Paleocene Foraminifera of the Gulf Coastal Region of the United States and Adjacent Areas

By JOSEPH A. CUSHMAN

GEOLOGICAL SURVEY PROFESSIONAL PAPER 232

Descriptions and illustrations of smaller Foraminifera from the Gulf Coastal Region, Cuba, Central America, Haiti, and Trinidad

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1951

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price $1.75 (paper cover)

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PALEOCENE FORAMINIFERA OF THE GULF COASTAL REGION OF THE UNITED STATES AND ADJACENT AREAS

By JOSEPH A. CUSHMAN [1]

ABSTRACT

This paper describes and figures the Foraminifera from the Paleocene of the Gulf Coastal Plain of the United States. The collections are largely from Texas, Arkansas, Mississippi, Alabama, and Tennessee. Records from related areas of Trinidad, Cuba, Haiti, and Central America are also included. Many of the species are excellent index fossils for study of the Paleocene. About 280 species and varieties are recorded and nearly all are illustrated.

INTRODUCTION

Some controversy exists as to what fossil material should be included in the Paleocene. In this report, well samples from Florida have been left out where the distribution of the species indicates latest Cretaceous rather than Paleocene age. Likewise, outcrop samples were left out where late Cretaceous species of Foraminifera, evidently redeposited, were associated with megafossils that definitely indicate Paleocene age. In the situation of well samples where the only fossils present are Foraminifera the age relations may also be obscured by the presence of redeposited fossils. To make the fauna more nearly complete, records from the West Indies region and Central America have been included.

Although many of the species of Foraminifera in the Paleocene are found also in the Upper Cretaceous and numerous others extend upward into the Wilcox group of the Eocene, many species remain that are excellent index fossils for the Paleocene. Many of these are very striking in their characters and should not be confused with species from other series or formations.

The work by Mrs. Helen Jeanne Plummer "Foraminifera of the Midway formation in Texas" (Texas Univ. Bull 2644, 1926 (1927), pp. 1–206, pls. 1–15, text figs. 1–13, table) is the pioneer work on this group. Later papers have been published on the Paleocene of other regions which have added much to the original fauna and undoubtedly many more species will be found as work progresses in different regions.

Many members of the U. S. Geological Survey have very kindly collected material for this work and a number of others have helped much. Their names will be found in the list of localities given here. Also, the collections of Dr. W. H. Deaderick, bequeathed to the U. S. National Museum, have added much to the faunas from Arkansas.

I wish to express my thanks to the many persons who have collected material at my suggestion, to Dr. John B. Reeside, Jr., for his help as chief of the Paleontology and Stratigraphy Branch, and to Miss Ruth Todd for her careful work in helping to prepare material, typing, and in publishing several joint papers which have added to the known faunas.

LIST OF LOCALITIES [2]

ALABAMA

PORTERS CREEK FORMATION, MATTHEWS LANDING MARL MEMBER

1. Road cut on east slope to a branch in SW ¼ sec. 12, T. 11 N., R. 9 E., Wilcox County, Ala. F. S. MacNeil.
2. Road cut just south of Dixon Creek, sec. 23, T. 13 N., R. 6. E., Wilcox County, Ala. F. S. MacNeil.
3. Foot of hill on south slope to Wolf Creek, probably in SE¼NE¼ sec. 20, T. 11 N., R. 12 E., Butler County, Ala. F. S. MacNeil.
4. On Alabama Highway 96, 10.2 miles northeast of Kimbrough, Wilcox County, Ala. C. G. Lalicker.
5. On Alabama Highway 96, 9.2 miles northeast of Kimbrough, Wilcox County, Ala. C. G. Lalicker.
6. North part of sec. 12, T. 12 N., R. 6 E., at Matthews Landing, 9 miles west and 2 miles north of Camden, Wilcox County, Ala. C. G. Lalicker.
7. Naheola Landing on Tombigbee River, Choctaw County, Ala. T. W. Vaughan. U. S. G. S. 5647.

NAHEOLA FORMATION, COAL BLUFF MARL MEMBER

8. Creek bottom just west of the intersection of Caledonia, about ¼ mile south of the center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. F. S. MacNeil.

CLAYTON FORMATION, CHALYBEATE LIMESTONE MEMBER

9. Chalk overlying *Ostrea pulaskensis* zone, U. S. Highway 80, south of Sucarnoochee Creek, ½ mile southwest of Livingston, Sumter County, Ala. L. W. Stephenson and W. H. Monroe.

[1] This report was received March 2, 1949. The author died on April 16, 1949. Its editorial preparation for publication has involved no substantial changes from the text as left by the author.

[2] The localities are referred to by number in the individual descriptions and in the faunal tables.

CLAYTON FORMATION. (HORIZON=BASE OF PORTERS CREEK CLAY OF WESTERN ALA.)

10. Glauconite bed 1 to 1½ feet thick between hard limestone of the Clayton formation and overlying fullers earth. Old fullers earth mine, sec. 23, T. 10 N., R. 25 E., just east of Pratts, Barbour County, Ala. F. S. MacNeil.

CLAYTON FORMATION, PINE BARREN MEMBER. (NEAR TOP)

11. 130 feet above water level on road leading down to ferry at Old Canton Landing, Alabama River, Wilcox County, Ala. L. W. Stephenson and W. H. Monroe.
12. Top of fullers earth zone, immediately underlying *Turritella* rock, SE¼SE¼ sec. 18, T. 11 N., R. 14 E., Butler County, Ala. F. S. MacNeil.

TENNESSEE

PORTERS CREEK CLAY. (PROBABLY IN TIPPAH SAND LENTIL)

13. Cut on Southern Railway 200 feet east of milepost 481, 1½ miles east of Middleton, Hardeman County, Tenn. U. S. G. S. 6495.
14. Cut on Southern Railway 260 feet east of milepost 481, 1½ miles east of Middleton, Hardeman County, Tenn. L. W. Stephenson.

MISSISSIPPI

CLAYTON FORMATION, CHALYBEATE LIMESTONE MEMBER

15. Within 5 feet of top of Cretaceous, U. S. Highway 45, 2 miles north of Scooba, Kemper County, Miss. F. F. Mellen.
16. South valley wall of Lynn Creek, sec. 22, T. 16 N., R. 15 E., Noxubee County, Miss. E. H. Rainwater and F. F. Mellen.

PORTERS CREEK CLAY

17. Field, 1,200 feet east of M. & O. Railroad, 3 miles north of Scooba, Kemper County, Miss. U. S. G. S. 6493.

ARKANSAS

MIDWAY FORMATION, LOWER PART

18. North bank of McNeil Creek, SW¼NW¼NE¼ sec. 10, T. 2 S., R. 15 W., at the north edge of Benton, Saline County, Ark. M. Gordon. Midway loc. 14.
19. North bank of McNeil Creek, about 600 feet west of Highway 70, NW¼NE¼NE¼ sec. 10, T. 2 S., R. 15 W., Saline County, Ark. M. Gordon. Midway loc. 13.

19A. Ravine alongside lumber yard at Benton, Saline County, Ark. 100 feet north of the south line of the SE¼SW¼SW¼ sec. 11, T. 2 S., R. 15 W. Coll. first by R. A. Schmidt and J. A. Gardner. Additional material collected by M. Gordon and M. W. Ellis. Midway loc. 4.

20. West bank of Trace Creek, SE¼SW¼ sec. 30, T. 2 S., R. 15 W., Saline County, Ark. Coll. first by R. A. Schmidt and J. A. Gardner. Additional material collected by M. Gordon and M. W. Ellis. Midway loc. 7.
21. Bed of McNeil Creek 50 to 75 yards upstream from Highway 70, SE cor. sec. 3, T. 2 S., R. 15 W., Saline County, Ark. M. Gordon and J. I. Tracey. Midway loc. 10.
22. Clay from just below limestone ledge in gully on the south side of U. S. Highway 67, 1.9 miles beyond bridge over Salt Creek, in the SE¼NW¼ sec. 20, T. 2 S., R. 15 W., Saline County, Ark. R. P. Bryson, M. Gordon, M. W. Ellis, R. A. Schmidt, and J. A. Gardner. Midway loc. 5.
23. Upper bed on east bank of valley of Fourche Creek, about ½ mile north of Terryton, 2,000 feet east of U. S. Highway 67 and 70, sec. 8, T. 1 S., R. 13 W., Pulaski County, Ark. R. A. Schmidt and J. A. Gardner. Midway loc. 3.

MIDWAY FORMATION, UPPER PART

24. (Near base of upper part) Gully 400 to 500 feet south of NE cor. NW¼ sec. 16, T. 1 N., R. 12 W., 600 to 700 feet up gully from Midway loc. 1, southwest part of Little Rock, Pulaski County, Ark. M. W. Ellis. Midway loc. 15.
25. (Base of upper part) about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks in small gully heading east, just upstream from small abandoned bridge, NE¼NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Pulaski County, Ark. M. W. Ellis, R. A. Schmidt, and J. A. Gardner, Midway loc. 1.

MIDWAY FORMATION

26. Side of bank, north side of Highway 67, 8 miles southwest of Benton, Saline County, Ark. W. H. Deaderick. No. 324.
27. 200 yards southwest of Camp Marion on Highway 67 between Pulaski-Saline County line and Little Rock, turn southeast and go through field and over suspension bridge to Bluffon Creek, Pulaski County, Ark. W. H. Deaderick. No. 342.
28. (At Paleozoic contact, Polk Creek shale) Natural erosion on Highway 67 about a mile south of Collegeville just beyond large sign, west side of road, Pulaski County, Ark., W. H. Deaderick. No. 344.
29. Roadside ditch, southeast side of road, Highway 67, at Beirne Cross Road, 3.2 miles south of

Gurdon railroad station, Clark County, Ark. W. H. Deaderick. No. 363.

30. Roadside ditch, northwest side of road, Highway 67, at Beirne Cross Road, 3.2 miles south of Gurdon railroad station, Clark County, Ark. W. H. Deaderick. No. 387.

31. Roadside ditch, east side, Highway 67, 0.7 mile north of Curtis Cross Road, Clark County, Ark. W. H. Deaderick. No. 377.

WILLS POINT (?) FORMATION

32. Deep roadside ditch, southeast side of road, Highway 67, 3.5 miles northeast of railroad station in Gurdon, Clark County, Ark. W. H. Deaderick. No. 364.

TEXAS

WILLS POINT FORMATION

33. 1.9 miles north of Lockhart on road to Austin, Travis County, Tex. U. S. G. S. 10793.

34. Gully in jog in secondary road 4.6 miles west and a little north of Lockhart, Caldwell County, Tex. U. S. G. S. 10794.

35. Upper bed of Dry Brushy Creek, 6 miles south of Thrall, Williamson County, Tex. J. A. Gardner. U. S. G. S. 10796.

WILLS POINT FORMATION, MEXIA MEMBER

36. About 2 miles north and slightly west of center of Mexia, Limestone County, Tex. C. G. Lalicker.

KINCAID FORMATION

37. On west or downthrow side of fault, 2 miles northwest of Lone Oak, Hunt County, Tex. L. W. Stephenson. U. S. G. S. 10797.

38. 3+miles above bridge over Cedar Creek on Austin-Red Rock road, Bastrop County, Tex. U. S. G. S. 10786.

MIDWAY GROUP

39. Exposure in creek bed on northeast-southwest country road, 1.1 miles due east of Honest Ridge School, and 2.5 miles due north of the cross roads in Thelma, Limestone County, Tex. H. J. Plummer. Sta. 697.

40. Shallow ditch at road corner southeast of new Corsicana reservoir on road to Mildred, Navarro County, Tex. H. J. Plummer. Sta. 23.

41. Exposure in deep roadside ditch on steep hill 0.2 mile east of road corner in north end of town of Commerce, on highway to Paris, Hunt County, Tex. H. J. Plummer. Sta. 3.

42. Clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex. H. J. Plummer. Sta. 46.

43. Base of high bluff on west side of Colorado River between the Travis-Bastrop County line and the mouth of Dry Creek, Bastrop County, Tex. H. J. Plummer. Stas. 67 and 379.

44. 4.6 miles north of Fentress, Caldwell County, Tex. L. W. Stephenson.

45. Branch on the F. Goericke farm, across ford on Wilbarger Creek, 1½ miles south of Littig, Travis County, Tex. U. S. G. S. 10787.

46. 800 yards above bridge over Wilbarger Creek, near Travis County line, Tex. J. A. Gardner. U. S. G. S. 10788.

47. On road southwest corner of F. V. Hughes property, east Alvarado Survey, Van Zandt County, Tex.

48. On creek, west line W. W. Pitts property, east Alvarado Survey, Van Zandt County, Tex.

49. Dry Creek, 3¼ miles above bridge on first road east of Travis, Bastrop County, Tex. J. A. Gardner. U. S. G. S. 10795.

50. Butler salt dome, 1,000 feet southeast of Lakeport store, Freestone County, Tex. L. W. Stephenson. U. S. G. S. 10789.

51. Right bank of Solomon's Creek, about ¼ mile east of its junction with Wilbarger Creek, 5.8 miles by road south-southwest of railroad crossing south of Elgin, Bastrop County, Tex. H. J. Plummer. Sta. 11–T–3.

52. On south side of Foggyhead Creek in Smith's pasture and about 0.15 mile west of the bridge on the Kerens-Round Prairie road, 3.8 miles by road south-southeast of the railroad station in Kerens, Navarro County, Tex. H. J. Plummer. Sta. 174–T–6.

SYSTEMATIC DESCRIPTIONS

Family RHIZAMMINIDAE

Genus BATHYSIPHON M. Sars, 1872

Bathysiphon eocenicus Cushman and G. D. Hanna

Plate 1, figures 1, 2

Bathysiphon eocenica Cushman and G. D. Hanna, California Acad. Sci. Proc., 4th ser., vol. 16, p. 210, pl. 13, figs. 2, 3, 1927.

Cushman and McMasters, Jour. Paleontology, vol. 10, p. 508, pl. 74, fig. 1, 1936.

Staesche and Hiltermann, Reichs. Bodenforschung Abhandl., n. ser., No. 201, pl. 37, figs. 4, 5, 1940.

Cushman and Siegfus, San Diego Soc. Nat. History Trans., vol. 9. no. 34, p. 400, pl. 15, fig. 1, 1942.

Kelley, Am. Assoc. Petroleum Geologists Bull., vol. 27, p. 11 (list), 1943.

Curran, idem, pp. 1378, 1381 (lists), 1943.

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

Cushman and Simonson, Jour. Paleontology, vol. 18, p. 193, pl. 30, fig. 1, 1944.

Cushman and Stone, Cushman Lab. Foram. Research Special Pub. 20, p. 2, pl. 1, fig. 1, 1947.

Test elongate, compressed cylindrical; wall of fine white amorphous material, fairly smooth on the exterior; interior tubular chamber distinct. Diameter of crushed specimens 0.62–0.75 mm.; diameter of tubular chamber averaging about 0.25 mm.

This species is widely recorded in the Eocene of California and also recorded from the Eocene of Peru and the lower Eocene of northwest Germany.

The Paleocene specimens are very similar to the types of this species and are unlike Cretaceous species that may be found redeposited in the Paleocene at some localities.

Midway group. Texas, Navarro County (40); Limestone County (42).

Family AMMODISCIDAE

Genus AMMODISCUS Reuss, 1861

Ammodiscus cf. A. cretaceus (Reuss) Cushman

Plate 1, figure 3

Specimens were found only at station 42 and may possibly be reworked from Upper Cretaceous deposits. One of the specimens is figured.

The forms figured by Mrs. Plummer as "*Ammodiscus incertus* (D'Orbigny)" (Texas Univ. Bull. 2644, p. 63, pl. 13, figs. 1a-d, 1927) are probably the same as the forms here referred to *A.* cf. *A. cretaceus.*

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

Haplophragmoides cf. H. excavata Cushman and Waters

Single specimens from two localities seem to belong in this species and may represent material reworked from the Upper Cretaceous. They are, however, more compressed than the types.

The somewhat distorted specimen figured by Mrs. Plummer as "*Haplophragmoides canariensis* (D'Orbigny)" (Texas Univ. Bull. 2644, p. 65, pl. 3, figs. 1a, b, 1927) may possibly be the same as those here referred to *H.* cf. *H. excavata.*

Midway formation. Arkansas, Clark County (31).
Midway group. Texas, Limestone County (42).

Genus AMMOBACULITES Cushman, 1910

Ammobaculites expansus Plummer

Plate 1, figures 5–7

Ammobaculites expansus Plummer, Texas Univ. Bull. 3201, p. 65, pl. 5, figs. 4–6, 1933.

Test broadly elongate, very coarsely arenaceous and roughly finished, composed of angular quartz grains bound by a reddish and insoluble cement up to the apertural rim, which on many specimens is white; about the first 12 chambers arranged in a tight and very strongly compressed and slightly umbilicate coil of two convolutions; final two or three chambers arranged in rectilinear succession and also strongly compressed; sutures very obscure except between last two or three chambers of a fully mature test where they are somewhat depressed; aperture a narrow elongate opening at the end of the final chamber. Length of holotype 0.58 mm.; breadth 0.40 mm.; thickness of final chamber 0.06 mm.

Like [*A. midwayensis*] this is a characteristic species of the uppermost upper Midway of Texas and often the only species present.—Plummer.

The type specimens came from the Paleocene, from north bank of Solomon's creek 6½ miles south-southwest of Elgin, Bastrop County, Tex.

We have specimens of this species from the type locality, sent by Mrs. Plummer, but have found no specimens in our material.

Ammobaculites midwayensis Plummer

Plate 1, figures 8–12

Ammobaculites midwayensis Plummer, Texas Univ. Bull. 3201, p. 63, pl. 5, figs. 7–11, 1933.

Test elongate, slender, very coarsely arenaceous and roughly finished, composed of angular quartz grains bound by a reddish insoluble cement up to the last chamber which is conspicuously whiter than the rest of the test; early 5 to 7 chambers arranged in a tight, compressed coil of a little more than one convolution and with rounded periphery; succeeding chambers rectilinear, about as high as broad, and varying from uncompressed to considerably compressed; sutures visible and very slightly depressed on some tests, but in general obscure or even hidden by the texture of the wall; aperture terminal and round or somewhat elongate, depending on the degree of compression due to forces of fossilization of a somewhat plastic original test. Length of holotype 0.65 mm.; diameter of coil 0.20 mm.; width of rectilinear chambers 0.18 mm.—Plummer.

The types of this species are from the Paleocene, from north bank of Solomon's Creek near its junction with Wilbarger Creek, 6½ miles south-southwest of Elgin, Bastrop County, Tex.

This seems to be a characteristic species of the upper 50 to 75 feet of the Midway group in outcrops and makes a good index fossil for this part of the section in Texas.

Ammobaculites paleocenicus Cushman

Plate 1, figures 13, 14

Ammobaculites paleocenicus Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 77, 1947.

Ammobaculites midwayensis Cushman (not Plummer) idem, vol. 16, p. 52, pl. 9, figs. 1, 2, 1940.

Test in the early stages close-coiled, planispiral, in the adult uncoiling and the chambers in a rectilinear series; chambers distinct, inflated, 6 to 9 in the coiled portion, only 2 or 3 in the uncoiled part, later ones circular in section; sutures distinct, depressed; wall finely arenaceous with occasional larger fragments, rather smoothly finished; aperture somewhat arcuate, narrow, elongate. Length up to 2.70 mm.; breadth 1.65 mm.; thickness 0.85 mm.

The types are from the Paleocene, U. S. Highway 80, S. of Sucarnoochee Creek, ½ mile SW. of Livingston, Sumter County, Ala.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).

Genus AMMOMARGINULINA Wiesner, 1931

Ammomarginulina sp.

Plate 1, figure 4

Ammomarginulina sp. Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 3, pl. 1, fig. 1, 1942.

A single specimen figured here has an arenaceous test with the early portion close-coiled and the last-formed chambers uncoiled in a rectilinear series and much compressed. This slightly resembles *Ammobaculites expansus* Plummer from the Paleocene of Texas but is not the same.

The present specimen is from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I.

Genus LITUOLA Lamarck, 1804

Lituola erecta Mellen and Gault

Plate 1, figure 17

Lituola erecta Mellen and Gault, Am. Midland Naturalist, vol. 22, p. 472, text figs. 2, 4 (middle row), 1939.

The test is long, crosier-shaped, and slightly compressed in the early close-coiled portion. The latter portion is very abruptly uncoiled and erect in the adult forms. The numerous labyrinthic chambers have very irregular, rough interiors, the number in the coil varying in the microspheric and megalospheric forms and in the young and adult stages. The sutures are indistinct and but slightly depressed. The wall is arenaceous, well cemented, and rough on the exterior. The aperture is terminal and multiple or cribrate, and occupies all the apertural face.

Maximum length 9 mm.; width of coil 2.5 mm.; thickness 2 mm.—Mellen and Gault.

The types are from the Paleocene Clayton formation, outcrops behind the J. W. Martin home in the SE¼ sec. 31, T. 19 N., R. 14 E., Oktibbeha County, Miss. The species is recorded from the Clayton formation in Clay, Oktibbeha, and Noxubee Counties of Mississippi.

Lituola erecta Mellen and Gault var. distincta Mellen and Gault

Plate 1, figure 18

Lituola erecta distincta Mellen and Gault, Am. Midland Naturalist, vol. 22, p. 473, text figs. 3, 4 (top row), 1939.

The subspecies differs from *L. erecta* in the more evolute coiling, in the more depressed sutures, and in size, having a maximum length of 5 mm., a width of 2.5 mm., and a thickness of 1 mm. The interiors of the chambers are smooth and the sutures are distinct.—Mellen and Gault.

The types are from the Paleocene, from a 5- by 40-inch sandy and calcareous lens in the Porters Creek clay 5 or 10 feet above the Clayton formation, from a road cut on the south valley wall of Lynn Creek, sec. 22, T. 16 N.; R. 15 E., Noxubee County, Miss. It is recorded from Clay County, Miss., and from the basal part of the Midway formation north of Hope, Ark.

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

Spiroplectammina rossae Plummer

Plate 1, figures 15, 16

Spiroplectammina rossae Plummer, Texas Univ. Bull. 3201, p. 66, pl. 5, figs. 1–3, 1933.

Test very small, elongate, expanding gradually from the somewhat bluntly pointed initial extremity, strongly compressed, thickest along the axis, white, composed of very fine siliceous particles bound by an insoluble cement, thin shelled; early four or five chambers arranged in so minute a coil that the average peripheral outline hardly suggests this structure; later chambers typically biserial, narrow, slowly lengthening through early maturity and still more slowly through late maturity, sloping from the axis on each side at an angle of about 45 degrees and gently curved downward along the outer edge; sutural limbations strongly elevated on each side of the center but not merged, and tapering rapidly toward the peripheral margin, which is very narrowly rounded and unflanged; aperture a rather high arch at the base of the septal face. Length of holotype, 0.32 mm.; width 0.19 mm.; thickness 0.09 mm.

This is another species that seems to be characteristic of the uppermost Midway beds and seems a definite guide in determining the Paleocene-Wilcox contact.—Plummer.

The types are from the Paleocene, from bank on Foggyhead Creek, 3.8 miles by road southeast of Kerens railroad station, and a few feet below the overlying Wilcox groups, Navarro County, Tex.

Spiroplectammina plummerae Cushman

Plate 1, figures 19, 20

Spiroplectammina plummerae Cushman, Maryland Dept. Geol., Mines and Water Resources, Bull. 2, p. 226, pl. 16, fig. 2, 1948.

Textularia carinata D'Orbigny, var. *expansa* Plummer (not *Spiroplectammina expansa* LeRoy, 1941), Texas Univ. Bull. 2644, p. 67, pl. 3, fig. 3, 1927.

Test somewhat elongate, much compressed, expanding rather rapidly from the acute initial end; periphery acute, somewhat lobulate, sometimes slightly carinate; chambers numerous, early ones planispiral, later ones biserial, rather rapidly increasing in size and height as added; sutures distinct, depressed, gently curved and somewhat oblique; wall finely arenaceous, smoothly finished; aperture a low, rather broad opening at the base of the inner margin of the last-formed chamber, which is slightly depressed. Length 0.40–0.65 mm.; breadth 0.30–0.40 mm.; thickness 0.18–0.20 mm.

The types are from the Paleocene, upper part of Midway group, 2¼ miles southeast of Corsicana, Navarro County, Tex. It has been recorded from the Eocene of well samples from Maryland.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).

Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation, lower part. Arkansas, Saline County (20).
Midway formation. Arkansas, Saline County (26).
Midway group. Texas, Limestone County (42).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Spiroplectammina wilcoxensis Cushman and Ponton

Plate 1, figures 21–23

Spiroplectammina wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 51, pl. 7, fig. 1, 1932.
Cushman and Garrett, idem, vol. 15, p. 78, pl. 13, figs. 1, 2, 1939.
Toulmin, Jour. Paleontology, vol. 15, p. 571, pl. 78, fig. 1, 1941.
Cushman, Am. Jour. Sci., vol. 242, p. 8, pl. 1, figs. 1, 2, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 19, pl. 3, figs. 26, 27; p. 29, pl. 5, fig. 1, 1944.

Test broad, compressed; periphery subacute; early chambers coiled; chambers distinct, low and broad in the early portion, gradually and rather regularly increasing in height as added, slightly overlapping, later ones slightly inflated; sutures distinct, slightly depressed especially in the later portion, gently curved, making a very slight angle with the horizontal; wall arenaceous but rather smoothly finished; aperture a low curved opening at the base of the apertural face. Length of holotype 0.45 mm.; breadth 0.25 mm.; thickness 0.12 mm.

The types are from the Wilcox group of Eocene age, railroad cut, 1 mile north of Ozark, Ala.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Porters Creek clay. Tennessee, Hardeman County (13, 14).
Midway formation, lower part. Arkansas, Saline County (22).
Midway group. Texas, Bastrop County (43).

Spiroplectammina laevis (Roemer) Cushman var. cretosa Cushman

Plate 1, figure 24

Spiroplectammina laevis (Roemer) Cushman, var. *cretosa* Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 87, pl. 11, fig. 3, 1932.
Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 12, pl. 1, fig. 2, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 52, pl. 9, fig. 3, 1940.
Cushman and Todd, idem, vol. 18, p. 25, pl. 5, fig. 1, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 13, pl. 1, fig. 1, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 2, pl. 1, fig. 4; p. 84, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 329, pl. 50, fig. 6, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 46, pl. 7, fig. 1, 1946.
Cushman, U. S. Geol. Survey Prof. Paper 206, p. 27, pl. ? figs. 1–3, 1946.

Test tapering, usually somewhat longer than broad the greatest breadth toward the apertural end, periphery subacute; apertural end only slightly rounded broad in end view, tapering rapidly to the subacute periphery; chambers with the early portion coiled, later biserial, distinct, the margin of the apertural face distinctly raised, giving a series of raised ridges at the suture lines and forming a raised zigzag line along the center of the test; wall finely arenaceous, stout, not usually collapsed; aperture a low opening on the inner margin of the apertural face with the peripheral portion of the face extending forward so that the aperture itself is in a reëntrant. Length up to 0.65 mm.; breadth 0.45 mm.; thickness 0.25 mm.

The types of this variety are from the upper part of the Taylor marl (Upper Cretaceous), 5.1 miles from Josephine along the highway to Nevada, Collin County, Tex.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member, Alabama, Choctaw County (7).
Midway formation, lower part. Arkansas Saline County (20).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27).

Spiroplectammina mexiaensis Lalicker

Plate 1, figures 25, 26

Spiroplectammina mexiaensis Lalicker, Cushman Lab. Foram. Research Contr., vol. 11, p. 43, pl. 6, figs. 5, 6, 1935.

Test elongate, much compressed, sides parallel, planispiral portion broader than remainder of test, periphery short, axial portion of test high, ridge-like, depressed area along each side near peripheral margin; chambers numerous, initial 4 or 5 coiled, later biserial, low and broad, commonly depressed, sutures distinct, usually somewhat limulate because of depressed chambers, straight and oblique; wall finely arenaceous, composed of very fine siliceous and calcareous fragments with considerable cement, rather smoothly finished; aperture in early biserial portion a low, narrow slit at the inner margin of the last-formed chamber, in a deep reëntrant, in adult form the reëntrant tends to close, causing the aperture to be distinctly above the inner margin of the chamber. Length of holotype 0.60 mm.; width 0.20 mm.; thickness 0.11 mm.—Lalicker.

The types are from the Paleocene Mexia member of the Wills Point formation, about 35 feet above top of the Tehuacana member of the Kincaid formation, from steep bank along eastern side of a tributary flowing due north into Tehuacana Creek, about 2 miles in a direct line north and slightly west of the center of the town of Mexia, about ¼ mile west of railroad, Limestone County, Tex.

This is a rather common species in the Wills Point formation.

Spiroplectammina paleocenica Cushman

Plate 1, figure 27

Spiroplectammina paleocenica Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 81, pl. 17, fig. 17, 1947.

Test very small, evenly tapering from the slightly rounded initial end to the greatest width at the apertural end, central portion thick and rounded, tapering rapidly to the subacute periphery, apertural end truncate; chambers of the early portion planispiral, later biserial, increasing slowly in height as added, not inflated; sutures fairly distinct, not depressed, nearly straight to slightly convex upward; wall finely arenaceous, smoothly finished; aperture a slight, low opening at the base of the inner margin of the last-formed chamber. Length 0.35–0.43 mm., breadth 0.22–0.25 mm., thickness 0.20–0.23 mm.

The types are from the Paleocene, road cut on east slope to a branch in SW ¼ sec. 12, T. 11 N., R. 9 E., Wilcox County, Ala. (1).

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 5).
Midway group. Texas, Bastrop County (43).

Genus TEXTULARIA Defrance, 1824

Textularia midwayana Lalicker

Plate 1, figures 28–30

Textularia midwayana Lalicker, Cushman Lab. Foram. Research Contr., vol. 11 p. 49, pl. 6, figs. 7–9, 1935.

Test elongate, about twice as long as broad, early portion rapidly expanding, later portion with sides nearly parallel, almost circular in top view, periphery broadly rounded; chambers numerous, somewhat wider than high, except apertural chambers whose width and height are about equal, slightly inflated; sutures distinct, depressed, straight, and in a horizontal position; wall rather coarsely arenaceous, composed of fine and coarse sand grains with considerable cement, somewhat roughened; aperture a small, comparatively high arched opening at the inner margin of the last-formed chamber, in a shallow reëntrant. Length of holotype 0.73 mm.; greatest width 0.30 mm.; thickness 0.24 mm.—Lalicker.

The types are from the Paleocene, uppermost part of the Midway group, 0.15 mile west of bridge on Kerens-Round Prairie road, 3.8 miles by road south-southeast of railroad station in Kerens, Navarro County, Tex., where it is frequent.

Midway formation, lower part. Arkansas, Saline County (20, 22).
Midway formation. Arkansas, Saline County (26); Pulaski County (27).
Midway group. Texas, Bastrop County (43).

Textularia midwayana Lalicker var. pansa Cushman

Plate 2, figure 1

Textularia midwayana Lalicker var. *pansa* Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 30, pl. 5, fig. 2, 1944.

Variety differing from the typical in the somewhat broader and more tapering form, the more compressed test, and the flatter and only slightly convex apertural face.

The types of this variety are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Midway formation. Arkansas, Saline County (26).

Textularia plummerae Lalicker

Plate 2, figures 2, 3

Textularia plummerae Lalicker, Cushman Lab. Foram. Research Contr., vol. 11, p. 50, pl. 6, fig. 10, 1935.
Glaessner, Moscow Univ. Problems of Paleontology, vol. 2–3, p. 364, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 52, pl. 9, fig. 4, 1940.
Davis, Jour. Paleontology, vol. 15, p. 151, pl. 25, figs. 8, 9, 1941.
Toulmin, idem, vol. 15, p. 572, pl. 78, fig. 3, 1941.
Textularia eocenica Plummer (not Gümbel), Texas Univ. Bull. 2644, p. 67, pl. 3, fig. 2, 1927.

Test very elongate, tapering, somewhat compressed, periphery broadly rounded; chambers numerous, distinct, width and height almost equal, somewhat inflated; sutures distinct, moderately depressed, straight, nearly horizontal; wall coarsely arenaceous, composed of fine and coarse sand grains with a moderate amount of cement, roughly finished; aperture a rather low arched slit at the base of the last-formed chamber in a slight reëntrant in the septal face. Length of holotype 0.84 mm.; greatest width 0.27 mm.; thickness 0.21 mm.—Lalicker.

The types are from the Paleocene Mexia member of the Wills Point formation, about 35 feet above the Tehuacana member of the Kincaid formation, from a steep bank along the east side of a tributary flowing due north into Tehuacana Creek, about 2 miles in a direct line north and slightly west of the center of the town of Mexia, about ¼ mile west of railroad, Limestone County, Tex.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Wills Point formation, Mexia member. Texas, Limestone County (36).
Midway group. Texas, Limestone County (42)

Textularia plummerae Lalicker var. arkansasana Cushman

Plate 2, figures 4, 5

Textularia plummerae Lalicker var. *arkansasana* Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 81, pl. 17, figs. 18, 19, 1947.
Textularia plummerae Lalicker var. Cushman and Todd, idem, vol. 22, p. 46, pl. 7, fig. 2, 1946.

Variety differing from the typical in the greater thickness and enlargement of the chambers at the apertural end and the much coarser arenaceous wall.

The types are from the Paleocene, side of bank, north side of Highway 67, 8 miles southwest of Bentor, Saline County, Ark. (26).

Midway formation, lower part. Arkansas Saline County (22).

Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).

Textularia portenta Cushman
Plate 2, figure 6

Textularia portenta Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 81, pl. 17, fig. 16, 1947.

Test small, initial end subacute, increasing rapidly in width in the early stages, only slightly increasing in width in the adult, periphery subacute in the early stages, rounded in the adult; chambers fairly distinct, increasing rapidly in size and height as added, somewhat inflated in the adult; sutures distinct and slightly depressed in the adult portion, slightly oblique; wall very finely arenaceous, exterior very smooth; aperture semicircular, at the inner margin of the last-formed chamber. Length 0.45 to 0.60 mm., breadth 0.25 to 0.32 mm., thickness 0.13 to 0.15 mm.

The types are from the Paleocene, middle part of the Midway group, foot of hill in south slope to Wolf Creek, probably in SE ¼, NE ¼ sec. 20, T. 11 N., R. 12 E., Butler County, Ala. (3).

This species somewhat resembles *Textularia dibollensis* Cushman and Applin but differs in the deeper sutures and very smooth exterior. It is very common at the type locality but was not found in any of the other Paleocene material.

Family VERNEUILINIDAE

Genus GAUDRYINA D'Orbigny, 1839

Gaudryina rudita Sandidge

Plate 2, figure 7

Gaudryina rudita Sandidge, Am. Midland Naturalist, vol. 13, p. 342, pl. 31, figs. 19, 20, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 46, pl. 7, figs. 8–10, 1937.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 51, pl. 9, fig. 4, 1943.
Cushman, idem, vol. 20, p. 84, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 329, pl. 50, figs. 9, 10, 1944.
Cushman, Cushman Lab. Foram. Research Special Pub. 7A, p. 8, 1946; U. S. Geol. Survey Prof. Paper 206, p. 34, pl. 7, figs. 23, 24; pl. 8, fig. 1, 1946.
Textularia agglutinans W. Berry (not D'Orbigny), in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 3, pl. 2, fig. 1, 1929.
Gaudryina rugosa Cushman (not D'Orbigny), Tennessee Div. Geology Bull. 41, p. 20, pl. 1, figs. 9, 10, 1931.
Gaudryina minima Cushman (?) (not Egger), Jour. Paleontology, vol. 5, p. 301, pl. 34, figs. 5a, b, 1931.

The previous records for this species are all from the Upper Cretaceous. A few specimens from the basal part of the Midway group, 9 feet above water level, Old Canton Landing, Alabama River, Wilcox County, Ala., seem to be this species and are very perfect, showing no sign of having been reworked from older beds, although there is evidence of reworking in these beds.

The form recorded from the Paleocene of Mississippi by Kline as "*Gaudryina rugosa* D'Orbigny" (Mississippi Geol. Survey Bull. 53, p. 14, pl. 7, fig. 11, 1943) is probably this species.

Kincaid formation. Texas, Hunt County (37).

Gaudryina soldadoensis Cushman and Renz

Plate 2, figures 8, 9

Gaudryina soldadoensis Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 4, pl. 1, fig. 1, 1942.
Cushman, Cushman Lab. Foram. Research Special Pub. 7A, p. 14, pl. 2, fig. 1; pl. 3, fig. 2, 1946.
Gaudryina sp. Cushman, Cushman Lab. Foram. Research Contr. vol. 16, p. 53, pl. 9, fig. 5, 1940.
Gaudryina sp. Kline, Mississippi Geol. Survey Bull. 53, p. 15, pl. 7, fig. 14, 1943.

Test somewhat longer than broad, slightly arcuate, early portion triangular and triserial, adult portion biserial, much compressed, the broader faces slightly concave, narrower one deeply so except in the final chamber in the adult; chambers distinct except in the early portion; sutures in the adult strongly depressed; wall finely arenaceous, the exterior slightly roughened; aperture a rounded opening near the inner margin of the last-formed chamber. Length of holotype 1.3 mm.; breadth 0.65 mm.; thickness 0.35 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. It also occurs in the Chalybeate limestone member of the Clayton formation of Alabama (9) and in the Clayton formation of Mississippi as recorded by Kline.

Gaudryina sp.

