsal side with a raised protuberance on the inner end of the earlier chambers, elongating in the adult to form an arcuate, raised rib on the proximal portion of each chamber; aperture a low, elongate opening on the ventral side. Diameter 0.30–0.35 mm; thickness 0.08–0.10 mm.—Cushman.

Rare specimens were found in all the sections. The species was described from the Oligocene, 16 feet above limestone ledge, bottom of hill on road between Waltersville, Miss., and National Cemetery, and was recorded from the Byram formation and Red Bluff clay of Mississippi.

Discorbis subglobosa Cushman

Plate 5, figure 9

Discorbis subglobosa Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 38, pl. 5, fig. 8, 1935.

Cushman and Todd, idem, vol. 22, p. 96, pl. 16, figs. 8a, b (not 8c), 1946; vol. 24, p. 9 (list), 1948.

Test subglobose, dorsal side slightly flattened, ventrally convex but somewhat depressed or concave at the umbilicus,

periphery very broadly rounded; chambers strongly inflated, 4 or 5 in the adult whorl, of rather uniform shape, increasing rather regularly in size as added; sutures distinct, depressed; wall coarsely and distinctly perforate, smooth; aperture semicircular, ventral, opening on the umbilicus, with a slight lip. Diameter 0.25 mm; thickness 0.15 mm.—Cushman.

This species seems to be a significant one in these samples, as it is fairly common in the lower portions of all the sections.

The species was described from the Byram formation and recorded from the lower Oligocene Red Bluff clay. It suggests a close relationship to the Jackson group species, *D. hemisphaerica* Cushman, but is only very slightly evolute on the ventral side.

Discorbis subaraucana Cushman

Plate 5, figure 7

Discorbis subaraucana Cushman, Carnegie Inst. Washington Pub. 311, p. 41, pl. 7, figs. 1, 2, 1922; Pub. 344, p. 78, 1926; Florida Geol. Survey Bull. 4, p. 52, pl. 10, fig. 1, 1930.
Cole, idem, Bull. 6, p. 47, pl. 6, figs. 11, 12, 1931.
Cushman, U. S. Nat. Museum Bull. 104, pt. 8, p. 32, pl. 7, fig. 2, 1931; U. S. Geol. Survey Prof. Paper 181, p. 43, pl. 18, fig. 1, 1935.
Cushman and McGlamery, idem, Prof. Paper 189–D, p. 109, pl. 26, fig. 13, 1938.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 24, no. 3, pl. 1, fig. 8, 1940.
Galloway and Heminway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Is., vol. 3, pt. 4, p. 386, pl. 21, fig. 2, 1941.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 72, pl. 6, figs. 17, 18, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 28, no. 9, pl. 7, fig. 8, 1944.
Discorbis cf. *subaraucana* Cushman, Cushman Lab. Foram. Research Special Pub. 16, p. 31, pl. 6, fig. 12, 1946.
Cushman and Renz, idem, Special Pub. 22, p. 34, pl. 7, fig. 12, 1947.

Test planoconvex, ventral side with deep, open umbilicus, periphery rounded, slightly lobulated; chambers six or seven in the last-formed whorl, rapidly increasing in size as added, slightly inflated; sutures distinct, gently curved, early sutures slightly limbate, later ones not limbate but slightly depressed; wall thin, smooth, finely and distinctly perforate; aperture a very low, elongate opening under the edge of the last-formed chamber, opening into the umbilicus. Diameter 0.37 mm, thickness 0.15 mm.

A few specimens in the present material seem to be very close to, if not identical with, the types of this species, from Recent material from the Dry Tortugas, off Florida. There are numerous records of this species from upper Eocene to Recent, but probably not all are the same.

Discorbis farishi Cushman and Ellisor

Plate 5, figure 8

Discorbis farishi Cushman and Ellisor, Cushman Lab. Foram. Research Contr., vol. 8, p. 43, pl. 6, fig. 6, 1932.
Ellisor, Am. Assoc. Petrol. Gelogists Bull., vol. 17, no. 11, pl. 7, fig. 6, 1933.

Test plano-convex, the dorsal side slightly convex, ventral side nearly flat, periphery with a slight keel especially marked on the dorsal side, bluntly rounded, dorsal side with the chambers all visible, those on the ventral side continuing in to the umbilical area; chambers distinct, 7 or 8 in the last-formed whorl, increasing rather evenly in size as added, the last-formed ones increasing slightly more rapidly in the adult; sutures distinct, slightly limbate, those of the dorsal side strongly curved, not depressed, ventrally slightly depressed, strongly curved, opening into the umbilical region to form a stellate pattern; wall on the dorsal side very smooth, finely perforate, on the ventral side with numerous, elongate, raised areas on each chamber, in general radiate; aperture an elongate, narrow slit on the ventral side of the last-formed chamber extending from the umbilicus toward the periphery, and often with a slight lip. Diameter 0.35 mm; thickness 0.08 mm.—Cushman and Ellisor.

Rare specimens seem to belong to this species, previously known only from the upper Eocene of Louisiana and Texas. They differ from *D. assulata* Cushman, from the Ocala limestone of Georgia, in having a radial ornamentation on the ventral side. They also resemble *D. arcuato-costata* Cushman but differ in lacking the ornamentation on the dorsal side.

Discorbis alabamensis Cushman

Plate 5, figure 5

Discorbis alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 16, pl. 2, fig. 3, 1933; U. S. Geol. Survey Prof. Paper 181, p. 44, pl. 17, fig. 3, 1935.

Test small, unequally biconvex, ventral side slightly convex, dorsal side more strongly so, periphery rounded; chambers distinct, usually about six in the final whorl, slightly inflated, of uniform shape, increasing very slightly in size as added, on the ventral side with the inner end of the chambers lobed; sutures distinct, slightly depressed, gently curved; wall smooth; aperture near the umbilicus, with a slight overhanging lip. Diameter 0.25 mm; height 0.06 mm.—Cushman.

A very few specimens from two of the sections seem to be close to this species, previously known only from the Ocala limestone at Beck, Ala. They do not, however, show the conspicuous lobed edges of the chambers on the ventral side.

Discorbis byramensis Cushman

Plate 5, figure 10

Discorbis byramensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 96, pl. 19, figs. 6–8, 1922; Prof. Paper 133, p. 37, 1923.
Cushman and McGlamery, idem, Prof. Paper 197–B, p. 72, pl. 6, fig. 15, 1942.
Discorbis sp. Cushman, Washington Acad. Sci. Jour., vol. 10, p. 200, 1920.

Test pyramidal, low, octagonal, ventral side slightly concave, peripheral margin subacute; eight chambers in each of the four or more coils, their margins uniting to form a series of eight ribs extending radially from the apex of the test to the periphery, the lateral sutures much less distinct, surface between the ridges concave but smooth; ventral surface composed of numerous radiating rounded costae broken up transversely to form a beaded surface; umbilical area hollow; aperture at the base

of the last-formed chamber. Diameter 0.35 to 0.40 mm, height 0.10 mm.—Cushman.

Rare specimens of this very striking species were found in the Mint Spring Bayou and Burke Creek sections. It has been known from the Byram formation of Mississippi and the Chickasawhay limestone at Millry, Ala.

Genus Lamarckina Berthelin, 1881

Lamarckina glabrata (Cushman) Cushman

Plate 5, figure 19

Pulvinulina glabrata Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 99, pl. 22, figs. 6, 7, 1922; Prof. Paper 129–F, p. 138, 1922.

Lamarckina glabrata Cushman and McGlamery, idem, Prof. Paper 189–D, p. 109, pl. 26, fig. 17, 1938; Prof. Paper 197–B, p. 73, 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 97, 1946; vol. 24, p. 9 (list), 1948.

Test 1½ to 1¾ times as long as broad, dorsal surface flat or slightly concave in the early part, dorsal surface of last one or two chambers bent over toward the ventral side but not inflated, ventral surface inflated, with a large open umbilicus, periphery slightly lobulated, bordered with a heavy, blunt keel, somewhat raised above the dorsal surface; chambers 6 or 7 in the adult whorl, inflated ventrally, rapidly increasing in size as added; sutures limbate, raised, and curved on the dorsal side, indistinct on the ventral side; wall smooth and polished on the ventral side, roughened with small spines on the dorsal side; aperture a large opening into the umbilicus under the inner edge of the last-formed chamber. Length up to 0.40 mm, breadth up to 0.28 mm, thickness about 0.18 mm.

This is a fairly common species and was found in all the sections. It was described from the Byram formation and recorded from the Mint Spring marl member of the Marianna limestone and Red Bluff clay of Mississippi and the Chickasawhay limestone of Alabama.

Lamarckina byramensis Cushman and Todd

Plate 5, figure 20

Lamarckina byramensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 98, pl. 16, figs. 12, 13, 1946; vol. 24, p. 9 (list), 1948.

Pulvinulina glabrata Cushman (not Cushman, 1922), U. S. Geol. Survey Prof. Paper 133, p. 45, pl. 6, figs. 11, 12, 1923.

Lamarckina glabrata Cushman (not Cushman, 1922), Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 11, pl. 1, fig. 6, 1926; Special Pub. 4, pl. 24, fig. 6, 1933.

Israelsky, Sixth Pacific Sci. Congress Proc., p. 588, pl. 4, fig. 1, 1939.

Test very slightly longer than broad, ventral surface nearly flat, with a large open umbilicus, dorsal surface strongly inflated, both as a whole and as individual chambers; periphery slightly lobulated, bordered by a sharp keel which projects outward as a part of the ventral surface, suggesting the appearance of callus in gastropoda; chambers distinct and inflated on the dorsal side, almost indistinguishable on the ventral side, rapidly increasing in size in the early stages, last two or three chambers of approximately the same size; sutures distinct, depressed, curved on the dorsal side, sometimes with the ventral "callus" protruding as a raised ridge along the depressed suture lines, invisible on the ventral side unless the shell is moistened; wall smooth and polished on the ventral side, covered thickly with coarse spines on the dorsal side; aperture under the inner edge of the last-formed chamber, opening into the umbilicus. Length up to 0.50 mm, breadth up to 0.42 mm, thickness up to 0.35 mm.

In these samples this species is more abundant than *L. glabrata*. It also occurs in all five sections. It was described from the Byram formation and recorded from the Mint Spring marl member of the Marianna limestone and Red Bluff clay.

Published figures indicate that there has been some confusion of the two species, *glabrata* and *byramensis*. Re-examination of the types of both shows clearly that they are distinct in the following features: (1) the ventral side is the more convex in *L. glabrata*, whereas the dorsal side is the more convex in *L. byramensis;* (2) *L. glabrata* is smaller and more elongate than *L. byramensis*, which is nearly as broad as long and proportionately thicker; and (3) the ornamentation of the dorsal side is different; that in *L. glabrata* is more delicate and includes raised ridges along the sutures, whereas that of *L. byramensis* is more coarsely spinose and the sutures are depressed.

Genus Heronallenia Chapman and Parr, 1931

Heronallenia vicksburgensis Cushman

Plate 5, figure 11

Heronallenia vicksburgensis Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 38, pl. 5, fig. 11, 1935.

Cushman and Todd, idem, vol. 24, p. 9 (list), 1948.

Test plano-convex, dorsal side greatly convex, ventral side flattened, slightly umbilicate, periphery with a rounded border; chambers distinct, five in the adult whorl, increasing rather rapidly in breadth as added, height increasing only slightly; sutures distinct, limbate and raised on the dorsal side, gently curved, ventrally nearly radial, very slightly depressed, slightly sigmoid; wall smooth except for the carina and raised sutures on the dorsal side; aperture elongate, radial, opening at the umbilicus. Length 0.25 mm; breadth 0.20 mm; thickness 0.10 mm.—Cushman.

This species was described from the lower Oligocene, from firm sandy clay bed between sandy lime ledges 35 feet above water level, 30 feet north of base of power tower, east bank of Mississippi River, south of Vicksburg, Miss., and has been recorded from the Red Bluff clay at Hiwannee, Miss. A few specimens were found in the four sections in Rankin County.