A few specimens occurring in the Paleocene appear to be reworked Cretaceous species and without further evidence are not included here. Some of the other records such as "*Gaudryina rugosa* D'Orbigny" (Kline, Mississippi Geol. Survey Bull. 53, p. 14, pl. 7, fig. 11, 1943) from the Porters Creek clay may also be reworked Cretaceous material.

Genus CLAVULINOIDES Cushman, 1936

Clavulinoides midwayensis Cushman

Plate 2, figures 10–16

Clavulinoides midwayensis Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 21, pl. 3, figs. 9, 15, 1936; Special Pub. 7, p. 126, pl. 18, figs. 8, 9, 1937; Cushman Lab. Foram. Research Contr., vol. 16, p. 53, pl. 9, fig. 6, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 13, pl. 1, fig. 2, 1943.
Applin and Jordan, Jour. Paleontology, vol. 19, p. 131 (list), 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 46, pl. 7, figs. 3–6, 1946.
Cushman, Cushman Lab. Foram. Research Special Pub. 7A, p. 34, 1946.
Clavulina angularis Plummer (not D'Orbigny), Texas Univ. Bull. 2644, p. 70, pl. 3, figs. 4, 5, 1927.

Test in the microspheric form very rapidly increasing in diameter toward the apertural end, test in the

megalospheric form with the sides parallel in the adult, and in the last-formed chambers with the diameter decreasing, triangular throughout, or in the megalospheric form in the later portion rounded, sides concave in the megalospheric form in the adult becoming convex; chambers distinct, not inflated except in the last chambers of the megalospheric form; sutures distinct, very slightly depressed in the earlier portions and in the microspheric form, but in the megalospheric form becoming deeply depressed in the adult; wall coarsely arenaceous, often rather roughly finished; aperture in the megalospheric form rounded, in the microspheric form with somewhat irregular lobes projecting toward the angles of the test. Length up to 1.25 mm.; diameter 0.30–0.60 mm.

The types are from the Paleocene, from a shallow ditch at road corner, SE. of New Corsicana Reservoir, on road to Mildred, Navarro County, Tex. (40).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Porters Creek clay. Mississippi, Kemper County (17).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30).
Midway group. Texas, Navarro County (40); Limestone County (42); Bastrop County (43); Caldwell County (44); Van Zandt County (48).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Mexia member. Texas. Limestone County (36).

Family VALVULINIDAE

Genus VALVULAMMINA Cushman, 1933

Valvulammina nassauensis Applin and Jordan var. cubana Cushman and Bermúdez

Plate 21, figure 16

Valvulammina nassauensis Applin and Jordan var. *cubana* Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 68, pl. 11, fig. 1, 1948.

Variety differing from the typical form in the larger size, more tapering form and more pointed initial end. Length of holotype 1.17 mm.; breadth 0.87 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

Genus MARSSONELLA Cushman, 1933

Marssonella oxycona (Reuss) Cushman

Plate 2, figure 21

Gaudryina oxycona Reuss, Akad. Wiss. Wien, Math-naturwiss. Kl., Sitzungsber., vol. 40, p. 229, pl. 12, fig. 3, 1860; idem, vol. 46, pt. 1, p. 33, 1862 (1863).
Marssonella oxycona Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 36, pl. 4, fig. 13, 1933.

A few poorly preserved specimens were found in the basal part of the Midway group, 9 feet above present water level, Old Canton Landing, Alabama River, Wilcox County, Ala. These have the appearance of being reworked from the Cretaceous. The species is also recorded by Kline (Mississippi Geol. Survey Bull. 53, p. 16, pl. 7, fig. 10, 1943) "from the uppermost Clayton chalk from a test hole (M65A) on the Dr. T. D. Houston property (NW¼, NE¼, NW¼ sec. 10, T. 16 S., R. 3 E.), above a road cut ¼ mile west of Prairie Creek," Clay County, Miss. The single specimen recorded is also a fragmentary one and may probably also be a reworked specimen.

Marssonella cf. M. indentata (Cushman and Jarvis) Cushman

Rare specimens from the Paleocene of Cuba, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba, seem very close to this Cretaceous species. It is recorded by Van den Bold from the Paleocene of Guatemala and British Honduras (Thesis Univ. Utrecht, Amsterdam, p. 122, pl. 18, figs. 2a, b, 1946). Specimens are not entirely typical.

Genus DOROTHIA Plummer, 1931

Dorothia alabamensis Cushman

Plate 2, figure 17

Dorothia alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 53, pl. 9, fig. 7, 1940.
Applin and Jordan, Jour. Paleontology, vol. 19, p. 131 (list), 1945.
Cushman, Cushman Lab. Foram. Research Special Pub. 8A, p. 29, pl. 2, fig. 21, 1947.

Test tapering throughout, broadest at the apertural end, usually distinctly twisted, little if at all compressed, earliest whorl with 4 or 5 chambers, later triserial, and in the adult biserial; chambers distinct, somewhat inflated, increasing rather regularly in size as added, slightly overlapping; sutures distinct, depressed, more strongly so in the adult portion; wall finely arenaceous, smoothly finished but not polished; aperture a low, broad opening at the base of the last-formed chamber at the inner margin. Length up to 1.15 mm.; breadth 0.60 mm.; thickness 0.30 mm.

The types are from the Paleocene, U. S. Highway 80, South of Sucarnoochee Creek, ½ mile SW. of Livingston, Sumter County, Ala. (9).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation. Arkansas, Clark County (30).

Genus MARTINOTTIELLA Cushman, 1933

Martinottiella paleocenica Cushman

Plate 2, figure 19

Martinottiella paleocenica Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 82, pl. 18, fig. 1, 1947.

Test minute, early portion irregularly triangular in section, later portion with a short, irregular biserial stage followed by a uniserial stage, rounded in section; chambers of the early portion indistinct, those of the later biserial and uniserial stages very few in number,

not increasing in diameter as added, very slightly inflated; sutures of the early portion indistinct, later ones distinct and slightly depressed; wall finely arenaceous, smoothly finished; aperture terminal, rounded, with a slight neck. Length 0.30–0.40 mm., diameter 0.12–0.15 mm.

The types are from the Paleocene Naheola formation, road cut on east slope to a branch in SW ¼ sec. 12, T. 11, N., R. 9 E., Wilcox County, Ala. This small but distinct species seems to be found only in the Naheola formation.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5, 6).

Genus SCHENCKIELLA Thalmann, 1942

Schenckiella alabamensis Cushman

Plate 2, figure 18

Listerella laevis Cushman (not Finlay), Cushman Lab. Foram. Research Contr., vol. 16, p. 54, pl. 9, fig. 8, 1940.
Schenckiella alabamensis Cushman, Cushman Lab. Foram. Research Special Pub. 8A, p. 51, pl. 8, fig. 10, 1947.

Test elongate, slender, of rather uniform diameter throughout, triserial portion rounded; chambers mostly rather indistinct, later ones becoming more inflated, 6 or 7 in the uniserial portion in the adult; sutures indistinct except in the last portion, where they are often distinctly depressed; wall finely arenaceous, smoothly finished; aperture terminal, rounded, small, often with a slight lip. Length up to 1.20 mm.; diameter 0.35 mm.

The types are from the Paleocene, U. S. Highway 80, S. of Sucarnoochee Creek, ½ mile S.W. of Livingston, Sumter County, Ala.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).

Genus TRITAXILINA Cushman, 1911

Tritaxilina cubensis Cushman and Bermúdez

Plate 2, figure 20

Tritaxilina cubensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 12, pl. 10, figs. 24, 25, 1936; vol. 13, p. 7, 1937.
Cushman, Cushman Lab. Foram. Research Special Pub. 8, p. 156, pl. 18, figs. 4, 5, 1937; Cushman Lab. Foram. Research Contr., vol. 16, p. 54, pl. 9, fig. 9, 1940.

Test elongate, fusiform, about twice as long as broad, greatest breadth at or a little above the middle, apertural end rounded, initial end pointed; chambers fairly distinct with deep excavation at the base at either side, middle of chambers extending downward; sutures fairly distinct, depressed; wall coarsely arenaceous but rather smoothly finished; aperture small, narrow, at right angles to the inner margin, in a distinct depression. Length up to 1.50 mm.; diameter 0.75 mm.

The types are from the Eocene, lower beds of "El Husillo" Quarry, Puentes Grandes, Havana, Cuba.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Family MILIOLIDAE

Genus QUINQUELOCULINA D'Orbigny, 1826

Quinqueloculina naheolensis Cushman

Plate 2, figure 22

Quinqueloculina naheolensis Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 82, pl. 17, fig. 14, 1947.

Test very small, about twice as long as broad, periphery rounded, base broadly rounded, apertural end truncate, sides only slightly convex; chambers slightly inflated, increasing very little in breadth as added; sutures fairly distinct, very slightly depressed; wall smooth; aperture terminal, circular, without a neck, with a distinct tooth, broad at the inner end and occasionally slightly bifid. Length 0.30–0.35 mm., breadth 0.15–0.18 mm., thickness 0.12–0.15 mm.

The types are from the Paleocene Matthews Landing marl member of the Porters Creek formation, Alabama Highway 96, 9.2 miles NE. of Kimbrough, Wilcox County, Ala. (5). It also occurs at other localities in Alabama and seems to be a distinctive fossil for this formation.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 5, 6).

Quinqueloculina pulcherrima Cushman

Plate 2, figure 23

Quinqueloculina pulcherrima Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 30, pl. 5, fig. 5, 1944.

Test very small, less than twice as long as broad, periphery rounded or subangular; chambers inflated, basal end little if at all projecting, apertural end without a neck, obliquely truncate, sutures depressed; wall ornamented with numerous fine, but distinct, longitudinal costae, the channels between with slight transverse ridges; aperture elliptical, with a slight thickening of the lip, and a simple elongate tooth on the inner margin. Length of holotype 0.28 mm., breadth 0.16 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

Porters Creek clay. Tennessee, Hardeman County (13).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Quinqueloculina alabamensis Cushman

Plate 2, figure 24

Quinqueloculina alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 30, pl. 5, fig. 4, 1944.

Test small, about 2½ times as long as broad, periphery angled; chambers with the basal end protruding, apertural end with a short cylindrical neck, chambers triangular in transverse section with the peripheral angle with a thickened ridge; sutures slightly if at all

depressed; wall smooth; aperture at the end of the short neck, with a very slight thickening and a small, simple tooth on the inner border. Length of holotype 0.47 mm.; breadth 0.20 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

This species somewhat resembles *Q. mauricensis* Howe, from the Cook Mountain formation of Louisiana, but is smaller, more elongate, the keels sharper, and the chambers more angled.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Quinqueloculina plummerae Cushman and Todd

Plate 2, figures 25, 26

Quinqueloculina plummerae Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 25, pl. 5, fig. 2, 1942. Cushman, idem, vol. 20, p. 30, pl. 5, fig. 3, 1944.
Quinqueloculina ferussacii Plummer (not D'Orbigny), Texas Univ. Bull. 2644, p. 161, pl. 12, fig. 10, 1927.

Test small, nearly as broad as long, in end view about twice as broad as thick, periphery truncate with rounded, carinate edges; chambers distinct, the sides flattened or slightly concave toward the periphery; sutures distinct but little if at all depressed; wall smooth; aperture terminal, without a neck, but with a slightly thickened lip and a short blunt tooth. Length 0.20 to 0.25 mm.; breadth 0.15 mm.; thickness 0.08 mm.

The types are from the Paleocene Naheola formation, greensand bed, upper fossiliferous horizon, Naheola Landing, Tombigbee River, Ala. (7).

Porters Creek clay. Tennessee, Hardeman County (13, 14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (4); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Quinqueloculina plummerae Cushman and Todd var. flectata Cushman

Plate 2, figure 27

Quinqueloculina plummerae Cushman and Todd var. *flectata* Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 82, pl. 17, fig. 15, 1947.

Variety differing from the typical form in the last-formed chambers, which have the periphery in a tortuous line and in some specimens with a depressed area at the edge.

The types of this variety are from the Paleocene, road cut on east slope to a branch in SW ¼ sec. 12, T. 11 N., R. 9 E., Wilcox County, Ala. (1). It occurs commonly at the type locality and several others in Wilcox County, but does not seem to occur with the typical form of the species. This variety should make a good index fossil for the Porters Creek formation.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 5, 6).

Genus SPIROLOCULINA D'Orbigny, 1826

Spiroloculina alabamensis Cushman

Plate 3, figure 1

Spiroloculina alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 31, pl. 5, fig. 8, 1944.

Test small, 2 to 2½ times as long as broad, slightly concave in the early portion, periphery flat, sharply angled at the margins; chambers few, rapidly increasingly in size as added, of equal width throughout, strongly projecting at the base, extending into a prominent neck at the apertural end; sutures distinct, depressed; wall glistening but roughened with irregular, short, longitudinal, incised lines, with occasionally a longitudinal costa on the peripheral face; aperture quadrangular, with a short, simple tooth on the inner margin. Length 0.35 to 0.40 mm., breadth 0.15 to 0.25 mm., thickness 0.07 to 0.08 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Genus TRILOCULINA D'Orbigny, 1826

Triloculina alabamensis Cushman

Plate 3, figure 2

Triloculina alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 32, pl. 5, fig. 11, 1944.
Triloculina inflata Terquem (not D'Orbigny), Soc. géol. France Mém., 3rd ser., vol. 2, p. 165, pl. 17 (25), figs. 4–6, 1882.

Test small, about twice as long as broad, periphery broadly rounded; chambers inflated, the base extending back in a broad curve, apertural end obliquely truncate without a neck, broadest near the base, tapering gradually to the apertural end; sutures distinct, depressed; wall smooth; aperture semicircular, with a distinct lip and a simple or slightly bifid tooth on the inner margin. Length of holotype 0.33 mm., breadth 0.18 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

This is not the same as D'Orbigny's species from the Recent and Late Tertiary of Europe. It is apparently identical with the form figured by Terquem from the middle Eocene of the Paris Basin.

Triloculina natchitochensis Howe

Plate 3, figure 3

Triloculina natchitochensis Howe, Louisiana Dept. Cons. Geol. Bull. 14, p. 38, pl. 3, figs. 3–5, 1939.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 32, pl. 5, fig. 7, 1944.

Test small, elongate, only the last two chambers showing definitely, and these added at angles of approximately 180 degrees; wall white, thick, longitudinally coarsely costate; aperture simple, subcircular, at the end of a long neck.—Howe.

Length 0.40 to 0.50 mm., breadth 0.15 to 0.20 mm.

Our specimens are slightly smaller than the type but seem to have the same general characters. The types are from the Eocene Cook Mountain formation, of Louisiana. The only specimens in our Paleocene collections referable to it are from Wilcox County, Ala. (8).

Triloculina deca Cushman

Plate 3, figures 4, 5

Triloculina natchitochensis Howe var. *deca* Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 32, pl. 5, figs. 9, 10, 1944.

Test small, in front view broadly oval, periphery strongly convex, in end view roughly triangular; chambers distinct, broad, strongly curved, the basal end broadly curved, apertural end broad and not projecting into a definite neck; sutures distinct, slightly depressed; wall ornamented with obliquely longitudinal depressions and ridges; aperture nearly circular, with a slightly thickened lip and a small, simple tooth at the inner side of the opening. Length 0.35 to 0.50 mm., breadth 0.20 to 0.25 mm., thickness 0.15 to 0.18 mm.

The types are from the Paleocene Coal Bluff marl member of Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

This species seems to be distinct from the form with which it was originally described as a variety.

Porters creek formation, Matthews Landing marl member. Alabama, Wilcox County (1).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

"Triloculina laevigata Bornemann"

Plate 3, figures 6, 7

Triloculina laevigata Plummer, Texas Univ. Bull. 2644, p. 161, pl. 12, fig. 11, 1927.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 26, pl. 5, fig. 3, 1942.

Under this name Mrs. Plummer figured a single specimen found in the Texas material from locality 40. I have found specimens questionably referable to this form in our material at only one locality, 7.

Family OPHTHALMIDIIDAE

Genus CORNUSPIRA Schultze, 1854

Cornuspira cf. C. byramensis Cushman

Plate 3, figures 8, 9

Specimens from the Paleocene of Alabama are very close to *C. byramensis*, described from the Oligocene and recorded from the Wilcox Eocene of Alabama.

Mrs. Plummer recorded and figured a single specimen from the Paleocene of Texas as "*Cornuspira carinata* (Costa)" (Texas Univ. Bull. 2644, p. 160, pl. 12, fig. 9, 1927). It has a carinate margin and may be different from the form recorded here as *C.* cf. *C. byramensis*.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).

Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1859

Trochammina cf. T. texana Cushman and Waters

Plate 3, figure 10

Specimens from two localities are comparable to *T. texana* and show no sign of reworking. In the Upper Cretaceous the species is restricted to beds of the Navarro group.

Midway group. Texas, Navarro County (40); Limestone County (42).

Family PLACOPSILINIDAE

Genus ADHAERENTIA Plummer, 1938

Adhaerentia midwayensis Plummer

Plate 3, figures 11–13

Adhaerentia midwayensis Plummer, Am. Midland Naturalist, vol. 19, p. 242, text figs. 1a-e, 1938.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 54, pl. 9, figs. 10, 11, 1940.

Test elongate, sides nearly parallel, attached in the early stages; chambers fairly distinct in the later portion, early 4 or 5 chambers compactly biserial, later loosely biserial and last few chambers in the adult uniserial, somewhat labyrinthic; sutures rather indistinct, somewhat depressed in all but the earliest portion; wall composed of various materials with considerable cement, somewhat roughened to fairly smooth on the exterior; aperture in the early stages single and rounded to slightly lunar toward the apex of the test on the apertural face, later becoming terminal and in the last-formed chambers in the adult multiple, consisting of two or three irregular openings. Maximum length about 5 mm., average thickness about 0.8 mm.

The types are from the Paleocene Clayton formation, outcrop on a branch of Dixon Creek, bed of stream, on State Highway 96 about 1 mile south of junction with Highway 28, sec. 1, T. 13 N., R. 6 E., Wilcox County, Ala.

TABLE 1.—*Distribution of Paleocene Rhizamminidae, Ammodiscidae, Lituolidae, Textulariidae, Verneuilinidae, Miliolidae, Ophthalmidiidae, Trochamminidae, and Placopsilinidae in the Gulf Coastal region*

[Prepared by J. B. Reeside, Jr. Numbers refer to locality list on pages 1-3. K=localities reported by V. H. Kline, P=localities reported by H. J. Plummer and C. G. Lalicker, C=Cuba and Haiti, G=Guatemala and Honduras, S=Soldado Rock, Trinidad, B. W. I.]

	Alabama												Tenn.		Miss.				Arkansas														Texas																				C	G	S
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	K	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	P			
Rhizamminidae																																																									
Bathysiphon eocenicus																																								X		X															
Ammodiscidae																																																								
Ammodiscus cf. *A. cretaceus*																																										X													X			
Lituolidae																																																								
Haplophragmoides cf. *H. excavata*																																X																									
Ammobaculites expansus																																																							X			
midwayensis																																																							X			
paleocenicus									X							X																																										
Ammomarginulina sp																																																									X	
Lituola erecta																		X																																								
erecta var. *distincta*																		X																																							
Textulariidae																																																									
Spiroplectammina rossae																																																								X		
plummerae			X					X					X	X		X					X					X											X				X		X													
wilcoxensis							X		X			X	X	X			X					X																																			
laevis var. *cretosa*																																																								
mexicensis																																																								X		
paleocenica	X				X											X										X																			X												
Textularia midwayana																					X		X				X	X																		X										
midwayana var. *panea*								X																				X																													
plummerae									X																												X				X													X		
plummerae var. *arkansasana*																						X		X	X																															
portenta			X																																																						
Verneuilinidae																																																									
Gaudryina rudita																																																									
soldadoensis									X									X																																								X
sp																		X																																							
Clavulinoides midwayensis									X							X									X	X	X	X			X			X	X		X																			
Valvulinidae																																																									
Valvulammina nassauensis var. *cubana*																																																								X	
Marssonella oxycona																		X																																						X	X
cf. *M. indentata*																																																									
Dorothia alabamensis					X	X			X																						X																									
Martinottiella paleocenica																																																									
Schenckiella alabamensis									X							X																																								
Tritaxilina cubensis									X																																																
Miliolidae																																																									
Quinqueloculina naheolensis	X	X			X	X																																																		
pulcherrima			X					X					X																																												
alabamensis			X					X																																																
plummerae				X			X	X				----	X	X																																										
plummerae var. *flectata*	X	X			X	X																																																		
Spiroloculina alabamensis			X					X																																															
Triloculina alabamensis								X																																															
natchitochensis								X																																															
deca	X							X																																															
"laevigata"							X																																																X	
Ophthalmidiidae																																																									
Cornuspira cf. *C. byramensis*			X																																																					
Trochamminidae																																																									
Trochammina cf. *T. texana*																																																								
Placopsilinidae																																																									
Adhaerentia midwayensis									X						X		X																																								

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Porters Creek clay. Tennessee, Hardeman County (14).

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

Robulus midwayensis (Plummer)

Plate 3, figures 14–17

Cristellaria midwayensis Plummer, Texas Univ. Bull. 2644, p. 95, pl. 13, fig. 5, 1927.
Lenticulina midwayensis Plummer, idem. Bull. 3201, pp. 54, 61, 64 (lists), 1933.
Lenticulina midwayana Israelsky, Sixth Pacific Sci. Congress, Proc., p. 573, pl. 2, figs. 7, 8, 1939.
Robulus midwayensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 54, pl. 9, fig. 12, 1940.
Toulmin, Jour. Paleontology, vol. 15, p. 579, pl. 78, fig. 23, text fig. 2G, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 26, pl. 5, figs. 4, 5, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 17, pl. 1, fig. 3, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 33, pl. 5, fig. 15, 1944.
Cooper, Jour. Paleontology, vol. 18, p. 351, pl. 55, figs. 22, 23, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 47, pl. 7, fig. 7, 1946.

Test large, circular, very closely coiled, full bodied, though somewhat compressed; periphery distinctly angular but not fianged in its typical form; chambers 10–12 in adult form, smooth, narrow, gently curved, radiate from a conspicuous central boss and tapering somewhat toward the peripheral margin; aperture at apex of broad septal face. Diameter up to 1.5 mm., usually less.—Plummer.

The types are from the Paleocene, in base of high bluff on west side of Colorado River between the Travis-Bastrop county line and the mouth of Dry Creek. (Bastrop Quadrangle), Tex.

This species is widely distributed in the Paleocene and shows a considerable amount of variation in the number of chambers and the relative amount of elevation of the sutures and umbones.

Porters Creek clay. Tennessee, Hardeman County (13, 14). Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Wilcox County (5, 6); Choctaw County (7).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation. Alabama, Barbour County (10).
Chalybeate limestone member. Alabama, Sumter County (9).
Pine Barren member, Alabama, Butler County (12).
Midway formation, lower part. Arkansas, Saline County (18, 19, 19A, 20, 21).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (28); Clark County (30, 31).
Midway group. Texas, Limestone County (39, 42); Navarro County (40); Hunt County (41); Bastrop County (43, 49); Caldwell County (44); Travis County (45, 46).
Willis Point formation. Texas, Travis County (33); Caldwell County (34); Williamson County (35).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Robulus midwayensis (Plummer) var. carinatus (Plummer) Cushman

Plate 3, figures 18–20

Cristellaria midwayensis Plummer, var. *carinata* Plummer, Texas Univ. Bull. 2644, p. 97, text fig. 5, 1927.
Robulus midwayensis (Plummer) var. *carinatus* (Plummer) Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 55, pl. 9, fig. 13, 1940.

Variety differing from the typical form in having a well developed peripheral flange.

The types of the variety are from the Paleocene, basal part of Midway group, gully in field west of north-south stretch of road about 3 miles in a straight line northwest of Campbell or 4 miles by road from that town to Neyland, Hunt County, Tex.

There seem to be all gradations between this variety and the typical form in the development of the peripheral flange. It seems to be characteristic of the lower part of the Paleocene of Texas and Alabama.

Midway formation. Arkansas, Clark County (30, 31).
Midway group. Texas, Hunt County (41); Van Zandt County (47, 48); Freestone County (50).
Wills Point formation. Texas, Caldwell County (34).
Kincaid formation. Texas, Hunt County (37).

Robulus pseudo-mamilligerus (Plummer) Cushman

Plate 4, figures 1–5

Cristellaria pseudo-mamilligera Plummer, Texas Univ. Bull. 2644, p. 98, pl. 7, fig. 11, 1927.
Robulus pseudo-mamilligerus Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 55, pl. 9, fig. 16, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 19, pl. 1, fig. 12, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 47, pl. 7, fig. 10, 1946.

Test very slightly elongate, strongly compressed; periphery bounded by a rather thick keel that shows on some specimens a slight lobation; chambers 9–11 in final convolution, distinctly curved; sutures marked by conspicuous tapering elevations curving outward from an irregularly developed central boss or from a group of protuberances; aperture radiate, protruding. Diameter up to 1.6 mm.—Plummer.

The types are from the Paleocene, exposure along a small branch about ¾ mile NW. of Tehuacana and 0.2 mile N. of the Tehuacana-Waco road on the first road turning north, Limestone County, Tex.

The species is most common in the glauconitic middle portion of the Midway group of Texas and is recorded from the Paleocene of Arkansas and Alabama and from the uppermost part of the Porters Creek clay of Mississippi.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Clark County (31).
Midway group. Texas, Limestone County (39); Caldwell County (44).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).

Robulus turbinatus (Plummer) Cushman

Plate 4, figures 6–9

Cristellaria turbinata Plummer, Texas Univ. Bull. 2644, p. 93, pl. 7, fig. 4, 1927.
Robulus turbinatus Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 55, pl. 9, fig. 17, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 20, pl. 1, fig. 7, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 47, pl. 7, fig. 11, 1946.

Test circular, considerably compressed; peripheral margin sharp and extended into a fragile, white flange that is typically ragged; chambers 8 in final convolution, narrow, smooth; sutures strongly elevated and of about equal width from the large umbonal area to the periphery, very strongly curved; aperture at apex of narrow septal face. Diameter up to 0.6 mm.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

The species occurs in the Paleocene of Texas, Arkansas, Alabama, and Mississippi.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Midway formation, upper part. Arkansas, Pulaski County (24, 25). Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30, 31).
Midway group. Texas, Navarro County (40); Limestone County (42); Caldwell County (44).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Mexia member. Texas, Limestone County (36).

Robulus degolyeri (Plummer) Bandy

Plate 3, figures 21, 22

Cristellaria degolyeri Plummer, Texas Univ. Bull. 2644, p. 97, pl. 7, fig. 7, 1927.
Robulus degolyeri Bandy, Jour. Paleontology, vol. 18, p. 368, pl. 60, fig. 5, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 47, pl. 7, fig. 13, 1946.
Lenticulina degolyeri Kline, Mississippi Geol. Survey Bull. 53, p. 21, pl. 1, fig. 8, 1943.

Test somewhat longer than broad, moderately compressed; peripheral margin very sharp and bounded by a ragged flange; chambers 7 to 9, gently curved, smooth; sutures marked by strong elevations of clear shell matter tapering outward from a conspicuous umbonal boss; aperture at apex of an elongate septal face. Length up to 0.8 mm.; usually less.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

The species has been recorded from the Paleocene of Texas, Mississippi, and Arkansas, and from the middle Eocene of Oregon.

Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Pulaski County (27); Clark County (29, 30).
Midway group, Texas, Caldwell County (44); Van Zandt County (47, 48).

Robulus pseudo-costatus (Plummer) Cushman

Plate 4, figures 10–12

Cristellaria pseudo-costata Plummer, Texas Univ. Bull. 2644, p. 98, pl. 7, fig. 9, 1927.
Robulus pseudo-costatus Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 55, pl. 9, fig. 18, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 18, pl. 1, fig. 5, 1943.

Test much compressed, not completely involute, changing from the loosely coiled form to linear development in specimens developed beyond maturity; periphery bound by a distinct, thin, transparent flange; chambers 7–8 in last whorl, ornamented by two to four irregularly developed thin costae that follow roughly the direction of coiling; sutures marked by thin, high, uneven ridges; aperture protruding from a strongly inflated septal face. Diameter up to .7 mm.—Plummer.

The types are from the Paleocene, gully in field west of north-south stretch of road about 3 miles in a straight line northwest of Campbell or 4 miles by road from that town on highway to Neyland, Hunt County, Tex.

This highly ornate species is fairly common at a number of localities in the Texas area but very rare elsewhere.

Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Porters Creek clay. Mississippi, Kemper County (17).
Midway formation. Arkansas, Clark County (29, 31).
Midway group, Texas, Hunt County. (41); Travis County (45, 46); Van Zandt County (47); Freestone County (50).
Kincaid formation. Texas, Hunt County (37).

Robulus pseudo-costatus (Plummer) Cushman var. comis Cushman, new name

Plate 4, figures 13, 14

Robulus pseudo-costatus (Plummer) Cushman var. *inornatus* Kline (not D'Orbigny), Mississippi Geol. Survey Bull. 53, p. 18, pl. 1, fig. 6, 1943.

Test much compressed, almost completely involute; periphery with a distinct, thin, transparent flange which is usually broken; chambers about 7 in final whorl, smooth; sutures marked by thin, high ridges which vary from smooth to crenulated; septal face less strongly inflated than in species; aperture less distinctly protuberant. Average diameter about 0.5 mm.—Kline.

The types are from the *Ostrea pulaskensis* bed of the Paleocene Clayton formation, test hole M 93, 3.8 to 11.0 feet below surface, 1½ miles northwest of Montpelier, Clay County, Miss.

The variety is recorded as characteristic of the Clayton formation but also occurs in the Porters Creek clay of Mississippi.

Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).

Robulus alabamensis Cushman

Plate 4, figures 15, 16

Robulus alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 33, pl. 5, fig. 13, 1944.
Cushman and Todd, idem, vol. 22, p. 47, pl. 7, fig. 8, 1946.
Robulus sp. Cushman, idem, vol. 16, p. 55, pl. 9, fig. 23, 1940.

Test small for the genus, umbonate, close coiled, periphery within the area of each adult chamber slightly flattened, sharply angled but not carinate; chambers numerous, 8 to 10 in the final coil, distinct, of uniform shape, increasing gradually and regularly in size as added, the apertural angle translucent; sutures distinct, nearly tangential, very slightly curved, not depressed; wall smooth, polished; aperture radiate, with a slight opening at the upper end of the ventral face. Diameter of holotype, 0.70 mm., thickness 0.40 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

This species seems related to *R. pondi* Cushman, of the Upper Cretaceous, but differs in the fewer chambers, the non-nodose periphery, and the more umbonate center.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Clark County (29–31).
Midway group. Texas, Hunt County (41); Caldwell County (44); Travis County (46); Van Zandt County (47); Freestone County (50).

Robulus wilcoxensis Cushman and Ponton

Plate 4, figure 17

Robulus wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 52, pl. 7, fig. 3, 1932.
Toulmin, Jour. Paleontology, vol. 15, p. 579, pl. 78, figs. 24, 25; text fig. 2H, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 27, pl. 5, fig. 7, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 20, pl. 7, fig. 27, 1943.

Test compressed, close-coiled except in the oldest portion where one or two chambers may become uncoiled, periphery in the earlier portion with a narrow blunt keel that becomes obsolescent and rounded in the last chambers; chambers numerous, 9 or 10 in the last-formed coil of the adult, later ones slightly inflated and uncoiling, early ones of uniform shape, gradually increasing in size as added; sutures distinct, rather strongly curved, in the early portion limbate and raised, then becoming flush with the surface and in the adult slightly depressed; wall smooth except for the early raised sutures; aperture radiate, terminal in the adult, in the earlier chambers at the outer peripheral angle. Length 1.00–1.15 mm., breadth 0.75–0.80 mm., thickness 0.25–0.30 mm.

The types are from Eocene of Wilcox age from railroad cut, 1 mile north of Ozark, Ala.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).
Midway group. Texas, Limestone County (39).

Robulus wilcoxensis Cushman and Ponton var. dissentius Cushman and Todd

Plate 4, figure 18

Robulus wilcoxensis Cushman and Ponton var. *dissentia* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 48, pl. 7, fig. 12, 1946.

Variety differing from the typical form in the deeply incised sutures, more umbonate center, which is frequently ornamented with small bead-like elevations, and the more inflated chambers.

The types of the variety are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

This seems to be a rare variety, common at the type locality, but rare elsewhere.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Midway formation, upper part. Arkansas, Pulaski County (25).

Robulus arkansasanus Cushman and Todd

Plate 4, figure 19

Robulus arkansasana Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 48, pl. 7, fig. 14, 1946.

Test close coiled, strongly umbonate; periphery acute but not keeled, very slightly lobulate; chambers distinct, very slightly inflated, seven or eight in the adult coil, increasing very gradually and uniformly in size as added; sutures distinct, strongly limbate, curved, raised, broadest near the umbo where they tend to fuse; wall smooth except for the raised sutures; aperture at the peripheral angle of the last-formed chamber, slightly projecting, with a distinct median slit extending slightly down the apertural face. Diameter 1.25 to 1.50 mm., thickness 0.65 to 0.75 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Pulaski County (27); Clark County (30); Navarro County (40); Caldwell County (44); Van Zandt County (47).
Kincaid formation. Texas, Hunt County (37).

Robulus cf. R. rosettus (Gümbel) Cushman

Plate 4, figures 20, 21

Robulina rosetta Gümbel, K. bayer. Akad. Wiss., Math.-phys. Abt., Abh., Kl. 2, vol. 10, p. 642, pl. 1, fig. 73, 1870.
Robulus rosetta Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 55, pl. 9, fig. 24, 1940.
Cushman and Renz, idem, vol. 18, p. 5, pl. 1, fig. 4, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 19, pl. 1, fig. 9, 1943.

Specimens compared with *R. rosettus*, described by Gümbel from the lower Eocene of Bavaria, are from the Paleocene of Alabama, Trinidad, Mississippi, and Texas. They have few, five or six, chambers in the adult whorl, distinctly inflated, periphery slightly lobulate with a distinct keel; sutures depressed and strongly curved; aperture in the adult with a slight neck.

Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation. Arkansas, Clark County (31).
Wills Point formation. Texas, Williamson County (35).

Robulus insulsus Cushman

Plate 5, figures 1–3

Robulus insulsus Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 83, pl. 18, figs. 2, 3, 1947.
Cristellaria orbicularis Plummer (not D'Orbigny), Texas Univ. Bull. 2644, p. 92, pl. 7, fig. 1, 1927.

Test small, close coiled, very thick; periphery acute and slightly keeled; chambers six or seven in number, not inflated, increasing very gradually in size as added; sutures distinct, very strongly curved, sometimes slightly raised, usually flush with the surface; wall smooth, polished, somewhat transparent; aperture radiate, slightly projecting. Diameter 0.30 to 0.40 mm., thickness 0.20 to 0.25 mm.

The types are from the Paleocene, 4.6 miles north of Fentress, Caldwell County, Tex. (44).

This species was first figured from the Paleocene by Mrs. Plummer as cited above. It occurs in Texas and Alabama in the Paleocene and is very constant in its size and general characters. It differs from *R. orbicularis* (D'Orbigny) in the much smaller size and fewer chambers.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Midway group. Texas, Caldwell County (44).

Robulus piluliferus Cushman

Plate 5, figure 4

Robulus piluliferus Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 83, pl. 18, fig. 4, 1947.

Test of medium size, close-coiled, apertural face slightly concave with raised borders, periphery acute, very slightly keeled; chambers ten to twelve in the adult coil, not inflated, of uniform shape and increasing very evenly and gradually in size as added; sutures distinct, curved, raised, the earlier ones often ending in a rounded boss near the umbo and broken into a series of bead-like projections toward the inner portion; wall smooth except for the raised sutures; aperture radiate, at the peripheral margin of the last-formed chamber. Diameter of holotype 1.50 mm., thickness 0.65 mm.

The types are from the Paleocene, upper bed at Dry Brushy Creek, 6 miles south of Thrall, Williamson County, Tex. (35).

The species differs from *R. midwayensis* (Plummer) in the generally smaller size and the beaded sutures.

Midway formation. Arkansas, Clark County (30).
Midway Group. Texas, Caldwell County (44).
Wills Point formation. Texas, Williamson County (35).

Robulus sp.

Plate 5, figures 9, 10

Robulus sp. Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 48, pl. 7, figs. 15, 16, 1946.

Rare specimens of a peculiar form with numerous chambers, tending to become slightly uncoiled in the adult, are inadequate for specific description.

Midway formation, upper part. Arkansas, Pulaski County (25).

Genus PLANULARIA Defrance, 1824

Planularia toddae Cushman

Plate 5, figures 5–8

Planularia toddae Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 34, pl. 5, fig. 12, 1944.
Astacolus jugleri Toulmin (not Reuss), Jour. Paleontology, vol. 15, p. 580, pl. 78, figs. 27, 28, 1941.
Planularia sp. Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 27, pl. 5, fig. 8, 1942.

Test small, compressed, very slightly umbonate, periphery subacute; chambers distinct, later ones tending to become more elongate, increasing very gradually in size as added; sutures distinct, very slightly curved, somewhat thickened, not depressed; wall smooth, polished; aperture radiate, at the peripheral angle. Length of holotype 0.45 mm., breadth 0.27 mm., thickness 0.15 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

This species differs from "*Cristellaria jugleri* Reuss" in its much smaller size, much less elongate form, slight increase in length of the chambers, and less curved ventral face.

Porters Creek clay. Tennessee, Hardeman County (13, 14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 5).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Wilcox County (11); Butler County (12).