Genus Valvulineria Cushman, 1926

Valvulineria sculpturata Cushman

Plate 5, figure 13

Valvulineria sculpturata Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 37, pl. 5, fig. 10, 1935.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 73, pl. 6, fig. 21, 1942.

Test trochoid, somewhat longer than broad, dorsally flattened or somewhat concave, ventrally convex except slightly depressed in the umbilical region, periphery lobulate, rounded in edge view; chambers distinct in the adult whorl, 4 or 5 in number, increasing somewhat in length as added, on the ventral side strongly convex, on the dorsal side with the outer half convex, the inner half strongly excavated; sutures distinct, depressed, strongly curved dorsally, less so ventrally; wall very coarsely perforate; aperture on the ventral side, nearly umbilical, with a rather thick, projecting lip above the aperture itself. Length 0.30 mm; breadth 0.20 mm; thickness 0.15–0.18 mm.—Cushman.

A single typical specimen was found in sample 662–13. It was described from the lower Oligocene, 36 feet above limestone ledge, bottom of hill on road between Waltersville, Miss. and National Cemetery, and was recorded in the Chickasawhay limestone near Millry, Ala.

Genus Gyroidina D'Orbigny, 1826

Gyroidina vicksburgensis (Cushman) Howe

Plate 5, figure 17

Rotalia vicksburgensis Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 139, pl. 35, figs. 3, 4, 1922; Prof. Paper 133, p. 46, 1923.

P. Applin, Am. Assoc. Petrol. Geologists Bull., vol. 9, p. 25, 1925.

Gyroidina vicksburgensis Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.

Cole and Ponton, Florida Geol. Survey Bull. 5, p. 41, 1930.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 4, fig. 2, 1933.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 10 (list), pl. 1, fig. 10, 1948.

Test of medium size for the genus, dorsal side flat or with the earliest whorl depressed, ventral side convex with umbilicus open and depressed, periphery broadly rounded and slightly lobulated in the later part; chambers 7 or 8 in the last whorl, early ones indistinct, later ones slightly inflated ventrally, sutures distinct, slightly limbate, last one or two slightly depressed, oblique and curved on the dorsal side, radial on the ventral side; wall smooth, polished, very finely perforate; aperture on the ventral side under the edge of the last-formed chamber. Length 0.45 to 0.55 mm, breadth 0.35 to 0.50 mm, thickness 0.25 to 0.35 mm.

This species seems to be a significant form in these samples, as it occurs abundantly and is limited to the lower portions of all the sections.

It was described from the Mint Spring marl member of the Marianna limestone and has been recorded from the Red Bluff clay, Glendon limestone member of the Byram formation, and Marianna limestone and subsurface Vicksburg formation in Texas.

Gyroidina byramensis Cushman and Todd

Plate 5, figure 18

Gyroidina byramensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 98, pl. 16, figs. 19–21, 1946; vol. 24, p. 9 (list), 1948.

Gyroidina sp. Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 73, pl. 6, fig. 20, 1942.

Test small, composed of 2 to 2½ whorls, dorsal side flat, ventral side strongly convex, periphery broadly rounded; chambers about 6 in the last-formed whorl, not inflated, gradually increasing in size but more rapidly in thickness as added; sutures distinct, not limbate, radial or slightly curved at their outer ends, spiral suture slightly depressed; wall thin, translucent, polished, very finely perforate; aperture ventral, a low slit under the edge of the last-formed chamber. Length 0.20 to 0.30 mm, breadth 0.20 to 0.25 mm, thickness 0.15 to 0.18mm.

This species, known from the Byram formation and Red Bluff clay of Mississippi and the Chickasawhay limestone of Alabama, occurs throughout the four sections in Rankin County but is limited to the upper part of the Mint Spring Bayou section. There, in sample 7, it apparently replaces *G. vicksburgensis*, which is not found above the zone from which sample 6 was obtained.

The two species are easily distinguished by the following features: (1) *G. vicksburgensis* is larger and thicker-walled; (2) *G. vicksburgensis* averages one more chamber per whorl, even in young specimens; (3) the chambers of *G. vicksburgensis* are slightly inflated and thus the periphery slightly lobulated; and (4) the dorsal sutures are oblique and slightly curved in *G. vicksburgensis*, but nearly radial in *G. byramensis*.

Gyroidina byramensis is very close to *G. danvillensis* Howe and Wallace, from the upper Eocene of Louisiana, but is slightly larger and the dorsal side is distinctly convex.

Genus Eponides Montfort, 1808

Eponides byramensis (Cushman) Howe

Plate 5, figure 16

Pulvinulina byramensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 99, pl. 22, figs. 4, 5, 1922; Prof. Paper 129–F, p. 138, 1922; Prof. Paper 133, p. 44, 1923.

Eponides byramensis Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.

Cole and Ponton, Florida Geol. Survey Bull. 5, p. 41, pl. 8, figs. 5, 6, 1930.

Hedberg, Jour. Paleontology, vol. 11, p. 679, pl. 92, fig. 2, 1937.

Howe, idem, vol. 16, p. 267 (list), 1942.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 73, pl. 6, fig. 22, 1942.

Applin and Jordan, Jour. Paleontology, vol. 19, p. 130 (list), 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 99, pl. 16, figs. 17, 18, 1946.
Cushman and Renz, idem, Special Pub. 22, p. 36, 1947.

Test of medium size for the genus, about equally biconvex, periphery bluntly angled but not keeled, evolute on the dorsal side but earlier whorls and chambers indistinct, ventral side involute, with a small, open umbilicus; chambers indistinct, 7 or 8 in the last-formed whorl; sutures nearly radial but slightly curved at their outer ends on the ventral side, straight and tangential to the spiral suture on the dorsal side; wall smooth, finely perforate; aperture an elongate slit under the edge of the last-formed chamber on the ventral side, extending from the umbilicus about halfway out to the periphery, with an overhanging lip. Diameter 0.50 to 0.60 mm, thickness 0.35 to 0.40 mm.

This species, described from the Byram formation and widely recorded in the Oligocene, is common to abundant throughout this material.

Eponides alabamensis Cushman and McGlamery

Plate 5, figure 15

Eponides alabamensis Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 110, pl. 27, fig. 2, 1938; Prof. Paper 197–B, p. 74, pl. 7, fig. 1, 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 99, pl. 16, fig. 22, 1946.

Test unequally biconvex, ventral side strongly convex, dorsal side slightly raised, periphery acute, slightly keeled; chambers distinct, slightly if at all inflated on the dorsal side, ventrally strongly so, 6 in the adult whorl, of uniform shape, very gradually increasing in size as added; sutures distinct, on the dorsal side limbate, strongly oblique, ventrally gently curved; wall on the dorsal side smooth and polished, on the ventral side finely papillate with occasional costae across the sutures; aperture a low, elongate opening on the ventral side at the margin of the last-formed chamber. Diameter 0.35–0.40 mm, thickness 0.15–0.18 mm.—Cushman and McGlamery.

Very few specimens of this small species were found. It was described from the Chickasawhay limestone at Choctaw Bluff, Ala., and also was recorded near Millry, Ala., and from the Byram formation at Byram, Miss.

Eponides vicksburgensis Cushman and Ellisor

Plate 5, figure 14

Eponides vicksburgensis Cushman and Ellisor, Cushman Lab. Foram. Research Contr., vol. 7, p. 56, pl. 7, fig. 8, 1931.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 3, fig. 20, 1933.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Test small, strongly biconvex, ventral side somewhat more convex than the dorsal, periphery acute with a distinct keel in the early portion; chambers distinct, not inflated, of uniform shape, increasing only slightly in size as added, about seven usually making up the last-formed whorl in the adult; sutures distinct, slightly limbate, not depressed, strongly oblique on the dorsal side, slightly curved on the ventral; wall finely perforate, smooth except on the ventral side which has numerous small papillae, especially on the inner end of the chambers; aperture a short, curved opening on the ventral side at the base of the chamber, midway between the umbilicus and the periphery. Diameter 0.30 mm; height 0.15–0.18 mm.—Cushman and Ellisor.

A single specimen from sample 521–20, 21 seems identical with the type of this species, from subsurface Vicksburg formation in Texas.

Genus Rotalia Lamarck, 1804

Rotalia byramensis Cushman

Plate 5, figures 21, 22

Rotalia byramensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 99, pl. 23, fig. 1, 1922; Prof. Paper 129–F, p. 138, 1922; Prof. Paper 133, p. 46, 1923.
Cushman and McGlamery, idem, Prof. Paper 189–D, p. 110, pl. 27, fig. 3, 1938; Prof. Paper 197–B, p. 74, 1942.
Applin and Applin, Am. Assoc. Petrol. Geologists Bull., vol. 28, no. 12, pl. 1, fig. 1, 1944.
Applin and Jordan, Jour. Paleontology, vol. 19, p. 129 (list), p. 142, 1945.
Cushman and Todd, Cushman Lab. Foram. Research. Contr., vol. 22, p. 100, pl. 16, fig. 23, 1946.

Test planoconvex, periphery subacute, serrate owing to both the shape of the chambers and the long, slender spines extending radially outward, one to a chamber, not present on all chambers, umbilicus with a small plug; chambers distinct, 7 to 9 in the last-formed whorl, not inflated, later chambers crudely diamond-shaped, with the outer point of the diamond, from which the spine protrudes, coming midway between the bounding suture lines; sutures on the ventral side distinct, straight, radial and deeply incised, joining to form an incised ring around the umbilical plug, on the dorsal side curved, slightly oblique and slightly depressed; wall thick, finely perforate, ornamented by irregular masses of shell material, and short, discontinuous costae transverse to the sutures on the outer portions of the chambers on the ventral side; aperture a low, elongate opening under the edge of the ventral face of the last-formed chamber. Diameter, exclusive of spines, up to 0.60 mm, thickness up to 0.25 mm.

Specimens, all much smaller than the types, are very rare in this material, and were found only in samples 2, 521–18, 19, 521–20, 21, and 662–13.

Rotalia incisura Todd, n. sp.

Plate 5, figure 25

Rotalia dentata Cushman (not Parker and Jones), U. S. Geol. Survey Prof. Paper 129–E, p. 100, pl. 23, fig. 2, 1922; Prof. Paper 133, p. 46, 1923.

Test of medium size for the genus, dorsal side nearly flat, ventral side convex, umbilicus depressed, with umbilical plug of clear shell material; periphery subacute, bluntly keeled, slightly serrate owing to the short projecting spines at the forward angles of the chambers, spines not always present; chambers distinct, 6 or 7 in the last-formed whorl, not inflated; sutures distinct, deeply incised and radial but slightly curved at their outer ends on the ventral side, curved and strongly

limbate but not raised on the dorsal side; wall thin, smooth, distinctly punctate; aperture a small, nearly circular opening under the edge of the last-formed chamber on the ventral side, nearer the periphery than the umbilicus. Diameter, exclusive of spines, up to 0.70 mm, thickness up to 0.20 mm.

Holotype (Cushman Coll. no. 47558) from the middle Oligocene marl member of the Byram formation (sample 20), Mint Spring Bayou, south of National Military Cemetery, Vicksburg, Miss.

This species differs from *R. byramensis* Cushman in the shorter spines, which originate from the sutural angle rather than the central part of the chamber, and project tangentially forward rather than radially, and in the lesser protrusion of the chambers, such that except for the spines the periphery would be only very slightly lobulated. This species also differs in its strongly limbate dorsal sutures and the presence of a blunt keel on the periphery, and in its lack of surface ornamentation. It is entirely different from the Recent species, *R. dentata* Parker and Jones, which has many more chambers and whorls. The records of *R. dentata* quoted above are from the Byram formation of Mississippi.

This new species was found only in the Burke Creek and Mint Spring Bayou sections, where it seems to be limited to the upper parts of the sections.

Rotalia parva Cushman

Plate 5, figure 26

Rotalia dentata Parker and Jones var. *parva* Cushman, U. S. Geol. Survey Prof. Paper 129–F, p. 139, pl. 35, figs. 1, 2, 1922; Prof. Paper 133, p. 47, 1923.
Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 4, fig. 3, 1933.
Rotalia parva Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 100, pl. 16, figs. 24, 25, 1946.

Test compressed, periphery broadly rounded and lobulate, umbilicus depressed, with a low plug; chambers globular, inflated, 5 or 6 in the last-formed whorl; sutures distinct, depressed, radial on the ventral side, slightly curved on the dorsal side; wall thin, rather coarsely perforate, ornamented with short, slender spines projecting radially in the plane of coiling from the center of each chamber; aperture a rather large arched opening under the ventral edge of the last-formed chamber. Diameter, exclusive of spines, 0.28 to 0.32 mm, thickness 0.15 mm.

This species, known from the Mint Spring marl member of the Marianna limestone and Byram formation and Red Bluff clay of Mississippi and subsurface Vicksburg formation of Texas, occurs fairly commonly in the Mint Spring Bayou section and less abundantly in two of the other sections.

Genus Epistomina Terquem, 1883

Epistomina sp.

A single specimen from sample 3 may be referred to this genus, but it does not seem to be identifiable with any known species. It has seven chambers in the last whorl, a sharp keel on the periphery, and a very slightly convex dorsal side.

Genus Mississippina Howe, 1930

Mississippina monsouri Howe

Plate 6, figure 6

Mississippina monsouri Howe, Jour. Paleontology, vol. 4, p. 330, pl. 27, fig. 4, 1930.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 31, fig. 1, 1933.
Cushman and Todd, idem, Contr., vol. 22, p. 100, pl. 16, fig. 26, 1946.

Test in early stages trochoid, later becoming almost planispiral, convex on the dorsal side, somewhat umbilicate on the ventral side, all whorls visible on the dorsal side and most of the preceding whorls visible on the ventral side; distinctly umbilicate. Sutures depressed on both dorsal and ventral sides; periphery rounded. Apertures of two sorts, one kind at the base of the last formed chamber at the periphery, the other kind being supplementary apertures elongated in the axis of coiling on both the dorsal and ventral sides of the periphery of each chamber. Diameter 0.50 mm.—Howe.

A few specimens, all very much smaller than but apparently identical with the types, were found in three of the sections. This species has been recorded only from the Byram formation of Mississippi.

Genus Siphonina Reuss, 1850

Siphonina advena Cushman

Plate 5, figure 23

Siphonina advena Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 98, pl. 21, figs. 1, 2, 1922; Prof. Paper 129–F, p. 137, 1922; Prof. Paper 133, p. 42, 1923; U. S. Nat. Museum Proc., vol. 72, art. 20, p. 7, pl. 1, fig. 7, 1927.
Howe, Jour. Paleontology, vol. 2, p. 175 (list), 1928.
Cole, Bull. Am. Paleontology, vol. 15, no. 57a, p. 4 (list), 1929.
Cole and Gillespie, idem, no. 57b, p. 12, pl. 4, figs. 5, 6, 1930.
Cole and Ponton, Florida Geol. Survey Bull. 5, p. 43, pl. 11, figs. 7, 8, 1930.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 3, fig. 22, 1933.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 74, pl. 7, figs. 2, 3, 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 100, 1946; vol. 24, p. 10 (list), 1948.

Test compressed, ventral side convex, dorsal side only slightly raised; periphery acute, with a narrow, sharp, slightly serrate keel; chambers distinct, not inflated, 4½ to 5 chambers in the last whorl, very slightly increasing in size as added; sutures distinct, radial but slightly curved on the ventral side, tangential, curved, limbate, and slightly depressed on the dorsal side; wall smooth, polished, with rather coarse perforations;

aperture with an elongate and very slightly protruding neck, surrounded by a distinct, phialine lip. Diameter 0.42 to 0.50 mm., thickness 0.20 mm.

This is one of the most abundant species in this material, occurring throughout all the sections.

Genus Siphoninella Cushman, 1927

Siphoninella byramensis Cushman

Plate 5, figure 24

Siphoninella byramensis Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 46, pl. 8, fig. 5, 1929.
Howe, Jour. Paleontology, vol. 16, p. 268 (list), 1942.

Test small, trochoid, nearly equally biconvex, last-formed one or two chambers tending to uncoil, periphery slightly keeled; chambers distinct, five or six in the last-formed coil, the last one or two slightly inflated as uncoiling takes place; sutures strongly oblique on the dorsal side, slightly curved on the ventral side, slightly limbate, not depressed except on the ventral side between the last-formed chambers; wall smooth on the dorsal side except along the keel which is slightly beaded, ventral side with the basal angle of the last-formed chambers distinctly beaded, otherwise nearly smooth; aperture in the early portion as in *Siphonina*, in the later uncoiled chambers, the aperture away from the edge of coiling, subterminal, elliptical with a distinct lip. Diameter 0.25 mm; thickness 0.10 mm.—Cushman.

The present specimens are identical with types, with which they have been compared. The test seems to be somewhat more convex on the ventral than on the dorsal side, and the rather prominent beading along the suture lines on the ventral side also adds to the appearance of planoconvexity.

Re-examination of the type of "*Pulvinulina advena*" (not *Siphonina advena*) Cushman (U. S. Geol. Survey Prof. Paper 129–E, p. 99, pl. 22, fig. 8, 1922) from the Byram marl indicates that it is probably a young specimen of *Siphoninella byramensis*.

The only other occurrences of this species seem to be in the Byram formation of Mississippi and the Glendon limestone member of the Byram formation of Alabama. It occurs rarely in the four sections in Rankin County.

Genus Cancris Montfort, 1808

Cancris vicksburgensis Todd, n. sp.

Plate 6, figure 1

Pulvinulina sagra Cushman (not D'Orbigny), U. S. Geol. Survey Prof. Paper 133, p. 45, pl. 6, figs. 9, 10, 1923.

Test compressed, about equally biconvex, umbilicus depressed; periphery acute, keeled, very slightly indented at the sutures; chambers very rapidly increasing in size, 5 in the last-formed whorl, very slightly inflated ventrally; sutures distinct, narrow, flush on the dorsal side, slightly incised on the ventral side, gently curved; wall smooth, finely perforate; aperture a low opening under the umbilical end of the chamber on the ventral side. Length 0.50 to 0.62 mm, breadth 0.38 to 0.48 mm, thickness 0.16 to 0.20 mm.

Holotype (Cushman Coll. no. 47579) from the middle Oligocene Glendon limestone member of the Byram formation (sample 521–8), Gulf and Ship Island Railroad cut, 1.5 miles south of Plain, Rankin County, Miss.

This species differs from *C. pauciloculatus* Cushman and McGlamery, from the Chickasawhay limestone of Alabama, in its flatter, more elongate test and in having more chambers and a more regular periphery. It somewhat resembles *C. cocoaensis* Cushman from the upper Eocene Cocoa sand member of the Yazoo clay in Alabama, but has fewer chambers, a keeled periphery, and is flatter and not inflated. It is flatter and more elongate than *C. cubensis* Cushman and Bermúdez.

In the present material, *C. vicksburgensis* occurs rather commonly in all the sections. The record of "*P. sagra* D'Orbigny," quoted above, is from the Glendon limestone member of the Byram formation at Vicksburg, Miss.

Genus Baggina Cushman, 1926

Baggina xenoula Hadley

Plate 5, figure 12

Baggina xenoula Hadley, Bull. Am. Paleontology, vol. 22, no. 74, p. 6, pl. 1, fig. 5, 1935.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 20, p. 99, pl. 15, figs. 9, 10, 1944.
Valvulineria paucilocula Cushman, idem, vol. 11, p. 37, pl. 5, fig. 7, 1935.
Galloway and Heminway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Is., vol. 3, pt. 4, p. 371, pl. 16, fig. 4, 1941.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 73, pl. 6, fig. 19, 1942.
Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 568, pl. 77, figs. 4, 5, 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 98, pl. 16, fig. 16, 1946.
Baggina thalmanni? Cushman and McGlamery (not Pijpers), U. S. Geol. Survey Prof. Paper 189–D, p. 111, pl. 26, fig. 14, 1938.

Test trochoid, subglobular, slightly compressed, periphery rounded and slightly lobulate, dorsal side flat; ventral side convex with umbilicus open and depressed; chambers few, about 5 in the last whorl, very rapidly increasing in size so that the last one forms about 2/5 of the surface of the test, becoming progressively more inflated; sutures fairly distinct, slightly curved, later ones slightly depressed; wall thin, very coarsely and distinctly perforate except for a clear area on each chamber next to the umbilicus; aperture a fairly large opening into the umbilicus under the clear-walled portion of the last-formed chamber. Length 0.25 to 0.45 mm, breadth 0.20 to 0.35 mm, thickness 0.12 to 0.24 mm.

Some specimens were found in all the sections. The species seems to be most easily identified by its coarse perforations, which make the surface resemble that typical of the Globigerinidae.

Upon comparison of the type of "*Valvulineria pauci-locula* Cushman" with topotypes of *Baggina xenoula* Hadley, it was concluded that the two are indistinguishable. *Baggina xenoula* was described from the west bank of Bucatunna Creek, NW¼ sec. 17, T. 8, R. 5 W., Wayne County, Miss., and recorded from numerous other nearby localities, as well as from the Glendon limestone member of the Byram formation and Chickasawhay formation of Alabama. "*Valvulineria pauci-locula*" was described from the Byram formation and other records for it includes the upper Oligocene to lower Miocene of Porto Rico and the subsurface Anahuac formation of Ellisor in Texas.

Family AMPHISTEGINIDAE

Genus Asterigerina D'Orbigny, 1839

Asterigerina subacuta Cushman

Plate 6, figure 2

Asterigerina subacuta Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 100, pl. 24, figs. 1–3, 1922; Prof. Paper 133, p. 47, 1923.

Cole and Gillespie, Bull. Am. Paleontology, vol. 15, no. 57b, p. 13, 1930.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 111, pl. 28, fig. 1, 1938.

Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 101, pl. 16, fig. 27, 1946.

Test planoconvex or unequally biconvex, composed of about three and one-half coils, the dorsal side slightly convex, smooth, the chambers all visible in well-preserved specimens, even those of the earlier coils showing through the layer of transparent shell material covering them; chambers about ten in the last-formed coil, the sutures oblique and curved backward but not depressed below the surface, slightly thickened and clear, joining at the periphery with the slight keel; from below, the chambers of the last coil only visible; sutures ending at a point about one-third of the way in from the periphery, from which a secondary chamber is developed to the umbilical region, where the sutures come together in a central boss of clear shell material; aperture elongate, curved, at the base of the inner margin on the ventral side. Diameter about 1 mm.—Cushman.

This species, described from the Byram formation, occurs rarely in four of the sections studied. It appears to be limited to the upper parts of the sections.

Asterigerina bracteata Cushman

Plate 6, figure 5

Asterigerina bracteata Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 48, pl. 8, fig. 6, 1929.

Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 111, pl. 28, fig. 3, 1938; Prof. Paper 197–B, p. 74, 1942.

Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 569, 1945.

Test small, scale-like, plano-convex, ventral side flat or even slightly concave, dorsal side moderately convex, periphery acute, somewhat keeled; chambers distinct, five or six in the last-formed coil, ventrally with angular, supplementary chambers coming in between the regular series, rhombic in outline, giving a stellate appearance to the base of the test; sutures on the dorsal side strongly curved, not depressed, slightly limbate, ventrally with the sutures a little depressed; wall finely perforate dorsally, somewhat more coarse on the ventral side, smooth; aperture very narrow, ventral. Diameter 0.22–0.30 mm; height 0.15–0.18 mm.—Cushman.