Genus MARGINULINA D'Orbigny, 1826

Marginulina tuberculata (Plummer) Cushman and Bermúdez

Plate 5, figures 11–13

Cristellaria subaculeata Cushman var. *tuberculata* Plummer, Texas Univ. Bull. 2644, p. 101, pl. 7, fig. 2; pl. 14, fig. 1, 1927.
Hemicristellaria subaculeata (Cushman) var. *tuberculata* Kline, Mississippi Geol. Survey Bull. 53, p. 22, pl. 1, fig. 11, 1943.
Marginulina tuberculata Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 69, pl. 11, fig. 5, 1948.

Test elongate, somewhat compressed; periphery rounded on early chambers and very bluntly angular on later chambers of mature forms; chambers numerous, smooth, first six or seven plano-spiral followed by a linear succession of short, compact chambers; sutures marked by rows of distinct beadlike tubercles best developed on the coiled portion of the test and giving place to more ridgelike elevations between later chambers or even to depressions in extreme maturity; aperture protruding, radiate, peripheral. Length up to 1.4 mm.; average 1 mm.—Plummer.

The types are from the Paleocene Mexia member of the Wills Point formation, clay pit of Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

The species is largely confined to the upper part of the Midway group of Texas, but rare specimens were found in the Naheola formation of Alabama, and it is also recorded from the Porters Creek clay of Mississippi and the Madruga formation of Cuba.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Mexia member. Texas, Limestone County (36).
Midway group. Texas, Limestone County (39, 42); Caldwell County (44).

Marginulina earlandi (Plummer) Cushman

Plate 5, figures 14–16

Cristellaria earlandi Plummer, Texas Univ. Bull. 2644, p. 103, pl. 7, fig. 10, 1927.
Marginulina earlandi Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 56, pl. 9, figs. 14, 15, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 22, pl. 1, fig. 10, 1943.

Test very elongate, much compressed; peripheral margin narrowly rounded; chambers numerous, first six or seven closely coiled about a conspicuous and only slightly protruding boss, later ones in an erect series; sutures oblique in both the coiled and uncoiled portion of test, strongly elevated in rather even development in the coiled area but more greatly thickened on each side of the linear series; aperture marginal. Length probably up to about 3 mm.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

The species is not common in our material but rare specimens occur in the Paleocene of Alabama and it is also recorded from Mississippi.

Clayton formation. Alabama, Barbour County (10). Chalybeate limestone member. Alabama, Sumter County (9).
Midway group. Texas, Limestone County (39, 42).

Marginulina toulmini Cushman

Plate 5, figure 17

Marginulina toulmini Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 34, pl. 5, fig. 16, 1944.
Vaginulinopsis brantlyi Toulmin (not *Hemicristellaria brantlyi* Garrett), Jour. Paleontology, vol. 15, p. 583, pl. 79, figs. 8–10, 1941.
Marginulina sp. Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 21, pl. 4, fig. 4, 1944.

Test elongate, compressed, the early portion close coiled, later adult portion uncoiled; periphery in the adult becoming nearly straight; chambers distinct, 6 to 8 in the coiled portion, rapidly increasing in size, the adult uncoiled portion consisting of 3 or 4 chambers increasing gradually in height but not in width; sutures distinct, slightly curved, raised, with a row of small tubercles of clear shell material increasing in number in the uncoiled portion; wall mostly smooth except for the sutural beading, the last one or two chambers in the adult occasionally with a few, small, slightly elongate tubercles; aperture radiate, at the outer peripheral angle, in the adult with a slight neck. Length of holotype 1.00 mm., breadth 0.37 mm., thickness 0.25 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8). It was abundant at the type locality but not found elsewhere in our material.

Marginulina eximia Neugeboren

Plate 5, figures 18, 19

Marginulina eximia Neugeboren, Ver. Mitth. Siebenburg. Ver. Nat., Jahrg. 2, p. 129, pl. 4, fig. 17, 1851.
Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 54, pl. 7, fig. 8, 1932.
Cushman, idem, vol. 15, p. 56, pl. 9, figs. 27, 28, 1939.
Beck, Jour. Paleontology, vol. 17, p. 597, pl. 104, figs. 15, 16, 1943.
Kelley, Am. Assoc. Petroleum Geologists Bull., vol. 27, p. 8 (list), 1943.
Martin, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 11 (list), 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 35, pl. 5, fig. 14, 1944.
Cushman and Todd, idem, vol. 22, p. 48, pl. 7, fig. 17, 1946.

The types of this species are from the Miocene of Lapugy, Hungary. Specimens that appear to belong to that species occur in the American Paleocene and younger portions of the Eocene. They show a considerable amount of variation, as do most species of the genus.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway group. Texas, Bastrop County (43).

Marginulina cf. M. scitula Bornemann

Plate 5, figures 20, 21

Rare specimens from a few localities have been compared with Bornemann's species, but not enough specimens have been available to make the identification certain. Two of these are figured for reference.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation. Arkansas, Clark County (30)
Midway group. Texas, Caldwell County (44).

Marginulina cf. M. subrecta Franke

Plate 5, figure 22

Very rare specimens from the Paleocene of Arkansas and Texas may be compared with *M. subrecta*, described from the Paleocene of Germany.

Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Caldwell County (44).

Marginulina cf. M. dubia Neugeboren

Plate 5, figure 23

Rare specimens from a very few localities in Arkansas, Texas, and Alabama somewhat resemble this species, described from the Miocene of Lapugy, Hungary, but are probably not the same. Specimens are too few to warrant a specific determination.

Clayton formation, Pine Barren member. Alabama, Butler County (12).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Caldwell County (44).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Marginulina cf. M. havanensis Cushman and Bermúdez

Plate 5, figure 24

Rare specimens from the Paleocene of Tennessee resemble this species described from the Eocene of Cuba. They also are somewhat like specimens from the American upper Eocene referred to *M. tenuis* Bornemann.

Porters Creek clay. Tennessee, Hardeman County (13, 14).

Marginulina cf. M. glabra D'Orbigny

Plate 5, figures 25–27

Specimens from the upper part of the Paleocene, Midway group of Texas resemble *M. glabra* but show a considerable amount of variation. The species has been recorded from the Paleocene of Texas by Plummer (Texas Univ. Bull. 2644, p. 104, pl. 6, figs. 3a–g, 1927) and as "*Vaginulina glabra* (D'Orbigny)" from the Paleocene Porters Creek clay of Mississippi by Kline (Mississippi Geol. Survey Bull. 53, p. 32, pl. 3, fig. 4, 1943).

Wills Point formation. Texas, Caldwell County (34).
Midway group. Texas, Limestone County (39); Bastrop County (43); Caldwell County (44).

Marginulina cf. M. hamata (Franke) Cushman and Todd

Plate 5, figures 28, 29

Marginulina cf. *M. hamata* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 49, pl. 7, figs. 19, 20, 1946.

A few specimens in the Paleocene material from Arkansas are similar in form to this species, described as "*Cristellaria hamata*" by Franke from the Paleocene of Denmark. Our specimens are much smaller than the European ones.

Midway formation, upper part. Arkansas, Pulaski County (25).

Marginulina distincta Cushman and Bermúdez

Plate 21, figure 6

Marginulina distincta Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 69, pl. 11, fig. 2, 1948.

Test elongate, early portion close coiled, becoming uncoiled in the adult portion, axis slightly curved, early portion somewhat compressed, adult portion circular in transverse section; chambers distinct, early ones not inflated, adult ones distinctly inflated, increasing in size rapidly as added, the last three making up a large proportion of the test; sutures distinct, earlier ones slightly raised, later ones depressed; wall ornamented with numerous fine longitudinal costae, those of the later portion independent of the sutures; aperture radiate, at the peripheral angle, somewhat projecting. Length of holotype 0.80 mm.; diameter 0.30 mm.

The types are from the Paleocene Madruga formation, highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *M. havanensis* Cushman and Bermúdez in the shorter and stouter form, more strongly oblique sutures, and the costate ornamentation.

Marginulina sp. A

Plate 5, figures 30, 31

The figured specimen is similar to that figured by Mrs. Plummer from the Paleocene of Texas as "*Marginulina regularis* D'Orbigny" (Texas Univ. Bull. 2644, p. 107, pl. 5, fig. 7, 1927). It is not the same as D'Orbigny's Miocene species but not enough specimens are available to warrant a specific identification.

Midway group. Texas, Caldwell County (44).

Marginulina sp. B

Plate 5, figures 32, 33

Specimens from the Paleocene of Arkansas are too rare to give the full characters for specific determination but are figured for future reference.

Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).

Genus DENTALINA D'Orbigny, 1826

Dentalina pseudo-obliquestriata (Plummer) Cushman

Plate 6, figure 1–3

Nodosaria pseudo-obliquestriata Plummer, Texas Univ. Bull. 2644, p. 87, pl. 4, fig. 18, 1927.

Dentalina pseudo-obliquestriata Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 58, pl. 10, fig. 18, 1940.
Cushman and Todd, idem, vol. 18, p. 28, pl. 5, fig. 10, 1942.
Martin, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 10 (list), 1943.
Kline, Mississippi Geol. Survey Bull. 53, p. 26, pl. 2, fig. 14, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 50, pl. 8, fig. 18, 1946.

Test long, slender, arcuate, tapering toward the aboral extremity; chambers numerous, strongly inflated, ornamented by coarse costae that follow the length of the test somewhat obliquely; sutures strongly constricted; aperture protruding, round, somewhat eccentric. Length up to 2 mm.—Plummer.

The types are from the Paleocene, gully in field west of north-south stretch of road about 3 miles in a straight line northwest of Campbell or 4 miles by road from that town on highway to Neyland, Hunt County, Tex.

The species occurs in Texas, Arkansas, and Alabama and the characters seem to be fairly constant for species in this genus. It seems to be most common in the lower part of the Paleocene.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Pine Barren member. Alabama, Butler County (12).
Porters Creek clay. Tennessee, Hardeman County (13).
Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).
Midway formation, lower part. Arkansas, Saline County (21).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Clark County (29)
Midway group. Texas, Limestone County (39); Hunt County (41); Bastrop County (43); Caldwell County (44); Travis County (45); Van Zandt County (47).
Kincaid formation. Texas, Bastrop County (38).

Dentalina gardnerae (Plummer) Cushman

Plate 6, figures 4–7

Marginulina gardnerae Plummer, Texas Univ. Bull. 2644, p. 106, pl. 5, fig. 11, 1927.

Dentalina (?) *gardnerae* Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 57, pl. 10, figs. 10–12, 1940.
Toulmin, Jour. Paleontology, vol. 15, p. 585, pl. 79, fig. 15, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 29, pl. 5, figs. 11, 12, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 26, pl. 2, fig. 14, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 50, pl. 8, fig. 18, 1946.
Cushman and Bermúdez, idem, vol. 24, p. 69, pl. 11, fig. 3, 1948.

Test elongate, straight to slightly arcuate, somewhat stout, tapering bluntly toward the initial extremity; early chambers very slightly compressed, later ones round in transverse section, compact, subcylindrical, narrow; sutures evident as dark bands or faint lines, constricted only between the last two or three chambers, early sutures oblique or displaying even a suggestion of coiling, later ones transverse; aperture eccentric, protruding, radiate. Length up to 1.5 mm.; average 1 mm.—Plummer.

The types are from the Paleocene, from fossiliferous clays, 2½ miles northwest of Ridgeway around the bend of a small creek that flows northward into South Sulphur River, Hopkins County, Tex.

This is a widely distributed species in the Paleocene and should make a good index fossil.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Porters Creek clay. Tennessee, Hardeman County (13).
Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).
Midway formation, lower part. Arkansas, Saline County (20).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27, 28); Clark County (29, 31).
Midway group. Texas, Hunt County (41); Bastrop County (43); Travis County (45, 46); Van Zandt County (47); Freestone County (50).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Dentalina colei Cushman and Dusenbury

Plate 6, figures 8–10

Dentalina colei Cushman and Dusenbury, Cushman Lab. Foram. Research Contr., vol. 10, p. 54, pl. 7, figs. 10–12, 1934.
Parr, Royal Soc. West Australia Jour., vol. 24, p. 76, pl. 1, fig. 8, 1937–38.
Toulmin, Jour. Paleontology, vol. 15, p. 584, pl. 79, fig. 12, 1941.
Beck, idem, vol. 17, p. 598, pl. 105, fig. 18, 1943.
Curran, Am. Assoc. Petroleum Geologists Bull., vol. 27, pp. 1378, 1381 (lists), 1943.
Martin, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 10 (list), 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 37, pl. 5, figs. 25–28, 1944.
Cushman and Todd, idem, vol. 22, p. 49, pl. 8, fig. 2, 1946.

Vaginulina legumen (Linné) var. *elegans* Cole (not D'Orbigny), Bull. Am. Paleontology, vol. 14, no. 51, p. 21, pl. 3, figs. 10, 11, 1927.
Plummer, Texas Univ. Bull. 2644, p. 110, pl. 6, fig. 1, 1927.

Test elongate, tapering, with the greatest width near the apertural end, slightly curved; chambers distinct, earliest ones slightly compressed, later ones circular in transverse section, increasing very gradually in size and height as added, little if at all inflated; sutures flush with the surface, slightly oblique; wall smooth; aperture radiate, toward the inner side of the apertural face. Length 1.00 to 2.50 mm., diameter 0.12 to 0.27 mm.

The types are from the Eocene Poway conglomerate, Murray Canyon, LaJolla Quadrangle, San Diego County, Calif.

Some specimens tend toward the form of *D. gardnerae* (Plummer), but the test is more slender and more curved than in that species. It has a wide distribution.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation. Matthews Landing marl member. Alabama, Butler County (3).

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Wilcox County (11). Chalybeate limestone member. Mississippi, Kemper County (16).
Midway formation, lower part. Arkansas, Saline County (21).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (29, 31).
Midway group. Texas, Limestone County (39, 42); Hunt County (41); Caldwell County (44); Van Zandt County (47); Freestone County (50).
Wills Point formation. Texas, Caldwell County (34). Mexia member. Texas, Limestone County (36).
Kincaid formation. Texas, Hunt County (37).

Dentalina plummerae Cushman

Plate 6, figures 11–15

Dentalina plummerae Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 57, pl. 10, figs. 7–9, 19?, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 25, pl. 2, fig. 6, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 50, pl. 8, fig. 3, 1946.

Test slender, elongate, slightly curved, tapering, greatest breadth at the last-formed chamber, initial end rounded in the megalospheric form, pointed in microspheric; chambers distinct, rapidly increasing in size as added, the later ones much inflated, subspherical; sutures of the later portion very strongly depressed, limbate; wall smooth; aperture with a distinct, rather elongate, tapering neck, radiate. Length 1.30 to 2.00 mm., diameter 0.20 to 0.32 mm.

The types are from the Paleocene, U. S. Highway 80, south of Sucarnoochee Creek, ½ mile southwest of Livingston, Sumter County, Ala.

Most of the specimens in our series are from the Paleocene of Texas but it occurs at a few stations in other areas. It has been rather rare at all localities. Specimens referred to as "*Nodosaria soluta* (Reuss)" (Plummer, Texas Univ. Bull. 2644, p. 78, pl. 4, fig. 10, 1927) may belong here.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (29, 30).
Midway group. Texas, Hunt County (41); Limestone County (42); Caldwell County (44).
Wills Point formation. Texas, Travis County (33).

Dentalina insulsa Cushman

Plate 6, figures 16, 17

Dentalina insulsa Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 84, pl. 18, figs. 6, 7, 1947.
Marginulina costata Plummer (not Batsch), Texas Univ. Bull. 2644, p. 107, pl. 5, figs. 8a-c, 1927.
Dentalina sp. B Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 51, pl. 8, figs. 15, 16, 1946.

Test slightly curved, the megalospheric form with very little increase in diameter from the proloculum, the microspheric form more tapering and compressed, initial end often with a distinct spine; chambers inflated in the adult portion, increasing very gradually in size as added and becoming more distinct; sutures distinct except in the early stages of the microspheric form where they are obscured by the costae of the wall, in the later portion depressed; wall ornamented with numerous, distinct, longitudinal costae, often slightly oblique to the longitudinal axis especially in the microspheric form; aperture radiate, usually at one side of the axis of the test, only slightly projecting. Length 1.00 to 1.40 mm., diameter 0.20 to 0.30 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

This species differs from *D. pseudo-nasuta* Cushman and Todd in the much shorter apertural neck, broader and generally larger test, the costae somewhat oblique, and the less distinct chambers in the early portion.

Porters Creek clay. Tennessee, Hardeman County (13).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Clark County (30).
Midway group. Texas, Limestone County (39, 42).
Wills Point formation. Texas, Travis County (33).

Dentalina naheolensis Cushman and Todd

Plate 6, figure 18

Dentalina delicatula Cushman var. *naheolensis* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 30, pl. 5, figs. 14, 15, 1942.
Dentalina naheolensis Cushman, idem. vol. 20, p. 35, pl. 5, fig. 17, 1944. Cushman and Todd, idem, vol. 22, p. 50, pl. 8, fig. 8, 1946.

Test small, slightly curved, initial end with a slight spine, apertural end with the distinct neck at the margin; chambers few, usually 4 or 5 in the adult, somewhat inflated, of nearly uniform size and shape; sutures distinct, slightly depressed and somewhat oblique; wall ornamented with numerous fine longitudinal, slightly oblique costae; aperture radiate, terminal with a distinct, slightly tapering neck. Length of holotype 0.65 mm., diameter 0.10 mm.

The types are from the Paleocene Naheola formation, greensand bed, upper fossiliferous horizon, Naheola Landing, Tombigbee River, Ala. (7).

Most of the records are from the Naheola formation, with a very few elsewhere. It should make a good index fossil for the Paleocene.

Porters Creek clay. Tennessee, Hardeman County (13, 14).
Porters Creek formation. Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4–6); Butler County (3); Choctaw County (7).

Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Wilcox County (11); Butler County (12).
Midway formation, lower part. Arkansas, Saline County (21, 22).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Pulaski County (27).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Dentalina pseudo-nasuta Cushman and Todd

Plate 6, figures 19, 20

Dentalina pseudo-nasuta Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 51, pl. 8, figs. 13, 14, 1946.
Dentalina cf. *D. pungens* Cushman (not Reuss), idem, vol. 15, p. 57, pl. 10, fig. 9, 1939.

Test small, elongate, slender; initial end with a single long spine, apertural end produced; chambers distinct, inflated, increasing very gradually in width as added, becoming more inflated in the adult portion; sutures distinct, somewhat depressed, slightly oblique; wall ornamented with numerous low costae, often slightly oblique on the earlier chambers; aperture terminal, slightly on the concave side of the test, radiate, projecting and tapering to a pointed end. Length 0.65 to 1.05 mm., breadth 0.10 to 0.16 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks in small gully heading east, just upstream from small abandoned bridge, NE ¼ NW ¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

Similar specimens were recorded as *Dentalina* cf. *D. pungens* Reuss from the Eocene of cores from the western Atlantic.

Dentalina alabamensis Cushman

Plate 6, figures 21–24

Dentalina alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 35, pl. 5, figs. 18–21, 1944.

Test slender, initial end pointed, sometimes with a slight spine, gently tapering, one side nearly straight or slightly concave, the other slightly convex; chambers few, distinct, the last ones in the adult slightly inflated, earlier ones small and slightly coiled; sutures distinct, earlier ones strongly oblique and slightly curved, becoming slightly separated; sutures of the early portion little if at all depressed, gradually becoming deeply depressed in the adult; wall ornamented with numerous longitudinal costae, as many as 20 in the adult chambers; aperture radiate, terminal, with a prominent, slightly tapering neck. Length of holotype, 1.17 mm., diameter 0.20 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8). The species has occurred only at the type locality.

Dentalina inepta Cushman

Plate 6, figure 25

Dentalina inepta Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 83, pl. 18, fig. 5, 1947.
Dentalina sp. A Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 51, pl. 8, fig. 10.

Test elongate, slender, slightly curved, later portion slightly compressed, basal end broadly rounded; chambers of nearly uniform width, distinctly inflated, increasing very slightly in size as added; sutures distinct, depressed, slightly oblique; wall smooth; aperture at the inner margin of the last-formed chamber, radiate, slightly projecting. Length 0.60 to 1.00 mm.; breadth 0.16 to 0.25 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE ¼ NW ¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

The species differs from *D. colei* Cushman and Dusenbury in the less curved and more slender test which is slightly compressed, and the nearly uniform size of the chambers.

The species occurs at several localities in Arkansas, Texas, and Alabama.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Caldwell County (44).

Dentalina aculeata D'Orbigny

Plate 6, figure 26

Dentalina aculeata D'Orbigny, Soc. géol. France Mém., ser. 1, vol. 4, p. 13, pl. 1, figs. 2, 3, 1940.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 51, pl. 8, fig. 9, 1946.

A few specimens from the Paleocene of Texas and Arkansas resemble this species, described from the Cretaceous of France and recorded from the Upper Cretaceous of America.

Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Limestone County (39); Caldwell County (44).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Dentalina wilcoxensis Cushman

Plate 6, figures 27–29

Dentalina wilcoxensis Cushman, Am. Jour. Sci., vol. 242, p. 8, pl. 1, figs. 5, 6, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 22, pl. 4, fig. 10; p. 36, pl. 5, figs. 22–24, 1944.
Dentalina sp. Cushman and Todd, idem, vol. 18, p. 30, pl. 5 fig. 20, 1942.

Test small, elongate, of nearly uniform diameter throughout, circular or slightly compressed in transverse section, rounded at the initial end; chambers few, slightly if at all inflated, increasing only slightly in height as added; sutures distinct but not depressed,

strongly oblique; wall smooth; aperture terminal, rounded, with the border finely toothed. Length 0.50 mm., diameter 0.10 to 0.12 mm.

The types of this species are from the Eocene Bashi marl member of the Hatchetigbee formation, of the Wilcox group of Alabama. Specimens that seem referable to this species occur rarely in the Paleocene.

Midway formation, upper part. Arkansas, Pulaski County (25).

Dentalina eocenica Cushman

Plate 6, figures 30–33

Dentalina eocenica Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 36, pl. 6, fig. 1, 1944.
Cushman and Todd, idem, vol. 22, p. 50, pl. 8, figs. 4, 5, 1946.
Nodosaria pauperata Plummer (not D'Orbigny), Texas Univ. Bull. 2644, p. 79, pl. 4, fig. 11, 1927.
Nodosaria cf. *N. pauperata* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 29, pl. 5, figs. 17, 18, 1942.

Test small, slender, slightly curved, increasing very slightly in diameter; chambers distinct, but only slightly inflated in the later portion, increasing gradually and rather regularly in size as added, the last-formed one in the adult nearly twice as high as broad; sutures distinct, depressed slightly in the later portion, earlier ones slightly oblique, later ones nearly at right angles to the long axis of the test; wall smooth; aperture radiate, terminal, nearly in the center of the terminal face. Length 0.75 to 0.85 mm., diameter 0.12 to 0.14 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala.

It is possible that the incomplete form figured by Cooper (Jour. Paleontology, vol. 18, p. 347, pl. 54, fig. 21, 1944) as "*Dentalina* cf. *D. cooperensis* Cushman," from the Paleocene of Illinois, may belong here.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4, 5); Butler County (3).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26).
Wills Point formation. Texas, Caldwell County (34).
Mexia member. Texas, Limestone County (36).

Dentalina cf. D. mucronata Neugeboren

Plate 6, figures 34, 35

Specimens similar to those figured from the Paleocene of Arkansas (Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 51, pl. 8, fig. 12, 1946) and from the Naheola formation of Alabama (idem, vol. 16, p. 57, pl. 10, fig. 27, 1940) occur at a number of other stations in Alabama.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Wilcox County (6); Choctaw County (7).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Midway formation, upper part. Arkansas, Pulaski County (25).

Dentalina nasuta Cushman

Plate 6, figures 37, 38

Dentalina nasuta Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 57, pl. 10, figs. 10, 11, 1939.
Cushman and Todd, idem, vol. 22, p. 50, pl. 8, figs. 6, 7, 1946.

Test elongate, slender, slightly curved, gradually tapering from the subacute initial end to the greatest breadth at the last-formed chamber, apertural end produced into a long, tapering cone; chambers distinct, somewhat inflated toward the apertural end, increasing rather rapidly in size and height in the adult portion, slightly overlapping; sutures distinct, depressed in the later portion, somewhat oblique; wall smooth; aperture radiate, at the end of a long, conical, tapering projection of the apertural end of the last-formed chamber. Length up to 1.75 mm., diameter 0.15 to 0.25 mm.

The types are from the Eocene of a core taken off the Atlantic coast of North America.

Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Bastrop County (43).

Dentalina cf. D. pauperata D'Orbigny

Plate 6, figure 36

Rare specimens from the Paleocene of Alabama and Texas seem closely related to *D. pauperata* but not identical. Not enough specimens are available for a full specific determination.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).
Clayton formation. Alabama, Barbour County (10).
Chalybeate limestone member. Alabama, Sumter County (9).
Wills Point formation. Texas, Caldwell County (34).
Midway group. Texas, Limestone County (39); Travis County (45).

Dentalina sp. A

Plate 6, figure 39

This form occurs as very rare specimens at several localities in Texas and Alabama. Not enough specimens are available to warrant a specific identification. It somewhat resembles *D. inepta* Cushman but is not compressed and the chambers are nearly spherical.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Kincaid formation. Texas, Bastrop County (38).
Midway group. Texas, Travis County (45).

Dentalina sp. B

Plate 6, figure 41

Dentalina sp. Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 57, pl. 10, fig. 13, 1940.

Specimens from two localities in the Paleocene of Texas are similar to those found in the Paleocene of Alabama but are very rare and not specifically identifiable. The species nearest to this is probably *D. alternata* (Jones), from the Upper Cretaceous, and these may possibly be reworked specimens.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Wills Point formation, Mexia member. Texas, Limestone County (36).

Midway group. Texas, Limestone County (39); Caldwell County (44).

Dentalina sp. C

Plate 6, figure 40

Dentalina sp. C Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, 52, pl. 8, fig. 17, 1946.

A few very slightly compressed specimens, similar to that figured, are insufficient to warrant description.

Midway formation, upper part. Arkansas, Pulaski County (25).

Genus NODOSARIA Lamarck, 1812

Nodosaria affinis Reuss

Plate 7, figures 3–6

Nodosaria affinis Rouss, Versteinerungen böhm. Kreideformation, pt. 1, p. 26, pl. 13, fig. 16, 1845; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 83, pl. 2 (20), fig. 12, 1874.

Perner, Foram. Ceskeho Cenomanu, p. 57, pl. 6, figs. 10, 14a, b, 1892.

Franke, Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 37, pl. 3, fig. 25, 1925.

W. Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 6, pl. 1, fig. 8, 1929.

Cushman, Tennessee Div. Geology Bull. 41, p. 30, pl. 3, figs. 16–20, 1931; Jour. Paleontology, vol. 5, p. 305, pl. 35, figs. 3–5 (not fig. 2), 1931; Cushman Lab. Foram. Research Contr., vol. 7, p. 38, pl. 5, fig. 4, 1931.

Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 34, pl. 10, fig. 13, 1932.

Cushman, Geol. Soc. America Bull., vol. 47, p. 417, 1936; Cushman Lab. Foram. Research Contr., vol. 16, p. 59, pl. 10, figs. 30–33; p. 86, pl. 15, figs. 8–23, 1940; vol. 18, p. 30, pl. 5, figs. 27–29; p. 58, 1942.

Cushman and Renz, idem, vol. 18, p. 6, pl. 1, figs. 8–10, 1942.

Cushman and Todd, idem, vol. 19, p. 57, pl. 10, fig. 11, 1943.

Cushman, idem, vol. 20, p. 7, pl. 2, fig. 1; p. 37, pl. 6, figs. 2–5; p. 87, pl. 13, fig. 18, 1944.

Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 333, pl. 51, figs. 19–21, 1944.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 52, pl. 8, figs. 21–24, 1946.

Cushman, U. S. Geol. Survey Prof. Paper 206, p. 70, pl. 25, figs. 8–23, 1946.

Cushman and Renz, Cushman Lab. Foram. Research Special Pub. 18, p. 30, pl. 5, fig. 1, 1946.

Nodosaria vertebralis Plummer (not Batsch), Texas Univ. Bull. 2644, p. 88, pl. 5, fig. 10, 1927.

Nodosaria proxima W. Berry and Kelley (not Silvestri), U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 7, pl. 1, fig. 13, 1929.

Nodosaria cf. *N. vertebralis* (Batsch) Cooper, Jour. Paleontology, vol. 18, p. 350, pl. 55, figs. 14, 15, 1944.

Nodosaria cf. *N. zippei* Reuss, Cooper, idem, p. 350, pl. 55, figs. 18, 19, 1944.

Test elongate, of differing shape in the microspheric and megalospheric forms; the former with many chambers and tapering, the greatest width near the apertural end; the latter with the chambers of nearly uniform diameter throughout; chambers distinct, inflated, especially toward the apertural end, initial end usually with a stout spine; sutures distinct, depressed, often somewhat limbate; wall ornamented by numerous (usually 13 to 15) longitudinal costae, continuous over the adjacent chambers, usually sharp and plate-like; aperture radiate, terminal, with a slight projection of the apertural face. Length up to 2.00 mm. or more, diameter normally about 0.30 mm., but in extreme megalospheric forms may be as much as 0.75 mm.

This species apparently has a very long range and wide distribution. It occurs throughout most of the American Upper Cretaceous and is common in the Paleocene and later formations.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4); Butler County (3); Choctaw County (7).

Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Pine Barren member. Alabama, Butler County (12).

Midway formation, lower part. Arkansas, Saline County (18, 20).

Midway formation, upper part. Arkansas, Pulaski County (25).

Midway formation. Arkansas, Saline County (26); Pulaski County (27).

Midway group. Texas, Hunt County (41); Bastrop County (43, 49); Caldwell County (44); Van Zandt County (47, 48); Freestone County (50).

Wills Point formation. Texas, Travis County (33); Williamson County (35).

Nodosaria latejugata Gümbel

Plate 7, figures 1, 2

Nodosaria latejugata Gümbel, K. bayer. Akad. Wiss., Math.-phys. Abt., Abh., Kl. 2, vol. 10, p. 619, pl. 1, fig. 32, 1870.

Kline, Mississippi Geol. Survey Bull. 53, p. 27, pl. 2, fig. 10, 1943.

(?) Cooper, Jour. Paleontology, vol. 18, p. 348, pl. 55, figs. 24, 25, 1944.

Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 37, pl. 6, figs. 6–8, 1944.

Cushman and Todd, idem, vol. 22, p. 52, pl. 8, figs. 19, 20, 1946.

Nodosaria affinis Plummer (not Reuss), Texas Univ. Bull. 2644, p. 89, pl. 14, figs. 2a-d, 1927.

There are many records in the literature for this species but many of them are without figures and only

those that relate to this particular fauna are given here. It differs from *Nodosaria affinis* Reuss mainly in the greater inflation of the chambers and consequent strongly depressed sutures. Some specimens are rather difficult to allocate and the two species are evidently closely related. *N. latejugata* is apparently not found in the Upper Cretaceous.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation, lower part. Arkansas, Saline County (21).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (28); Clark County (29, 31).
Midway group. Texas, Limestone County (39, 42); Hunt County (41); Travis County (45, 46); Van Zandt County (47, 48); Bastrop County (49); Freestone County (50).
Wills Point formation. Texas, Caldwell County (34); Williamson County (35).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Nodosaria macneili Cushman

Plate 7, figure 7

Nodosaria macneili Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 37, pl. 6, fig. 9, 1944.
Nodosaria paupercula Toulmin (not Reuss), Jour. Paleontology, vol. 15, p. 588, pl. 79, figs. 29, 30, 1941.

Test slightly tapering, nearly straight, of rather few chambers, basal end rounded; chambers inflated; later ones nearly spherical and more separated; sutures of the early portion little if at all depressed, gradually becoming deeply depressed in the adult; wall ornamented with numerous longitudinal costae, as many as 20 in the adult chambers; aperture radiate, terminal, with a prominent, slightly tapering neck. Length of holotype 1.17 mm., diameter 0.20 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

The species is evidently limited in its distribution, occurring in our material only in the Naheola formation of Alabama and the Clayton formation of Tennessee.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Porters Creek clay. Tennessee, Hardeman County (13, 14).

Nodosaria cf. N. amphioxys Reuss

Plate 7, figure 8

Nodosaria cf. *N. amphioxys* Reuss, Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 52, pl. 8, fig. 25, 1946.
Nodosaria oligotoma Plummer (not Reuss), Texas Univ. Bull. 2644, p. 87, pl. 4, fig. 14, 1927.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 59, pl. 10, figs. 25, 26, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 27, pl. 2, fig. 16, 1943.

Specimens from the American Paleocene have been referred to this species with some question. The types are from the Upper Cretaceous of Saxony and it occurs in the upper portion of the Taylor marl and in the Navarro group of the southeastern United States. The references above are to Paleocene occurrences in this same area: Arkansas, Texas, Alabama, and Mississippi. They all seem to come under one species and are more like *N. amphioxys* than *N. oligotoma*.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway group. Texas, Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).

Nodosaria? cf. N. longiscata D'Orbigny

Plate 7, figures 9, 10

Nodosaria longiscata Plummer, Texas Univ. Bull. 2644, p. 82, pl. 4, fig. 17, 1927.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 59, pl. 10, fig. 28, 1940.
Cushman and Todd, idem, vol. 22, p. 52, pl. 8, fig. 26, 1944.
Nodosarina (Nodosaria) longiscata Kline, Mississippi Geol. Survey Bull. 53, p. 28, pl. 2, fig. 8, 1943.

Very rare specimens from the Paleocene of Texas, Arkansas, Mississippi, and Alabama are referred to this species with considerable question.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Limestone County (39); Van Zandt County (47).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Genus CHRYSALOGONIUM Schubert, 1907

Chrysalogonium granti (Plummer) Toulmin

Plate 13, figure 11

Nodosaria granti Plummer, Texas Univ. Bull. 2644, p. 83, pl. 5, figs. 9*a-d*, 1927.
Dentalina granti Plummer, idem, Bull. 3101, p. 149, pl. 11, figs. 8, 9, 1931.
Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 176, pl. 29, fig. 6, 1936.
Ellipsonodosaria? granti Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 51, pl. 9, figs. 3–5, 1936.
Cushman, idem, vol. 16, p. 69, pl. 12, fig. 3, 1940.
Cushman and Todd, idem, vol. 19, p. 67, pl. 11, fig. 30, 1943.
Cushman, U. S. Geol. Survey Prof. Paper 206, p. 136, pl. 56, figs. 24–26, 1946.
Chrysalogonium granti Toulmin, Jour. Paleontology, vol. 15, p. 589, pl. 79, figs. 34, 35, 1941.
Kline, Mississippi Geol. Survey Bull. 53, p. 29, pl. 2, fig. 9, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 346, pl. 54, figs. 26, 27, 1944.

Test very elongate, slightly arcuate, slightly tapering, initial end with a stout spine; chambers numerous, later ones becoming slightly inflated, sometimes but not always pyriform in shape, increasing in relative length as added; sutures transverse, indistinct, sometimes unobservable in the early part of the test, later becoming progressively more constricted; wall smooth, thick, opaque; aperture terminal, a bluntly pointed cribrate cone. Length up to 3 mm. or more, diameter up to 0.25 mm., usually less.

This species has been recorded frequently from the Upper Cretaceous and lower Eocene under various generic names. The test is very easily broken and usually only fragments are found. Recently Mrs. Plummer sent me a specimen showing the aperture, which is characteristic of *Chrysalogonium* and the species is here included under that genus. It is common in our Paleocene material.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30, 31).
Midway group. Texas, Hunf County (41); Caldwell County (44); Travis County (45, 46); Van Zandt County (47); Freestone County (50).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Kincaid formation. Texas, Hunt County (37).

Chrysalogonium arkansasanum Cushman and Todd

Plate 7, figures 11, 12

Chrysalogonium arkansasanum Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 52, pl. 9, figs. 1, 2, 1946.
Chrysalogonium cf. *C. texanum* Cushman, idem, vol. 16, p. 60, pl. 10, fig. 14, 1940.

Test very elongate, nearly straight to slightly curved, very slightly tapering, widest toward the apertural end, initial end with a short spine; chambers distinct, numerous, slightly inflated, averaging about twice as long as broad, increasing very slightly in relative length as added; sutures distinct, very slightly depressed; wall smooth; aperture terminal, cribrate, raised in a blunt cone. Length up to 3.75 mm., diameter up to 0.25 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

This species is very close to *C. granti* (Plummer) but differs in having more evenly inflated and nonpyriform chambers.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).

Chrysalogonium eocenicum Cushman and Todd

Plate 7, figures 13–15

Chrysalogonium eocenicum Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 53, pl. 9, figs. 3–5, 1946.

Test elongate, slender, distinctly curved, tapering, widest toward the apertural end, initial end subacute; chambers distinct, numerous, slightly inflated, slightly longer than broad in the adult, increasing little in relative length as added; sutures distinct, depressed and slightly oblique in the earlier portion; wall smooth; aperture terminal, cribrate, little if at all projecting above the contour of the chamber. Length up to 1.25 mm., breadth up to 0.15 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

This species is very constant in its characters and occurs at a number of localities in the Paleocene of Arkansas, Texas, and Alabama.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2); Butler County (3).
Clayton formation. Alabama, Barbour County (10).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Clark County (30).
Midway group. Texas, Caldwell County (44).