This is a very distinctive species of *Asterigerina*, with its almost concentric suture pattern on the convex dorsal side. In this material the supplementary chambers on the ventral side become increasingly inflated as added, but still the test remains planoconvex.

The species was described from the Byram formation and is known from the Chickasawhay limestone at Choctaw Bluff and near Millry, Ala., and from the subsurface Anahuac formation of Ellisor in Texas. It is fairly common in all five sections but is apparently limited to the middle parts of each section.

Family CASSIDULINIDAE

Genus Alabamina Toulmin, 1941

Alabamina mississippiensis Todd, n. sp.

Plate 6, figure 8

Pulvinulinella obtusa Cushman and Todd (not Burrows and Holland), Cushman Lab. Foram. Research Contr., vol. 21, p. 101, pl. 16, figs. 7, 8, 1945.

Cushman, idem, Special Pub. 16, p. 36, pl. 7, figs 7, 8, 1946.

Alabamina wilcoxensis Cushman and Todd (not Toulmin), idem. Contr., vol. 24, p. 10 (list), 1948.

Test closely coiled, compressed, ventral side more strongly convex than the dorsal, periphery bluntly angled, not lobulated; chambers rapidly increasing in size, 5 in the last-formed whorl; sutures indistinct, tangential and slightly curved on the dorsal side, radial but slightly curved toward their outer ends on the ventral side, ventral sutures very slightly depressed; wall smooth, very finely perforate; aperture a very low slit under the edge of the last-formed chamber extending from the umbilicus to the beginning of the septal fold. Length 0.35 to 0.47 mm, breadth 0.30 to 0.35 mm, thickness 0.20 to 0.24 mm.

Holotype (Cushman Coll. no. 47646) from the middle Oligocene Glendon limestone member of the Byram formation (sample 757–16), section in Burke Creek, sec. 15, T. 4 N., R. 1 E., Rankin County, Miss.

This species closely resembles *A. wilcoxensis* Toulmin from the Salt Mountain limestone of lower Eocene age of Alabama but differs in having a more nearly equally biconvex test, in having the chambers increase more rapidly in size to form a more elongate, less circular outline, and in having the ventral sutures slightly depressed. However, all these characteristics are varied in the series of specimens from these Vicksburg samples, and a few specimens appear to be indistinguishable from paratypes of *A. wilcoxensis* Toulmin, with which they have been compared.

This species occurs fairly commonly in the four

sections in Rankin County and rarely in the Mint Spring Bayou section.

Specimens recorded in the references above probably belong here. They are from the upper Eocene Moodys Branch formation of Mississippi and Cocoa sand member of Yazoo clay of Alabama, and the lower Oligocene Red Bluff clay of Mississippi.

Genus Cassidulina D'Orbigny, 1826

Cassidulina moodysensis Cushman and Todd

Plate 6, figure 3

Cassidulina moodysensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 102, pl. 16, figs. 9, 10, 1945; vol. 22, p. 101, 1946.

Test small, compressed, equally biconvex, periphery entire, acute but not angled or keeled; chambers distinct, 4 or 5 pairs in the last whorl; sutures distinct, curved, slightly depressed; wall smooth, polished; aperture a comparatively broad, elongate opening at the base of the last-formed chamber. Diameter 0.17–0.23 mm; thickness 0.12–0.15 mm.—Cushman and Todd.

Very rare specimens in three of the sections seem identical with this very small species, described from the upper Eocene Moodys Branch formation and recorded from the Oligocene Byram formation of Mississippi.

Genus Cassidulinoides Cushman, 1927

Cassidulinoides compacta Cushman and Ellisor

Plate 6, figure 4

Cassidulinoides compacta Cushman and Ellisor, Jour. Paleontology, vol. 19, p. 570, pl. 78, fig. 3, 1945.

Cassidulinoides bradyi Cushman (not Norman), Florida Geol. Survey Bull. 4, p. 58, pl. 11, fig. 8, 1930.

Cushman and Ponton, idem, Bull. 9, p. 98, 1932.

Cushman and Cahill, U. S. Geol. Survey Prof. Paper 175–A, p. 33, pl. 12, fig. 4, 1933.

Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 24, no. 3, pl. 6, fig. 5, 1940.

Test longer than broad, compressed, close-coiled for most of its development, but the last two chambers tending to uncoil, periphery rounded; chambers distinct, moderately inflated, increasing rapidly in length in the adult; sutures distinct, slightly if at all depressed; wall smooth; aperture somewhat longer than broad, in the adult near the periphery. Length 0.25–0.30 mm; breadth 0.15–0.20 mm; thickness 0.12–0.15 mm.—Cushman and Ellisor.

Rare specimens of this species, described from the subsurface Anahuac formation of Ellisor in Texas, occur in the four Rankin County sections.

Family CHILOSTOMELLIDAE

Genus Pullenia Parker and Jones, 1862

Pullenia alazanensis Cushman

Plate 6, figure 11

Pullenia alazanensis Cushman, Jour. Paleontology, vol. 1, p. 168, pl. 26, figs. 14, 15, 1927.

Cushman and Todd, Cushman Lab. Foram, Research Contr., vol. 19, p. 13, pl. 2, fig. 14, 1943.

Test compressed, periphery rounded, slightly lobulate; chambers 5 in the last-formed whorl; sutures curved, very slightly depressed; wall smooth, polished; aperture in unbroken last chamber not observed. Diameter 0.37 mm, thickness 0.20 mm.

This species is very rare, and was found in only four samples. The specimens seem to be identical with specimens from the Oligocene Alazan clays of Mexico.

Family GLOBIGERINIDAE

Genus Globigerina D'Orbigny, 1826

Globigerina sp. A

Plate 6, figure 9

Test trochoid, compressed, spire low, umbilicus large and deep, periphery deeply indented; chambers globular, very rapidly increasing in size as added, 4 or 5 in the last whorl; sutures deeply incised; wall thin, finely perforate, thickly set with fine spines; aperture large, an arched opening from the last-formed chamber into the umbilicus, surrounded by a narrow lip, in some specimens the previous one or two apertures also visible. Diameter up to 0.45 mm, commonly about 0.35 mm, thickness up to 0.25 mm.

Specimens of this form were found commonly to abundantly in every sample studied; yet I have hesitated to describe it formally because of its great range of variation and lack of distinctive features.

It somewhat resembles topotypes of *G. spirata* Bornemann, from the Septaria clays of Hermsdorf, Germany, but is a less compact form with the chambers more nearly spherical. It differs from *G. ouachitaensis* Howe and Wallace, from the upper Eocene of Louisiana, in having the chambers rapidly increasing in size, and it differs from *G. danvillensis* Howe and Wallace, from the same locality, in its large aperture.

Globigerina sp. B

Plate 6, figure 7

Test subglobular, compact, periphery only slightly indented, spire small, not elevated, umbilicus small, obscured by overhanging edge of last-formed chamber; chambers very rapidly increasing in size, much embracing so that the last chamber comprises about one-third of test; sutures distinct, incised; wall thick, densely covered with a fine cancellated pattern, aperture a small, rimmed, arched opening into the umbilicus from the last-formed chamber. Diameter up to 0.45 mm, thickness up to 0.35 mm.

This species occurs commonly in all the sections but is less abundant than *G.* sp. A. The two forms are easily distinguished by their surface ornamentation and shape of test.

Family ANOMALINIDAE

Genus Anomalina D'Orbigny, 1826

Anomalina bilateralis Cushman

Plate 6, figure 12

Anomalina bilateralis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 97, pl. 21, figs. 1, 2, 1922; Prof. Paper 129–F, p. 137, 1922; Prof. Paper 133, p. 42, 1923.
Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.
Cole and Ponton, Florida Geol. Survey Bull. 5, p. 46, pl. 10, figs. 8, 9, 1930.
Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 4, figs. 7, 9, 1933.
Cushman, U. S. Geol. Survey Prof. Paper 181, p. 50, pl. 21, figs. 4, 5, 1935.
Bermúdez, Soc. cubana hist. nat. Mem., vol. 11, p. 339, 1937.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 98, 1942.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197–B, p. 75, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 103, pl. 16, figs. 14, 15, 1945.
van Bellen, Geol. Stichting Mededeel., ser. C–V, no. 4, p. 73, pl. 10, figs. 16–18, 1946.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 10 (list), 1948.

Test of about four coils, bilateral or nearly so, composed of numerous chambers, ten or more in the last-formed whorl, umbilical region on both sides with a knob of clear shell material, more pronounced on the dorsal side, chambers smooth but coarsely punctate, more coarsely so on the ventral side, sutures broad and somewhat limbate with clear shell material; aperture a narrow curved opening at the base of the final chamber. Diameter 1 mm or less.—Cushman.

This species, described from the Byram formation, occurs in scattered samples.

Genus Cibicides Montfort, 1808

Cibicides mississippiensis (Cushman) Ellisor

Plate 6, figure 13

Anomalina mississippiensis Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 98, pl. 21, figs. 6–8, 1922; Prof. Paper 129–F, p. 137, 1922; Prof. Paper 133, p. 42, 1923.
Howe, Jour. Paleontology, vol. 2, p. 174 (list), 1928.
Cole and Ponton, Florida Geol. Survey Bull. 5, p. 46, pl. 9, figs. 2, 3, 1930.
van Bellen, Geol. Stichting Mededeel., ser. C–V, no. 4, p. 76, pl. 11, figs. 10–12, 1946.
Cibicides mississippiensis Ellisor, Am. Assoc. Petrol. Geologists Bull., vol. 17, no. 11, pl. 5, figs. 6, 7, 1933.
Cushman, U. S. Geol. Survey Prof. Paper 181, p. 54, pl. 22, fig. 3, 1935.
Cushman and McGlamery, idem, Prof. Paper 197–B, p. 75, pl. 7, fig. 14, 1942.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 101, pl. 10, fig. 7, 1942.
Howe, Jour. Paleontology, vol. 16, p. 267 (list), 1942.
Applin and Jordan, idem, vol. 19, p. 130 (list), 1945.
Cushman and Herrick, Cushman Lab. Foram. Research Contr., vol. 21, p. 72, 1945.
Cushman, idem, Special Pub. 16, p. 39, pl. 8, figs. 5, 6, 1946.
Cushman and Todd, idem, Contr., vol. 22, p. 102, 1946.
Cushman, U. S. Geol. Survey Prof. Paper 210–A, p. 13, 1946.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 24, p. 10 (list), 1948.

Test planoconvex or with dorsal side slightly concave; periphery blunt, slightly lobulated; chambers few, distinct, 6 to 8 in the last-formed whorl, rapidly increasing in size, thickness, and inflation as added, the last two or three chambers with their inner margins on the dorsal side slightly above the general surface; sutures distinct, limbate and strongly curved on the dorsal side, curved, but less so, on the ventral side, early ventral sutures limbate, later ones narrow and incised; wall smooth, finely perforate; aperture a low, arched opening at the periphery under the edge of the last chamber and extending dorsally to the umbilicus. Length 0.35 to 0.40 mm, breadth 0.27 to 0.33 mm, thickness 0.18 to 0.24 mm.

This is one of the most abundant species in this material, and was found in every sample. It was described from the Byram formation and is widely recorded in the upper Eocene and Oligocene of the southeastern United States.

Cibicides choctawensis Cushman and McGlamery

Plate 6, figure 10

Cibicides choctawensis Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189–D, p. 111, pl. 28, fig. 6, 1938.
Galloway and Hemingway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Is., vol. 3, pt. 4, p. 391, pl. 23, fig. 1, 1941.
Truncatulina americana Cushman (not Cushman, 1918), U. S. Geol. Survey Prof. Paper 129–E, p. 97, pl. 20, figs. 7, 8, 1922; Prof. Paper 133, p. 41, 1923.

Test planoconvex, dorsal side flattened and somewhat evolute, the ventral side convex and involute, periphery subacute; chambers distinct, very slightly inflated, about 10 in the final whorl, low and broad, of uniform shape, increasing very gradually in size as added; sutures distinct, limbate, strongly curved; wall smooth, finely perforate; aperture a low, arched opening at the periphery and extending over onto the dorsal side below a slightly extended lip of the last-formed chamber. Diameter 0.30–0.35 mm, thickness 0.12 mm.—Cushman and McGlamery.

This species is only slightly less abundant than *C. mississippiensis* (Cushman) and occurs throughout all the sections. It was described from the Chickasawhay limestone at Choctaw Bluff, Ala., and has been recorded from the upper Oligocene Cibao formation of Porto Rico.

It seems to have been confused with *Cibicides americanus* (Cushman) but is a flatter, more circular form. Another closely related form is *C. concentricus* (Cushman) var. *texana* Cushman and Ellisor, from the subsurface Anahuac formation of Ellisor in Texas, but that is an even more strongly compressed form with the ventral side more distinctly evolute.

Cibicides hazzardi Ellis

Plate 6, figure 14

Cibicides hazzardi Ellis, Jour. Paleontology, vol. 13, p. 424, pl. 48, figs. 8, 9, 1939.

Test nearly plano-convex, dorsal side nearly flat, ventral side convex, periphery rounded, distinct ventral umbo; chambers

distinct, gradually increasing in size as added, last few distinctly inflated ventrally, about ten in the final whorl, on the dorsal side the inner ends having 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 distinct, curved, limbate, flush except those joining the last few chambers, which on the ventral side are thin and slightly depressed; wall smooth, with numerous coarse punctations; aperture a low arched opening at the periphery below a slightly extended lip at the base of the last-formed chamber.—Ellis.

Diameter 0.37 to 0.41 mm, thickness 0.16 to 0.19 mm.

Fairly abundant specimens in the Mint Spring Bayou section have been compared with metatypes of this species, described from the Chickasawhay limestone near Waynesboro, Miss., and seem to be included within the range of variation of this species. Generally, part of the earlier whorls are visible through the large ventral umbo of clear shell material.

Cibicides lobatulus (Walker and Jacob) Cushman

Plate 6, figure 19

"Nautilus spiralis lobatus, etc." Walker and Boys, Testacea minuta, p. 20, pl. 3, fig. 71, 1784.

"Hammoniae tuberculatae, etc." Soldani, Testaceographia, vol. 1, pt. 1, p. 58, pl. 45, figs. *ii, kk, ll, mm*, 1789.

Nautilus lobatulus Walker and Jacob, Adams Essays, Kanmacher's ed., p. 642, pl. 14, fig. 36, 1798.

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Truncatulina lobatula D'Orbigny, in Barker-Webb and Berthelot, Histoire naturelle des Iles Canaries, vol. 2, pt. 2, "Foraminifères," p. 134, pl. 2, figs. 22–24, 1839; Foraminifères fossiles du bassin tertiaire de Vienne, p. 168, pl. 9, figs. 18–23, 1846.

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Planorbulina farcta Fichtel and Moll var. (*Truncatulina*) *lobatula* Parker and Jones, Philosophical Trans., vol. 155, p. 368, pl. 14, figs. 3–6; pl. 16, figs. 18–20, 1865.

Planorbulina lobatula Goës, K. svenska vetensk. akad. Handl., vol. 25, no. 9, p. 88, pl. 15, fig. 774, 1894.

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Cushman and Gray, idem, Special Pub. 19, p. 45, pl. 8, fig. 14, 1946.

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Cushman, idem, Special Pub. 23, p. 78, pl. 8, fig. 14, 1948.

Test large, planoconvex or with dorsal side concave or irregular owing to attachment to an irregular object; periphery acute but commonly not keeled, generally lobulated but with great range in degree; chambers distinct, slightly inflated ventrally, about 8 in the last-formed whorl, later ones of many specimens of irregular shape; sutures rather indistinct except the later ones that are slightly incised on both dorsal and ventral sides, spiral suture generally distinct and incised, suture pattern varying from straight and radial to sinuous owing to irregularity of the test; wall thin, coarsely

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perforate, smooth; aperture a low slit extending from the periphery over onto the dorsal side under the edge of the last-formed chamber, with a slight rim. Diameter up to 0.70 mm or more, thickness about 0.25 mm.

Cibicides lobatulus is one of the most abundant species, and was found in nearly every sample. This extremely varied species is widely distributed geographically and known through the Tertiary and the Recent.

Cibicides lobatulus (Walker and Jacob) Cushman var.

Plate 6, figure 17

Cibicides vicksburgensis Cushman and Todd (not "*Rotalia vicksburgensis* Cushman"), Cushman Lab. Foram. Research Contr., vol. 22, p. 102, pl. 16, figs. 30–32, 1946.

Variety differing from the typical form in its more regular shape, without inflated chambers or depressed sutures, and its proportionally thicker test.

Specimens from all the sections closely resemble *C. lobatulus* (Walker and Jacob) but seem to be distinguishable by the features noted above.

Similar specimens in the Byram formation were called "*Cibicides vicksburgensis* (Cushman)" by Cushman and Todd, referring in error to "*Rotalia vicksburgensis*", which is a *Gyroidina*. There is a *Cibicides vicksburgensis* (Cushman), originally called "*Anomalina vicksburgensis*" (Cushman, 1922, p. 137, pl. 35, figs. 5, 6), but it is not the same as the Byram species, as that is a much smaller species with a clear mass of shell material at the umbilicus on the ventral side.

Cibicides pseudoungerianus (Cushman) Cole and Gillespie

Plate 6, figure 15

Truncatulina pseudoungeriana Cushman, U. S. Geol. Survey Prof. Paper 129–E, p. 97, pl. 20, fig. 9, 1922; Prof. Paper 129–F, p. 136, 1922; Prof. Paper 133, p. 40, 1923.

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Cushman and Todd, Cushman Lab. Foram. Research Special Pub. 15, p. 70, pl. 12, fig. 7, 1945.

Truncatulina ungeriana H. B. Brady (not *Rotalina ungeriana* D'Orbigny), *Challenger* Rept., Zoology, vol. 9, p. 664, pl. 94, fig. 9, 1884.

Cushman, U. S. Nat. Museum Bull. 103, p. 69, pl. 24, fig. 1, 1918.

Test biconvex, almost equally so; periphery subacute, chambers nine to eleven in the last-formed whorl, those of the earlier whorls not showing on the dorsal side because they are hidden by the roughness of the surface, or on the ventral side because of the involute character; periphery lobulated; sutures distinct above in the last whorl and very distinct below, as the chambers are somewhat tumid on the ventral side; umbilical region filled nearly flush with the chambers by clear shell material, last few chambers on the dorsal side slightly above the surface on the inner margin; surface dorsally with coarse punctae, below smooth and more finely punctate; aperture at the periphery. Diameter 1 mm or less.—Cushman.

This species occurs in scattered samples in all but one of the sections. It was described from the Byram formation, and is very widely recorded throughout the Tertiary and the Recent.

Cibicides plano-convexus Cushman and Todd

Plate 6, figure 16

Cibicides plano-convexa Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 104, pl. 16, figs. 18, 19, 1945; vol. 22, p. 102, 1946.

Test plano-convex, dorsal side flattened or even slightly concave, ventral side strongly convex, periphery acute, slightly keeled; chambers distinct, 8 to 10 in the adult whorl, increasing very gradually in size as added, slightly inflated on the ventral side, periphery of the chambers with a distinct, broad keel; sutures distinct, strongly curved; wall coarsely perforate except the keeled periphery which is smooth; aperture at the periphery and extending over onto the dorsal side beneath keel of the inner margin of the last-formed chamber. Diameter 0.30–0.40 mm; thickness 0.15–0.18 mm.—Cushman and Todd.

This is a common species in all the sections. It is close to *C. pseudoungerianus* (Cushman) but differs in lacking the raised umbo of clear shell material on the ventral side. On the contrary, the umbo tends to be somewhat depressed, owing to the joining of the raised and limbate sutures around it. *C. plano-convexus* has previously been known from the upper Eocene Moodys Branch formation and the Oligocene Byram formation of Mississippi.

Family PLANORBULINIDAE

Genus Planorbulina D'Orbigny, 1826

Planorbulina mediterranensis D'Orbigny

Plate 6, figure 18

Planorbulina mediterranensis D'Orbigny, Annales sci. nat., vol. 7, p. 280, no. 2, pl. 5 (14), figs. 4–6; Modeles, no. 79, 1826; Foraminifères fossiles du bassin tertiaire de Vienne, p. 166, pl. 9, figs. 15–17, 1846.

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Planorbulinella larvata Cushman and Ellisor (not Parker and Jones), Jour. Paleontology, vol. 19, p. 572, pl. 78, fig. 10, 1945.

Test adherent, large and flat, composed of a single layer of chambers; dorsal surface smooth and conforming to the object to which the animal was attached, ventral surface evenly undulating, owing to the inflation of the individual chambers, periphery irregularly lobulate; chambers numerous, of approximately the same size, early ones indistinct, later ones added in an irregularly annular series, often irregularly overlapping on the ventral side; sutures deeply depressed on the ventral side, early dorsal sutures indistinct, later ones slightly depressed; wall thin, very coarsely perforate; apertures multiple, inconspicuous, one or more per chamber, at the junctions between chambers on the periphery, usually slightly rimmed. Diameter up to 1 mm or more, thickness about 0.20 mm.

This species is present throughout all the sections. It was described from the Mediterranean Sea and is known widely in Recent seas and throughout the Tertiary.

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29. *Pyrgo byramensis* Cushman and Todd. Cushman Coll. 47619. Sample 757–4. *a*, Front view; *b*, apertural view. × 50. (p. 10)

30. *Pyrgo monroei* Cushman and Todd. Cushman Coll. 47556. Sample 20. *a*, Front view; *b*, side view. × 50. (p. 10)

31. *Flintia laticoncava* Cushman. Cushman Coll. 47624. Sample 757–8. × 50. (p. 10)

32. *Cornuspira byramensis* Cushman. Cushman Coll. 47620. Sample 757–4. × 65. (p. 10)

33. *Triloculina architectura* Todd, n. sp. Cushman Coll. 47618. Sample 757–4. Holotype, *a*, side view; *b*, apertural view. × 50. (p. 10)