Genus PSEUDOGLANDULINA Cushman, 1929

Pseudoglandulina manifesta (Reuss) Cushman

Plate 7, figures 16, 17

Glandulina manifesta Reuss, Haidinger's Naturwiss. Abh., vol. 4, pt. 1, p. 22, pl. 1, fig. 4, 1851.
Franke, Preuss. geol. Landesanstalt Abh., n. ser., vol. 111, p. 52, pl. 4, fig. 28, 1928.
Cushman and Church, California Acad. Sci. Proc., 4th ser. vol. 18, p. 511, pl. 39, fig. 10, 1929.
Nodosaria manifesta Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 594, pl. 18, fig. 8, 1926.
Sandige, Jour. Paleontology, vol. 6, p. 278, pl. 42, fig. 8, 1932.
Pseudoglandulina manifesta Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 60, pl. 11, fig. 1, 1940.
Toulmin, Jour. Paleontology, vol. 15, p. 590, pl. 79, fig. 32, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 31, pl. 6, figs. 1, 2, 1942; vol 19, p. 58, pl. 10, fig. 15, 1943.
Kline, Mississippi Geol. Survey Bull. 53, p. 30, pl. 2, fig. 12, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 53, pl. 9, figs. 6–9, 1946.
Cushman, U. S. Geol. Survey Prof. Paper 206, p. 76, pl. 27, figs. 20–26, 1946.
Nodosaria larva Carsey, Texas Univ. Bull. 2612, p. 31, pl. 2, fig. 2, 1926.
Nodosaria radicula Plummer (Not Linné), idem. Bull. 2644, p. 77, pl. 4, fig. 9, 1927.
Nodosaria humilis Cushman (not Roemer), Tennessee Div. Geology Bull. 41, p. 32, pl. 4, fig. 5, 1931.

Test uniserial; the microspheric form rapidly tapering, initial end pointed, often with a small spine; the megalospheric form with a large proloculum forming a rounded base and the test much more nearly cylindrical; chambers in the early stages strongly overlapping with little or no inflation, in the adult stage much inflated; sutures in the early stages flush with the surface, in the adult depressed; wall smooth and polished; aperture terminal, radiate. Length 0.70 to 0.90 mm., diameter 0.25 to 0.35 mm.

The types are from the Upper Cretaceous of Lemberg. The species occurs in the American Upper Cretaceous, most abundantly in beds of Navarro and Taylor age. The Paleocene specimens seem identical with the Cretaceous ones but show some variation, especially in the rounded or acute base, evidently dependent on whether microspheric or megalospheric.

Porters Creek formation, Matthews Landing marl member. Alabama, **Choctaw County (7).**
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27).
Midway group. Texas, Navarro County (40); Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).

Pseudoglandulina cf. P. caudigera (Schwager) Cushman

Plate 7, figures 18, 19

Pseudoglandulina cf. *P. caudigera* Schwager, Cushman Lab. Foram. Research Contr., vol. 16, p. 60, pl. 11, figs. 2, 3, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 29, pl. 2, fig. 17, 1943.

Specimens from the Paleocene of Alabama, Mississippi, and Texas have been referred with some question to Schwager's species, the types of which are from the lower Eocene of northern Africa. They are shorter and more tapering than typical specimens of *P. manifesta* (Reuss) Cushman but otherwise are much like the microspheric forms of that species. The specimens referred to "*Nodosaria* (*Glandulina*) *laevigata* D'Orbigny var. *occidentalis* Cushman" by Mrs. Plummer (Texas Univ. Bull. 2644, p. 75, pl. 4, fig. 8, 1927) may belong to *Pseudoglandulina caudigera.*

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4, 5); Butler County (3).
Midway formation. Arkansas, Pulaski County (27).
Midway group. Texas, Bastrop County (43); Caldwell County (44).

Pseudoglandulina pygmaea (Reuss) Cushman

Plate 7, figures 20–22

Glandulina pygmaea Reuss, Haidinger's Naturwiss. Abh., vol. 4, pt. 1, p. 6, pl. 1, fig. 3, 1851.
Pseudoglandulina pygmaea Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 60, pl. 11, fig. 4, 1940.
Cushman and Todd, idem, vol. 22, p. 54, pl. 9, figs. 10, 11, 1946.
Cushman, U. S. Geol. Survey Prof. Paper 206, p. 76, pl. 27, figs. 27, 28, 1946.
Nodosaria (*Glandulina*) *comata* Plummer (not Batsch), Texas Univ. Bull. 2644, p. 76, pl. 4, fig. 7, 1927.
Pseudoglandulina comata Kline (not Batsch), Mississippi Geol. Survey Bull. 53, p. 29, pl. 2, fig. 13, 1943.

Test short and stout, only a little longer than broad, circular in transverse section, initial and pointed; chambers few, much overlapping, the final chamber making up more than half the test; sutures indistinct; wall ornamented by numerous longitudinal costae; aperture terminal, radiate. Length 0.30 to 0.50 mm., diameter 0.25 to 0.40 mm.

The types are from the Upper Cretaceous of Lemberg. It occurs in the American Cretaceous in beds of Navarro and Taylor age and similar specimens are widely distributed in the American Paleocene.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Pine Barren member. Alabama, Butler County (12).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (29–31).
Midway group. Texas, Hunt County (41); Bastrop County (43); Travis County (45); Van Zandt County (47); Freestone County (50).
Kincaid formation. Texas, Bastrop County (38).

Pseudoglandulina madrugaensis Cushman and Bermúdez

Plate 21, figure 4

Pseudoglandulina madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 70, pl. 11, fig. 7, 1948.

Test elongate, circular in transverse section, rectilinear; chambers distinct, inflated, increasing very gradually in size as added; sutures distinct, depressed; wall ornamented with very fine longitudinal costae; aperture terminal, radiate. Length of holotype 1.05 mm.; diameter 0.40 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

The species differs from *P. manifesta* (Reuss) in the slightly higher chambers, deeper sutures, and finely costate surface.

Genus LINGULINA D'Orbigny, 1826

Lingulina naheolensis Cushman

Plate 7, figure 23

Lingulina naheolensis Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 18, 1947.
Lingulina minuta Cushman (not Franke), idem, vol. 20, p. 38, pl. 6, fig. 10, 1944.

Test minute, about twice as long as broad, compressed, tapering from the acute initial end to the greatest breadth at the middle of the last-formed chamber, thence narrowing to the bluntly angled, apertural

end; chambers few, increasing rapidly in size as added, strongly overlapping; sutures distinct, not depressed, at right angles to the long axis of the test; wall smooth; aperture terminal, radiate, not projecting. Length of holotype 0.35 mm., breadth 0.15 mm., thickness 0.12 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Lingulina cf. L. wilcoxensis Cushman and Ponton

Plate 7, figure 24

Lingulina cf. *L. wilcoxensis* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 54, pl. 9, fig. 12, 1946.

The only record for this form in the Paleocene is from Arkansas (25); it is represented by a single, incomplete specimen.

Genus SARACENARIA Defrance, 1824

Saracenaria trigonata (Plummer) Cushman

Plate 7, figures 25, 26

Cristellaria trigonata Plummer, Texas Univ. Bull. 2644, p. 101, pl. 7, fig. 3, 1927.

Saracenaria trigonata Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 61, pl. 9, fig. 31, 1940.

Kline, Mississippi Geol. Survey Bull. 53, p. 31, pl. 3, fig. 2, 1943.

Test elongate, triangular in cross section, tapering toward the oral end; peripheral margin carinate; early chambers closely coiled, later ones sharply carinate on each side of the septal face; sutures as dark lines; aperture at the apex of a long, broad, septal face on mature specimens. Length up to 0.7 mm.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

The species is recorded by Kline from the Paleocene of Clay County, Mississippi.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Saracenaria sublatifrons (Plummer) Kline

Plate 7, figure 27

Cristellaria sublatifrons Plummer, Texas Univ. Bull. 2644, p. 100, pl. 7, fig. 6, 1927.

Saracenaria cf. *sublatifrons* Kline, Mississippi Geol. Survey Bull. 53, p. 31, pl. 3, fig. 1, 1943.

Test elongate, smooth, tapering at both ends; peripheral margin bluntly angular; chambers few, passing from very slightly spiral to linear oblique in rapidly lengthening series, later chambers bluntly triangular but not keeled; sutures strongly oblique, smooth, distinct; aperture at apex of a long, narrow, slightly inflated septal face marked by a faint longitudinal furrow. Length up to 0.5 mm.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

Wills Point formation, Mexia member. Texas, Limestone County (36).

Midway group. Texas, Caldwell County (44).

Saracenaria midwayensis Kline

Plate 7, figures 28–30

Saracenaria midwayensis Kline, Mississippi Geol. Survey Bull. 53, p. 30, pl. 3, fig. 3, 1943.

Test nearly triangular, periphery acute, apertural face elliptical; closely coiled; chambers few, 4 to 5 usually visible, increasing rapidly in size; sutures distinct, depressed slightly or not at all, slightly curved; wall smooth, glossy; aperture peripheral, radiate. Average length 0.5 mm.—Kline.

The types came from the Paleocene Porters Creek clay, 1½ miles northwest of Montpelier, Clay County, Miss. Kline also reports that this species is widely distributed in Mississippi but is confined to the Porters Creek clay. No specimens were found in our collections.

Genus VAGINULINA D'Orbigny, 1826

Vaginulina gracilis Plummer

Plate 8, figures 1–3

Vaginulina gracilis Plummer, Texas Univ. Bull. 2644, p. 111, pl. 6, fig. 5, 1927.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 61, pl. 9, fig. 27, 1940.

Kline, Mississippi Geol. Survey Bull. 53, p. 32, pl. 3, fig. 7, 1943.

Cooper, Jour. Paleontology, vol. 18, p. 351, pl. 55, figs. 5, 6 1944.

Test long, slender, slightly arcuate, gradually tapering toward the initial end, compressed; chambers numerous, short, smooth, compact, except the primordial chamber which is bulbous in megalospheric forms; sutures oblique on early portion of test to less oblique above, expressed outwardly by distinct and narrow ridges that extend around the apertural margin; wall moderately strong; aperture marginal, protruding, radiate. Length up to 2.5 mm.—Plummer.

The types are from the Paleocene, gully in field west of north-south stretch of road about 3 miles in a straight line northwest of Campbell or 4 miles by road from that town on highway to Neyland, Hunt County, Tex.

This species is very common in the Paleocene of America and, together with *V. midwayana* Fox and Ross, makes an excellent index fossil for the Paleocene.

Clayton formation, Pine Barren member. Alabama, Butler County (12).

Chalybeate limestone member. Mississippi, Noxubee County (16).

Porters Creek clay. Mississippi, Kemper County (17).

Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (29, 31).

Midway group. Texas, Hunt County (41); Bastrop County (43, 49); Travis County (45, 46); Van Zandt County (47); Freestone County (50).

Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Vaginulina midwayana Fox and Ross

Plate 8, figures 4–9

Vaginulina midwayana Fox and Ross, Jour. Paleontology, vol. 16, p. 669, 1942.

Vaginulina robusta Plummer (not Chapman), Texas Univ. Bull. 2644, p. 112, pl. 6, fig. 4; pl. 13, fig. 3, 1927.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 61, pl. 10, figs. 1–4, 1940.

Cushman and Renz, idem, vol. 18, p. 6, pl. 2, figs. 1, 2, 1942.

Cushman and Todd, idem, vol. 18, p. 32, pl. 5, figs. 21, 22, 1942.

Kline, Mississippi Geol. Survey Bull. 53, p. 34, pl. 3, fig. 8, 1943.

Cooper, Jour. Paleontology, vol. 18, p. 351, pl. 55, figs. 16, 17, 1944.

Applin and Jordan, idem, vol. 19, p. 132 (list), 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 54, pl. 9, figs. 15–19, 1946.

Test elongate, moderately broad, stout, somewhat compressed, tapering bluntly in megalospheric forms but very acutely in microspheric forms; chambers smooth, few, first two or three very slightly twisted followed by the usual straight linear series; sutures oblique, conspicuously marked by sharp, high ridges that on most specimens encircle the test, though a slight amount of discontinuity is frequently evident; aperture on extreme margin. Length up to 1.4 mm.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

This is an excellent index fossil for the Paleocene. Some specimens are difficult to distinguish from *V. gracilis* Plummer, but *V. midwayana* has a greater amount of ornamentation and the costae extend out on the peripheral margins and become spinose. The general form is also shorter and broader.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Midway formation, lower part. Arkansas, Saline County (20).

Midway formation, upper part. Arkansas, Pulaski County (25).

Midway formation. Arkansas, Saline County (26); Pulaski County (27, 28); Clark County (30, 31).

Midway group. Texas, Limestone County (39, 42); Navarro County (40); Bastrop County (43); Caldwell County (44).

Wills Point formation. Texas, Travis County (33); Caldwell County (34).

Mexia member. Texas, Limestone County (36).

Vaginulina longiforma (Plummer) Cushman

Plate 8, figures 10–15

Cristellaria longiforma Plummer, Texas Univ. Bull. 2644, p. 102, pl. 13, fig. 4, 1927.

Hemicristellaria longiforma Plummer, idem, Bull. 3201, pp. 54, 61, 62, 64 (lists), 1933.

Vaginulina longiforma Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 38, pl. 6, figs. 11–13, 1944.

Cushman and Todd, idem, vol. 22, p. 54, pl. 9, figs. 13, 14, 1946.

Cushman and Bermúdez, idem, vol. 24, p. 70, pl. 11, fig. 4, 1948.

Test elongate, stout, broad, compressed; few early chambers more or less coiled, later chambers erect and somewhat oblique; sutures very strongly limbate on each side but apparent on the margins as lines or less distinct ridges; aperture marginal, protruding, radiate. Length up to 1.7 mm.—Plummer.

The types are from the Paleocene, exposure along an east-west road about three-quarters of a mile north of New Hope between two creeks, Freestone County, Tex.

This species is very distinct from the preceding ones and should also make a good index fossil for the upper portion of the Paleocene.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4); Butler County (3).

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Midway formation, lower part. Arkansas, Saline County (21).

Midway formation, upper part. Arkansas, Pulaski County (25).

Midway formation. Arkansas, Saline County (26); Pulaski County (27).

Wills Point formation. Texas, Travis County (33); Caldwell County (34).

Vaginulina plumoides Plummer

Plate 8, figures 16–18

Vaginulina plumoides Plummer, Texas Univ. Bull. 2644, p. 113, pl. 6, fig 6, 1927.

Cushman, Cushman Lab. Foram. Research Contr., vol 16, p. 61, pl. 9, fig. 26, 1940.

Cushman and Renz, idem, vol. 18, p. 6, pl. 1, fig. 6, 1942.

Kline, Mississippi Geol. Survey Bull. 53, p. 33, pl. 3, fig. 6, 1943.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 55, pl. 9, fig. 20, 1944.

Test very thin, wing shaped, acuminate posteriorly and anteriorly, spreading rapidly upward; chambers very oblique and somewhat curved, ornamented by very fine delicate striae parallel to the direction of growth; aperture protruding. Length up to .8 mm.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

This species, although not as common as some of the others, is very distinctive and makes an excellent marker for the Paleocene. Typical specimens also occur in the Paleocene of Trinidad.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3)

Midway formation, upper part. Arkansas, Pulaski County (25).

Midway formation. Arkansas, Clark County (29).

Midway group. Texas, Bastrop County (43); Caldwell County (44); Travis County (45); Van Zandt County (47); Freestone County (50).

Wills Point formation. Texas, Caldwell County (34).

Vaginulina semilaevis Cushman and Bermúdez

Plate 21, figure 5

Vaginulina semilaevis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 70, pl. 11, fig. 6, 1948.

Test elongate, somewhat compressed, slender, increasing in width to the last-formed chamber, initial end

Table 2.—*Distribution of Paleocene Lagenidae in the Gulf Coastal region*

[Prepared by J. B. Reeside, Jr. Numbers refer to locality list on pages 1-3. K=localities reported by V. H. Kline, P=localities reported by H. J. Plummer and C. G. Lalicker, C=Cuba and Haiti, G=Guatemala and Honduras, S=Soldado Rock, Trinidad, B. W. I.]

	Alabama												Tenn.		Miss.				Arkansas															Texas																					C	G	S
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	K	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	P			
Robulus midwayensis			X		X	X	X	X	X	X		X	X	X			X		X	X	X	X			X	X	X		X		X	X		X	X	X		X	X	X	X	X	X	X	X	X	X			X							
midwayensis var. *carinatus*																															X	X			X			X				X						X	X		X						
pseudo-mamilligerus									X																	X						X		X	X					X					X												
turbinatus			X						X							X								X	X	X	X			X	X		X	X		X				X		X		X											
degolyeri																										X		X		X	X															X			X	X								
pseudo-costatus																X	X															X		X						X				X				X	X	X			X						
pseudo-costatus var. *comis*																X																																												
alabamensis								X	X																X				X	X	X										X			X		X	X			X						
wilcoxensis							X																																	X																			
wilcoxensis var. *dissentius*			X																							X																																
arkansasanus																										X		X			X							X			X				X			X								
cf. *R. rosettus*																X																	X				X																							
insulsus			X																																												X										
piluliferus																															X						X								X											
sp.																										X																															
Planularia toddae	X	X			X			X			X	X	X	X																																											
Marginulina tuberculata					X																													X	X		X			X			X		X											X		
earlandi									X	X																												X			X													
toulmini								X																																																		
eximia								X																	X	X																		X												
cf. *M. scitula*							X		X																					X														X												
cf. *M. subrecta*																										X																	X												
cf. *M. dubia*												X															X											X							X												
cf. *M. havanensis*													X	X																																										
cf. *M. glabra*																		X																	X					X				X	X											
cf. *M. hamata*																										X																															
distincta																																																							X		
sp. *A*																																														X												
sp. *B*																										X	X																														
Dentalina pseudo-obliquestriata							X		X			X	X									X				X				X								X	X		X		X	X	X		X									
gardnerae							X		X				X									X					X	X	X	X	X		X						X	X			X		X		X	X	X			X						
colei			X					X			X					X	X						X			X	X	X		X		X			X		X	X		X		X	X		X			X			X						
plummerae			X						X								X									X	X	X		X	X			X								X	X		X											
insulsa													X														X	X				X			X						X			X														
naheolensis	X	X	X	X	X	X	X	X			X	X	X	X								X	X			X		X											X	X																	
pseudo-nasuta																										X																															
alabamensis								X																																																		
inepta			X																						X																	X												
aculeata																X										X												X			X				X												
wilcoxensis																										X																															
eocenica	X	X	X	X	X			X				X					X									X	X	X									X		X																				
nasuta																										X																		X													
cf. *D. mucronata*			X			X	X					X														X																															
cf. *D. pauperata*							X		X	X																							X					X						X										
sp. *A*					X							X																										X							X									
sp. *B*									X																											X			X					X												
sp. *C*																										X																															
Nodosaria affinis		X	X	X			X	X	X			X				X			X		X					X	X	X						X		X						X		X	X			X	X	X	X						
latejugata			X													X					X				X	X		X	X		X			X	X		X	X	X		X	X			X	X	X	X	X	X						
macneili								X					X	X																																												
cf. *N. amphioxys*			X													X								X	X										X									X												
cf. *N. longiscata*							X					X														X													X			X							X								
Chrysalogonium granti									X								X										X	X			X	X		X	X			X				X			X	X	X	X			X						
arkansasanum			X						X																X																															
eocenicum		X	X							X															X					X														X												
Pseudoglandulina manifesta							X		X																X	X	X						X						X				X												
cf. *P. caudigera*		X	X	X	X											X												X																	X	X											
pygmaea									X			X				X									X	X	X	X		X	X	X								X			X		X		X		X			X						
madrugaensis																																																							X		
Lingulina naheolensis			X						X																																																
cf. *L. wilcoxensis*																										X																															
Saracenaria trigonata					X				X									X																																						
sublatifrons																																					X							X												
midwayensis																			X																																						
Vaginulina gracilis												X			X	X											X	X		X		X							X	X			X		X		X	X	X		X	X						
midwayana							X		X											X					X	X	X	X		X	X		X	X		X			X	X		X	X	X											
longiforma		X	X	X				X													X				X	X	X						X	X																						
plumoides			X																						X				X				X									X	X	X		X			X						
semilaevis																																																							X		
sp.																										X																															
Palmula budensis							X		X																X	X								X																				
delicatissima									X																											X						X														
rugosa																X																X																							
primitiva var. *paleocenica*									X									X																																						
Frondicularia midwayensis			X						X																																	X													
naheolensis				X			X																		X	X								X					X					X												
cf. *F. goldfussi*																															X						X																		
cf. *F. frankei*									X																					X																										
sp. *A*												X														X	X																														
Lagena cf. *L. laevis*	X	X	X	X			X											X				X				X	X																											
sulcata var. *semiinterrupta*										X																									X		X								X												
cf. *L. acuticosta*								X	X			X									X	X						X								X										X												
cf. *L. costata*			X								X	X														X																				X												
"cf. *L. primigera*"																			X																																						

acute with a slight spine, periphery slightly rounded; chambers of the early portion rather indistinct, later ones distinct and very slightly inflated, increasing rather evenly in size as added; sutures of the early portion indistinct, later ones distinct and slightly depressed, strongly oblique; wall of the early portion nearly smooth, later portion with longitudinal costae independent of the sutures; aperture terminal, radiate. Length of holotype 2.30 mm.; breadth 0.30 mm. The types are from the Paleocene Madruga formation, San Juan y Martinez, Pinar del Rio Province, Cuba.

This species differs from *V. plumoides* Plummer in the more slender, elongate form, higher chambers, and smooth early portion.

Vaginulina sp.

Plate 8, figure 19

Vaginulina sp. A Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 55, pl. 8, fig. 11, 1946.

Rare specimens of a compressed, faintly costate form may be new but are too few to warrant description.

Midway formation, upper part. Arkansas, Pulaski County (25).

Genus PALMULA Lea, 1833

Palmula budensis (Hantken) Cushman

Plate 7, figures 31, 32

Flabellina budensis Hantken, K. Ungar. geol. Anstalt Mitth., vol. 4, p. 44, pl. 4, fig. 17, 1875 (1881).
Frondicularia budensis Plummer, Texas Univ. Bull. 2644, p. 116, pl. 5, fig. 5, 1927.
Palmula cf. *P. budensis* Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 62, pl. 10, figs, 5, 6, 1940.
Cushman and Todd, idem, vol. 18, p. 33, pl. 6, fig. 3, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 34, pl. 3, fig. 9, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 55, pl. 9, figs. 21, 22, 1946.

Test strongly compressed, elongate oval; chambers distinct, earlier ones loosely coiled, later extending back on both sides toward the base, narrow, increasing only slightly in size as added; sutures distinct, slightly depressed, very slightly curved; wall smooth; aperture terminal, radiate. Length 0.75 to 1.40 mm.

The types are from the upper Eocene of Hungary. Specimens referred to this species have been recorded from the Paleocene of Texas, Arkansas, Mississippi, and Alabama, but seem to be very rare.

The figures of "*Frondicularia oldhami* Plummer" (Texas Univ. Bull. 2644, p. 117, text figs. 12a-c, 1927) are similar to specimens of *Palmula budensis*, but no specimens are available.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).
Wills Point formation. Texas, Caldwell County (34).

Palmula delicatissima (Plummer) Cushman

Plate 7, figures 33–35

Frondicularia delicatissima Plummer, Texas Univ. Bull. 2644, p. 120, pl. 5, fig. 4, 1927.
Palmula delicatissima Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 61, pl. 9, figs. 28, 29, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 35, pl. 3, fig. 12, 1943.

Test very thin, broadly subovate, tapering rapidly toward the apertural extremity and bluntly rounded posteriorly; peripheral edges narrowly quadrate; early chambers Flabelline and irregularly coiled, later series typically sagittate; sutures delicate, thin, raised ridges from which branch a few wavy elevations especially near the apertural extremities of the sutures; shell wall coarsely punctate; aperture protruding. Length up to .95 mm., average .5 mm.—Plummer.

The types are from the Paleocene, clay in section of Tehuacana Creek, 200 feet east of the Mexia-Wortham road bridge, Limestone County, Tex.

This species is apparently characteristic of the upper portion of the Paleocene of Texas and Alabama, and is recorded from the Porters Creek clay of Mississippi.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Wills Point formation, Mexia member. Texas, Limestone County (36).
Midway group. Texas, Limestone County (42).

Palmula rugosa (D'Orbigny) Cushman

Plate 7, figures 36, 37

Flabellina rugosa D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 23, pl. 2, figs. 4, 5, 7, 1840.
Reuss (in Geinitz), Grundriss der Verstein., p. 658, pl. 24, fig. 23, 1845–46.
D'Orbigny, Prodome de paléontologie stratigraphique universelle des animaux mollusques et rayonnés, vol. 2, p. 281, No. 1379, 1850.
Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Denkschr., vol. 7, pt. 1, p. 67, 1854; idem, Sitzungsber., vol. 40, p. 215, 1860; idem, vol. 52, Abt. 1, p. 453, 1865.
Karrer, K. K. geol. Reichsanst. Jahrb., vol. 20, p. 176, 1870.
Marsson, Naturw. Ver. Neu-Vorpommern u. Rügen Mitt., Jahrg. 10, p. 140, 1878.
Goës, K. svenska vetensk. akad. Handl., vol. 15, pt. 4, No. 2, pl. 2, fig. 4, 1889.
Beissel, Preuss. geol. Landesanstalt Abh., new ser., vol. 3, p. 47, pl. 9, figs. 20–24; pl. 16, figs. 30, 31, 1891.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 108, pl. 10, figs. 5, 6; pl. 13, figs. 1, 2, 1899; Naturwiss. Ver. Passau Ber., p. 30, pl. 1, fig. 8, 1907.
Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 189, 1927.
Sandidge, Jour. Paleontology, vol. 6, p. 279, pl. 42, fig. 22, 1932.
Brotzen, Zeitschr. Deutschen Palästina-Vereins, Jahrg., p. 45, 1934.
Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 83, pl. 13, figs. 1–6, 1935.

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Frondicularia rugosa Plummer, Texas Univ. Bull. 2644, p. 118, pl. 5, fig. 1, 1927.

Palmula rugosa Cushman, Foraminifera, Ed. 3, Key, pl. 20, fig. 8, 1940; Cushman Lab. Foram Research Contr., vol. 16, p. 62, pl. 9, fig. 30, 1940; idem, vol. 20, p. 8, pl. 2, fig. 6, 1944.

Kline, Mississippi Geol. Survey Bull. 53, p. 36, pl. 3, fig. 11, 1943.

Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 335, pl. 52, fig. 7, 1944.

Flabellina interpunctata Von der Marck, Naturh. Ver. preuss. Rheinland Verh., vol. 15, p. 53, pl. 1, fig. 5, 1858.

Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 216, pl. 9, fig. 1, 1860.

Heron-Allen and Earland, Royal Micr. Soc. Jour., p. 422, pl. 8, fig. 5, 1910.

Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 277 (1913).

Chapman, W. Australia Geol. Survey Bull. 72, p. 34, pl. 10, fig. 91, 1917.

Franke, Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 64, pl. 5, fig. 13, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 92, pl. 8, fig. 17, 1928.

Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 30, pl. 4, figs. 16, 17, 1930; Jour. Paleontology, vol. 5, p. 307, pl. 35, fig. 9, 1931.

Plummer, Texas Univ. Bull. 3101, p. 163, pl. 12, figs. 1–3, 1931.

Cushman, Jour. Paleontology, vol. 6, p. 336, 1932.

Sandidge, Am. Midland Naturalist, vol. 13, p. 194, pl. 19, figs. 12–14, 1932; Jour. Paleontology, vol. 6, p. 279, pl. 42, fig. 21, 1932.

Frondicularia projecta Carsey, Texas Univ. Bull. 2612, p. 41, pl. 6, fig. 5, 1926.

Flabellina projecta Plummer, idem, Bull. 3101, p. 165, pl. 12, figs. 5–8, 1931.

Frondicularia baudouiniana Cushman (not D'Orbigny), Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 21, pl. 3, fig. 5, 1926; Jour. Paleontology, vol. 1, p. 155, pl. 24, fig. 13, 1927.

Test sagittate to rhomboid or even broadly elliptical in outline, much compressed, sides nearly flat, periphery truncate; early chambers coiled, especially in the microspheric form, later chambers chevron-shaped, narrow and of uniform width, extending back on both sides, often at first nearly enclosing the earlier coiled chambers; sutures raised and sharp, later chambers with a loop at the apical end; wall between the raised sutures with a series of small, raised papillae; apertural end projecting, with a slight neck. Length up to 1.20 mm., breadth 1.00 mm.

The types of this species are from the Upper Cretaceous Craie blanche of the Paris Basin. It is a very common species in the Upper Cretaceous of America. It occurs especially in the lower portion of the Paleocene of Texas, Alabama, and Mississippi. Some of the specimens seem worn and may have been reworked from Upper Cretaceous beds.

Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).

Midway formation. Arkansas, Clark County (31).

Palmula primitiva Cushman var. paleocenica Cushman

Plate 7, figure 38

Palmula primitiva Cushman var. *paleocenica* Cushman, Cushman Lab. Foram. Research Contr., vol. 24, p. 43, pl. 8, fig. 7, 1948.

Palmula cf. *P. primitiva* Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 62, pl. 9, fig. 33, 1940.

Kline, Mississippi Geol. Survey Bull. 53, p. 35, pl. 3, fig. 10, 1943.

Variety differing from the typical form in the shorter broader shape and the thicker wall.

The types are from the Paleocene *Ostrea pulaskensis* bed, old abandoned roadway south of Sucarnoochee Creek, about 1/10 mile upstream from crossing of U. S. Highway 80, 1/2 mile southwest of Livingston, Sumter County, Ala. (9).

This is probably the same as the form figured by Kline from the Paleocene of Mississippi, where it is recorded from the Porters Creek clay and the Clayton formation.

Genus FRONDICULARIA Defrance, 1824

Frondicularia midwayensis Cushman

Plate 9, figures 4, 5

Frondicularia midwayensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 63, pl. 10, figs. 34, 35, 1940.

Frondicularia sp. Cushman, idem, vol. 20, p. 39, pl. 6, fig. 14, 1944.

Test large, much compressed, irregularly rhomboid in front view, with the greatest breadth toward its apertural end, initial end with a slight spine; chambers numerous, distinct, of uniform shape, increasing very gradually in height as added, proloculum globular; sutures distinct, slightly raised above the general surface; wall of the proloculum with a few longitudinal costae, the surface in the adult finely but distinctly papillate; aperture terminal, radiate, slightly projecting. Length 1.75 to 2.50 mm., breadth 0.50 to 0.65 mm.

The types are from the Paleocene, U. S. Highway 80, south of Sucarnoochee Creek, 1/2 mile southwest of Livingston, Sumter County, Ala. (9).

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Midway group. Texas, Bastrop County (43).

Frondicularia naheolensis Cushman and Todd

Plate 8, figures 24, 25

Frondicularia naheolensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 33, pl. 6, figs. 5, 6, 1942; vol. 22, p. 55, pl. 9, fig. 23, 1946.

Frondicularia archiaciana D'Orbigny var. *strigillata* Plummer (not Bagg), Texas Univ. Bull. 2644, p. 114, pl. 5, fig 2, 1927.

Frondicularia cf. *F. frankei* Kline, Mississippi Geol. Survey Bull. 53, p. 37, pl. 3, fig. 14, 1943.

Test elongate, compressed, the periphery truncate, flattened or slightly concave, the sides angled, some-

times almost keeled, the sides nearly parallel for most of their length, initial end with a short stout spine, apertural end tapering to a blunt point; chambers few, strongly overlapping at the sides; sutures distinct, somewhat limbate, little if at all raised, strongly oblique; wall ornamented with numerous very fine longitudinal costae, independent of the sutures, the proloculum in the megalospheric form with a strong central costa; aperture terminal, radiate. Length of holotype 0.87 mm. including the spine, breadth 0.25 mm., thickness 0.13 mm.

The types are from the Paleocene Naheola formation, greensand bed, upper fossiliferous horizon, Naheola Landing, Tombigbee River, Ala.

Specimens of this species are mostly from the upper part of the Paleocene but seem to be well distributed in the area covered by our collections. It should make a good index fossil for this part of the section.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (4); Choctaw County (7).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).
Midway group. Texas, Limestone County (39); Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).

Frondicularia cf. F. goldfussi Reuss

Plate 8, figures 20–23

Frondicularia goldfussi Reuss Plummer, Texas Univ. Bull. 2644, p. 115, pl. 5, fig. 3, 1927.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 62, pl. 10, fig. 29. 1940.
Nodosarina (*Frondicularia*) *goldfussi* Kline, Mississippi Geol. Survey Bull. 53, p. 28, pl. 2, fig. 7, 1943.

Rare specimens from the Paleocene of Texas and Alabama may be compared with *F. goldfussi* with some question. They represent only the early stages and no adult specimens were found to confirm the identification. The specimen figured by Mrs. Plummer and copied here shows a slightly greater development.

The species is recorded by Kline as fairly abundant from three localities in the Porters Creek clay in Clay County, Miss.

Midway formation. Arkansas, Clark County (30).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Frondicularia cf. F. frankei Cushman

Plate 9, figures 1–3

A few specimens from the Paleocene of Alabama have been recorded and figured under this name (Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 63, pl. 10, figs. 36, 37, 1940). They may possibly be reworked specimens from Upper Cretaceous beds. Similar specimens are recorded and figured from the Paleocene of Mississippi (Kline, Mississippi Geol. Survey Bull. 53, p. 37, pl. 3, fig. 14, 1943).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation. Arkansas, Clark County (30).

Frondicularia sp. A

Plate 9, figure 6

Frondicularia sp A. Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 55, pl. 8, fig. 11, 1946.

The peculiar species figured occurs at a few localities in the Paleocene of Arkansas and Alabama, but no adult specimens were found to give the full specific characters.

Clayton formation, Pine Barren member. Alabama, Butler County (12).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).

Genus LAGENA Walker and Jacob, 1798

Lagena cf. L. laevis (Montagu) Williamson

Plate 9, figures 8, 9

Lagena cf. *L. laevis* (Montagu) Williamson, Cushman and Todd, Cushman Lab. Foram Research Contr., vol. 18, p. 34, pl. 6, fig. 4, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 38, pl. 4, fig. 4, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 56, pl. 9, fig 26, 1946.

Specimens similar to those figured are rather common in some of the Paleocene material. It is recorded from the Paleocene of Arkansas, the Naheola formation of Alabama, and the Porters Creek clay and Clayton formation of Mississippi.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4); Butler County (3); Choctaw County (7).
Midway formation, lower part. Arkansas, Saline County (20).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).

Lagena sulcata (Walker and Jacob) Parker and Jones var. semiinterrupta W. Berry

Plate 9, figures 10, 11

Lagena sulcata (Walker and Jacob) Parker and Jones var. *semiinterrupta* W. Berry, in Berry and Kelley, U. S Nat. Mus. Proc., vol. 76, art. 19, p. 5, pl. 3, fig. 19, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 37, pl. 5, figs. 9–11, 1931
Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 23, pl. 2, fig. 23, 1936.
Berquist, Mississippi Geol. Survey Bull. 49, p. 52, pl. 5, figs. 21, 22, 1942.
Kline, idem, Bull. 53, p. 39, pl. 7, figs. 15, 16, 1943.
Cushman, U. S. Geol. Survey Prof. Paper 206, p. 95, pl. 39, figs. 18–21, 1946.

Specimens from several stations may be referred to this variety with some question. They are very small but have the general ornamentation. The species is known mainly in Upper Cretaceous beds of Navarro age but is recorded from the Eocene Jackson group and

the Paleocene Porters Creek clay and Clayton formation of Mississippi.

Clayton formation. Alabama, Barbour County (10).
Wills Point formation. Texas, Caldwell County (34).
Mexia member. Texas, Limestone County (36).
Midway group. Texas, Caldwell County (44).

Lagena cf. L. acuticosta Reuss

Plate 9, figure 12

Very rare specimens from the Paleocene are not entirely typical of *L. acuticosta* but are compared with that species until more specimens are available.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Pine Barren member. Alabama, Butler County (12).
Midway formation, lower part. Arkansas, Saline County (20, 21).
Midway formation. Arkansas, Pulaski County (27).
Midway group. Texas, Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).

Lagena cf. L. costata (Williamson) Reuss

Plate 9, figure 13

Lagena sp. A Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 56, pl. 9, fig. 27, 1946.

Very rare specimens from a few Paleocene localities may be compared with *L. costata* with some question. They are rather finely costate and have a slender neck when well preserved.

Porters Creek clay. Tennessee, Hardeman County (13).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Caldwell County (44).

"Lagena cf. L. primigera H. B. Brady"

Plate 9, figure 14

This species is recorded by Kline (Mississippi Geol. Survey Bull. 53, p. 38, pl. 7, fig. 21, 1943) from the uppermost part of the Clayton formation of Clay County, Miss. A single specimen was all that was found. Kline's figure is copied on our plate.

Family POLYMORPHINIDAE

Genus GUTTULINA D'Orbigny, 1839

Guttulina problema D'Orbigny

Plate 9, figures 15–18

Specimens referred to this widely ranging species occur at a number of stations but show a very considerable amount of variation. It is also recorded from Mississippi as fairly common in the Clayton formation and extremely rare in the Porters Creek clay (Kline, Mississippi Geol. Survey Bull. 53, p. 39, pl. 4, fig. 2, 1943).

Porters Creek clay. Tennessee, Hardeman County (13, 14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4, 6); Butler County (3); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation. Alabama, Barbour County (10).
Pine Barren member. Alabama, Wilcox County (11).
Midway formation, lower part. Arkansas, Saline County (18, 19A, 20, 21).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (31).
Midway group. Texas, Van Zandt County (47).