TEXTULARIIDAE, VERNEUILINIDAE, VALVULINIDAE,
MILIOLIDAE, OPTHALMIDIIDAE

PLATE 2

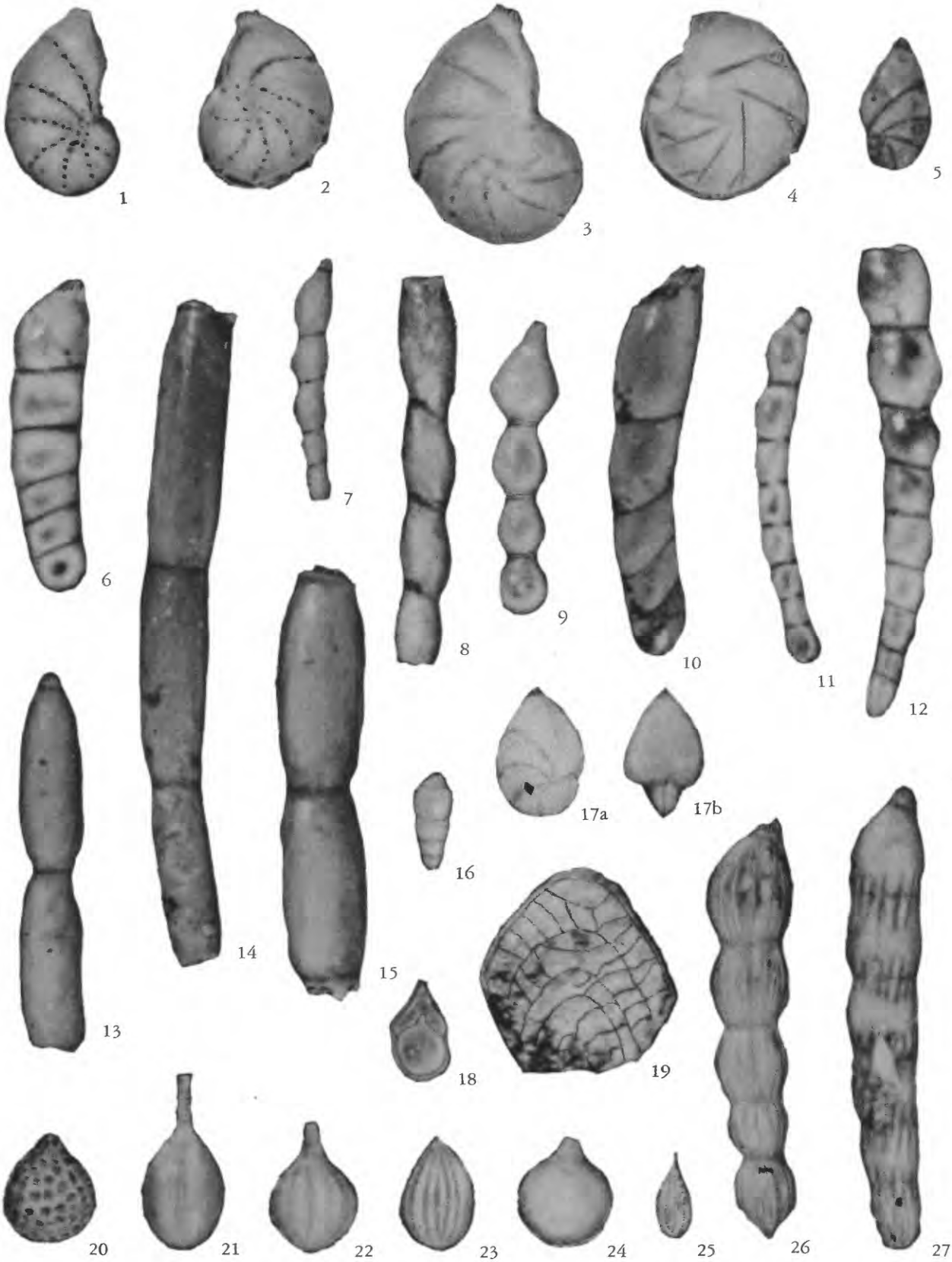
FIGURE 1, 2. *Robulus vicksburgensis* (Cushman) Ellisor. 1, Cushman Coll. 47621. Sample 757–4; 2, Cushman Coll. 47625. Sample 757–8. × 50. (p. 10)

3. *Robulus vicksburgensis* (Cushman) Ellisor var. *aperta* (Cushman) Todd. Cushman Coll. 47569. Sample 521–6. × 50. (p. 11)
4. *Robulus* cf. *R. alato-limbatus* (Gümbel) Howe and Wallace. Cushman Coll. 47570. Sample 521–6. × 50. (p. 11)
5. *Marginulina* sp. Cushman Coll. 47571. Sample 521–6. × 65. (p. 11)
6. *Dentalina monroei* Todd, n. sp. Cushman Coll. 47540. Sample 13. Holotype. × 65. (p. 12)
7. *Dentalina hantkeni* Cushman. Cushman Coll. 47649. Sample 662–4. × 65. (p. 12)
8. *Dentalina badenensis* D'Orbigny. Cushman Coll. 47541. Sample 13. × 50. (p. 12)
9. *Dentalina soluta* Reuss. Cushman Coll. 47650. Sample 662–4. × 65. (p. 13)
10. *Dentalina mesonensis* Cole and Gillespie. Cushman Coll. 47527. Sample 6. × 65. (p. 12)

11, 12. *Dentalina emaciata* Reuss. 11, Cushman Coll. 47572. Sample 521–6; 12, Cushman Coll. 47542. Sample 13. × 65. (p. 13)

13–15. *Chrysalogonium vicksburgense* Todd, n. sp. Sample 662–5. 13, Cushman Coll. 47658. Holotype, apertural end. × 65; 14, 15, Cushman Coll. 47659. Paratypes. × 50. (p. 13)

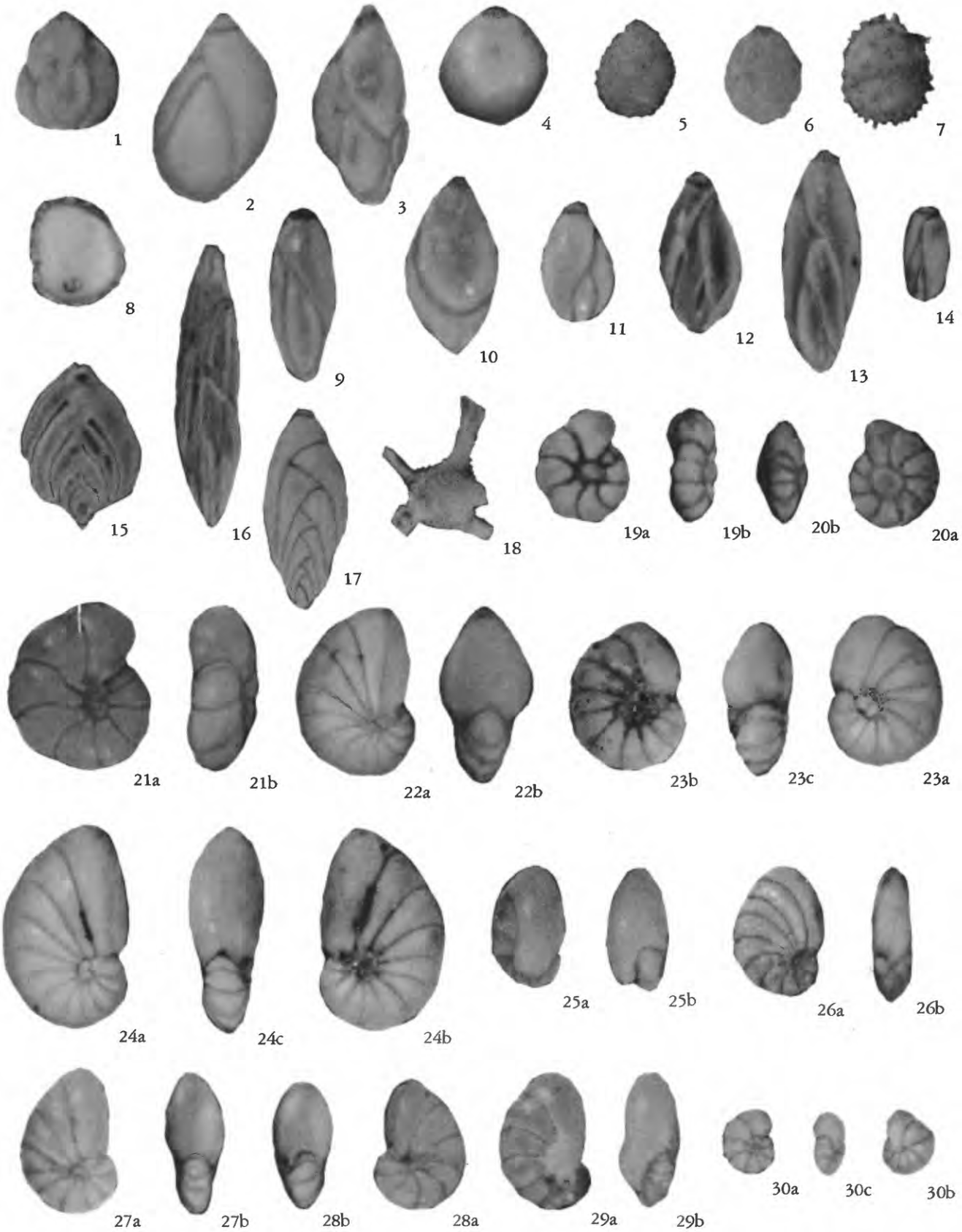
16. *Pseudoglandulina* sp. Cushman Coll. 47524. Sample 4. × 65. (p. 14)
17. *Saracenaria moresiana* Howe and Wallace. Cushman Coll. 47522. Sample 3. *a*, Oblique side view; *b*, edge view. × 50. (p. 14)
18. *Frondicularia garretti* Cushman, juv. Cushman Coll. 47573. Sample 521–6. × 65. (p. 14)
19. *Palmula caelata* (Cushman) Israelsky. Cushman Coll. 47641. Sample 757–16. × 65. (p. 14)
20. *Lagena hexagona* (Williamson) Siddall. Cushman Coll. 47543. Sample 13. × 65. (p. 16)
21. *Lagena substriata* Williamson. Cushman Coll. 47574. Sample 521–6. × 65. (p. 15)
22. *Lagena acuticosta* Reuss. Cushman Coll. 47560. Sample 521–1. × 65. (p. 16)
23. *Lagena costata* (Williamson) Reuss. Cushman Coll. 47692. Sample 545–2. × 65. (p. 15)
24. *Lagena cookei* Cushman. Cushman Coll. 47599. Sample 521–15. × 65. (p. 16)
25. *Lagena striatopunctata* Parker and Jones. Cushman Coll. 47602. Sample 757–2a. × 65. (p. 16)
26. *Dentalina praecatesbyi* (Cushman and Todd) Cushman and Todd. Cushman Coll. 47548. Sample 15. × 30. (p. 13)
27. *Dentalina pseudoinvolvens* Cushman and McGlamery. Cushman Coll. 47523. Sample 4. × 65. (p. 13)