Guttulina hantkeni Cushman and Ozawa

Plate 9, figures 19–21

Guttulina hantkeni Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 33, pl. 5, figs. 4–6, 1930.
Cushman and Dusenbury, Cushman Lab. Foram. Research Contr., vol. 10, p. 60, pl. 8, fig. 5, 1934.
Cushman and Todd, idem, vol. 18, p. 34, pl. 6, figs. 11, 12, 1942.
Curran, Am. Assoc. Petroleum Geologists Bull., vol. 27, p. 1381 (list), 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 56, pl. 10, fig. 2, 1946.
Polymorphina acuta Hantken (not D'Orbigny), Jahrb. K. Ungar. geol. Anstalt Mitth., vol. 4, p. 60, pl. 8, fig. 4 (*acuminata* on explanation of plate), 1875 (1881).

Test oval, botryoidal, more or less rounded at the base, acute at the apertural end, greatest breadth above the middle; chambers ovate, only slightly embracing, arranged in a contraclockwise, quinqueloculine series, each succeeding chamber removed farther from the base; sutures distinct, strongly depressed; wall smooth; aperture radiate, projecting. Length 0.60 to 1.20 mm., breadth 0.35 to 0.75 mm., thickness 0.30 to 0.60 mm.

The types are from the Eocene of Hungary, and the species has a wide range in the Eocene. Numerous specimens occur in our Paleocene material and show a considerable amount of variation.

Porters Creek clay. Tennessee, Hardeman County (13).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Wilcox County (6); Choctaw County (7).
Clayton formation, Pine Barren member. Alabama, Wilcox County (11).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (29).
Midway group. Texas, Caldwell County (44).

Guttulina wilcoxensis Cushman and Ponton

Plate 9, figure 22

Guttulina wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 60, pl. 8, figs. 1, 2, 1932.
Cushman and Garrett, idem, vol. 15, p. 80, pl. 14, figs. 8, 9, 1939.
Cushman, Am. Jour. Sci., vol. 242, p. 9, pl. 1, fig. 8, 1944; Cushman Lab. Foram Research Contr., vol. 20, p. 23; p. 39, pl. 6, fig. 18, 1944.

Test elongate, fusiform, composed of comparatively few chambers, distinct, inflated, elongate, usually two or three times as long as wide, each chamber added in the adult only reaching to about one-half or two-thirds of the distance to the base of the preceding chamber, sutures distinct, depressed; wall smooth, finely perforate; aperture radiate, terminal. Length 0.60 to 0.75 mm., diameter 0.20 to 0.25 mm.

The types are from the Eocene of Wilcox age from railroad cut, 1 mile north of Ozark, Ala.

The species has been recorded from a number of localities of Wilcox age and also from the Coal Bluff member of the Naheola formation of the Paleocene. In the Paleocene it is largely confined to the Naheola formation, with one occurrence in the Clayton formation.

Porters Creek clay. Tennessee, Hardeman County (14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Wilcox County (11).

Genus GLOBULINA D'Orbigny, 1839

Globulina gibba D'Orbigny

Plate 9, figures 26–28

(For earlier references, see U. S. Geol. Survey Prof. Paper 181, p. 25, 1935.)

So many forms have been placed under this specific name that it is difficult to try to give a complete synonymy. In the Paleocene material specimens seemingly referable to this species have occurred at numerous localities. These show a considerable degree of variation. Fistulose forms occur but are rather rare.

Porters Creek clay. Tennessee, Hardeman County (13, 14). Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4–6); Butler County (3); Choctaw County (7).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation, lower part. Arkansas, Saline County (19A, 20–22); Pulaski County (23).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30).
Midway group. Texas, Hunt County (41); Bastrop County (43, 49); Caldwell County (44); Travis County (45); Van Zandt County (47).
Wills Point formation. Texas, Williamson County (35).
Kincaid formation. Texas, Hunt County (37).

Globulina rotundata (Bornemann) Cushman and Ozawa

Plate 9, figures 29–33

(For earlier references, see U. S. Geol. Survey Prof. Paper 181, p. 27, 1935.)
Parr, Royal Soc. West Australia Jour., vol. 24, p. 80, pl. 2, fig. 2, 1937–8.
Bergquist, Mississippi Geol. Survey Bull. 49, p. 56, 1942.
Crespin, Commonwealth of Australia, Min. Res. Survey, Bull. 9 (Pal. Ser. No. 4), p. 80 (list), 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 40, pl. 6, figs. 20–22, 1944.
Cushman and Todd, idem, vol. 21, p. 14, 1945; vol. 22, p. 56, pl. 10, fig. 4, 1946.
Cushman, Cushman Lab. Foram. Research Special Pub. 16, p. 19, pl. 4, figs. 14, 15, 1946.

Test ellipsoidal or ovoid to cylindrical, rounded at the base, slightly produced at the apertural end; chambers rounded, almost as long as broad, arranged in a nearly triserial series, each succeeding chamber removed much farther from the base, rarely becoming almost uniserial in the last chamber; sutures only slightly depressed, generally distinct; wall smooth, thick, often with fistulose tubes; aperture radiate. Length 0.45 to 0.90 mm., breadth 0.30 to 0.60 mm., thickness 0.25 to 0.55 mm.

According to the records this species appears to have a long range and wide distribution. Specimens referable to it occurred at a number of localities in our Paleocene material and show a considerable amount of variation. Occasional specimens show a fistulose development.

Porters Creek clay. Tennessee, Hardeman County (14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 6); Butler County (3).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Pulaski County (28); Clark County (29).
Midway group. Texas, Hunt County (41); Caldwell County (44).
Kincaid formation. Texas, Hunt County (37).

Globulina cf. G. minuta (Roemer) Reuss

Plate 9, figure 34

Very rare specimens from the Paleocene of Arkansas and Texas are compared with *G. minuta*, as not enough specimens are available to make the specific identification certain.

Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Caldwell County (44).

Genus PYRULINA D'Orbigny, 1839

Pyruliha cf. P. cylihdroides (Roemer) Cushman and Ozawa

Plate 9, figures 23, 24

Pyrulina cylindroides (Roemer) Kline, Mississippi Geol. Survey Bull. 53, p. 40, pl. 7, fig. 5, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 40, pl. 6, fig. 23, 1944.
Cushman and Todd, idem, vol. 22, p. 57, pl. 10, fig. 6, 1944.

This species is recorded with some question as to its presence in the Paleocene of Mississippi, Alabama, and Arkansas because specimens here compared with *P. cylindroides* are very rare and not entirely typical. Very rare specimens of a similar form were also found in the Paleocene of Texas.

Porters Creek clay. Tennessee, Hardeman County (14).

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2).

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Midway formation, lower part. Arkansas, Saline County (20).

Midway formation, upper part. Arkansas, Pulaski County (25).

Midway formation. Arkansas, Pulaski County (27).

Midway group. Texas, Caldwell County (34).

Pyrulina extensa (Cushman) Cushman and Ozawa

Plate 9, figure 25

Polymorphina extensa Cushman, U. S. Nat. Mus. Bull. 104, pt. 4, p. 156, pl. 41, figs. 7, 8, 1923.

Pyrulina extensa Cushman and Ozawa, idem, Proc., vol. 77, art. 6, p. 53, pl. 12, fig. 5, 1930.

The only Paleocene record for this species is from Arkansas (Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 57, pl. 10, fig. 7, 1946). One other specimen from Arkansas is the only additional material found in the numerous samples examined.

Midway formation, upper part. Arkansas, Pulaski County (24, 25).

Genus PSEUDOPOLYMORPHINA Cushman and Ozawa, 1928

Pseudopolymorphina wilcoxensis Cushman and Ponton

Plate 10, figure 1

Pseudopolymorphina wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 61, pl. 8, figs. 5, 6, 1932.

Cushman and Garrett, idem, vol. 15, p. 81, pl. 14, fig. 11, 1939.

Cushman, idem, vol. 20, p. 23, pl. 4, fig. 19; p. 41, pl. 7, fig 2, 1944.

Test somewhat compressed, only slightly longer than broad, periphery broadly rounded, apertural end slightly produced, early chambers irregularly spiral, later ones becoming biserial; chambers distinct, very slightly if at all depressed in the early stages, slightly so in the adult; wall thick, opaque, ornamented with definite, short, slightly raised, somewhat elongate papillae arranged generally lengthwise of the test but irregularly placed; aperture fairly large, radiate, terminal, slightly projecting. Length 0.60 to 0.75 mm., breadth 0.55 to 0.60 mm., thickness 0.30 to 0.35 mm.

The types are from the Eocene Wilcox group, from railroad cut, 1 mile north of Ozark, Ala.

Most of the records for this species are from beds of the Wilcox group but it occurs in the Paleocene, in the Coal Bluff marl member of the Naheola formation of Alabama (8).

Pseudopolymorphina sp. A

Pseudopolymorphina sp. A Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 57, pl. 10, fig. 8, 1946.

The only specimen found in the Paleocene is from Arkansas and is noted here for the record until more material can be found and a specific identification established.

Midway formation, upper part. Arkansas, Pulaski County (25).

Genus SIGMOMORPHINA Cushman and Ozawa, 1928

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

Plate 10, figures 2, 3

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

Sigmomorphina semitecta (Reuss) Cushman and Ozawa var. *terquemiana* (Fornasini) Cushman and Ozawa, U. S. Nat. Mus. 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, figs. 12a-c, 1931; 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 and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 35, pl. 6, figs. 16, 17, 1942.

Cushman and Applin, idem, vol. 19, p. 37, pl. 7, fig. 23, 1943.

Cushman, idem, vol. 20, p. 41, pl. 7, fig. 3, 1944.

Cushman and Todd, idem, vol. 21, p. 90, pl. 14, fig. 11, 1945; vol. 22, p. 57, 1946.

Cushman, U. S. Geol. Survey Prof. Paper 206, p. 98, pl. 41, fig. 13, 1946.

Test compressed, oval to elongate, lanceolate, tapering toward the aperture; chambers elongate, arranged in a clockwise sigmoid series, all extending down to the base, but not involute; sutures scarcely depressed, distinct; wall smooth; aperture radiate. Length 0.30 to 0.55 mm., breadth 0.20 to 0.35 mm., thickness 0.10 to 0.20 mm.

Specimens referable to this variety are fairly common in the Paleocene. From the records the variety has a wide range in the Upper Cretaceous and Eocene.

Porters Creek clay. Tennessee, Hardeman County (13, 14).

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 5, 6); Butler County (3); Choctaw County (7).

Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Clayton formation, Pine Barren member. Alabama, Wilcox County (11); Butler County (12).

Midway formation, lower part. Arkansas, Saline County (19, 20, 21).

Midway formation, upper part. Arkansas, Pulaski County (25).

Sigmomorphina wilcoxensis Cushman and Ponton

Plate 10, figure 4

Sigmomorphina wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 61, pl. 8, fig. 7, 1932.

Toulmin, Jour. Paleontology, vol. 15, p. 595, pl. 80, fig. 15, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 35, pl. 6, fig. 15, 1942.
Cushman, idem, vol. 20, p. 41, pl. 7, fig. 4, 1944.
Cushman and Todd, idem, vol. 22, p. 57, pl. 10, fig. 9, 1946.

Test elongate, in the type specimen about twice as long as broad, much compressed, periphery rounded; chambers in the early portion in an elongate spiral, later ones becoming somewhat sigmoid, successive chambers in the adult being removed rapidly from the base, inflated; sutures distinct, later ones slightly depressed, earlier ones flush with the surface; wall smooth, finely perforated; aperture comparatively large, terminal, radiate. Length 0.90 mm., breadth 0.45 mm., thickness 0.20 mm.

The types are from the Eocene Wilcox group from railroad cut, 1 mile north of Ozark, Ala.

Specimens that seem referable to this species occurred at a number of localities in the Paleocene of Alabama, Tennessee, and Arkansas.

Porters Creek clay. Tennessee, Hardeman County (13,14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 4); Butler County (3); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Midway formation, upper part. Arkansas, Pulaski County (25).

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

Plate 10, figure 5

Sigmomorphina cf. *williamsoni* (Terquem) Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 41, pl. 7, fig. 5, 1944.

Specimens resembling *S. williamsoni* are recorded from the Paleocene of Alabama, and a single specimen occurred in a sample from Tennessee, making the only Paleocene records for this form.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Porters Creek clay. Tennessee, Hardeman County (13).

Sigmomorphina soldadoensis Cushman and Renz

Plate 10, figure 6

Sigmomorphina soldadoensis Cushman and Renz, Cushman Lab. Foram. Research Contr. vol. 18, p. 7, pl. 2, fig. 5, 1942.

Test about twice as long as broad, the greatest breadth above the middle, strongly compressed, two biserial chambers in the adult making up more than half the test, earlier ones sigmoid; chambers of the last part slightly inflated; sutures distinct, but only slightly depressed in the adult portion; wall smooth; aperture terminal, radiate. Length of holotype 0.60 mm., breadth 0.30 mm., thickness 0.15 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. It was not found in any of our other material.

Genus POLYMORPHINA D'Orbigny, 1826

Polymorphina cushmani Plummer

Plate 10, figures 8–12

Polymorphina cushmani Plummer, Texas Univ. Bull. 2644, p. 125, pl. 6, fig. 9; pl. 15, fig. 1, 1927.
Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 117, pl. 30, fig. 8, 1930.
Kline, Mississippi Geol. Survey Bull. 53, p. 41, pl. 4, fig. 8, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 57, pl. 10, fig. 10, 1946.

Test broadly ovoid, strongly compressed; peripheral margin narrowly rounded and somewhat lobate; sutures marked by faint depressions toward the margins but marked by irregularly disposed and broken elevations down the central axis on each side of the test; aperture extended, radiate. Length up to 1 mm.—Plummer.

The types are from the Paleocene, about 5¼ miles due south and very slightly west of Littig where the 440-foot contour cuts a northeast-southwest road (Bastrop quadrangle), Bastrop County, Tex.

Typical specimens occur in the Paleocene of Texas, Arkansas and Mississippi.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).
Midway group. Texas, Bastrop County (43); Caldwell County (44); Van Zandt County (47, 48).

Polymorphina frondea (Cushman) Cushman

Plate 10, figure 13

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.

This species has been recorded by Kline (Mississippi Geol. Survey Bull. 53, p. 41, pl. 4, fig. 7, 1943) from the Porters Creek clay and Clayton formation of Mississippi. In the Chalybeate limestone member of the Clayton formation of Alabama (9), a single specimen recorded as *Polymorphina* sp. (Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 64, pl. 11, fig. 8, 1940) seems to be the same as that recorded from Mississippi.

Polymorphina sp.

Plate 10, figure 7

Rare specimens from the Paleocene of Alabama evidently represent the early stages of a smooth form related to *P. cushmani* Plummer, but no adult specimens were found. They seem identical with the form figured by Kline (Mississippi Geol. Survey Bull. 53, p. 41, pl. 4, fig. 6, 1943) from the Clayton formation of Mississippi as "*Sigmomorphina* sp."

Clayton formation, Pine Barren member. Alabama, Butler County (12).

Genus POLYMORPHINELLA Cushman and Hanzawa, 1936

Polymorphinella cf. P. elongata Toulmin

Plate 10, figures 14–16

Rare specimens from the Paleocene of Texas and Alabama seem related to *P. elongata*, described from the Eocene Wilcox group of Alabama.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Wills Point formation. Texas, Caldwell County (34).

Polymorphinella sp.

Plate 10, figure 17

Polymorphinella sp. Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 41, pl. 7, fig. 6, 1944.

The only record for this species is from the Paleocene Coal Bluff marl member of the Naheola formation (8).

Genus BULLOPORA Quenstedt, 1856

Bullopora laevis (Sollas) Wickenden

Plate 10, figure 18

Webbina laevis Sollas, Geol. Mag., dec. 2, vol. 4, p. 103, pl. 6, figs. 1–3, 1877.
Vitrewebbina laevis Chapman, idem, dec. 3, vol. 8, p. 53, pl. 2, fig. 4, 1892; Annals and Mag. Nat. History, ser. 6, vol. 18, p. 332, text fig. 3, 1896; Royal Micr. Soc. Jour., p. 585, pl. 12, fig. 12, 1896.
Bagg, U. S. Geol. Survey Bull. 88, p. 36, pl. 2, figs. 4a, b, 1898.
Chapman, Annals and Mag. Nat. History, ser. 7, vol. 3, p. 314, 1899.
Weller, New Jersey Geol. Survey, Paleontology, vol. 4, p. 205, pl. 1, figs. 40, 41, 1907.
Chapman, Western Australia Geol. Survey Bull. 72, p. 37, pl. 11, fig. 101, 1917.
Plummer, Texas Univ. Bull. 2644, p. 128, pl. 8, fig. 3, 1927.
Bullopora laevis (Sollas) Wickenden, Jour. Paleontology, vol. 6, p. 206, pl. 29, figs. 6–8, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 22, fig. 24, 1933; idem, Contr., vol. 16, p. 64, pl. 11, fig. 12, 1940.
Tappan, Jour. Paleontology, vol. 14, p. 115, pl. 18, fig. 6, 1940; idem, vol. 17, p. 507, pl. 81, figs. 11, 12, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 63, pl. 11, fig. 8, 1943.
Kline, Mississippi Geol. Survey Bull. 53, p. 43, pl. 4, fig. 13, 1943.
Lozo, Am. Assoc. Petroleum Geologists Bull., vol. 27, p. 1066 (list), 1943; Am. Midland Naturalist, vol. 31, p. 560, pl. 3, fig. 2, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 9, pl. 2, fig. 33, 1944; U. S. Geol. Survey Prof. Paper 206, p. 98, pl. 42, figs. 1–4, 1946.

Test attached, consisting of a *Globulina*-like stage followed by a series of globular, oval, fusiform, or irregularly shaped chambers, generally in a single series joined by stolon-like connections, or branching into two or more series, wall smooth.

The globular shape of the chambers is retained even where the test is attached to an elongate object such as a *Nodosaria*. The species evidently has a fairly long range in the Upper Cretaceous and Tertiary.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Midway group. Texas, Caldwell County (44).

"Bullopora laevis (Sollas) var. hispida Kline"

Bullopora laevis (Sollas) var. *hispida* Kline (not *B. chapmani* (Plummer) var. *hispida* Kline), Mississippi Geol. Survey Bull. 53, p. 43, pl. 4, fig. 16, 1943.

This hispid variety described from the Porters Creek clay 2½ miles north of Pheba, Miss., needs a new name as the name *hispida* has already been used.

Bullopora chapmani (Plummer) Cushman

Plate 10, figures 19–22

Vitrewebbina chapmani Plummer, Texas Univ. Bull. 2644, p. 128, pl. 8, fig. 2, 1927.
Bullopora chapmani Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 64, pl. 11, figs. 10, 11, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 42, pl. 4, fig. 11, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 58, pl. 10, figs. 13, 14, 1946.
Cushman and Bermúdez, idem, vol. 24, p. 71, pl. 11, fig. 8, 1948.

Test adherent, composed of strongly inflated, perfectly smooth, elongate chambers joined by narrow slender tubes, and edged by a slight flange that is so thin and merges so well into the shell on which it is adherent, that it is hardly evident unless the test has been broken away from its support. Average length of single chamber .7 mm.; average width .3 mm.—Plummer.

The types are from the Paleocene, Alamo Brick Co. clay pit southeast of San Antonio on north side of the road leading southeast from the city and about ¼ mile from the area broken up into city blocks, Bexar County, Tex.

Rare specimens with elongate chambers occur in the Paleocene material. It is not as common as *B. laevis*.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway group. Texas, Freestone County (50).

Bullopora chapmani (Plummer) Cushman var. hispida Kline

Plate 10, figure 23

Bullopora chapmani (Plummer) var. *hispida* Kline, Mississippi Geol. Survey Bull. 53, p. 43, pl. 4, fig. 12, 1943.

Variety differs from the typical form of the species in having a finely hispid surface. The variety resembles the species very closely in size and shape, but may readily be identified by its hispid test. No intermediate forms between species and variety have been noted.—Kline.

The variety was described from the Porters Creek clay, 2½ miles north of Pheba, Miss.

Genus RAMULINA Rupert Jones, 1875

Ramulina cf. R. aculeata (D'Orbigny) Wright

Plate 10, figures 24–26

Rare specimens occur in our Paleocene material. *R. aculeata* has been recorded from widely separated

areas and from both the Cretaceous and Tertiary. It has been previously recorded from the Paleocene (Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 64, pl. 11, figs. 13, 14, 1940 and Cushman and Todd, idem, vol. 18, p. 35, pl. 6, fig. 24, 1942; vol. 22, p. 58, pl. 10, fig. 12, 1946). A smooth specimen evidently belonging to this genus was figured by Mrs. Plummer from the Paleocene of Texas (Texas Univ. Bull. 2644, p. 127, pl. 8, fig. 7, 1927). The early stages were not found at any of the localities.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Choctaw County (7).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Pulaski County (27). Caldwell County (44).
Wills Point formation. Texas, Travis County (33).

Family NONIONIDAE

Genus NONIONELLA Cushman, 1926

Nonionella insecta (Schwager) Cushman and Ponton

Plate 11, figure 1

Anomalina insecta Schwager, Palaeontographica, vol. 30, Pal. Theil, p. 128, pl. 28 (5), figs. 1, 2, 1883.
Nonionella insecta Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 65, pl. 8, figs. 13, 14, 1932.
Glaessner, Problems of Paleontology, Moscow Univ., vols. 2–3, p. 368, 1937.
Cushman, U. S. Geol. Survey Prof. Paper 191, p. 29, pl. 8, fig. 1, 1939.
Toulmin, Jour. Paleontology, vol. 15, p. 597, pl. 80, fig. 22, 1941.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 42, 1944.

The types of this species are from the middle Eocene of northern Africa. It has been recorded from the Eocene Wilcox group of Alabama, in the Tuscahoma sand, the Hatchetigbee formation, and the Salt Mountain limestone. Rare specimens assigned to this species occurred in the Paleocene material from Alabama and Arkansas.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Midway formation, lower part. Arkansas, Saline County (21).

Nonionella soldadoensis Cushman and Renz

Plate 11, figures 2–4

Nonionella soldadoensis Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 7, pl. 2, fig. 7, 1942.
Nonionina turgida Plummer (not Williamson) (part), Texas Univ. Bull. 2644, p. 159, pl. 12, fig. 6, 1927.

Test somewhat longer than broad, strongly compressed, periphery rounded, ventral side with the basal portion of the umbilical area covered, in peripheral view with the sides nearly parallel; chambers distinct, slightly inflated on the ventral side, all visible on the dorsal side, on the ventral side with the last-formed chamber extended into a lobe over the umbilical region; sutures distinct, slightly depressed; wall smooth; aperture extending from the periphery ventrally under the lobe of the last-formed chamber. Length of holotype 0.40 mm., breadth 0.25 mm., thickness 0.08 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I.

Midway formation, lower part. Arkansas, Pulaski County (23).
Midway formation. Arkansas, Saline County (26); Clark County (29).

Nonionella sp.

Plate 11, figures 5, 6

Nonionina turgida Plummer (not Williamson) (part), Texas Univ. Bull. 2644, p. 159, pl. 12, fig. 7, 1927.

A single specimen from the Paleocene of Alabama here figured seems very close to the figure given by Mrs. Plummer of a specimen from the Paleocene of Texas. More specimens are needed to give this a specific identification.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).

Family HETEROHELICIDAE

Genus BOLIVINOPSIS Yakovlev, 1891

Bolivinopsis sp.

Two very small specimens, evidently the young stages but definitely belonging in this genus, were found in the Paleocene Naheola formation on Alabama Highway 96, 9.2 miles northeast of Kimbrough, Wilcox County, Ala. (5).

Genus GÜMBELINA Egger, 1899

Gümbelina midwayensis Cushman

Plate 11, figures 7, 8

Gümbelina midwayensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 65, pl. 11, fig. 15, 1940.
Cushman and Todd, idem, vol. 22, p. 58, pl. 10, fig. 15, 1946

Test small, compressed, usually twice as long as broad, rapidly tapering, with the greatest breadth formed by the last pair of chambers, periphery rounded throughout, lobulate; chambers with breadth and height about equal, slightly overlapping, inflated, increasing rapidly in height as added; sutures distinct, depressed, very slightly curved; wall finely spinose; aperture high, arched, with distinct lateral flanges. Length 0.18 to 0.22 mm., breadth 0.10 to 0.12 mm., thickness 0.15 mm.

The types are from the Paleocene, U. S. Highway 80, south of Sucarnoochee Creek, ½ mile southwest of Livingston, Sumter County, Ala.

This seems to be an index fossil for the Paleocene, occurring in our material from Alabama, Arkansas, and Texas.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Pine Barren member. Alabama, Butler County (12).

Midway formation, lower part. Arkansas, Saline County (20).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Clark County (30).
Midway group. Texas, Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).

Gümbelina trinitatensis Cushman and Renz

Plate 11, figure 9

Gümbelina trinitatensis Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 8, pl. 2, fig. 8, 1942.

Test slightly longer than broad, moderately compressed, rapidly tapering, greatest breadth formed by the last-formed pair of chambers, periphery rounded, lobulate; chambers with breadth and height about equal, the last-formed pair in the adult usually much larger than the remainder of the test; sutures distinct, depressed, straight, nearly at right angles to the elongate axis; wall smooth or slightly hispid; aperture high, arched. Length of holotype 0.27 mm., breadth 0.20 mm., thickness 0.15 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. It has not been recorded elsewhere.

Gümbelina morsei Kline

Plate 11, figure 10

Gümbelina morsei Kline, Mississippi Geol. Survey Bull. 53, p. 44, pl. 7, fig. 12, 1943.

Test small, about twice as long as broad, regularly tapering, with greatest breadth at apertural end, periphery rounded and lobulate; chambers with breadth greater than height, inflated, increasing rapidly in size, especially in breadth; sutures distinct, depressed; wall finely but distinctly spinose; aperture high, arched, with distinct lateral flanges.

This minute species resembles *Gümbelina midwayensis* Cushman, from the Midway of Alabama, but may readily be distinguished from that species by the proportionately greater breadth of the chambers.

The species is common in the Porters Creek and transitional beds, but is not known from typical Clayton beds.—Kline.

The types are from the Paleocene, test hole M 49, 2½ miles north of Pheba, Clay County, Miss.

This species seems very similar to *G. trinitatensis* Cushman and Renz.

Genus RECTOGÜMBELINA Cushman, 1932

Rectogümbelina alabamensis Cushman

Plate 11, figure 11

Rectogümbelina alabamensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 65, pl. 11, fig. 16, 1940.
Cooper, Jour. Paleontology, vol. 18, p. 351, pl. 55, figs. 3, 4, 1944.

Test minute, elongate, early portion definitely biserial, *Gümbelina*-like, later portion uniserial; chambers of the early portion not much inflated, later ones distinctly so; sutures not depressed in the early portion, later much depressed; wall very finely hispid throughout; aperture small, nearly terminal, with a very slightly raised edge above the upper margin. Length 0.17 to 0.22 mm., diameter 0.06 to 0.08 mm.

The types are from the Paleocene, U. S. Highway 80, south of Sucarnoochee Creek, ½ mile southwest of Livingston, Sumter County, Ala. (9). The only other record is that of Cooper, from the Paleocene Porters Creek clay of Illinois.

Genus PLANOGLOBULINA Cushman, 1927

"Planoglobulina acervulinoides (Egger) Cushman"

This species is recorded by Kline (Mississippi Geol. Survey Bull. 53, p. 45, pl. 7, fig. 1, 1943) from the Paleocene Clayton formation of Mississippi. As it is represented by a single specimen and is typically a Cretaceous species it may have been redeposited from Upper Cretaceous beds.

Genus EOUVIGERINA Cushman, 1926

Eouvigerina excavata Cushman

Plate 11, figure 12

Eouvigerina excavata Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 66, pl. 11, fig. 18, 1940.
Cushman and Todd, idem, vol. 18, p. 35, pl. 6, figs. 20, 21, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 45, pl. 4, fig. 19, 1943.
Cushman, Am. Jour. Sci., vol. 242, p. 10, pl 1, fig 18, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 42, pl. 7, fig. 7, 1944.
Cushman and Todd, idem, vol. 22, p. 58, pl. 10, fig. 16, 1946.

Test small, mostly biserial, in the adult quadrangular in end view, tapering, greatest breadth formed by the last two chambers, initial end rounded; chambers very distinct, the broader faces deeply excavated, the angles of the chamber raised into narrow plate-like projections; sutures distinct, strongly raised; wall smooth, finely perforate; aperture terminal, rounded, with a distinct neck and lip. Length 0.18 to 0.25 mm., diameter 0.08 to 0.10 mm.

The types are from the Paleocene, U. S. Highway 80, south of Sucarnoochee Creek, ½ mile southwest of Livingston, Sumter County, Ala.

Except for a single record from the Bashi marl member of the Hatchetigbee formation of the Wilcox group (Eocene), this is recorded only from the Paleocene, where it occurs at a number of localities in Alabama, Arkansas, Mississippi, and Texas.

Porters Creek clay. Tennessee, Hardeman County (14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5, 6); Choctaw County (7).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Pine Barren member. Wilcox County (11); Butler County (12).

Midway formation, lower part. Arkansas, Saline County (20-22).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Clark County (30).
Midway group, Texas, Bastrop County (43); Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).
Mexia member. Texas, Limestone County (36).

Genus PSEUDOUVIGERINA Cushman, 1927

Pseudouvigerina naheolensis Cushman and Todd

Plate 11, figures 13–15

Pseudouvigerina naheolensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 36, pl. 6, figs. 18, 19, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 46, pl. 7, fig. 2, 1943.
Cushman, Am. Jour. Sci., vol. 242, p. 11, pl. 1, figs. 15, 16, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 59, pl. 10, fig. 17, 1946.

Test small, broadly fusiform in front view, in end view triangular with the sides flattened or somewhat concave, the periphery angled and slightly carinate, or slightly truncate; chambers distinct, very slightly inflated in the last whorl; sutures distinct, slightly depressed in the later portion; wall distinctly perforate, generally smooth; aperture circular, at the end of a short but distinct cylindrical neck with a slight phialine lip. Length 0.30 mm., breadth 0.15 mm.

The types are from the Paleocene Naheola formation, greensand bed, upper fossiliferous horizon, Naheola Landing, Tombigbee River, Ala.

Except for a single record from the Eocene Bashi marl member of the Hatchetigbee formation of the Wilcox group of Alabama, the species seems limited to the Paleocene.

Porters Creek clay. Tennessee, Hardeman County (13, 14).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Wilcox County (4, 5); Choctaw County (7).
Clayton formation, Pine Barren member. Alabama, Wilcox County (11).
Midway formation, lower part. Arkansas, Saline County (20-22).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26).

Genus SIPHOGENERINOIDES Cushman, 1927

Siphogenerinoides eleganta (Plummer) Cushman

Plate 11, figures 16–19

Siphogenerina eleganta Plummer, Texas Univ. Bull. 2644, p. 126, pl. 8, fig. 1, 1927.
Bifarina eleganta Plummer, idem, Bull. 3201, pp. 54, 62, 1933.
Siphogenerinoides eleganta Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 66, pl. 11, fig. 17, 1940.
Cushman and Renz, idem, vol. 18, p. 8, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 46, pl. 4, fig. 18, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 351, pl. 54, fig. 14, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 42, pl. 7, fig. 8, 1944.
Cushman and Todd, idem, vol. 22, p. 59, pl. 10, fig. 18, 1946.
Cushman and Bermúdez, idem, vol. 24, p. 71, pl. 11, fig. 9, 1948.

Test elongate; early chambers biserial merging into a succession of alternately oblique chambers that very rarely reach a Nodosarian development; very earliest portion of test marked by indistinct and irregularly developed longitudinal striations and spinulose projections that disappear rapidly upward; mature chambers very smooth and coarsely punctate; sutures sharply depressed; aperture terminal, elliptical, bounded by a short, flaring rim and connected to earlier apertures by an inner tube. Length up to 0.9 mm.; average 0.5 mm.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

This seems to be an excellent index fossil for the Paleocene. It has occurred at numerous stations in our Paleocene material from Alabama, Mississippi, Texas, and Arkansas. It has been recorded by Kline from the Porters Creek clay and the Clayton formation of Mississippi and by Cooper from the Porters Creek clay of Illinois. The species also occurs in the Paleocene Soldado rock formation of Trinidad.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Porters Creek clay. Mississippi, Kemper County (17).
Midway formation, lower part. Arkansas, Saline County (19A, 21).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Pulaski County (27); Clark County (29, 30).
Midway group. Texas, Limestone County (39, 42); Hunt County (41); Caldwell County (44); Van Zandt County (47).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Mexia member. Texas, Limestone County (36).

Family BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

Buliminella elegantissima (D'Orbigny) Cushman

Plate 11, figure 20

(For references, see U. S. Geol. Survey Prof. Paper 210–D, p. 67, pl. 17, figs. 106–12, 1947.)

Numerous specimens from the Paleocene of Arkansas and Alabama give the first records for this species earlier than the Wilcox group (Eocene). The Paleocene specimens are very small but otherwise seem to be typical and are common at all localities.

Clayton formation, Pine Barren member. Alabama, Wilcox County (11); Butler County (12).
Midway formation, lower part. Arkansas, Saline County (18, 19).

Genus ROBERTINA D'Orbigny, 1846

Robertina wilcoxensis Cushman and Ponton

Plate 11, figure 21

Robertina wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 66, pl. 8, fig. 19, 1932.
Cushman and Parker, idem, vol. 12, p. 96, pl. 16, fig. 13, 1936.
Cushman and Garrett, idem, vol. 15, p. 82, pl. 14, fig. 16, 1939.
Cushman and Todd, idem, vol. 18, p. 36, pl. 6, fig. 22, 23, 1942.
Cushman, Am. Jour. Sci., vol. 242, p. 11, pl. 1, fig. 17, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 42, pl. 7, fig. 9, 1944.
Cushman and Parker, U. S. Geol. Survey Prof. Paper 210–D, p. 71, pl. 18, fig. 1, 1947.

Test elongate, about twice as long as broad, fusiform, greatest breadth slightly above the middle; chambers in an elongate spiral, those in each whorl alternating, very slightly inflated; sutures distinct, not depressed; wall smooth, finely perforate; aperture on the ventral side formed by an elongate narrow opening deeply entering the apertural face. Length 0.35 mm., breadth 0.18 mm., thickness 0.15 mm.

The types are from the Eocene Wilcox group from railroad cut, 1 mile north of Ozark, Ala.

Occasional specimens from the Paleocene Naheola formation of Alabama are probably to be placed under this species, recorded previously only from the Eocene of Alabama. These make the oldest records for this genus.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5, 6); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Genus BULIMINA D'Orbigny, 1826

Bulimina cacumenata Cushman and Parker

Plate 11, figures 22, 23

Bulimina cacumenata Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 40, pl. 7, fig. 3, 1936.
Cushman, idem, vol. 16, p. 67, pl. 11, fig. 20, 1940.
Cushman and Todd, idem, vol. 18, p. 37, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 47, pl. 7, fig. 8, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 59, pl. 10, fig. 20, 1946.
Cushman and Parker, U. S. Geol. Survey Prof. Paper 210–D, p. 92, pl. 21, fig. 27, 1947.

Test small, somewhat fusiform, greatest width slightly above the middle, gradually tapering to a long, subacute point; chambers numerous, 6 to 7 whorls, those of the last whorl somewhat inflated; arranged in a slightly twisted series, those of adjacent series meeting in a zigzag line; sutures distinct in the upper part, obscure in the lower part of the test, very slightly depressed; wall, except for the last whorl and occasionally for the next to the last, covered with irregular, low, closely set costae, last whorl smooth, coarsely perforate; aperture loop-shaped, with a slight lip. Length 0.20 to 0.23 mm., diameter 0.10 to 0.11 mm.

The types are from the Paleocene, 3 miles above bridge over Cedar Creek on Austin-Red Rock road, Bastrop County, Tex.

The species is an excellent index fossil for the Paleocene as it is usually rather common. It occurs in our Paleocene material from Alabama, Texas, and Arkansas, and has been recorded by Kline from the Paleocene of Mississippi.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4–6); Butler County (3); Choctaw County (7).
Clayton formation. Alabama, Barbour County (10).
Pine Barren member. Alabama, Wilcox County (11); Butler County (12).
Midway formation, lower part. Arkansas, Saline County (19–22); Pulaski County (23).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Clark County (29, 30).
Midway group. Texas, Bastrop County (43); Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).

Bulimina arkadelphiana Cushman and Parker var. midwayensis Cushman and Parker

Plate 11, figures 25, 26

Bulimina arkadelphiana Cushman and Parker var. *midwayensis* Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 42, pl. 7, figs. 9, 10, 1936.
Kline, Mississippi Geol. Survey Bull. 53, p. 47, pl. 7, fig. 9, 1943.
Cushman and Parker, U. S. Geol. Survey Prof. Paper 210–D, p. 92, pl. 21, figs. 24, 25, 1947.
Bulimina aculeata Plummer (not D'Orbigny), Texas Univ. Bull. 2644, p. 73, pl. 4, fig. 3, 1927.

Test small, about 1½ times as long as broad, tapering, usually with a well-defined basal spine; chambers distinct, undercut at base, giving a "collared" effect, about 5 whorls, last-formed chambers inflated, sutures distinct, depressed; wall of all but the last-formed whorl, covered with sharp, fine spines, usually extending from the lower edges of the chambers, last-formed whorl smooth, finely perforate; aperture loop-shaped with a well-defined lip. Length 0.26 to 0.38 mm., diameter 0.16 to 0.25 mm.

The types are from the Paleocene, road cut south of Reservoir 3½ miles southeast of Corsicana, Tex.

Specimens are not common but occurred at several stations in Arkansas and Texas. It has been recorded by Kline from the Porters Creek clay of Mississippi.

Midway formation, upper part. Arkansas, Pulaski County (24).
Midway formation. Arkansas, Clark County (30).
Midway group. Texas, Limestone County (39).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Bulimina kugleri Cushman and Renz

Plate 11, figure 24

Bulimina kugleri Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 9, pl. 2, fig. 9, 1942.
Cushman and Parker, U. S. Geol. Survey Prof. Paper 210-D, p. 93, pl. 30, fig. 13, 1947.

Test elongate, fusiform, about twice as long as broad, greatest breadth at about the middle; chambers distinct, slightly inflated, elongate; sutures distinct, very slightly depressed; wall smooth; aperture a high, arched, slightly curved opening at the base of the inner margin of the last-formed chamber. Length of holotype 0.50 mm., diameter 0.23 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. It has not been recorded elsewhere.

Subgenus DESINOBULIMINA Cushman and Parker, 1940

Bulimina (Desinobulimina) quadrata Plummer

Plate 11, figures 27–30

Bulimina (Ellipsobulimina) quadrata Plummer, Texas Univ. Bull. 2644, p. 72, pl. 4, figs. 4, 5, 1927.
Bulimina quadrata Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 30, pl. 3, fig. 19, 1936.
Albritton and Phleger, Jour. Paleontology, vol. 11, p. 352, 1937.
Bulimina (Desinobulimina) quadrata Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 67, pl. 11, fig. 21, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 48, pl. 4, fig. 20, 1943.
Applin and Jordan, Jour. Paleontology, vol. 19, p. 131 (list), 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 60, pl. 10, fig. 19, 1946.
Cushman and Parker, U. S. Geol. Survey Prof. Paper 210-D, p. 128, pl. 29, figs. 18, 19, 1947.

Test of megalospheric form (Form A) almost cylindrical, stout, increasing in diameter only very slightly from the broad blunt initial end toward the broadly rounded oral extremity; microspheric form (Form B) pointed aborally through a succession of small chambers that follow the proloculum to the later mature chambers that comprise a test identical in shape with that of the much more frequent megalospheric form; chambers smooth, very little inflated, broad, and short; sutures as sharp lines in early part of test and faintly depressed above; wall thin; aperture a large vertical slit on the inner side of the last chamber and connected with all previous apertures by an inner tube that traverses the entire length of the shell. Length up to 0.65 mm. in megalospheric form, average 0.5 mm.; up to 0.8 mm. in microspheric form.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

The species is often very common in some of the Paleocene samples examined. It is recorded from the Upper Cretaceous but these probably are to be included under *B. kickapooensis* Cole.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26); Clark County (30).
Midway group. Texas, Limestone County (39, 42); Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).
Mexia member. Texas, Limestone County (36).

Genus ENTOSOLENIA Ehrenberg, 1848

Entosolenia crumenata Cushman

Plate 12, figures 1, 2

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.
Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 66, pl. 11, figs. 4, 5, 1939.
Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197-B, p. 70, pl. 5, figs. 16–18, 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 37, pl. 6, fig. 28, 1942.
Cushman, idem, 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 0.35 to 0.40 mm., breadth 0.18 to 0.20 mm., thickness 0.10 to 0.12 mm.

The types are from the Oligocene of Mississippi and it has been recorded from the Oligocene of Texas and from Eocene cores from the Atlantic. Specimens show considerable variation and more than one species may have been included under this name.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 5); Butler County (3); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Entosolenia cf. E. laevigata (Reuss) Cushman and McGlamery

Plate 12, figures 3, 4

Rare specimens from the Paleocene of Alabama are compared to *E. laevigata* with some question.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Entosolenia cf. E. orbignyana (Seguenza) Cushman

Plate 12, figure 5

Specimens from the Porters Creek clay of Mississippi have been referred to as "*Lagena orbignyana* (Seguenza)" by Kline (Mississippi Geol. Survey Bull. 53, p. 38, pl. 4, fig. 5, 1943). Kline's figure is reproduced on our plate.

Entosolenia morsei Kline

Plate 12, figure 6

Entosolenia morsei Kline, Mississippi Geol. Survey Bull. 53, p. 48, pl. 4, fig. 17, 1943.

Test ovate to globular, greatest width usually a little below center, with short apical spine; surface smooth; aperture round, small, at end of short but distinct neck. Length of holotype 0.46 mm.; breadth 0.34 mm.—Kline.

The types are from the Paleocene Porters Creek clay, from shallow test hole, 2¼ miles north of Pheba, Clay County, Miss. It is also recorded from the Clayton formation of Mississippi. It was found in our material at only two localities. The type figure is copied on our plate.

Porters Creek clay. Mississippi, Kemper County (17).
Midway group. Texas, Caldwell County (44).

Entosolenia cf. E. apiculata (Reuss) Cushman

Plate 9, figure 7

Lagena apiculata Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 46, p. 318, pl. 1, figs. 4–8, 10, 11, 1862.
Plummer, Texas Univ. Bull. 2644, p. 75, pl. 4, fig. 6, 1927.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 56, pl. 9, fig. 25, 1946.
Entosolenia cf. *E. apiculata* Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 43, pl. 7, fig. 10, 1944.

Rare specimens from a few localities in the Paleocene may be compared questionably with *E. apiculata*. Some specimens are circular in section and others are compressed. The form is close to *E. morsei* Kline but does not have a definite neck as in that species.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2); Butler County (3).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Midway formation, upper part. Arkansas, Pulaski County (25).

Entosolenia sp.

Plate 12, figure 7

Very rare specimens of the smooth form here figured occurred at but two localities in the Paleocene of Alabama. More specimens are needed to give a definite specific determination and it is here figured for future reference.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2); Butler County (3).

Genus VIRGULINA D'Orbigny, 1826

Virgulina wilcoxensis Cushman and Ponton

Plate 12, figures 8, 9

Virgulina wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 67, pl. 8, fig. 22, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 67, pl. 8, fig. 22, 1937.
Cushman and Garrett, Cushman Lab. Foram. Research Contr., vol. 15, p. 82, pl. 14, figs. 19–21, 1939.
Cushman, idem, vol. 16, p. 67, pl. 11, fig. 19, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 49, pl. 6, fig. 24, 1943.
Cushman, Am. Jour. Sci., vol. 242, p. 11, pl. 1, figs. 19, 20, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 24, pl. 4, fig. 24; p. 43, 1944.

Test elongate, fusiform, somewhat compressed, about 2¼ times as long as broad, early portion irregularly spiral, adult irregularly biserial, periphery rounded; chambers distinct, very slightly inflated; sutures distinct, very slightly depressed; wall smooth, distinctly perforate; aperture a broad, comma-shaped opening at the base of the apertural face in the median line. Length 0.50 mm., breadth 0.15 mm., thickness 0.10 mm.

The types are from the Eocene Wilcox group, from railroad cut, 1 mile north of Ozark, Ala.

Specimens apparently identical with the species from the Wilcox strata occur at numerous localities in the Paleocene of Alabama, Texas, and Arkansas, often very abundantly. It is also recorded by Kline from the Porters Creek clay and the Clayton formation of Mississippi.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation. Alabama, Barbour County (10).
Chalybeate limestone member. Alabama, Sumter County (9).
Pine Barren member. Alabama, Wilcox County (11); Butler County (12).
Porters Creek clay. Tennessee, Hardeman County (13).
Midway formation, lower part. Arkansas, Saline County (18, 19); Pulaski County (23).
Midway formation, upper part. Arkansas, Pulaski County (24).
Midway formation. Arkansas, Saline County (26).
Midway group, Texas, Hunt County (41).

Virgulina naheolensis Cushman

Plate 12, figure 10

Virgulina naheolensis Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 78, 1944.
Virgulina alabamensis Cushman (not Cushman and McGlamery), idem, vol. 20, p. 43, pl. 7, fig. 13, 1944.

Test about 3 times as long as broad, fusiform, somewhat compressed, periphery rounded, very slightly lobulate, little if at all twisting in the early stages, adult with 8 to 10 biserial chambers; chambers distinct, very slightly if at all inflated, biserial, much higher than broad; sutures distinct, very strongly oblique, very slightly curved, little if at all depressed; wall smooth, finely perforate; aperture comma-shaped, broadest at the outer end. Length 0.42 to 0.60 mm., breadth 0.12 to 0.15 mm., thickness 0.07 to 0.08 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

This species seems to be very rare in the Paleocene material examined but is small and might easily be overlooked.

Genus BOLIVINA D'Orbigny, 1839

Bolivina midwayensis Cushman

Plate 12, figures 11, 12

Bolivina midwayensis Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 50, pl. 7, fig. 12, 1936; Special Pub. 9, p. 45, pl. 6, figs. 11–13, 1937; idem, Contr., vol. 16, p. 67, pl. 11, fig. 22, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 49, pl. 4, fig. 14, 1943.
Cushman, Am. Jour. Sci., vol. 242, p. 11, pl. 1, figs. 22, 23, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 44, pl. 7, fig. 14, 1944.

Test elongate, very slightly tapering, much compressed, periphery rounded, biserial throughout; chambers distinct, slightly inflated, low and broad, very slightly overlapping, of rather uniform shape throughout; sutures distinct, slightly depressed, very strongly oblique, forming an angle of at least 45° with the horizontal, and slightly curved; wall smooth, very finely perforate; aperture an oval opening, tending very slightly to be somewhat removed from the inner margin of the last-formed chamber. Length up to 0.85 mm., breadth 0.15 to 0.18 mm., thickness 0.08 to 0.10 mm.

The types are from the Paleocene, from a shallow ditch at road corner southeast of New Corsicana Reservoir on road to Mildred, Navarro County, Tex.

This species occurs at numerous localities in Alabama, Mississippi, and Texas. It seems to have a considerable vertical range within the Paleocene and should make a good index fossil for the Paleocene. It has, however, been recorded with some question from the Bashi marl member of Hatchetigbee formation of Wilcox age of Alabama.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation. Matthews Landing marl member. Alabama, Wilcox County (5).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation. Arkansas, Clark County (30).
Midway group. Texas, Caldwell County (44).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Bolivina crenulata Cushman

Plate 12, figures 13, 14

Bolivina crenulata Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 50, pl. 7, fig. 13, 1936; Special Pub. 9, p. 53, pl. 6, figs. 33, 34, 1937; idem, Contr., vol. 20, p. 44, pl. 7, figs. 15, 16, 1944.

Test about twice as long as broad, tapering, greatest breadth near the apertural end, periphery subacute, slightly lobulate; chambers numerous, rather indistinct, later ones slightly inflated, about twice as broad as high; sutures rather indistinct, sigmoid, slightly oblique; wall finely perforate, ornamented by distinct, longitudinal ridges, and the base of the chambers crenulate, forming a pattern of irregularly rounded depressions. Length 0.40 mm., breadth 0.20 mm., thickness 0.15 mm.

The types are from the upper Eocene Kleinzellner Tegel, clay pit, near Budapest, Hungary.

Rare specimens seemingly identical with this species occurred in the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

Bolivina budensis (Hantken) Cushman

Plate 12, figure 15

Bolivina budensis (Hantken) Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 47, pl. 6, figs. 21–23, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 44, pl. 7, fig. 17, 1944.

A few specimens from the Paleocene of Alabama seem very close to this species, which elsewhere is recorded only from the upper Eocene of Europe. Our specimens may be a new species, but not enough specimens are available to warrant a full description.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Bolivina sp. A

Plate 12, figure 16

The figured specimen from the Paleocene Naheola formation of Alabama has very oblique sutures, smooth surface, and peculiar early chambers that seem almost as though partially divided. No other specimens were found.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).

Bolivina sp. B

Plate 12, figure 17

The figured specimen, from the Paleocene of Alabama, has a broad test, rounded periphery, nearly horizontal sutures, and the early portion with a rough surface. More material is needed to warrant a specific determination.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).

Genus LOXOSTOMUM Ehrenberg, 1854

Loxostomum applinae (Plummer) Nuttall

Plate 12, figure 18

Bolivina applini Plummer, Texas Univ. Bull. 2644, p. 69, pl. 4, fig. 1, 1927.
Loxostomum applinae Nuttall, Jour. Paleontology, vol. 4, p. 285, pl. 24, figs. 4, 5, 1930.
Plummer, Texas Univ. Bull. 3201, p. 54 (list), 1933.
Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 173, pl. 20, fig. 20, 1937; idem, Contr., vol. 16, p. 68, pl. 11, fig. 23, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 50, pl. 5, fig. 7, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 60, pl. 10, fig. 22, 1946.

Cushman and Bermúdez, idem, vol. 24, p. 71, pl. 11, fig. 10, 1948.

Test very elongate, about five times as long as broad, slender, only slightly compressed, very gradually tapering, the adult portion with the sides nearly parallel; chambers numerous, fairly distinct, later ones slightly inflated, increasing rather regularly in size as added, earlier ones distinctly biserial, later ones tending to become somewhat uniserial, the basal border in the adult extending backward in definite lobes with straight reentrants between; sutures distinct, in the early portion somewhat limbate, later depressed and crenulate, very slightly oblique; wall distinctly perforate, earlier portion sometimes with slight traces of longitudinal grooves or costae, later portion smooth except for the crenulations along the sutures; aperture in the adult an elongate, oval opening, with a slight lip, tending to become terminal. Length up to 1.00 mm., diameter 0.18 to 0.20 mm.

The types are from the Paleocene, clay pit of Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

Although there are one or two records from other regions and formations, this seems to be a characteristic species of the Paleocene of Alabama, Arkansas, Mississippi, and Texas.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Pine Barren member. Alabama, Wilcox County (11); Butler County (12).
Midway formation, lower part. Arkansas, Saline County (19A).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30, 31).
Midway group. Texas, Limestone County (39, 42). Caldwell County (44).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Loxostomum plummerae Cushman

Plate 12, figures 19, 20

Loxostoma plummerae Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 59, pl. 8, fig. 13, 1936; Special Pub. 9, p. 174, pl. 20, fig. 21, 1937.
Cushman and Todd, idem, Contr., vol. 22, p. 60, pl. 10, fig. 21, 1946.

Test small, elongate, 3½ to 4 times as long as broad, very slightly compressed, the early portion biserial, later strongly tending to become uniserial; chambers distinct, somewhat inflated throughout, more strongly so in the adult; sutures distinct, depressed, nearly at right angles to the periphery; wall distinctly perforate, smooth; aperture in the adult terminal, elongate, elliptical, with a slight lip. Length 0.40 mm., breadth 0.10 to 0.12 mm.

The types are from the Paleocene, Dry Creek, ¾ mile above bridge on first road east of Travis-Bastrop County line, Bastrop County, Tex. (49).

This species is much less common than *L. applinae*, being recorded only from the Paleocene of Texas and Arkansas.

Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway group. Texas, Bastrop County (49).
Wills Point formation. Texas, Caldwell County (34).

Loxostomum deadericki Cushman

Plate 12, figures 21–23

Loxostomum deadericki Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 85, pl. 18, figs. 8–10, 1947.

Test elongate, slender, little if at all compressed, early portion biserial and somewhat twisted, later chambers becoming uniserial; chambers distinct, slightly inflated, increasing very gradually in size as added; sutures distinct, slightly depressed, earlier ones strongly oblique, becoming less so, and in the last-formed portion at right angles to the elongate axis; wall smooth, but distinctly perforate; aperture in the adult terminal, narrow. Length 0.60 to 0.90 mm., breadth 0.17 to 0.20 mm; thickness 0.15 to 0.18 mm.

The types are from the Paleocene, north side of Highway 67, 8 miles southwest of Benton, Saline County, Ark. (26). The species is very common at the type locality.

It differs from *L. applinae* (Plummer) in the less tapering form and only slight compression, and is without the basal indentations.

Loxostomum deadericki Cushman var. exilis Cushman

Plate 12, figures 24–26

Loxostomum deadericki Cushman var. *exilis* Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 85, pl. 18, figs. 11–13, 1947.

Variety differing from the typical form in the smaller size and more slender form, deeper sutures and more inflated chambers, and the more tapering early portion. Length 0.40 to 0.60 mm., breadth 0.10 to 0.12 mm., thickness 0.08 to 0.10 mm.

The types are from the Paleocene Clayton formation, top of fuller's earth zone, immediately underlying *Turritella* rock, SE ¼ SE ¼ sec. 18, T. 11 N., R. 14 E., Butler County, Ala. (12).

Genus ANGULOGERINA Cushman, 1927

Angulogerina wilcoxensis (Cushman and Ponton) Cushman and Garrett

Plate 12, figure 27

Pseudouvigerina wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 66, pl. 8, fig. 18, 1932.

TABLE 3.—*Distribution of Paleocene Polymorphinidae, Nonionidae, Heterohelicidae, Buliminidae, and Ellipsoidinidae in the Gulf Coastal region*

[Prepared by J. B. Reeside, Jr. Numbers refer to locality list on pages 1—3. K=localities reported by V. H. Kline, P=localities reported by H. J. Plummer and C. G. Lalicker, C=Cuba and Haiti, G=Guatemala and Honduras, S=Soldado Rock, Trinidad, B. W. I.]

	Alabama												Tenn.		Miss.				Arkansas															Texas																					C	G	S
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	K	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	P			
Polymorphinidae																																																									
Guttulina problema		X	X	X		X	X	X		X	X		X	X				X	X	X	X	X				X	X	X				X																X									
hantkeni			X			X	X				X		X												X	X	X	X		X															X												
wilcoxensis	X	X		X				X			X			X																																											
Globulina gibba	X	X	X	X	X	X	X	X				X	X	X		X	X			X	X	X	X	X	X	X	X	X			X					X		X				X		X	X	X		X		X							
rotundata		X	X			X		X						X												X	X		X	X								X				X			X													
cf. *G. minuta*																										X																			X												
Pyrulina cf. *P. cylindroides*	X	X						X						X							X					X		X							X																						
extensa																								X	X																														
Pseudopolymorphina wilcoxensis								X																																																
sp. *A*																									X																														
Sigmomorphina semitecta var. *terquemiana*		X	X		X	X	X	X			X	X	X	X						X	X	X				X																															
wilcoxensis	X		X	X			X	X			X		X	X												X																															
cf. *S. williamsoni*								X					X																																											
soldadoensis																																																								X
Polymorphina cushmani			X																						X	X																	X	X			X	X								
frondea									X									X																																						
sp												X						X																																						
Polymorphinella cf. *P. elongata*			X																															X																						
sp								X																																																
Bullopora laevis			X						X							X																												X												
"*laevis* var. *hispida*"																		X																																					
chapmani									X																X																								X						
chapmani var. *hispida*																		X																																					
Ramulina cf. *R. aculeata*			X				X		X							X										X		X						X											X												
Nonionidae																																																									
Nonionella insecta			X					X														X																																			
soldadoensis																								X			X			X																											X
sp			X																																																						
Heterohelicidae																																																									
Bolivinopsis sp					X																																																				
Gümbelina midwayensis					X				X			X								X				X	X					X				X										X												
trinitatensis																																																								X
morsei																		X																																					
Rectogümbelina alabamensis									X																																														
"*Planoglobulina acervulinoides*"																		X																																					
Eouvigerina excavata					X	X	X	X	X		X	X		X							X	X	X			X					X				X		X							X	X												
Pseudouvigerina naheolensis			X	X	X		X				X		X	X							X	X	X		X	X	X																													
Siphogenerinoides eleganta								X								X	X	X		X					X	X		X		X	X			X	X		X			X		X	X		X			X										X
Buliminidae																																																									
Buliminella elegantissima											X	X							X	X																																				
Robertina wilcoxensis					X	X	X	X																																																
Bulimina cacumenata	X	X	X	X	X	X	X			X	X	X								X	X	X	X	X	X	X	X			X	X				X									X	X												
arkadelphiana var. *midwayensis*																								X						X						X			X																	
kugleri																																																								X
(*Desinobulimina*) *quadrata*									X																X	X				X				X		X			X			X		X												
Entosolenia crumenata		X	X	X			X	X																																																
cf. *E. laevigata*					X		X	X																																																
cf. *E. orbignyana*																		X																																					
morsei																	X	X																										X												
cf. *E. apiculata*		X	X					X																	X																														
sp		X	X																																																					
Virgulina wilcoxensis								X	X	X	X	X	X						X	X				X	X		X															X															
naheolensis								X																																															
Bolivina midwayensis					X			X								X	X													X						X								X												
crenulata								X																																															
budensis								X																																															
sp. *A*							X																																																
sp. *B*							X																																																
Loxostomum applinae			X						X		X	X				X	X			X					X	X	X	X			X	X					X			X			X		X												
plummerae																								X	X									X															X							
dederichi																										X																													
dederichi var. *exilis*												X																																											
Angulogerina wilcoxensis								X					X	X																																									
virginiana								X																																															
Trifarina herberti																																																								X
Ellipsoidinidae																																																									
Pleurostomella paleocenica																		X													X						X								X												
Nodosarella attenuata									X																	X																X														
paleocenica					X																				X																														
Ellipsonodosaria plummerae			X						X			X				X		X							X	X	X	X			X	X		X	X		X	X		X	X		X	X	X	X					X						
paleocenica					X				X							X	X				X					X	X										X				X	X						X			X							
midwayensis										X															X	X		X		X										X	X	X	X					X	X		X						
alexanderi																																												X												

Angulogerina wilcoxensis Cushman and Garrett, idem, vol. 15, p. 84, pl. 14, figs. 24, 25, 1939.
Toulmin, Jour. Paleontology, vol. 15, p. 599, pl. 80, fig. 30, 1941.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 44, pl. 7, fig. 18, 1944.

Test small, elongate, about twice as long as broad, sides in the adult nearly parallel, triangular in transverse section, the angles with two distinct ribs and a deep channel between; chambers fairly distinct, strongly curved, not depressed; wall coarsely perforate; aperture in the adult terminal, with a short neck and slight lip. Length 0.30 mm., diameter 0.15 mm.

The types are from the Eocene Wilcox group, from railroad cut, 1 mile north of Ozark, Ala.

This species is rare in the Paleocene, specimens occurring in the Coal Bluff marl member of the Naheola formation in Alabama and in the Clayton formation of Tennessee.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Porters Creek clay. Tennessee, Hardeman County (13, 14).

Angulogerina virginiana Cushman

Plate 12, figure 28

Angulogerina virginiana Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 25, pl. 4, fig. 23; p. 44, pl. 7, fig. 19, 1944.

Test minute, elongate, tapering, triangular in section, the sides concave and the angles slightly rounded, triserial except for the last 2 or 3 chambers in the adult, which are irregularly uniserial; chambers of the early portion indistinct, in the adult somewhat separated and more inflated; sutures indistinct except in the very last portion in the adult where they are somewhat depressed; wall ornamented with fine longitudinal costae continuous over most of the test; aperture in the adult terminal, with a short neck and slight lip. Length 0.30 to 0.40 mm., diameter 0.10 to 0.12 mm.

The types are from the Eocene Aquia formation, 19–22-foot sample, below second rock layer, Marlboro Point, Stafford County, Va.

The only Paleocene occurrence of specimens referable to this species is from the Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8).

Genus TRIFARINA Cushman, 1923

Trifarina herberti Cushman and Renz

Plate 12, figures 29, 30

Trifarina herberti Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 9, pl. 2, figs. 11, 12, 1942.

Test elongate, about twice as long as broad, triangular in transverse section, sides slightly concave, angles rounded, rapidly tapering in the microspheric form, more fusiform in the megalospheric; chambers few, increasing rapidly in height as added; sutures distinct, depressed, strongly curved upward in the middle of each lateral face; wall smooth; aperture terminal, rounded, at the end of a short, tubular neck. Length 0.50 to 0.55 mm., diameter 0.25 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. It has not been recorded elsewhere.

Family ELLIPSOIDINIDAE

Genus PLEUROSTOMELLA Reuss, 1860

Pleurostomella paleocenica Cushman

Plate 12, figures 31–33

Pleurostomella paleocenica Cushman, Cushman Lab. Foram. Research Contr., vol. 23, p. 86, pl. 18, figs. 14, 15, 1947.
Pleurostomella alternans Plummer (not Schwager), Texas Univ. Bull. 2644, p. 69, pl. 4, fig. 2, 1927.
Pleurostomella cf. *P. brevis* var. *alternans* Kline (not Schwager), Mississippi Geol. Survey Bull. 53, p. 50, pl. 6, fig. 23, 1943.

Test very small, slender, tapering from the slightly rounded base to the greatest breadth formed by the last pair of chambers, nearly circular in transverse section; chambers few, distinctly inflated in the later portion, nearly as wide as high, increasing rapidly in size in the early portion, only slightly in the later portion; sutures distinct, later ones strongly depressed; wall smooth; aperture on the upper part of the inner face of the last-formed chamber, with a deeper reëntrant toward the base of the opening, without definite tooth-like projections. Length 0.38 to 0.45 mm., breadth 0.10 to 0.12 mm., thickness 0.10 to 0.12 mm.

The types are from the Paleocene, 4.6 miles north of Fentress, Caldwell County, Tex.

This species has been referred to *P. alternans* Schwager, a name that has been used for specimens from Cretaceous to Recent. A comparison with topotypes from the Pliocene of the Pacific shows that the Paleocene species differs in the much smaller size, fewer and shorter chambers, and smaller and more rounded aperture.

Kline has recorded it from the Porters Creek clay of Mississippi and specimens occur in the Paleocene collections from Texas and Arkansas.

Midway formation. Arkansas, Clark County (30). Midway group. Texas, Caldwell County (44).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Genus NODOSARELLA Rzehak, 1895

Nodosarella attenuata (Plummer) Cushman

Plate 12, figures 34–37

Ellipsopleurostomella attenuata Plummer, Texas Univ. Bull. 2644, p. 131, pl. 8, fig. 6, 1927.
Nodosarella attenuata Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 68, pl. 11, fig. 30, 1940.

Test long, tapering, straight or slightly uneven; chambers inflated, smooth, first two or three Textularian followed by a Bifarine series that merges into true Nodosarian succession;

sutures faint lines in early part of test and faint constrictions above; successive apertures connected by an internal column, and final aperture a somewhat curved terminal fissure one side of which arches slightly over the other. Length up to 0.8 mm.—Plummer.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation. Arkansas, Saline County (26).
Midway group. Texas, Limestone County (42).

Nodosarella paleocenica Cushman and Todd

Plate 12, figure 38

Nodosarella paleocenica Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 60, pl. 10, fig. 23, 1946.

Test small, elongate, often slightly curved, tapering from the very narrow initial end to the greatest width formed by the last one or two chambers, rounded in section; chambers distinct, later ones inflated, increasing rather rapidly in size and height as added, in the adult slightly longer than broad; sutures distinct, in the later portion depressed; wall smooth; aperture terminal, narrow, elongate, with a slightly raised lip at one side. Length up to 1.00 mm., breadth 0.20 to 0.23 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼ NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

The only other specimen is from the Matthews Landing marl member of the Porters Creek formation on Alabama Highway 96, 9.2 miles northeast of Kimbrough, Wilcox County, Ala. (5).

Genus ELLIPSONODOSARIA A. Silvestri, 1900

Ellipsonodosaria plummerae Cushman

Plate 13, figures 1, 2

Nodosaria sagrinensis Plummer (not Bagg), Texas Univ. Bull. 2644, p. 85, pl. 4, fig. 16, 1927.
Ellipsonodosaria plummerae Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 69, pl. 12, figs. 4, 5, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 51, pl. 5, fig. 8, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 352, pl. 54, figs. 18, 19, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 61, pl. 10, fig. 24, 1946.
Ellipsonodosaria sagrinensis Cooper (not Bagg), Jour. Paleontology, vol. 18, p. 352, pl. 54, fig. 22, 1944.

Test elongate, very slightly tapering, chambers in a straight linear series, circular in transverse section, initial end with one or more short spines; chambers distinct, later ones becoming pyriform with the greatest breadth toward the base, which is somewhat excavated, increasing in size very gradually as added; sutures deeply excavated in the later portion; wall ornamented by low, longitudinal costae, broken into irregular short spines, and limited largely to the upper part of the chamber, ending often in short spines at the ridge near the base of the chamber; aperture terminal, rounded, with a distinct tooth at one side, and with a definite neck and slight lip. Length 0.80 to 1.00 mm., diameter 0.10 to 0.14 mm.

The types are from the Paleocene, from U. S. Highway 80, south of Sucarnoochee Creek, ½ mile southwest of Livingston, Sumter County, Ala.

This is a very common species in the Paleocene and should make a good index fossil. In addition to the localities given below it has been recorded by Kline from the Paleocene of Mississippi and by Cooper from the Paleocene of Illinois.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Pine Barren member. Alabama, Butler County (12).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30, 31).
Midway group. Texas, Limestone County (39, 42); Navarro County (40); Bastrop County (43); Caldwell County (44); Travis County (45); Freestone County (50).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Mexia member. Texas, Limestone County (37).
Kincaid formation. Texas, Hunt County (37).

Ellipsonodosaria paleocenica Cushman and Todd

Plate 13, figures 3–5

Ellipsonodosaria paleocenica Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 61, pl. 10, fig. 26, 1946.
Ellipsonodosaria sp. Cushman, idem, vol. 16, p. 70, pl. 12, figs. 1, 2, 1940.

Test elongate, slender, straight, tapering very gradually from the very narrow initial end to the greatest breadth near the apertual end; chambers distinct, inflated, numerous as many as 14 in the adult, increasing very gradually in size as added, strongly inflated, subspherical; sutures distinct, strongly depressed throughout; wall nearly smooth or slightly hispid in the earliest portion, in the last two or three chambers with a trace of very short spines; aperture terminal with a short neck and distinct lip, with a short tooth at one side of the opening. Length 1.50 to 1.90 mm., breadth 0.20 to 0.25 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼ NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark.

This should make a good index fossil for the Paleocene. It may be distinguished from *E. plummerae* by its more rounded chambers and smoother surface.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Midway formation, lower part. Arkansas, Saline County (20).
Midway formation, lower part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Saline County (26). Midway group. Texas, Limestone County (39); Navarro County (40); Travis County (46); Bastrop County (49).
Wills Point formation. Texas, Williamson County (35).

Ellipsonodosaria midwayensis Cushman and Todd

Plate 13, figures 6–10

Ellipsonodosaria midwayensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 61, pl. 10, fig. 25, 1946.
Nodosaria spinulosa Plummer (not *Nautilus spinulosus* Montagu), Texas Univ. Bull. 2644, p. 84, pl. 4, fig. 19, 1927.
Ellipsonodosaria spinulosa (Plummer) Cooper, Jour. Paleontology, vol. 18, p. 352, pl. 54, fig. 20, 1944.
Ellipsonodosaria alexanderi Cushman (not Cushman, 1936), Cushman Lab. Foram. Research Contr., vol. 16, p. 69, pl. 11, figs. 27–29, 1940.
Kline (part), Mississippi Geol. Survey Bull. 53, pl. 5, fig. 1 (not fig. 2), 1943.

Test elongate, slender, arcuate, gradually tapering from the acute initial end to the greatest width at the last-formed chamber, initial end with one or more distinct, short spines; chambers distinct, pyriform in shape, greatest width near the base, sides tapering but convex; sutures distinct, strongly depressed; wall ornamented with numerous, platelike longitudinal costae ending in two series of spinose projections near the base of the chambers, in the earlier portion often with the costae continuous over several chambers; aperture terminal, with a very short neck and distinct lip. Length 2.00 to 2.60 mm., breadth 0.25 to 0.30 mm.

The types are from the Paleocene, about 1,000 feet south of Roosevelt Road viaduct, 200 feet east of railroad tracks, in small gully heading east, just upstream from small abandoned bridge, NE¼ NW¼ sec. 16, T. 1 N., R. 12 W., Little Rock, Ark. (25).

This species should make a good index fossil for the Paleocene. It occurs mostly in material from Texas but there are occasional specimens from Arkansas and a questionable one from Alabama. One of Kline's figures is of this species and gives a record from the Paleocene of Mississippi. Cooper's specimens from Illinois should apparently be placed here.

Clayton formation. Alabama, Barbour County (10).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Pulaski County (27); Clark County (29).
Midway group. Texas, Limestone County (39, 42); Navarro County (40); Hunt County (41); Van Zandt County (47, 48); Freestone County (50).

Ellipsonodosaria alexanderi Cushman

Plate 13, figure 12

Ellipsonodosaria alexanderi Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 52, pl. 9, figs. 6–9, 1936.
Kline (part), Mississippi Geol. Survey Bull. 53, p. 51, pl. 5, fig. 2 (not fig. 1), 1943.
Cushman, U. S. Geol. Survey Prof. Paper 206, p. 135, pl. 56, figs. 12–15, 1946.

Test elongate, straight or slightly curved, microspheric form increasing rather rapidly in diameter from the small proloculum, the megalospheric form with the proloculum having nearly as great a diameter as the last-formed chambers; chambers distinct, inflated, increasing rather gradually in length, the adult chambers about twice as long as broad; sutures distinct, strongly depressed; wall ornamented with short backwardly pointing spines, in the early stages of the microspheric form with a single ring of spines slightly below the middle of the chamber, in the adult with numerous spines rather irregularly scattered over the surface; aperture a semicircular opening with a single tooth; with a distinct neck and slightly raised lip. Length up to 2.00 mm., diameter 0.20 mm.

The types are from the Upper Cretaceous Taylor marl in a road cut 14.4 miles south of Paris and 0.9 mile north of Lake City, Delta County, Tex.

This is typically an Upper Cretaceous species. Very rare specimens from a single Paleocene locality in Texas may be referred here with some question. One of the specimens figured by Kline from the Paleocene of Mississippi seems to belong here.

Midway group. Texas, Caldwell County (44).

Family ROTALIIDAE

Genus SPIRILLINA Ehrenberg, 1843

Spirillina selseyensis Heron-Allen and Earland

Plate 13, figures 13, 14

Spirillina selseyensis Heron-Allen and Earland, Royal Micr. Soc. Jour., 1909, p. 440, pl. 18, figs. 6, 7.
Cushman and Garrett, Cushman Lab. Foram. Research Contr., vol. 15, p. 84, pl. 14, figs. 28, 29, 1939.
Cushman and Todd, idem, vol. 18, p. 38, pl. 7, fig. 2, 1942
Cushman, idem, vol. 20, p. 45, pl. 7, fig. 20, 1944.

Test close coiled, dorsal side somewhat concave, ventral side flattened or slightly concave near the center; spiral suture distinct; wall of the dorsal side with a series of rectangular depressions extending from the peripheral thickening to the inner margin of uniform size, ventral side with slightly oblique linear depressions with raised areas between; aperture at the end of the tubular chamber. Diameter 0.25 to 0.30 mm.

The types of this species are from the Eocene of Selsey Bill, England. It has been recorded in America from the Eocene Wilcox group of Woods Bluff, Alabama, and from the Paleocene Naheola formation, of Alabama.

Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Porters Creek clay. Tennessee, Hardeman County (13, 14).
Porters Creek formation. Matthews Landing marl member. Alabama, Choctaw County (7).

Spirillina cf. S. vivipara Ehrenberg

Plate 13, figure 15

Spirillina cf. *vivipara* Ehrenberg, Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 38, pl. 7, fig. 1, 1943. Cushman, idem, vol. 20, p. 44, pl. 7, fig. 21, 1944.

Single specimens have been recorded and figured as noted above.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5); Choctaw County (7).

Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Spirillina sp.

Plate 13, figures 16, 17

Spirillina sp. Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 10, pl. 2, figs. 14, 15, 1942.

Specimens from the Paleocene of Soldado Rock, Trinidad, B. W. I., evidently belong to this genus or to *Conicospirillina*. They are not preserved well enough for a specific description.

Genus PATELLINA Williamson, 1858

Patellina sp.

Plate 13, figure 18

Patellina sp. Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 45, pl. 7, fig. 22, 1944.

Very rare specimens from the Paleocene Coal Bluff marl member of the Naheola formation of Wilcox County, Ala., and from Tennessee seem to belong to this genus, but more specimens are needed to give an adequate description.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Porters Creek clay. Tennessee, Hardeman County (13).

Genus PATELLINOIDES Heron-Allen and Earland, 1932

Patellinoides? sp.

Plate 13, figure 19

Patellinoides? sp. Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 38, pl. 7, fig. 3, 1942.

A single specimen from the Paleocene at the type locality of the Naheola formation, Naheola Landing, on Tombigbee River, Choctaw County, Ala. (7), is referred with some question to this genus. The adult chambers make up about half a coil. The sutures on the dorsal side are raised and plate-like. It apparently does not belong to any described species, but more specimens are needed for a full specific description.

Genus DISCORBIS Lamarck, 1804

Discorbis midwayensis Cushman

Plate 13, figure 20

Discorbis midwayensis Cushman, Cushman Lab. Foram. Research Contr., vol 16, p. 70, pl. 12, fig. 6, 1940.

Kline, Mississippi Geol. Survey Bull. 53, p. 52, pl. 5, figs. 9, 10, 1943.

Test trochoid, plano-convex, dorsal side somewhat convex, ventral side flattened or even slightly concave, periphery subacute but not keeled, ventral side umbilicate; chambers normally 7 in the last-formed whorl, fairly distinct, of uniform shape, increasing gradually in size as added, slightly inflated on the dorsal side; sutures distinctly curved on both dorsal and ventral sides, slightly depressed; wall distinctly papillate on both dorsal and ventral sides, the center of the dorsal side sometimes slightly umbonate and smooth; aperture on the ventral side, in the umbilical region, low and elongate, with a distinct, overhanging lip. Diameter 0.65 to 0.80 mm., thickness 0.18 to 0.25 mm.