LAGENIDAE

PLATE 3

FIGURE. 1. *Guttulina byramensis* (Cushman) Howe. Cushman Coll. 47660. Sample 662–5. × 50. (p. 16)
2. *Guttulina problema* D'Orbigny. Cushman Coll. 47563. Sample 521–4. × 50. (p. 17)
3. *Guttulina spicaeformis* (Roemer) Cushman and Ozawa var. *australis* (D'Orbigny) Cushman and Ozawa. Cushman Coll. 47549. Sample 15. × 50. (p. 17)
4. *Globulina gibba* D'Orbigny. Cushman Coll. 47661. Sample 662–5. × 30. (p. 17)
5. *Globulina gibba* D'Orbigny var. *punctata* D'Orbigny. Cushman Coll. 47626. Sample 757–8. × 50. (p. 17)
6. *Globulina gibba* D'Orbigny var. *striata* Egger. Cushman Coll. 47519. Sample 2. × 50. (p. 18)
7. *Globulina alabamensis* Cushman and McGlamery. Cushman Coll. 47662. Sample 662–5. × 30. (p. 18)
8. *Globulina fimbriata* Cushman and McGlamery. Cushman Coll. 47588. Sample 521–14. × 65. (p. 18)
9. *Pyrulina albatrossi* Cushman and Ozawa. Cushman Coll. 47544. Sample 13. × 50. (p. 18)
10. *Pyrulina aequalis* Todd, n. sp. Cushman Coll. 47663. Sample 662–5. Holotype. × 50. (p. 19)
11. *Sigmomorphina semitecta* (Reuss) Cushman and Ozawavar. *terquemiana* (Fornasini) Cushman and Ozawa. Cushman Coll. 47651. Sample 662–4. × 50. (p. 19)
12. *Sigmomorphina undulosa* (Terquem) Cushman and Ozawa. Cushman Coll. 47604. Sample 757–2a. × 65. (p. 19)
13. *Sigmomorphina pulchra* Todd, n. sp. Cushman Coll. 47664. Sample 662–5. Holotype. × 50. (p. 20)
14. *Sigmomorphina* cf. *S. williamsoni* (Terquem) Cushman and Ozawa. Cushman Coll. 47627. Sample 757–8. × 65. (p. 20)
15. *Polymorphina frondea* (Cushman) Cushman. Cushman Coll. 47666. Sample 662–5. × 65. (p. 20)
16. *Pseudopolymorphina rutila* (Cushman) Cushman and Ozawa. Cushman Coll. 47603. Sample 757–2a. × 65. (p. 19)
17. *Polymorphina advena* Cushman. Cushman Coll. 47665. Sample 662–5. × 65 (p. 20)
18. *Ramulina globulifera* H. B. Brady. Cushman Coll. 47642. Sample 757–16. × 50. (p. 21)
19. *Nonion decoratum* Cushman and McGlamery. Cushman Coll. 47685. Sample 662–13. *a*, Side view; *b*, peripheral view. × 65. (p. 21)
20. *Nonion advenum* (Cushman) Howe. Cushman Coll. 47553. Sample 18. *a*, Side view; *b*, peripheral view. × 65. (p. 21)
21. *Nonion vicksburgense* Todd, n. sp. Cushman Coll. 47652. Sample 662–4. Holotype, *a*, side view; *b*, peripheral view. × 65. (p. 22)
22. *Nonion alabamense* Cushman and Todd. Cushman Coll. 47589. Sample 521–14. *a*, Side view; *b*, peripheral view. × 50.(p. 22)
23. *Nonionella hantkeni* (Cushman and Applin) Cushman var. *spissa* Cushman. Cushman Coll. 47590. Sample 521–14. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 50. (p. 22)
24. *Nonionella hantkeni* (Cushman and Applin) Cushman var. *byramensis* Cushman and Todd. Cushman Coll. 47591. Sample521–14. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 50. (p. 23)
25. *Nonionella jacksonensis* Cushman. Cushman Coll. 47628. Sample 757–8. *a*, Ventral view; *b*, peripheral view. × 65. (p. 23)
26. *Nonionella jacksonensis* Cushman var. *compressa* Cushman and Todd. Cushman Coll. 47561. Sample 521–1. *a*, Dorsal view; *b*, peripheral view. × 65. (p. 23)
27. *Nonionella oligocenica* Cushman and McGlamery. Cushman Coll. 47668. Sample 662–5. *a*, Dorsal view; *b*, peripheral view. × 65. (p. 24)
28. *Nonionella pauciloba* Cushman. Cushman Coll. 47667. Sample 662–5. *a*, Dorsal view; *b*, peripheral view. × 65. (p. 23)
29. *Nonionella tatumi* Howe. Cushman Coll. 47669. Sample 662–5. *a*, Ventral view; *b*, peripheral view. × 65. (p. 24)
30. *Nonionella minutissima* Todd, n. sp. Cushman Coll. 47612. Sample 757–2b. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 24)



POLYMORPHINIDAE, NONIONIDAE

PLATE 4

FIGURE 1. *Gümbelina cubensis* Palmer. Cushman Coll. 47592. Sample 521–14. × 65. (p. 24)
2. *Bolivinella subpectinata* Cushman. Cushman Coll. 47535. Sample 11b. × 65. (p. 25)
3. *Bolivinella vicksburgensis* Howe. Cushman Coll. 47536. Sample 11b. × 65. (p. 25)
4. *Amphimorphina* sp. Cushman Coll. 47564. Sample 521–4. × 65. (p. 25)
5. *Buliminella obtusata* Cushman. Cushman Coll. 47622. Sample 757–4. × 65. (p. 25)
6. *Buliminella madagascariensis* (D'Orbigny) Cushman and Parker var. *spicata* Cushman and Parker. Cushman Coll. 45747. Sample 14. × 65. (p. 25)
7. *Buliminella robertsi* (Howe and Ellis) Martin. Cushman Coll. 47528. Sample 9. × 65. (p. 26)
8. *Robertina angusta* (Cushman) Cushman and Parker. Cushman Coll. 47557. Sample 20. × 65. (p. 26)
9–11. *Bulimina ovata* D'Orbigny var. *primitiva* Todd, n. var. Sample 4. 9, Cushman Coll. 47525. Holotype, *a*, front view; *b*, apertural view; 10, 11, Cushman Coll. 47526. Paratypes. × 65. (p. 26)
12. *Bulimina byramensis* Cushman and Todd. Cushman Coll. 47600. Sample 521–15. × 65. (p. 26)
13. *Bulimina* sp. Cushman Coll. 47682. Sample 662–9. × 65. (p. 27)
14. *Entosolenia mississippiensis* Todd, n. sp. Cushman Coll. 47670. Sample 662–5. Holotype, *a*, front view; *b*, apertural view. × 65. (p. 27)
15. *Entosolenia crumenata* Cushman. Cushman Coll. 47653. Sample 662–4. *a*, Front view; *b*, apertural view. × 65. (p. 27)
16. *Entosolenia laevigata* (Reuss) Cushman and McGlamery? Cushman Coll. 47633. Sample 757–12. × 65. (p. 27)
17. *Entosolenia byramensis* (Cushman) Todd. Cushman Coll. 47565. Sample 521–4. × 65. (p. 27)
18, 19. *Entosolenia orbignyana* (Seguenza) H. B. Brady var. *flintii* (Cushman) Howe. Cushman Coll. 47575. Sample 521–6. × 65. (p.27)
20, 21. *Virgulina vicksburgensis* Cushman. Cushman Coll. 47593. Sample 521–14. × 65. (p. 28)
22. *Bolivina byramensis* Cushman. Cushman Coll. 47683. Sample 662–11. × 65. (p. 28)
23. *Bolivina mississippiensis* Cushman. Cushman Coll. 47582. Sample 521–12. × 65. (p. 28)
24. *Bolivina costifera* Cushman. Cushman Coll. 47671. Sample 662–5. × 65. (p. 29)
25. *Bolivina choctawensis* Cushman and McGlamery. Cushman Coll. 47672. Sample 662–5. × 65. (p. 29)
26. *Bolivina cookei* Cushman. Cushman Coll. 47576. Sample 521–6. × 65. (p. 29)
27. *Bolivina mexicana* Cushman. Cushman Coll. 47554. Sample 18. × 65. (p. 29)
28, 29. *Bolivina quadricosta* Cushman and McGlamery. 28, Cushman Coll. 47566. Sample 521–4; 29, Cushman Coll. 47581. Sample 521–10. × 65. (p. 30)
30. *Bolivina mornhinvegi* Cushman. Cushman Coll. 47551. Sample 17. × 65. (p. 30)
31. *Loxostomum vicksburgense* (Howe) Cushman. Cushman Coll. 47594. Sample 521–14. × 65. (p. 30)
32. *Loxostomum hiwanneense* Howe. Cushman Coll. 47605. Sample 757–2a. × 65. (p. 30)
33. *Loxostomum delicatum* Cushman. Cushman Coll. 47643. Sample 757–16. × 65. (p. 31)
34. *Bifarina vicksburgensis* (Cushman) Cushman. Cushman Coll. 47684. Sample 662–11. × 65. (p. 31)
35. *Bolivina tortuosa* H. B. Brady. Cushman Coll. 47686. Sample 662–13. × 65. (p. 30)
36. *Bitubulogenerina hiwanneensis* Howe. Cushman Coll. 47636. Sample 757–15. × 65. (p. 32)
37. *Bitubulogenerina aperta* (Cushman) Howe. Cushman Coll. 47635. Sample 757–15. × 65. (p. 31)
38. *Bitubulogenerina howei* Cushman. Cushman Coll. 47606. Sample 757–2a. × 65. (p. 32)
39. *Tubulogenerina vicksburgensis* Howe. Cushman Coll. 47583. Sample 521–13. × 65. (p. 32)
40. *Reussella byramensis* Cushman and Todd. Cushman Coll. 47629. Sample 757–8. × 65. (p. 32)
41. *Reussella oligocenica* Cushman and Todd. Cushman Coll. 47630. Sample 757–8. × 65. (p. 32)
42. *Uvigerina* sp. Cushman Coll. 47607. Sample 757–2a. × 65. (p. 33)
43–46. *Angulogerina byramensis* (Cushman) Ellisor. 43, 44, Cushman Coll. 47637. Sample 757–15; 45, 46, Cushman Coll. 47608. Sample 757–2a. × 65. (p. 33)
47, 48. *Uvigerina vicksburgensis* Cushman and Ellisor. Cushman Coll. 47654. Sample 662–4. × 50. (p. 33)
49. *Angulogerina byramensis* (Cushman) Ellisor var. *fera* Todd, n. var. Cushman Coll. 47609. Sample 757–2a. Holotype, *a*, side view; *b*, apertural view. × 65. (p. 33)
50. *Angulogerina byramensis* (Cushman) Ellisor var. *anfracta* Todd, n. var. Cushman Coll. 47584. Sample 521–13. Holotype, *a*, side view; *b*, apertural view. × 65. (p. 34)
51. *Angulogerina hispidula* Cushman and McGlamery. Cushman Coll. 47638. Sample 757–15. × 65. (p. 34)
52. *Angulogerina rugoplicata* Cushman. Cushman Coll. 47595. Sample 521–14. × 65. (p. 34)
53. *Angulogerina vicksburgensis* Cushman. Cushman Coll. 47644. Sample 757–16. × 65. (p. 34)

HETEROHELICIDAE, BULIMINIDAE

PLATE 5

FIGURE 1. *Spirillina vicksburgensis* Cushman. Cushman Coll. 47552. Sample 17. × 65. (p. 34)

2. *Spirillina subdecorata* Cushman. Cushman Coll. 47537. Sample 11b. × 65. (p. 35)

3. *Patellina advena* Cushman. Cushman Coll. 47538. Sample 11b. × 65. (p. 35)

4. *Discorbis tentoria* Todd, n. sp. Cushman Coll. 47596. Sample 521–14. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 35)

5. *Discorbis alabamensis* Cushman. Cushman Coll. 47639. Sample 757–15. *a*, Dorsal view; *b*, ventral view. × 65. (p. 36)

6. *Discorbis arcuato-costata* Cushman. Cushman Coll. 47645. Sample 757–16. *a*, Dorsal view; *b*, ventral view. × 65. (p. 35)

7. *Discorbis subaraucana* Cushman. Cushman Coll. 47597. Sample 521–14. *a*, Dorsal view; *b*, ventral view. × 65. (p. 36)

8. *Discorbis farishi* Cushman and Ellisor. Cushman Coll. 47693. Sample 545–5. *a*, Dorsal view; *b*, ventral view. × 65. (p. 36)

9. *Discorbis subglobosa* Cushman. Cushman Coll. 47631. Sample 757–8. × 65. (p. 35)

10. *Discorbis byramensis* Cushman. Cushman Coll. 47632. Sample 757–8. *a*, Dorsal view; *b*, ventral view. × 65. (p. 36)

11. *Heronallenia vicksburgensis* Cushman. Cushman Coll. 47567. Sample 521–4. *a*, Dorsal view; *b*, ventral view. × 65. (p. 37)

12. *Baggina xenoula* Hadley. Cushman Coll. 47577. Sample 521–6. *a*, Dorsal view; *b*, ventral view. × 65. (p. 41)

13. *Valvulineria sculpturata* Cushman. Cushman Coll. 47687. Sample 662–13. *a*, Dorsal view; *b*, peripheral view. × 65. (p. 38)

14. *Eponides vicksburgensis* Cushman and Ellisor. Cushman Coll. 47601. Sample 521–15. *a*, Dorsal view; *b*, ventral view. × 65. (p. 39)

15. *Eponides alabamensis* Cushman and McGlamery. Cushman Coll. 47688. Sample 662–13. *a*, Dorsal view; *b*, ventral. view. × 65. (p. 39)

16. *Eponides byramensis* (Cushman) Howe. Cushman Coll. 47676. Sample 662–5. *a*, Dorsal view; *b*, ventral view. × 50. (p. 38)

17. *Gyroidina vicksburgensis* (Cushman) Howe. Cushman Coll. 47562. Sample 521–1. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 50. (p. 38)

18. *Gyroidina byramensis* Cushman and Todd. Cushman Coll. 47675. Sample 662–5. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 38)