The types are from the Paleocene, from an old abandoned roadway, south of Sucarnoochee Creek, about $\frac{1}{10}$ mile upstream from crossing of U. S. Highway 80, $\frac{1}{2}$ mile southwest of Livingston, Sumter County, Ala. (9).

Clayton formation, Pine Barren member. Alabama, Butler County (12).

Midway formation. Arkansas, Saline County (26); Pulaski County (28); Clark County (31).

Discorbis midwayensis Cushman var. soldadoensis Cushman and Renz

Plate 13, figure 21

Discorbis midwayensis Cushman var. *soldadoensis* Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 10, pl. 3, fig. 4, 1942.

Variety differing from the typical form in the thicker, more convex test, fewer chambers, deeper umbilical region, narrower and more triangular and more inflated final chamber.

The types of the variety are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. It has not been recorded elsewhere.

Discorbis midwayensis Cushman var. trinitatensis Cushman and Renz

Plate 13, figure 22

Discorbis midwayensis Cushman var. *trinitatensis* Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 10, pl. 3, fig. 5, 1942.

Cushman, idem, vol. 20, p. 45, pl. 7, fig. 23, 1944.

Variety differing from the typical form in the ornamentation of the test, consisting of thickened and raised sutures on the dorsal side and deeper sutures on the ventral side.

The types of the variety are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I., and it has not been recorded elsewhere.

Discorbis infrequens Plummer

Plate 13, figure 23

Discorbis infrequens Plummer, Texas Univ. Bull. 2644, p. 138, pl. 9, figs. 1a-c, 1927.

Test very small, round, trochoid, the dorsal face being broadly conical and the ventral face almost flat; peripheral margin acute, very faintly lobate; chambers 3 or 4 in final whorl, narrow, strongly curved, very smooth; aperture a narrow arched

opening along the edge of the final chamber between the periphery and the umbilicus. Diameter up to 0.3 mm.—Plummer.

The types are from the Paleocene, exposure in side of steep west-facing hill on Richland-Streetman road 1½ miles southwest of Richland where roads branch off both northeast and southwest with a short offset, Navarro County, Tex.

The species is recorded as exceedingly rare. No specimens have been found in our material.

Genus LAMARCKINA Berthelin, 1881

Lamarckina naheolensis Cushman and Todd

Plate 14, figures 4–6

Lamarckina naheolensis Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 39, pl. 7, figs. 5–7, 1942. Cushman, idem, vol. 20, p. 45, pl. 7, fig 25, 1944.

Test small, longer than broad, dorsal side flattened or even slightly concave in the earlier portion, ventral side strongly convex, deeply umbilicate, periphery acute, even slightly keeled in the early stages; chambers distinct, about 8 in the adult whorl, increasing rapidly in size as added; sutures distinct on the dorsal side, slightly limbate as each chamber tends to slightly overlap the previous one, gently curved, on the ventral side indistinct; wall smooth, distinctly perforate on the dorsal side, smooth and polished on the ventral side; aperture opening into the umbilical cavity, with a large, slightly convex lip extending into and partially covering the umbilicus. Length of holotype 0.25 mm., breadth 0.20 mm., thickness 0.13 mm.

The types are from the Paleocene Naheola formation, greensand bed, upper fossiliferous horizon, Naheola Landing, Tombigbee River, Ala.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4–6); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Lamarckina limbata Cushman and Todd

Plate 14, figures 1–3

Lamarckina limbata Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 39, pl. 7, figs. 8–10, 1942.

Test about as broad as long, biconvex, periphery acute and slightly carinate; chambers distinct, 5 or 6 in the adult whorl, increasing rapidly in size as added; sutures on the dorsal side strongly limbate and raised, only slightly curved toward the periphery, indistinct on the ventral side, especially on the earlier chambers, smooth and polished on the ventral side; aperture opening into the umbilical cavity, without a definite lip. Length of holotype 0.32 mm., breadth 0.28 mm., thickness 0.18 mm.

The types are from the Paleocene Naheola formation, greensand bed, upper fossiliferous horizon, Naheola Landing, Tombigbee River, Ala.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3), Choctaw County (7).

Lamarckina rugulosa Plummer

Plate 13, figure 24

Lamarckina rugulosa Plummer, Ms, in Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 8, pl. 3, figs. 6a-c, 1926; Univ. Texas Bull. 2644, p. 140, pl. 9, figs. 3a-c, 1927.

Test very broadly elliptical to almost round in outline, moderately compressed in average development to nearly globular in extreme old age; convolutions not over 1½; chambers 5–6 in the last-formed whorl, enlarging rapidly, very smooth and glistening on the ventral face, highly granular on the dorsal face; dorsal sutures slightly depressed between last 2 or 3 chambers, but commonly obliterated by the granulations, or rarely marked by faint ridges of smooth shell material; ventral sutures faintly depressed; umbilicus deeply excavated; aperture a low arch on the umbilical edge of the final chamber under a narrow and delicately fringed flap on well-preserved tests. Maximum length up to 0.50 mm.; maximum breadth 0.40 mm.; thickness 0.30 mm.—Plummer in Cushman.

The types are from the Paleocene, road cut south of city reservoir, 3½ miles southeast of Corsicana, Tex. It has also been recorded from the Clayton formation, from a bluff on the south side of Owl Creek, 2¾ miles northeast of Ripley, Tippah County, Miss.

Wills Point formation. Texas, Caldwell County (34).
Mexia member. Texas, Limestone County (36).
Midway group. Texas, Bastrop County (43); Caldwell County (44).

Lamarckina paleocenica Cushman

Plate 14, figure 7

Lamarckina paleocenica Cushman, Cushman Lab. Foram. Research Contr., vol. 24, p. 44, pl. 8, fig. 8, 1948.

Test small, dorsal side moderately convex, ventral side flattened or slightly concave, slightly umbilicate, periphery subacute; chambers distinct on the dorsal side, rather indistinct on the ventral side, 6 or 7 in the adult whorl, increasing rapidly in size as added; sutures distinct on the dorsal side, slightly thickened and somewhat raised in the earlier portion, the last one or two often depressed, rather indistinct on the ventral side; wall smooth except for the raised sutures of the dorsal side; aperture ventral, beneath an extended lobe of the last-formed chamber. Length 0.32 to 0.37 mm., breadth 0.27 to 0.30 mm., thickness 0.15 to 0.18 mm.

The types are from the Paleocene Clayton formation, cut on Southern Railway, 200 feet east of mile post 481, 1½ miles east of Middleton, Hardeman County, Tenn.

The species is common at the type locality and another locality a short distance away and at one Alabama locality. It differs from *L. ripleyensis* Cushman in the more compressed and smaller test, fewer chambers, and less raised sutures.

Porters Creek clay, Tennessee, Hardeman County (13, 14).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1).

Genus VALVULINERIA Cushman, 1926

Valvulineria allomorphinoides (Reuss) Cushman

Plate 14, figures 8, 9

Valvulina allomorphinoides Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 223, pl. 11, figs. 6a–c, 1860.

Discorbina allomorphinoides Franke, Greifswald Univ. Geol.-palaeont. Inst., Abh., vol. 6, p. 91, pl. 8, figs. 11a, b, 1925, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 189, pl. 18, figs. 7a, b, 1928.

Discorbis allomorphinoides Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 606, pl. 20, figs. 18, 19; pl. 21, fig. 5, 1926.

Plummer, Texas Univ. Bull. 2644, p. 139, pl. 9, fig. 2, 1927.

Valvulineria allomorphinoides Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 43, pl. 6, figs. 2a-c, 1931; Tennessee Div. Geology Bull. 41, p. 53, pl. 9, figs. 6a-c, 1931; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 46, pl. 13, figs. 17a-c, 1932.

Brotzen, Sveriges geol. Undersökning, ser. C, No. 396, p. 153, pl. 11, figs. 1a-c, text fig. 56, 1936.

Morozova, Soc. naturalistes Moscou Bull., n. ser., vol. 47, p. 78, pl. 2, figs. 21, 22, 1939.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 70, pl. 12, fig. 9, 1940.

Cushman and Hedberg, idem, vol. 17, p. 96, pl. 23, figs. 9a-c, 1941.

Kline, Mississippi Geol. Survey Bull. 53, p. 52, pl. 5, figs. 11, 12, 1943.

Applin and Jordan, Jour. Paleontology, vol. 19, p. 132 (list), 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 62, pl. 11, fig. 1, 1946.

Cushman, U. S. Geol. Survey Prof. Paper 206, p. 138, pl. 57, figs. 6, 7, 1946.

Cushman and Renz, Cushman Lab. Foram. Research Special Pub. 18, p. 44, pl. 17, figs. 13, 14, 1946.

Schijfsma, Med. Geol. Stichting, ser. C-V, No. 7, p. 89, 1946.

Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 23, p. 48, 1946.

Test trochoid, biconvex, slightly longer than broad, oval, periphery rounded; chambers distinct, very slightly inflated, 4 to 6 or 7 in the adult whorl, usually 5; sutures distinct, dorsally slightly curved, not depressed; wall smooth, very finely perforate; aperture a low opening, on the ventral side, beneath an overhanging, plate like lip. Length 0.25 to 0.40 mm., breadth 0.20 to 0.35 mm., thickness 0.13 to 0.20 mm.

This species was described from the Upper Cretaceous of Europe and has a wide distribution in the Cretaceous and lower Eocene.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2); Butler County (3).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Midway formation, upper part. Arkansas, Pulaski County (25).

Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30).

Midway group. Texas, Limestone County (39, 42); Caldwell County (44).

Wills Point formation, Mexia member. Texas, Limestone County (36).

Kincaid formation. Texas, Hunt County (37).

Valvulineria wilcoxensis Cushman and Ponton

Plate 14, figures 10–13

Valvulineria wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 70, pl. 9, fig. 6, 1932.

Cushman and Garrett, idem, vol. 15, p. 85, pl. 15 figs. 1, 2, 1939.

Cushman, Am. Jour. Sci., vol. 242, p. 13, pl. 1, figs. 36, 37, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 26, pl. 4, fig. 26, 1944.

Test nearly circular in side view, periphery slightly lobulate, nearly bilaterally symmetrical, umbilical region slightly depressed on the ventral side; chambers very distinct, 6 or 7 in the last-formed whorl, inflated; sutures distinct, slightly curved, strongly limbate on the ventral side, less so on the dorsal side in the early stages, sutures of later portion depressed, not limbate; wall smooth, distinctly perforate; aperture a low opening, extending from near the periphery along the ventral side beneath the somewhat flattened lip of the ventral margin of the chamber. Diameter of type 0.75 mm., thickness 0.30 mm.

The types of this species are from the Eocene Tuscahoma sand, railroad cut, 1 mile north of Ozark, Ala. The species has not previously been recorded from the Paleocene, but rather typical specimens occur at a number of localities.

Porters Creek clay. Tennessee, Hardeman County (18).

Midway formation, lower part. Arkansas, Saline County (21).

Midway formation. Arkansas, Saline County (26).

Midway group, Texas, Bastrop County (43); Travis County (45).

Valvulineria extensa Cushman and Bermúdez

Plate 23, figures 6–8

Valvulineria extensa Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 72, pl. 12, figs. 7–9, 1948.

Test trochoid, the dorsal side very slightly convex, ventral side increasing rapidly in thickness in the adult, periphery subacute to slightly rounded; chambers distinct, numerous, 10 or more in the adult whorl, increasing very gradually in size as added, with a ventral lobe over the umbilical area in the early stages becoming high and extending outward in the later portion; sutures distinct, slightly depressed, curved; wall smooth, distinctly perforate; aperture extending from the periphery along the ventral margin of the last-formed chamber. Length 0.45–0.50 mm.; breadth 0.35–0.40 mm.; thickness 0.28–0.32 mm.

The types are from the Paleocene Madruga formation, under highway bridge, Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *V. herricki* (Hadley) in the larger number of chambers, more concave periphery, and more open umblical region.

Valvulineria madrugaensis Cushman and Bermúdez

Plate 23, figure 5

Valvulineria madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 73, pl. 12, fig. 10, 1948.

Test trochoid, with the dorsal side much less convex than the ventral, periphery rounded, becoming more acute in the later portion; chambers distinct in the later portion, slightly inflated, numerous, earlier ones indistinct, not inflated, increasing very gradually in size as added, with a narrow, ventral lobe over the umbilical area; sutures distinct in the later portion and slightly depressed, earlier ones indistinct; wall smooth; aperture extending from the periphery along the ventral margin of the last-formed chamber. Length of holotype 0.65 mm.; breadth 0.50 mm.; thickness 0.35 mm.

The types are from the Paleocene Madruga formation, under highway bridge, Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *V. extensa* Cushman and Bermúdez in the somewhat larger size, tendency for the last-formed chambers to not reach the periphery on the dorsal side, and the less projecting ventral lobe.

Valvulineria insueta Cushman and Bermúdez

Plate 23, figures 2–4

Valvulineria insueta Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 85, pl. 14, figs. 7–9, 1948.

Test trochoid, biconvex, dorsal side nearly flat, ventral side strongly convex, slightly umbilicate, periphery broadly rounded; chambers few, 4 or 5 in the adult whorl, inflated, increasing very gradually in size as added; sutures distinct, depressed, curved; wall smooth; aperture at the ventral margin of the last-formed chamber with a distinct lip, partially covering the umbilicus. Length of holotype 0.55 mm.; breadth 0.47 mm.; thickness 0.32 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species resembles *V. advena* Cushman and Siegfus, but differs in the slightly larger number of chambers, the last-formed one making up much less of the surface, and the much less prominent lip.

Genus GYROIDINA D'Orbigny, 1826

Gyroidina subangulata (Plummer) Cushman

Plate 14, figures 14, 15

Rotalia soldanii (D'Orbigny var. *subangulata* Plummer, Texas Univ. Bull. 2644, p. 154, pl. 12, fig. 1, 1927.

Gyroidina subangulata Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 71, pl. 12, fig. 7, 1940.

Cushman and Renz, idem, vol. 18, p. 11, pl. 2, fig. 18, 1942.

Kline, Mississippi Geol. Survey Bull. 53, p. 53, pl. 5, figs. 13–15, 1943.

Applin and Jordan, Jour. Paleontology, vol. 19, p. 132 (list), 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 62, pl. 11, figs. 2–4, 1946.

Test almost plano-convex, the dorsal side being flat or faintly convex, the ventral side very strongly convex, composed of about two convolutions; peripheral margin bluntly angular; chambers 8–9 in final whorl; sutures slightly depressed between the last two or three chambers on both sides and around the small umbilical excavation, otherwise plain or faintly elevated, moderately oblique dorsally and radiate ventrally; shell wall very finely punctate, very smooth, glistening; aperture a long narrow slit at the base of a broad septal face extending from a point below the periphery almost into the umbilicus. Diameter up to 0.4mm.; usually less.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Pine Barren member. Alabama, Butler County (12).

Midway formation, lower part. Arkansas, Saline County (19, 19A, 20, 22).

Midway formation, upper part. Arkansas, Pulaski County (24, 25).

Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30).

Midway group. Texas, Limestone County (39, 42); Navarro County (40); Bastrop County (43, 49); Caldwell County (44); Travis County (46).

Wills Point formation. Texas, Travis County (33); Caldwell County (34).

Mexia member. Texas, Limestone County (36).

Gyroidina aequilateralis (Plummer) Cushman

Plate 14, figures 16, 17

Rotalia aequilateralis Plummer, Texas Univ. Bull. 2644, p. 155, pl. 12, fig. 3, 1927.

Gyroidina aequilateralis Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 45, pl. 7, fig. 24, 1944.

Gyroidina subangulata Cushman and Todd (not Plummer), idem, vol. 18, p. 40, pl. 7, figs. 11, 12, 1942.

Test almost equally biconvex, composed of about two and one-half convolutions that increase very slowly in width; peripheral margin narrowly rounded, faintly lobate in the last-formed portion of the test; chambers compact, numerous, about 10 in final whorl; dorsal sutures distinct, narrow, tapering bands without elevation, strongly curved with a slight angulation, but not oblique, depressed gently between last two or three chambers only; ventral sutures elevated most markedly around the small umbilicus and tapering radially toward the margin, dark on tests filled with mineral matter; aperture a very narrow slit at base of septal face and bearing a very narrow extended lip. Diameter up to 0.4 mm.; usually less.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of the new Corsicana reservoir, or road to Mildred, Navarro County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4–6); Butler County (3); Choctaw County (7).

Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Clayton formation, Pine Barren member. Alabama, Butler County (12).

Midway formation, lower part. Arkansas, Saline County (22).
Midway group. Texas, Bastrop County (49).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Gyroidina madrugaensis Cushman and Bermúdez

Plate 24, figures 4–6

Gyroidina madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 85, pl. 14, figs. 10–12, 1948.

Test small, about as broad as long, thick, ventral side slightly umbilicate, dorsal side depressed in the center, periphery broadly rounded; chambers distinct, somewhat inflated, about six in the final whorl, increasing very gradually in size as added, on the dorsal side with a lobular extension, partially filling the central depression; sutures distinct, slightly depressed, ventrally somewhat sinuate, dorsally slightly curved; wall smooth; aperture a low opening at the ventral margin of the last-formed chamber extending from just below the periphery nearly to the umbilical area. Length 0.30–0.35 mm.; breadth 0.25–0.28 mm.; thickness 0.25 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *G. subangulata* (Plummer) in the fewer chambers to the whorl and very depressed dorsal side with an extension of the chambers over this area.

Genus EPONIDES Montfort, 1808

Eponides elevatus (Plummer) Cushman and Renz

Plate 14, figures 18, 19

Truncatulina elevata Plummer, Texas Univ. Bull. 2644, p. 142, pl. 11, fig. 1, 1927.

Eponides elevata Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 11, pl. 3, fig. 1, 1942.

Test subconical, the dorsal face being highly elevated and the ventral face gently convex; periphery bluntly angular; chambers usually 7 in final convolution; dorsal sutures moderately oblique, almost straight, strongly elevated; ventral sutures less elevated, radiates from a distinct, thick ridge of shell matter surrounding a small excavated umbilicus; shell wall coarsely punctate; aperture a small, arched slit near the periphery. Diameter up to 0.35 mm.—Plummer.

The types are from the Paleocene, exposure along a small branch about ¾ mile northwest of Tehuacana, and 0.2 of a mile north of Tehuacana-Waco road at first road turning north, Limestone County, Tex.

Porters Creek clay. Tennessee, Hardeman County (13, 14).
Midway formation, lower part. Arkansas, Saline County (21).
Midway group. Texas, Hunt County (41); Bastrop County (43, 49); Travis County (46).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Eponides lotus (Schwager) Cushman and Ponton

Plate 14, figure 21

Pulvinulina lotus Schwager, Palaeontographica, vol. 30, Pal. Theil, p. 132, pl. 28 (5), fig. 9, 1883.

Eponides lotus Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 71, pl. 9, fig. 8, 1932.
Glaessner, Problems of Paleontology, Moscow Univ., vols. 2–3, p. 379, pl. 3, fig. 26, 1937.
Bermúdez, Soc. cubana hist. nat. Mem., vol. 12, p. 7, 1938.
Cushman and Garrett, Cushman Lab. Foram. Research Contr., vol. 15, p. 85, pl. 15, figs. 3–6, 1939.
Israelsky, Sixth Pacific Sci. Congress, Proc., p. 578, pl. 5, figs. 1–4; pl. 6, fig. 1, 1939.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 40, pl. 7, figs. 13, 14, 1942.
Thalmann, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 1, p. 13 (list), 1942.
Curran, Am. Assoc. Petroleum Geologists Bull., vol. 27, p. 1379 (list), 1943.
Cushman, Am. Jour. Sci., vol. 242, p. 13, pl. 2, figs. 5, 6, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 26; p. 46, pl. 7, fig. 26, 1944.

It seems very difficult to distinguish between this species and *E. elevatus*. In this material the specimens with the sutures generally flush with the surface or slightly depressed and with a generally smooth test have been placed in *E. lotus*.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 6); Choctaw County (7).
Naheola formation Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Wilcox County (11); Butler County (12).
Midway formation, lower part. Arkansas, Saline County (18, 19).
Midway formation. Arkansas, Pulaski County (20).
Midway group. Texas, Hunt County (41); Travis County (45).

Eponides plummerae Cushman

Plate 14, figures 20, 22

Eponides plummerae Cushman, Cushman Lab. Foram. Research Contr., vol. 24, p. 44, pl. 8, fig. 9, 1948.
Truncatulina tenera Plummer (not H. B. Brady), Texas Univ. Bull. 2644, p. 146, pl. 9, fig. 5, 1927.
Eponides cf. *E. tenera* Kline, Mississippi Geol. Survey Bull. 53, p. 53, pl. 5, figs. 16–18, 1943.
Eponides cf. *E. haidingerii* Cushman and Todd (not D'Orbigny), Cushman Lab. Foram. Research Contr., vol. 22, p. 62, pl. 11, figs. 5, 6, 1946.
Eponides sp. Cushman, idem, vol. 16, p. 71, pl. 12, fig. 8, 1940.

Test small, biconvex, periphery subacute; chambers distinct but not inflated, usually six in the adult whorl, increasing very uniformly in size as added; sutures distinct but not depressed except very slightly on the ventral side, on the dorsal side somewhat oblique, on the ventral side nearly radial, very slightly curved; wall smooth, polished; aperture elongate, narrow, on the ventral side of the last-formed chamber running from just below the periphery almost to the umbilical area, often with a very slight overhanging lip. Diameter 0.32 to 0.37 mm., thickness 0.22 to 0.25 mm.

The types are from the Paleocene, exposure in creek bed on northeast-southwest country road, 1.1 mi. due east of Honest Ridge School, and 2.5 mi. due north of the cross roads in Thelma, Limestone County, Tex. (39).

This species differs from *E. tenera* (H. B. Brady) in its more convex dorsal side and more oblique sutures on the dorsal side.

Clayton formation, Chalyeate limestone member. Alabama, Sumter County (9).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Pulaski County (27); Clark County (30).
Midway group. Texas, Limestone County (39); Navarro County (40); Caldwell County (44).
Wills Point formation. Texas, Travis County (33).

Eponides vanbelleni (Van den Bold) Cushman and Bermúdez

Plate 20, figures 11–13; plate 23, figure 10

?Cibicides vanbelleni Van den Bold, Thesis Univ. Utrecht, Amsterdam, p. 125, pl. 18, figs. 8a-c, 1946.
Eponides vanbelleni Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 71, pl. 12, figs. 1–3, 1948.

Test trochoid, unequally biconvex, rotaliform. Dorsal side only slightly elevated, ventral side strongly convex. Chambers numerous in the last formed whorl (at least 14), but hardly visible, owing to the ornamentation; sutures very indistinct except dorsally in the few last-formed chambers. There they are slightly depressed. Ventral side strongly ornamented with numerous flat papillae, vermicular in the umbilical region, diminishing in size and becoming nodular towards the periphery. Dorsal side less strongly ornamented in the same way. Aperture a short arched slit at the periphery and the ventral side and probably extending on the dorsal side. But as this could not be seen very well owing to the rather poor state of preservation of the tests, the reference to *Cibicides* is questionable.—Van den Bold.

Diameter 0.65 mm., height 0.40 mm.

This species was described from the lower Eocene of Guatemala and British Honduras. Specimens apparently identical occurred in the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba, and indicate that from the position of the aperture the species belongs in *Eponides*.

Eponides gratiosus Cushman and Bermúdez

Plate 23, figure 9

Eponides gratiosus Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 71, pl. 11, fig. 14, 1948.

Test trochoid, unequally biconvex, the ventral side very strongly convex, dorsal side much less so, periphery acute; chambers fairly distinct on the ventral side, those of the last-formed whorl on the dorsal side fairly distinct, earlier whorls obscured by the surface ornamentation; sutures mostly indistinct, ventrally slightly curved, dorsally strongly oblique; wall of the ventral side somewhat roughened but not definitely papillate, dorsal side finely but distinctly papillate except over the last few chambers, which are fairly smooth; aperture ventral, a low elongate opening at the margin of the last-formed chamber. Diameter of holotype 0.63 mm.; thickness 0.38 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *E. vanbelleni* (Van den Bold) in the acute periphery, smoother ventral side, and nearly straight ventral sides in edge view.

Genus PARRELLA Finlay, 1939

Parrella expansa Toulmin

Plate 16, figures 11, 12

Parrella expansa Toulmin, Jour. Paleontology, vol. 15, p. 604, text figs. 3, 4F, 4G, 1941.
Kline, Mississippi Geol. Survey Bull. 53, p. 54, pl. 5, figs. 19, 20, 1943.
Truncatulina culter Plummer (not Parker and Jones), Texas Univ. Bull. 2644, p. 147, pl. 10, fig. 1; pl. 15, fig. 2, 1927.
Pulvinulinella culter (Parker and Jones) var. *mexicana* Cushman (not Cole), Cushman Lab. Foram. Research Contr., vol. 16, p. 72, pl. 12, fig. 12, 1940.
Pulvinulinella culter (Parker and Jones) var. *midwayana* Cushman and Todd, idem, vol. 22, p. 63, pl. 11, fig. 12, 1946.

Test trochiform, close coiled, subcircular in outline, ventral side strongly convex, dorsal side nearly flat with earliest coils gently elevated, periphery sharply acute with a broad thin flange; all chambers visible on dorsal side, with flange of all coils forming a limbate whorl suture, only chambers in final convolution visible ventrally, eight or nine chambers in the final whorl; dorsal sutures broad, oblique, slightly curved, flush or slightly elevated, ventral sutures limbate between early chambers of the final whorl, generally depressed between the last two or three chambers, radiating from a small umbilical filing and curving backward near the junction with the peripheral flange; wall smooth, perforate; aperture consisting of two portions, a narrow elliptical opening extending from the base of the final chamber near the periphery obliquely across the apertural face, at an angle of 45 degrees or more to the peripheral plane, and a very narrow slit at base of the septal face extending ventrally toward the umbilical area from the dorsal end of the oblique opening. Average diameter 0.5 mm.—Toulmin.

The types are from the Paleocene Wills Point formation, abandoned clay pit in west edge of Mexia, Tex.

Porters Creek clay. Mississippi, Kemper County (17).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Pulaski County (27); Clark County (30).
Midway group. Texas, Limestone County (39, 42); Navarro County (40); Caldwell County (44).
Wills Point formation. Texas, Williamson County (35).
Mexia member. Texas, Limestone County (36).

Parrella macneili Cushman

Plate 16, figures 13, 14

Parrella macneili Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 47, pl. 7, figs. 30, 31, 1944.

Test small, close coiled, trochoid, consisting of about 4 chambers in the adult whorl; periphery acute, slightly keeled and serrate; chambers fairly distinct, increasing rapidly in size as added, the last-formed one strongly inflated on the ventral side, making up nearly half the surface of the test; sutures indistinct, tangential, little if at all depressed; wall slightly papillate in the umbonal region of the ventral side, on the dorsal side papillate along the sutures; aperture fairly large, ven-

tral, with a rounded, somewhat triangular lip curved on the outer side making a rounded indentation into the ventral face. Diameter 0.35 to 0.45 mm., thickness 0.10 mm.

The types are from the Paleocene Coal Bluff marl member of the Naheola formation, creek bottom, just west of store at Caledonia, about ¼ mile south of center of sec. 29, T. 11 N., R. 10 E., Wilcox County, Ala. (8). It is known only from the type locality.

Genus COLEITES Plummer, 1934

Coleites reticulosus (Plummer) Plummer

Plate 15, figures 1–5

Pulvinulina reticulosa Plummer, Texas Univ. Bull. 2644, p. 152, pl. 12, fig. 5, 1927.

Coleites reticulosus Plummer, Am. Midland Naturalist, vol. 15, p. 606, pl. 24, figs. 5–9, 1934.

Cushman and Garrett, Cushman Lab. Foram. Research Contr., vol. 15, p. 87, pl. 15, figs. 14–20, 1939.

Cushman, idem, vol. 16, p. 71, pl. 12, fig. 20, 1940.

Cushman and Bermúdez, idem, vol. 24, p. 81, pl. 13, figs. 1–4, 1948.

Test broadly elongate, strongly compressed, flat or gently convex on the dorsal side, more convex on the ventral side, coarsely and irregularly reticulate on both sides except over the septal face; periphery very sharp and bounded by a ragged flange; early chambers tightly coiled through two or more convolutions, very narrow, curved, gradually lengthening, 7 in the final whorl; fully mature chambers short, broad, and rapidly becoming almost rectilinear; foramina connected by a stout tube, which in the final chamber extends to the aperture; early sutures completely obscured by the coarse reticulation of the test but clearly visible when test is mounted in liquid, strongly curved dorsally but somewhat less curved ventrally, later sutures very slightly constricted and not quite parallel; aperture of very young tests an elliptical opening on the ventral side of the peripheral angle above the base of the septal face, but with growth of the test the opening becomes more narrow and longer and develops a faint blunt tooth on its ventral edge. Length of most mature test observed 0.85 mm.; breadth 0.52 mm.; thickness 0.21 mm.—Plummer, 1934.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3).

Midway formation. Arkansas, Clark County (30).

Coleites pasionensis Cushman and Bermúdez

Plate 24, figure 7

Coleites pasionensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 84, pl. 14, fig. 6, 1948.

Test only slightly longer than broad, thick, the dorsal side strongly convex, ventral side less convex, the adult portion tending to uncoil and much more compressed, periphery subacute, in the adult with a raised and thickened border on the dorsal side; chambers obscured by the surface ornamentation except the last two or three; sutures obscure, except the last two or three which are strongly raised and thickened on the dorsal side, only slightly so on the ventral side, only slightly curved; wall ornamented with very coarse reticulations on the early coiled portion, becoming much less coarse in the later uncoiled portion; aperture an elongate slit on the ventral margin of the last-formed chamber. Length of holotype 1.12 mm.; breadth 0.85 mm.; thickness 0.38 mm.

The types are from the lower Eocene, Rio Pasion, Peten Province, Guatemala.

This species differs from *C. reticulosus* (Plummer) in the very coarse reticulations of the early portion, the raised and thickened sutures of the dorsal side, and the more irregular periphery.

Coleites guatemalensis Cushman and Bermúdez

Plate 24, figures 8–10

Coleites guatemalensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 84, pl. 14, figs. 3–5, 1948.

Test strongly compressed, early portion trochoid and slightly thicker than the later portion, adult portion uncoiling but somewhat curved, periphery subacute, the early portion irregularly dentate, later slightly lobulate; chambers of the early trochoid portion rather indistinct, in the later uncoiled portion much more distinct; sutures distinct except in the early portion, strongly curved, depressed on the ventral side and slightly raised and limbate on the dorsal side; wall of the early coiled portion finely reticulate, the uncoiled portion nearly smooth; aperture in the adult elongate in the middle of the terminal border, slightly on the ventral side. Length of holotype 1.00 mm.; breadth 0.70 mm.; thickness 0.10 mm.

The types are from the lower Eocene, Rio Pasion, Peten Province, Guatemala.

This species differs from *C. abuillotensis* Cushman and Bermúdez in the broader form, smoother test, and slightly raised, limbate sutures on the dorsal side.

Coleites abuillotensis Cushman and Bermúdez

Plate 24, figures 11, 12

Coleites abuillotensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 83, pl. 14, figs. 1, 2, 1948.

Test elongate, strongly compressed, nearly flat, 3 times as long as broad, greatest breadth toward the central portion, slightly convex ventrally, peripheral margin subacute; chambers numerous, 14 to 15 comprising the entire test, early portion involute, formed by 7 to 8 chambers, each connected with the preceding by the apertural openings; sutures slightly depressed, strongly curved on both sides of the test; wall distinctly reticulate; aperture a longitudinal slit at the middle of the peripheral edge of the last-formed chamber. Length of holotype 1.11 mm.; breadth 0.55 mm.; thickness 0.12 mm.

The types are from the lower Eocene, Abuillot River, Central Plain, Haiti, and the species is known only from the type locality.

This species differs from *C. reticulosus* (Plummer) in the less convex ventral side, more compressed form, and less acute peripheral margin.

Genus ROTALIA Lamarck, 1804

Rotalia havanensis Cushman and Bermúdez

Plate 15, figure 11

Rotalia havanensis Cushman and Bermúdez Cushman Lab. Foram. Research Contr., vol. 23, p. 24, pl. 5, fig, 5, 1947.

Test rather small, strongly and nearly evenly biconvex, periphery rounded; chambers fairly distinct, very slightly if at all inflated, 9 or 10 in the adult whorl, increasing very gradually in size as added; sutures fairly distinct, very slightly curved but nearly radial, little if at all depressed; wall fairly smooth, except near the aperture on the ventral side where it is distinctly papillate, on the dorsal side with a series of fine linear papillae near the periphery and on the ventral side with a series of short oblique costae on each chamber at the basal peripheral angle, umbonal boss strongly developed; aperture a low opening just below the periphery on the ventral side of the last-formed chamber. Length of holotype 0.60 mm., breadth 0.50 mm., thickness 0.30 mm.

The types are from the Paleocene, water well, 200 meters north of Cerro Avenue on Rancho Boyeros road, Habana Province, Cuba, and the species is frequent in samples of Paleocene age from the vicinity of Havana.

Rotalia madrugaensis Cushman and Bermúdez

Plate 15, figure 12

Rotalia madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 23, p. 24, pl. 5, fig. 4, 1947.

Test of medium size, strongly biconvex but with the central areas of both sides slightly depressed, periphery broadly rounded; chambers strongly inflated in the later portion, about 10 in the adult whorl, increasing in size rather rapidly as added in the last portion, earlier ones indistinct; sutures indistinct except in the last whorl, where they are radial on both sides and become increasingly depressed; wall strongly ornamented with longitudinal costae confined to each chamber, those of the earlier portion of the final whorl broken up into very short ones, almost papillate, ventral side with several large papillae in the umbilical area; aperture a low opening on the ventral edge of the last-formed chamber, toward the periphery. Length of holotype 0.85 mm., breadth 0.65 mm., thickness 0.37 mm.

The types are from the Paleocene, under bridge in the highway, Central San Antonio, Madruga, Habana Province, Cuba, and the species occurs in numerous samples of Paleocene age from the vicinity of Madruga.

Genus EPISTOMINA Terquem, 1883

Epistomina eocenica Cushman and M. A. Hanna

Plate 15, figures 13, 14

Epistomina eocenica Cushman and M. A. Hanna, San Diego Soc. Nat. History Trans., vol. 5, no. 4, p. 53, pl. 5, figs. 4, 5, 1927.

Cushman and Schenck, California Univ., Dept. Geol. Sci., Bull., vol. 17, p. 313, pl. 44, fig. 9, 1928.

Weinzierl and Applin, Jour. Paleontology, vol. 3, p. 407, 1929.

Cushman and McMasters, idem, vol. 10, p. 515, pl. 76, fig. 5, 1936.

Cushman and Frizzell, Cushman Lab. Foram. Research Contr., vol. 19, p. 87, pl. 15, figs. 9, 10, 1943.

Martin, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 10 (list), 1943.

Cushman and Simonson, Jour. Paleontology, vol. 18, p. 202, pl. 34, fig. 6, 1944.

Pulvinulina partschiana Plummer (not D'Orbigny), Texas Univ. Bull. 2644, p. 153, pl. 11, fig. 5, 1927.

Test trochoid, biconvex, periphery subacute, ventral side more convex than the dorsal, composed of about three coils, the adult coil having seven chambers, which are distinct due to the darker appearance of the chamber walls between the sutures which are raised and very white and confluent with the raised border; aperture a narrow slit near the inner margin of the chamber on the ventral side and a supplementary one consisting of a long narrow slit, parallel to and just below the periphery on the ventral side; sutures on the ventral side coalescing in an umbilical thickening. Diameter 0.50 mm.—Cushman and Hanna.

Wills Point formation, Mexia member. Texas, Limestone County (36).

Midway group. Texas, Limestone County (39, 42); Navarro County (40).

Genus SIPHONINA Reuss, 1850

Siphonina prima Plummer

Plate 15, figures 7–9

Siphonina prima Plummer, Texas Univ. Bull. 2644, p. 148, pl. 12, fig. 4, 1927.

Cushman, U. S. Nat. Mus. Proc., vol. 72, art. 20, p. 2, pl. 2, fig. 4, 1927.

Plummer, Texas Univ. Bull. 3201, pp. 54, 62 (lists), 1933.

Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 33, pl. 4, fig. 3, 1936.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 71, pl. 12, fig. 10, 1940.

Cushman and Todd, idem, vol. 18, p. 40, pl. 7, figs. 16, 17, 1942.

Kline, Mississippi Geol. Survey Bull. 53, p. 55, pl. 5, figs. 21, 22, 1943.

Cooper, Jour. Paleontology, vol. 18, p. 353, pl. 55, figs. 7–9, 1944.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 62, pl. 11, figs. 7, 8, 1946.

Cushman, U. S. Geol. Survey Prof. Paper 206, p. 143, pl. 59, figs. 3–5, 1946.

Test small, nearly circular, about equally biconvex but much compressed; periphery angled, sharply acute and delicately serrate, very slightly lobate; chambers usually 5 in the last-formed volution, very slightly inflated on the ventral side; sutures distinct, obliquely curved, marked by the serrate edges of the chambers of the dorsal side, not depressed, on the ventral side more nearly radial, very slightly curved, somewhat depressed; wall smooth, distinctly and somewhat coarsely perforate; aperture a small, narrowly elliptical opening on the ventral side close to the periphery, the elongate axis in the axis of coiling, without a definite neck. Diameter up to 0.25 mm., thickness 0.12 mm.