19. *Lamarckina glabrata* (Cushman) Cushman. Cushman Coll. 47673. Sample 662–5. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 37)

20. *Lamarckina byramensis* Cushman and Todd. Cushman Coll. 47674. Sample 662–15. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 50. (p. 37)

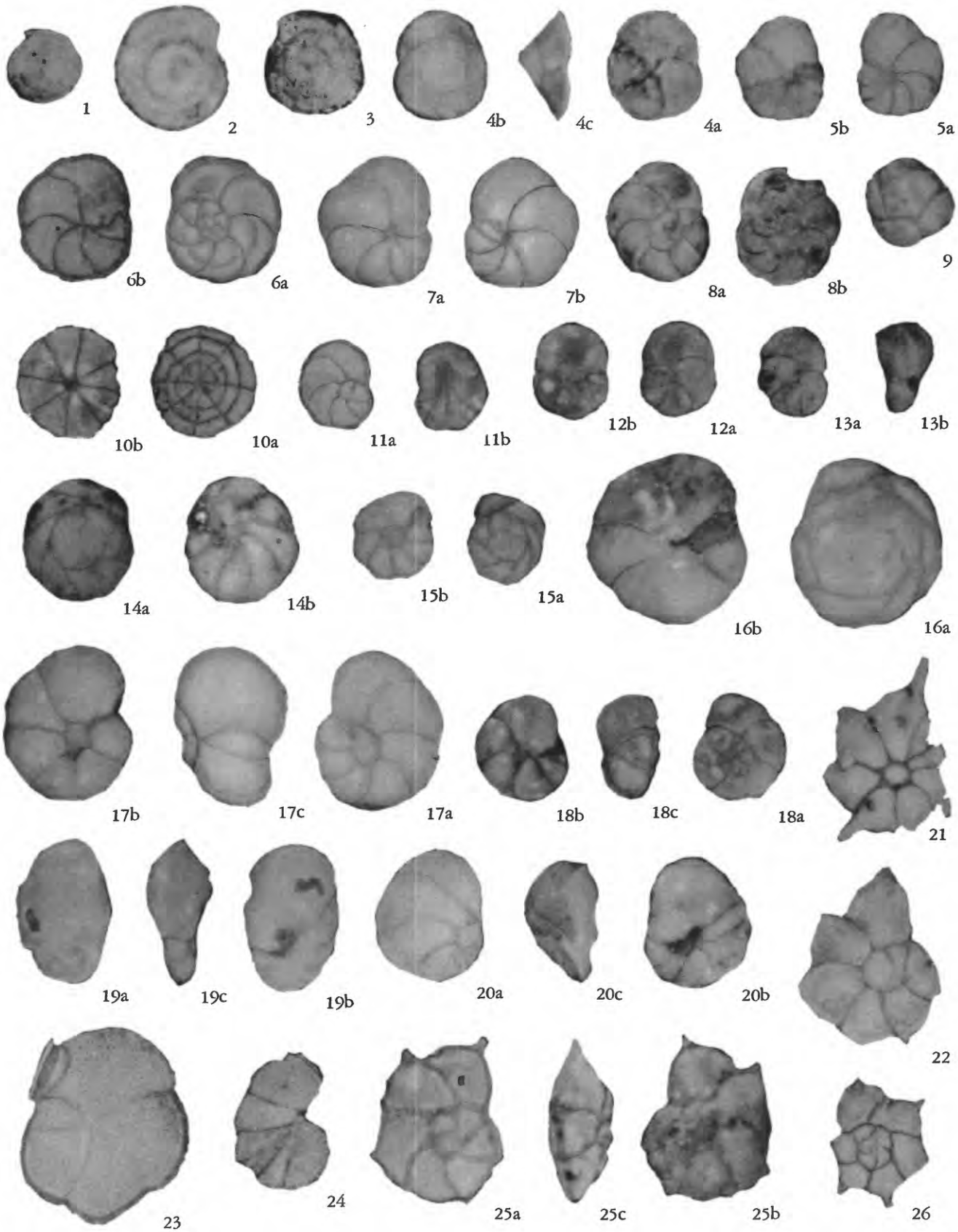
21, 22. *Rotalia byramensis* Cushman. Cushman Coll. 47598. Sample 521–14. 21, Ventral view. × 65; 22, Dorsal view. × 50. (p. 39)

23. *Siphonina advena* Cushman. Cushman Coll. 47655. Sample 662–4. Ventral view. × 65. (p. 40)

24. *Siphoninella byramensis* Cushman. Cushman Coll. 47677. Sample 662–5. Ventral view. × 65. (p. 41)

25. *Rotalia incisura* Todd, n. sp. Cushman Coll. 47558. Sample 20. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 39)

26. *Rotalia parva* Cushman. Cushman Coll. 47520. Sample 2. Dorsal view. × 65. (p. 40)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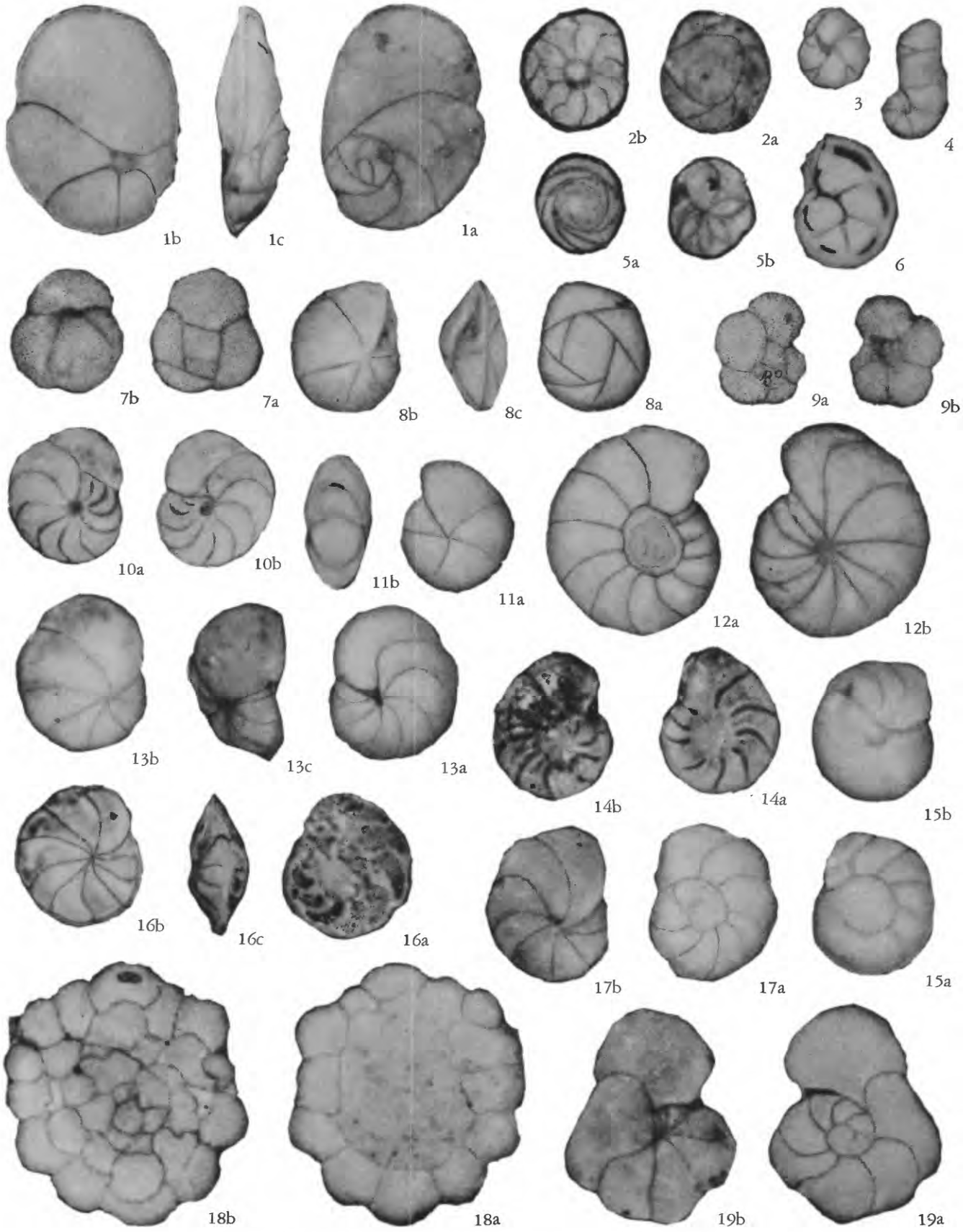
ROTALIIDAE

PLATE 6

FIGURE 1. *Cancris vicksburgensis* Todd, n. sp. Cushman Coll. 47579. Sample 521–8. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 41)

2. *Asterigerina subacuta* Cushman. Cushman Coll. 47559. Sample 20. *a*, Dorsal view; *b*, ventral view. × 65. (p. 42)
3. *Cassidulina moodysensis* Cushman and Todd. Cushman Coll. 47610. Sample 757–2a. Ventral view. × 65. (p. 43)
4. *Cassidulinoides compacta* Cushman and Ellisor. Cushman Coll. 47578. Sample 521–6. Dorsal view. × 65. (p. 43)
5. *Asterigerina bracteata* Cushman. Cushman Coll. 47678. Sample 662–5. *a*, Dorsal view; *b*, ventral view. × 65. (p. 42)
6. *Mississippina monsouri* Howe. Cushman Coll. 47640. Sample 757–15. Ventral view. × 65. (p. 40)
7. *Globigerina* sp. B. Cushman Coll. 47568. Sample 521–4. *a*. Dorsal view; *b*, ventral view. × 50. (p. 43)
8. *Alabamina mississippiensis* Todd, n. sp. Cushman Coll. 47646. Sample 757–16. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 42)
9. *Globigerina* sp. A. Cushman Coll. 47679. Sample 662–5. *a*, Dorsal view; *b*, ventral view. × 65. (p. 43)
10. *Cibicides choctawensis* Cushman and McGlamery. Cushman Coll. 47680. Sample 662–5. *a*, Dorsal view; *b*, ventral view. × 65. (p. 44)
11. *Pullenia alazanensis* Cushman. Cushman Coll. 47648. Sample 662–2. *a*, Side view; *b*, peripheral view. × 65. (p. 43)
12. *Anomalina bilateralis* Cushman. Cushman Coll. 47656. Sample 662–4. *a*, Dorsal view; *b*, ventral view. × 65. (p. 44)
13. *Cibicides mississippiensis* (Cushman) Ellisor. Cushman Coll. 47689. Sample 662–13. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 44)
14. *Cibicides hazzardi* Ellis. Cushman Coll. 47539. Sample 11b. *a*, Dorsal view; *b*, ventral view. × 65. (p. 44)
15. *Cibicides pseudoungerianus* (Cushman) Cole and Gillespie. Cushman Coll. 47647. Sample 757–16. *a*, Dorsal view; *b*, ventral view. × 65. (p. 46)
16. *Cibicides plano-convexus* Cushman and Todd. Cushman Coll. 47691. Sample 662–13. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 65. (p. 46)
17. *Cibicides lobatulus* (Walker and Jacob) Cushman var. Cushman Coll. 47580. Sample 521–9. *a*, Dorsal view; *b*, ventral view. × 65. (p. 46)
18. *Planorbulina mediterranensis* D'Orbigny. Cushman Coll. 47657. Sample 662–4. *a*, Dorsal view; *b*, ventral view. × 65. (p. 46)
19. *Cibicides lobatulus* (Walker and Jacob) Cushman. Cushman Coll. 47690. Sample 662–13. *a*, Dorsal view; *b*, ventral view. × 65. (p. 45)



ROTALIIDAE, AMPHISTEGINIDAE, CASSIDULINIDAE,
CHILOSTOMELLIDAE, GLOBIGERINIDAE, ANOMALINIDAE, PLANORBULINIDAE