The types are from the Paleocene, clay pit, Mexia Brick Works, about 1 mile west of the town of Mexia, Limestone County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Wilcox County (5, 6); Choctaw County (7).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Midway formation, lower part. Arkansas, Saline County (19, 19A–21); Pulaski County (23).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30).
Midway group. Texas, Caldwell County (44).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Siphonina wilcoxensis Cushman

Plate 15, figure 10

Siphonina wilcoxensis Cushman, U. S. Nat. Mus. Proc., vol. 72, art. 20, p. 3, pl. 2, figs. 1–3, 1927.
Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 70, pl. 9, fig. 7, 1932.
Cushman and Garrett, idem, vol. 15, p. 86, pl. 15, figs. 7–9, 1939.
Israelsky, Sixth Pacific Sci. Congress Proc., p. 578, pl. 7, fig. 3, 1939.
Toulmin, Jour. Paleontology, vol. 15, p. 605, pl. 81, figs. 15, 16, 1941.
Cushman, Am. Jour. Sci., vol. 242, p. 14, pl. 2, figs. 3, 4, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 27; p. 46, pl. 7, fig. 27, 1944.

Test small, nearly circular, biconvex but slightly more inflated on the ventral side, compressed, periphery angled, sharply acute and delicately serrate, slightly lobulate; chambers usually six in the last-formed volution, slightly inflated on the ventral side; sutures on the dorsal side somewhat indistinct, strongly oblique, slightly curved, somewhat marked by the serrate edges of the chambers, not depressed, on the ventral side very nearly radial, distinctly depressed; wall smooth, distinctly and coarsely perforate; aperture a small, elliptical opening on the ventral side close to the periphery, with a distinct lip but with the neck only slightly developed or wanting. Diameter up to 0.30 mm., thickness 0.16 mm.

The types are from the Eocene, Nanafalia formation, upper portion of Nanafalia Bluff, Tombigbee River, Ala.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation, Pine Barren member. Alabama, Butler County (12).
Midway formation. Arkansas, Pulaski County (28).

Genus CANCRIS Montfort, 1808

Cancris mauryae Cushman and Renz

Plate 15, figure 6

Cancris mauryae Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 11, pl. 2, fig. 17, 1942.
Cushman and Todd, idem, vol. 18, p. 86, pl. 22, fig. 8, 1942.

Test nearly equally biconvex, periphery subacute and slightly keeled; chambers distinct, about 10 in the final whorl, increasing rather rapidly in size as added, the last 2 or 3 making up more than half of the test, slightly inflated; sutures distinct, slightly limbate and raised, especially on the dorsal side; wall smooth; aperture a low slit below the ventral extension of the last-formed chambers. Length of holotype 0.70 mm., breadth 0.50 mm., thickness 0.35 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I., and the species has not been recorded elsewhere.

Family AMPHISTEGINIDAE

Genus ASTERIGERINA D'Orbigny, 1839

Asterigerina primaria Plummer

Plate 15, figure 15

Asterigerina primaria Plummer, Texas Univ. Bull. 2644, p. 157, pl. 12, fig. 8, 1927.
Toulmin, Jour. Paleontology, vol. 15, p. 606, pl. 81, fig. 22, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 41, pl. 7, fig. 18, 1942.
Cushman, idem, vol. 20, p. 46, pl. 7, fig. 28, 1944.

Test round, obtusely conical, the dorsal side being distinctly elevated and the ventral side almost flat; peripheral margin sharply keeled, lobate; number of whorls about two in well-developed tests; chambers 5–6 in final convolution, smooth, conspicuously punctate; dorsal sutures moderately curved, faintly elevated, produced peripherally to form the marginal keel, rather strongly elevated in the early portion of the spire; ventral sutures strongly curved but partly masked by the supplementary chambers formed by the umbilical lobes over the successive apertures of the last whorl; aperture a strongly arched slit directed toward the irregularly pustulate umbilicus. Diameter up to 0.3 mm.—Plummer.

The types are from the Paleocene, exposure in base of high bluff on west side of Colorado River between the Travis-Bastrop county line and the mouth of Dry Creek (Bastrop quadrangle), Bastrop County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Midway group. Texas, Bastrop County (43).

Family CASSIDULINIDAE

Genus CERATOBULIMINA Toula, 1915

Ceratobulimina perplexa (Plummer) Cushman and Harris

Plate 16, figures 1–5

Rotalia perplexa Plummer, Texas Univ. Bull. 2644, p. 156, pl. 12, fig. 2, 1927.
Ceratobulimina perplexa Cushman and Harris, Cushman Lab. Foram. Research Contr., vol. 3, p. 173, pl. 29, fig. 2, 1927.
Plummer, Texas Univ. Bull. 3201, pp. 54, 62 (lists), 1933; (part), Am. Midland Naturalist, vol. 17, p. 469, text figs. 1–4, 1936.
Glaessner, Moscow Univ. Studies in Micropaleontology, vol. 1, pp. 20, 23, pl. 1, figs. 2, 3; pl. 2, fig. 25, 1937.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 41, pl. 7, figs. 23, 24, 1942.

Cushman, idem, vol. 22, p. 108, pl. 17, figs. 3–5, 1946.

Test oval, about equally biconvex, considerably compressed; peripheral margin broadly rounded, somewhat lobate; chambers smooth, glistening, finely punctate, gently curving, 6 to the final whorl; dorsal sutures marked by thick, smooth or very slightly elevated, tapering bands that become distinctly angular at their broadest points; ventral sutures depressed, radiate from a sunken umbilicus; aperture a conspicuous round opening at the base of the septal face and protected by an arched flap that is directed into the umbilicus. Length up to 0.5 mm.; average 0.35 mm.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5); Choctaw County (7).

Wills Point formation. Texas, Travis County (33); Caldwell County (34).

Mexia member. Texas, Limestone County (36).

Midway group. Texas, Bastrop County (43).

Genus ALABAMINA Toulmin, 1941

Alabamina wilcoxensis Toulmin

Plate 16, figures 6, 7

Alabamina wilcoxensis Toulmin, Jour. Paleontology, vol. 15, p. 603, pl. 81, figs. 10–14, text figs. 4A–C, 1941.

Cushman, Cushman Lab. Foram. Research Contr., vol. 24, p. 14, pl. 2, figs. 18–20, 1948.

Pulvinulina exigua H. B. Brady var. *obtusa* Plummer (not Burrows and Holland), Texas Univ. Bull. 2644, p. 151, pl. 11, fig. 2, 1927.

Pulvinulinella exigua (H. B. Brady) var. *obtusa* Cushman and Ponton (not Burrows and Holland), Cushman Lab. Foram. Research Contr., vol. 8, p. 71, pl. 9, fig. 9, 1932.

Pulvinulinella obtusa (Burrows and Holland) Cushman and Garrett, idem, vol. 15, p. 87, pl. 15, figs. 12, 13, 1939.

Cushman and Renz, idem, vol. 18, p. 11, pl. 2, fig. 16, 1942.

Cushman and Todd, idem, vol. 18, p. 42, pl. 7, figs. 19, 20, 1942.

Cushman, Am. Jour. Sci. vol. 242, p. 14, pl. 2, figs. 7, 8, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 27, pl. 4, fig. 32; p. 46, pl. 7, fig. 29, 1944.

Applin and Jordan, Jour. Paleontology, vol. 19, p. 132 (list), 1945.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 21, p. 101, pl. 16, figs. 7, 8, 1945; vol. 22, p. 63, pl. 11, figs. 9, 10, 1946.

Test trochiform, close coiled, subcircular in outline, unequally biconvex or planoconvex, ventral side strongly convex, periphery bluntly acute; five of six chambers in the final whorl; wall smooth, finely perforate; sutures flush with the surface, on the dorsal side almost straight, oblique to the periphery, on the ventral side radial; aperture a long narrow opening on the ventral side at the base of the septal face, with a supplementary indentation extending peripherally from the true aperture, formed by a fold in the wall of the test and not opening into the interior of the chamber. Diameter up to 0.42 mm.; height up to 0.21 mm.—Toulmin.

The types are from the Eocene Wilcox group, railroad cut one mile north of Ozark, Ala.

Paratypes of this species have been compared with topotypes of Burrows and Holland's variety and the two seem distinct.

Porters Creek clay. Tennessee, Hardeman County (13, 14). Mississippi, Kemper County (17).

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4–6); Butler County (3); Choctaw County (7).

Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Clayton formation, Pine Barren member. Alabama, Butler County (12).

Midway formation, lower part. Arkansas, Saline County (19A, 22).

Midway formation, upper part. Arkansas, Pulaski County (24, 25).

Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (29–31).

Midway group. Texas, Limestone County (39); Navarro County (40); Hunt County (41); Bastrop County (43); Caldwell County (44).

Wills Point formation. Texas, Travis County (33); Caldwell County (34).

Mexia member. Texas, Limestone County (36).

Kincaid formation. Texas, Hunt County (37).

Alabamina wilcoxensis Toulmin var. limbata (Plummer) Cushman

Plate 16, figure 8

Pulvinulina exigua H. B. Brady var. *limbata* Plummer, Texas Univ. Bull. 2644, p. 152, pl. 11, figs. 4a–c, 1927.

From the type of this species this varietal form differs in having strong sutural elevations on the dorsal side and slight elevations on the ventral side. Diameter up to 0.5 mm.—Plummer.

The types of the variety are from the Paleocene, deep roadside ditch on steep hill 0.2 of a mile east of road corner in north end of town of Commerce on highway to Paris, Hunt County, Tex. (41).

This variety is evidently related to *Alabamina wilcoxensis* Toulmin. It is known only from the type locality.

Genus PSEUDOPARRELLA Cushman and Ten Dam, 1948

Pseudoparrella cf. P. exigua (H. B. Brady) Cushman

Plate 16, figures 9, 10

Very rare specimens in the Paleocene material are different from *Alabamina wilcoxensis* Toulmin and may be compared with *P. exigua* with considerable question, but not enough well preserved specimens are available to give the full characters. Specimens from the Paleocene of Texas have been referred to this species by Plummer (Texas Univ. Bull. 2644, p. 150, pl. 11, fig. 3, 1927) and by Kline from the Paleocene of Mississippi (Mississippi Geol. Survey Bull. 53, p. 55, pl. 5, figs. 23, 24, 1943).

Porters Creek clay. Tennessee, Hardeman County (13, 14).

Midway group. Texas, Van Zandt County (47).

Pseudoparrella madrugaensis Cushman and Bermúdez

Plate 24, figures 1–3

Pseudoparrella madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 73, pl. 12, figs. 11–13, 1948.

Test trochoid, nearly equally biconvex, ventral side slightly more convex, periphery acute, slightly keeled; chambers distinct, very slightly inflated, about 5 in the adult whorl, increasing rather evenly in size as added; sutures distinct, dorsally strongly curved, ventrally nearly radial; wall smooth, distinct perforate; aperture at the ventral margin of the last-formed chamber and extending outward parallel to the periphery, narrow and with a distinct lip. Diameter 0.35–0.40 mm.; thickness 0.15–0.18 mm.

The types are from the Paleocene Madruga formation, under highway bridge, Central San Antonio, Habana Province, Cuba.

This species differs from *P. obtusa* (Burrows and Holland) in the definite keel, curved dorsal sutures, and less extended aperture.

Genus EPISTOMINOIDES Plummer, 1934

Epistominoides midwayensis Plummer

Plate 16, figures 15, 16

Epistominoides midwayensis Plummer, Am. Midland Naturalist, vol. 15, p. 605, pl. 24, fig. 4, 1934.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 42, pl. 7, figs. 21, 22, 1942.
Brotzen, Sveriges geol. undersökning, ser. C, no. 451, p. 36, text fig. 11, 1942.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 47, pl. 8, fig. 1, 1944.

Test elongate, somewhat more than half as broad as long, strongly bilaterally unsymmetrical, umbilicate; periphery sharply carinate but not distinctly flanged; dorsal face gently convex, ventral face somewhat more convex; chambers 7–8 in the mature whorl, increasing successively at the rate of about 1.2, subdivided internally by a thin partition that extends from the short, slit-like aperture into each chamber across its ventro-anterior angle making by its junction with the ventral wall a supplementary ventral suture so close to the anterior edge of the chamber and so nearly parallel to it as to be somewhat obscure; septal face triangular, width about three-quarters the height and marked externally by the junction of the inner partition from the anterior end of the apertural slit part way across the septal face and parallel to its ventral edge; ventral sutures nearly straight and marked by a slight thickening of the ventral wall between each true suture and the parallel supplementary suture to form blunt ridges that radiate from a small umbilical depression; dorsal sutures narrowly elevated, radiating from a broad central boss, and sharply curved backward near the periphery; aperture a short elongate slit located on the peripheral angle at the end of the septal face and bounded by protruding ventral and dorsal lips. Length of holotype 0.55 mm.; breadth 0.32 mm.; thickness 0.27 mm.—Plummer.

The types are from the Paleocene, expoure in base of high bluff on west side of Colorado River between the Travis-Bastrop county line and the mouth of Dry Creek (Bastrop quadrangle), Bastrop County, Tex.

This species differs from *E. wilcoxensis* (Cushman and Ponton) in its broader chambers, and umbilicate, strongly asymmetrical, and more compressed form.

Porters Creek clay. Tennessee, Hardeman County (13).
Porters Creek formation. Matthews Landing marl member. Alabama, Butler County (3); Wilcox County (4); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Midway group. Texas, Bastrop County (43).

Epistominoides wilcoxensis (Cushman and Ponton) Plummer

Plate 16, figures 17, 18

Saracenaria wilcoxensis Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 54, pl. 7, fig. 9, 1932.
Epistominoides wilcoxensis Plummer, Am. Midland Naturalist, vol. 15, p. 604, pl. 24, figs. 1–3, 1934.
Glaessner, Moscow Univ. Studies in Micropaleontology, vol. 1, p. 21, pl. 2, fig. 22, 1937.
Cushman, Foraminifera, 3d Ed., Key, pl. 48, figs. 15, 16, 1940.

Test elongate, sharply trihedral, with septal face nearly as broad as ventral and dorsal faces, very nearly bilaterally symmetrical, involute but showing very slightly more of the coil on the dorsal side of the consistently left-handed spire; chambers 6 or 7 to the whorl, increasing successively in length at the rate of about 1.4, each one subdivided very unequally by a thin inner wall or partition that extends from the dorsal lip of the aperture obliquely across the ventro-anterior angle of the chamber and is attached to the septal face, to the ventral wall, and to the septum on the ventral side of the foramen; sutures flush to elevated, radiating from a boss on each side of the test, almost straight across both ventral and dorsal faces but curved sharply backward near the periphery; umbilical area filled with shell matter; aperture a narrow and elongate slit located in the peripheral angle of the final chamber at the end of the septal face and bounded by protruding ventral and dorsal lips.
—Plummer.

The types are from the Eocene Wilcox group in railroad cut 1 mile north of Ozark, Ala.

Length 0.50 mm., breadth 0.30 mm., thickness 0.25 mm.

Family CHILOSTOMELLIDAE

Genus ALLOMORPHINA Reuss, 1850

Allomorphina paleocenica Cushman

Plate 16, figures 19–22

Allomorphina paleocenica Cushman, Cushman Lab. Foram. Research Contr., vol. 24, p. 45, pl. 8, fig. 10, 1948.
Allomorphina trigona Plummer (not Reuss), Texas Univ. Bull. 2644, p. 129, pl. 8, fig. 5, 1927.
Kline, Mississippi Geol. Survey Bull. 53, p. 56, pl. 6, figs. 1, 2, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 63, pl. 11, figs. 11, 15, 1946.

Test semielliptical in outline, trochoid, one side nearly straight, the other strongly curved, periphery broadly rounded; chambers distinct, slightly inflated, three in a whorl in the adult, increasing very rapidly in size as added; sutures distinct, slightly depressed; wall smooth; aperture an elongate opening on the ventral side at the base of the last-formed chamber, with a

distinct, overhanging lip. Length 0.35 to 0.45 mm., breadth 0.25 to 0.30 mm., thickness 0.22 to 0.27 mm.

The types are from the Paleocene, 4.6 miles north of Fentress, Caldwell County, Tex. (44).

This species differs from *A. trigona* Reuss in the much broader form and the wide aperture. In 1936 Jennings proposed a new name, *A. halli* (Bull. Am. Paleontology, vol. 23, no. 78, p. 34, pl. 4, fig. 5, 1936), referring to Mrs. Plummer's figures. His figures from the Hornerstown marl of New Jersey are quite different from those of Mrs. Plummer and of later authors given above. The chambers are much more rounded and even in size in his figures. Therefore the name *paleocenica* would seem to represent the species from Texas, Arkansas, Mississippi, and Alabama.

In the original description of *A. paleocenica*, an error in the use of the type figures was made. Figure 10*b* is not the ventral view of the holotype but instead is a figure copied from Cushman and Todd (Cushman Lab. Foram. Research Contr., vol. 22, p. 63, pl. 11, fig. 11, 1946) of a specimen from the Paleocene of Arkansas. On the present plate 16 this error is corrected and figures 21*a* and *b* are the dorsal and ventral views of the holotype of *A. paleocenica;* the ventral view, figure 21*b*, being first published here.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4, 5); Butler County (3).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Clark County (30).
Midway group. Texas, Caldwell County (44).

Allomorphina subtriangularis (Kline) Cushman

Plate 17, figures 1, 2

Chilostomella subtriangularis Kline, Mississippi Geol. Survey Bull. 53, p. 56, pl. 6, fig. 3, 1943.

Test subtriangular, about one and one-half times as long as broad, greatest width a little above middle, ends bluntly rounded; wall smooth, finely punctate; aperture narrow, nearly straight. Average length 0.75 mm.—Kline.

The types are from the Paleocene Porters Creek clay, 1½ miles northwest of Montpelier, Clay County, Miss.

The dorsal side of specimens shows the chambers to be arranged in a triserial manner and the species seems to belong in *Allomorphina*.

Midway formation. Arkansas, Clark County (30).
Midway group. Texas, Caldwell County (44).
Wills Point formation. Texas, Caldwell County (34).

Allomorphina globulosa Plummer

Plate 17, figure 3

Allomorphina globulosa Plummer, Texas Univ. Bull. 2644, p. 130, pl. 8, figs. 4a, b, 1927.

Test bluntly ellipsoidal, last three chambers only partly embracing on superior face thus revealing the inner whorl; chambers very smooth and thin shelled; sutures not depressed; aperture a narrow slit at base of final chamber and protected by a conspicuous, somewhat flaring lip. Length of only specimen .35 mm.

From *A. trigona* Reuss this new species differs in showing no angulation of outline and in the greater overlap of its chambers, so that the last two almost complete the final whorl. As only one specimen has been found in the Midway material no statement can be made regarding its distribution either geographically or stratigraphically.—Plummer.

As this is based on a single specimen it is difficult to determine the full characters. The type specimen is from the Paleocene, gully close to the short northwest-southeast road about 2½ miles S. 25° E. of Littig (Bastrop quadrangle), Bastrop County, Tex.

Genus CHILOSTOMELLOIDES Cushman, 1926

Chilostomelloides eocenica Cushman

Plate 17, figures 4, 5

Chilostomelloides eocenica Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 4, p. 78, pl. 11, fig. 20, 1926.
Plummer, Texas Univ. Bull. 2644, p. 129, pl. 8, fig. 8, 1927.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 72, pl. 12, fig. 11, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 57, pl. 6, fig. 8, 1943.

Test elongate, about 2½ times as long as broad, ends rounded, sides gently convex, tapering toward either end; wall smooth, very finely punctate; aperture semicircular, standing out at an angle from the contour of the test, with a distinct, slightly thickened lip. Length 0.5 mm.

The types are from the Paleocene of the Mexia Oil Field, Texas.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Midway formation. Arkansas, Clark County (30).

Genus PULLENIA Parker and Jones, 1862

Pullenia quinqueloba (Reuss) Reuss var. angusta Cushman and Todd

Plate 17, figure 6

Pullenia quinqueloba (Reuss) var. *angusta* Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 10, pl. 2, figs. 3, 4, 1943; idem, vol. 22, p. 63, 1946.
Cushman, idem, Special Pub. 16, p. 37, pl. 7, fig. 11, 1946.
Pullenia quinqueloba Plummer (not Reuss), Texas Univ. Bull. 2644, p. 136, pl. 8, fig. 12, 1927.
Cole, Bull. Am. Paleontology, vol. 14, no. 51, p. 32, pl. 5, fig. 15, 1927.
Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 73, pl. 12, fig. 17, 1939; idem, vol. 16, p. 72, pl. 12, figs. 13, 14, 1940.
Toulmin, Jour. Paleontology, vol. 15, p. 607, pl. 81, fig. 24, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 42, pl. 7, fig. 15. 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 57, pl. 6, figs. 4, 7, 1943.
Applin and Jordan, Jour. Paleontology, vol. 19, p. 132 (list), 1945.

Variety differing from the typical form in the smaller size and somewhat narrower test. Length 0.25 to 0.50 mm., breadth 0.20 to 0.40 mm., thickness 0.15 to 0.30 mm.

The types of the variety are from the Paleocene, clay pit of Mexia Brick Works about 1 mile west of Mexia, Limestone County, Tex.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Choctaw County (7).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Pulaski County (27).
Midway group. Texas, Limestone County (39); Caldwell County (44).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Family GLOBIGERINIDAE

Genus GLOBIGERINA D'Orbigny, 1826

Globigerina pseudo-bulloides Plummer

Plate 17, figures 7, 8

Globigerina pseudo-bulloides Plummer, Texas Univ. Bull. 2644, p. 133, pl. 8, fig. 9, 1927.
Nuttall, Jour. Paleontology, vol. 4, p. 290, 1930.
Plummer, Texas Univ. Bull. 3201, pp. 54, 62 (lists), 1933.
Glaessner, Moscow Univ. Problems of Paleontology, vol. 2–3, p. 382, pl. 4, fig. 31, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 72, pl. 12, fig. 16, 1940.
Cushman and Todd, idem, vol. 18, p. 43, pl. 8, figs. 3, 4, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 58, pl. 6, figs. 9–11, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 48, pl. 8, fig. 3, 1944.
Applin and Jordan, Jour. Paleontology, vol. 19, p. 131 (list), 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 64, 1946.

Test rotaliform, very obtusely trochoid to plane dorsally, composed of about two and one-half convolutions, of which the last consists most generally of 5 (rarely 6) highly ventricose chambers increasing rapidly in size; periphery broadly rounded and lobate; shell wall thin and distinctly punctate but finely reticulate; superior face bearing a spire of small chambers only very slightly elevated, if at all, above the circumambient chambers of the final whorl; interior face less convex and with a very distinct, though not large, umbilical depression; aperture a single moderately large, lunate opening on the last chamber extending from the margin to the umbilicus and edged with a narrow, delicate, flaring lip. Diameter up to 0.4 mm.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Porters Creek clay. Tennessee, Hardeman County (14). Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4–6); Butler County (3); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation. Alabama, Barbour County (10).
Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Pine Barren member. Alabama, Wilcox County (11); Butler County (12).
Midway formation, lower part. Arkansas, Saline County (18, 19A–22); Pulaski County (23).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (29, 30).
Midway group. Texas, Limestone County (39, 42); Navarro County (40); Hunt County (41); Bastrop County (43, 49); Caldwell County (44); Travis County (45); Freestone County (50).
Wills Point formation. Texas, Travis County (33); Caldwell County (34); Williamson County (35).
Mexia member. Texas, Limestone County (36).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Globigerina compressa Plummer

Plate 17, figure 9

Globigerina compressa Plummer, Texas Univ. Bull. 2644, p. 135, pl. 8, fig. 11, 1927.
Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 193, pl. 31, fig. 8, 1936.
Glaessner, Moscow Univ. Problems of Paleontology, vol. 2–3, p. 382, pl. 4, fig. 32, 1937.
Toulmin, Jour. Paleontology, vol. 15, p. 607, pl. 82, figs. 1, 2, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 44, pl. 8, figs. 5, 6, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 58, pl. 6, figs. 5, 6, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 353, pl. 54, figs. 8, 9, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 47, pl. 8, fig. 2, 1944.

Test small, rotaliform, closely coiled, somewhat compressed, equally biconvex; peripheral margin bluntly angular, lobate; chambers increasing gradually, 5 in last-formed whorl, moderately inflated, overlapping on dorsal face; sutures distinctly depressed and strongly curved on the dorsal side; shell wall thin, smooth, finely punctate; aperture a single moderately arched slit protected by a definite flaring flap at base of septal face and extending into the small but distinct umbilical depression. Diameter up to 0.4 mm.; average 0.3 mm.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (4); Choctaw County (7).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Midway formation. Arkansas, Clark County (30).

Globigerina triloculinoides Plummer

Plate 17, figures 10, 11

Globigerina triloculinoides Plummer, Texas Univ. Bull. 2644, p. 134, pl. 8, fig. 10, 1927.
Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 193, pl. 31, fig. 10, 1936.
Glaessner, Moscow Univ. Problems of Paleontology, vol. 2–3, p. 382, pl. 4, fig. 33, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 72, pl. 12, fig. 15, 1940.
Toulmin, Jour. Paleontology, vol. 15, p. 607, pl. 82, fig. 3, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 43, pl. 8, figs. 1, 2, 1942.
Thalmann, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 1, p. 13 (list), 1942.
Martin, idem, vol. 3, no. 3, p. 10 (list), 1943.

TABLE 4.—*Distribution of Paleocene Rotaliidae, Amphisteginidae, Cassidulinidae, Chilostomellidae, Globigerinidae, Globorotaliidae, and Anomalinidae in the Gulf Coastal region*

[Prepared by J. B. Reeside, Jr. Numbers refer to locality list on pages 1-3. K=localities reported by V. H. Kline, P=localities reported by H. J. Plummer and C. G. Lalicker, C=Cuba and Haiti, G=Guatemala and Honduras, S=Soldado Rock, Trinidad, B. W. I.]

	Alabama												Tenn.		Miss.				Arkansas															Texas																					C	G	S
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	K	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	P			
Rotaliidae																																																									
Spirillina selseyensis							X	X					X	X																																											
cf. *S. vivipara*					X		X	X																																																
sp.																																																									X
Patellina sp.								X					X																																												
Patellinoides? sp.							X																																																		
Discorbis midwayensis									X			X															X		X			X																									
midwayensis var. *soldadoensis*																																																									X
midwayensis var. *trinitatensis*																																																									X
infrequens																																																						X			
Lamarckina naheolensis		X		X	X	X	X	X																																																	
limbata			X				X																																																		
rugulosa																																			X		X							X	X													
paleocenica	X												X	X																																											
Valvulineria allomorphinoides		X	X						X																	X	X	X			X						X	X		X			X		X												
wilcoxensis													X									X					X																	X		X											
extensa																																																									X
madrugaensis																																																									X
insueta																																																									X
Gyroidina subangulata			X						X			X								X	X		X		X	X	X	X			X			X	X		X			X	X		X	X	X		X			X							
aequilateralis	X	X	X	X	X	X	X	X				X											X															X	X											X							
madrugaensis																																																									X
Eponides elevatus													X	X								X																X	X			X		X			X			X							
lotus	X	X				X	X	X			X	X							X	X									X													X				X											
plummerae									X																X	X		X			X			X						X	X				X												
vanbelleni																																																							X	X	
gratiosus																																																							X		
Parrella expansa																	X									X		X			X					X	X			X	X		X		X												
macneili								X																																																	
Coleites reticulosus			X																												X																										
pasionensis																																																								X	
guatemalensis																																																								X	
abuillotensis																																																							X		
Rotalia havanensis																																																							X		
madrugaensis																																																							X		
Epistomina eocenica																																					X			X	X		X														
Siphonina prima			X		X	X	X		X							X				X	X	X		X	X	X	X	X			X							X	X						X												
wilcoxensis								X				X																	X																												
Cancris mauryae																																																									X
Amphisteginidae																																																									
Asterigerina primaria		X					X	X																																			X													
Cassidulinidae																																																									
Ceratobulimina perplexa					X		X																											X	X		X							X													
Alabamina wilcoxensis	X	X	X	X	X	X	X	X				X	X	X			X			X			X		X	X	X	X		X	X	X		X	X		X	X		X	X	X		X	X												
wilcoxensis var. *limbata*																																										X															
Pseudoparrella cf. *P. exigua*													X	X				X																														X						X			
madrugaensis																																																						X		
Epistominoides midwayensis			X	X			X	X					X																															X													
wilcoxensis																																																						X			
Chilostomellidae																																																									
Allomorphina paleocenica		X	X	X	X																					X					X										X																
subtriangularis																		X													X				X										X												
globulosa																																																						X			
Chilostomelloides eocenica									X																						X																										
Pullenia quinqueloba var. *angusta*			X				X		X							X	X								X	X		X									X			X					X												
Globigerinidae																																																									
Globigerina pseudo-bulloides	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X		X	X	X	X	X	X	X	X	X	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X				X	X						
compressa				X			X	X																							X																										
triloculinoides		X	X	X	X		X	X	X	X		X				X	X			X			X		X	X					X			X	X		X	X		X	X	X	X		X					X							
Globorotaliidae																																																									
Globorotalia wilcoxensis var. *acuta*		X		X	X	X		X																													X					X															
crassata var. *aequa*							X																																																		X
cf. *G. membranacea*							X																																																		
albeari																																																							X		
Anomalinidae																																																									
Anomalina umbonifera								X																																																	
midwayensis									X								X								X	X		X		X	X	X		X	X		X	X	X	X	X	X	X		X		X	X		X							
midwayensis var. *trochoidea*																		X									X	X			X														X									X			
acuta		X	X													X					X		X	X	X	X	X	X			X			X			X	X	X			X		X	X	X				X							
basilobata																																																									X
clementiana																	X									X		X									X								X												
clementiana var. *assimilis*																																																						X		
welleri																																														X											
martinezensis																																																							X		
cubana																																																							X		
madrugaensis																																																							X		
praespissiformis																																																							X		
sp. *A*																																																									X
sp. *B*							X																																																		
Boldia vandersluisi																																																								X	
carinata																																																							X		
madrugaensis																																																							X		
cubensis																																																							X		
Cibicides praecursorius	X	X		X			X	X		X	X		X	X					X	X	X	X	X	X	X	X																						X									
alleni		X		X	X	X			X			X					X										X	X			X									X	X	X		X		X											
vulgaris									X								X			X						X								X	X					X				X	X				X								
newmanae	X	X	X	X			X							X					X																							X															
howelli			X		X			X		X	X						X						X		X		X															X															
blanpiedi					X		X	X																																																	
browni								X						X					X				X																			X															
cf. *C. williamsoni*																																																									X
cf. *C. semiplectus*																																																									X
mirificus																																																							X		
reprimatus																																																							X		
madrugaensis																																																							X		

Beck, Jour. Paleontology, vol. 17, p. 609, pl. 108, figs. 2, 3, 1943.
Kelley, Am. Assoc. Petroleum Geologists Bull., vol. 27, p. 11 (list), 1943.
Curran, idem, pp. 1378, 1381 (lists), 1943.
Kline, Mississippi Geol. Survey Bull. 53, p. 59, pl. 6, figs. 12, 13, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 48, pl. 8, fig. 4, 1944.
Cooper, Jour. Paleontology, vol. 18, p. 353, pl. 54, figs. 12, 13, 1944.
Applin and Jordan, idem, vol. 19, p. 132 (list), 1945.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 64, 1946.

Test spiral, trochoid, composed of about 2 convolutions, the last of which is composed of 3½ very rapidly increasing and highly globose chambers; periphery very broadly rounded and distinctly lobate; shell surface strongly reticulate; superior face rounded with a very low spire of neatly coiled tiny chambers of the preceding whorl; inferior face rounded with a very shallow umbilical depression; aperture a small arched slit on the last chamber and edged with a more or less prominent, delicately notched flap that extends from a point near the periphery to the umbilical depression. Greatest diameter up to 0.35 mm.; usually less.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana Reservoir on the road to Mildred, Navarro County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4, 5); Butler County (3); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation. Alabama, Barbour County (10).
Chalybeate limestone member. Alabama, Sumter County (9). Mississippi, Noxubee County (16).
Pine Barren member. Alabama, Butler County (12).
Porters Creek clay. Mississippi, Kemper County (17).
Midway formation, lower part. Arkansas, Saline County (19A, 22).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Clark County (30).
Midway group. Texas, Limestone County (39, 42); Navarro County (40); Hunt County (41); Caldwell County (44); Bastrop County (49).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Mexia member. Texas, Limestone County (36).
Kincaid formation. Texas, Hunt County (37).

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

Globorotalia wilcoxensis Cushman and Ponton var. acuta Toulmin

Plate 17, figures 12, 13

Globorotalia wilcoxensis Cushman and Ponton var. *acuta* Toulmin, Jour. Paleontology, vol. 15, p. 608, pl. 82, figs. 6–8.
Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 12, pl. 3, fig. 2, 1942.
Cushman, Am. Jour. Sci., vol. 242, p. 15, pl. 2, figs. 16, 17, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 48, pl. 8, fig. 5, 1944.

Test trochiform, plano-convex, dorsal side flat, ventral side strongly convex, deeply umbilicate, periphery strongly lobate, acute, and bounded by a thick flange; chambers distinct, about 4½ in the last whorl, increasing regularly in size as added; sutures distinct, on the dorsal side slightly curved, limbate, slightly if at all depressed, on the ventral side radiate, depressed; wall roughened with minute, low spinose processes, especially along the peripheral border; aperture an arched opening on the ventral side of the final chamber extending from the peripheral flange to the umbilicus. Length 0.46 mm.; width 0.37 mm.; thickness 0.24 mm.—Toulmin.

The types are from the Eocene Salt Mountain limestone, from Richmond Branch, half a mile north of Salt Mountain, Clarke County, Ala.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4–6).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Wills Point formation, Mexia member. Texas, Limestone County (36).
Midway group. Texas, Hunt County (41).

Globorotalia crassata (Cushman) Cole var. aequa Cushman and Renz

Plate 17, figure 14

Globorotalia crassata (Cushman) Cole var. *aequa* Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18 p. 12, pl. 3, fig. 3, 1942.
Cushman and Todd, idem, vol. 18, p. 44, pl. 8, figs. 7–9, 1942.

Variety differing from the typical form in the much smoother surface and the broader and more arcuate chambers, especially the later ones.

The types of the variety are from the Paleocene Soldado formation, Soldado Rock, Trinidad, B. W. I.

Porters Creek formation, Matthews Landing marl member. Alabama, Choctaw County (7).

Globorotalia cf. G. membranacea (Ehrenberg) White

Plate 17, figure 15

This species was recorded from the type locality (7) of the Naheola formation of Alabama by a single specimen and that not entirely typical (Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 45, pl. 8, fig. 10, 1942). No additional specimens have been found that could be assigned to this species.

Globorotalia albeari Cushman and Bermúdez

Plate 24, figures 13–15

Globorotalia albeari Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol 25, p. 33, pl. 6, figs. 13–15, 1949.

Test very small for the genus, strongly biconvex, dorsal side showing all the coils and ventral side only the last-formed whorl, periphery somewhat rounded; chambers not very distinct, 9 or 10 in the last-formed whorl, only slightly inflated ventrally, increasing very gradually in size as added; sutures fairly distinct but only slightly depressed, except in the last whorl on the ventral side, rather strongly curved on the dorsal side; wall slightly spinose, coarsely perforate; aperture an elongate opening on the ventral side of the last-formed chamber extending from nearly the inner end to the

periphery and with a distinct thin lip. Diameter 0.30 to 0.32 mm., thickness 0.20 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *G. praemenardii* Cushman and Stainforth in its smaller size, more numerous chambers, more strongly biconvex test, and less umbilicate ventral side.

Family ANOMALINIDAE

Genus ANOMALINA D'Orbigny, 1826

Anomalina umbonifera (Schwager) Cushman and Ponton

Plate 17, figure 16

Discorbina umbonifera Schwager, Palaeontographica, vol 30, Pal. Teil, p. 126, pl. 27 (4), fig. 14, 1883.

Anomalina umbonifera Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 72, pl. 9, fig. 11, 1932. Cushman, Am. Jour. Sci., vol. 242, p. 15, pl. 2, figs. 18, 19, 1932; Cushman Lab. Foram. Research Contr., vol. 20, p. 27, pl. 4, fig. 30; p. 49, pl. 8, fig. 6, 1944.

Test strongly compressed, ventral side completely involute, dorsal side slightly evolute, periphery slightly rounded; chambers distinct, slightly inflated, 7 or 8 chambers making up the adult whorl, increasing gradually and rather uniformly in size as added; sutures distinct, slightly limbate, gently curved; wall smooth, finely perforate; aperture at the base of the last-formed chamber, near the periphery. Diameter up to 0.40 mm., thickness 0.15 mm.

The types of this species are from the middle Eocene of northern Africa. It is recorded from the Paleocene and Eocene (Wilcox group) of the United States.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).

Anomalina midwayensis (Plummer) Cushman

Plate 17, figures 17–19

Truncatulina midwayensis Plummer, Texas Univ. Bull. 2644, p. 141, pl. 9, fig. 7; pl. 15, fig. 3, 1927.

Anomalina midwayensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 73, pl. 12, fig. 18, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 60, pl. 6, figs. 17, 18, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 354, pl. 54, figs. 15–17, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 64, pl. 11, figs. 18, 19, 1946.

Test almost equally biconvex, moderately compressed; peripheral margin rounded; convolutions about 2, the final one being strongly embracing; chambers usually 9 in final whorl, conspicuously punctate, gradually increasing, moderately curving; sutures broadly elevated on both sides, tapering toward the margin, and curved; aperture a slit at base of septal face under a narrow lip that extends to the umbilicus. Diameter up to 0.5 mm.; usually less.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).

Porters Creek clay. Mississippi, Kemper County (17).

Midway formation, upper part. Arkansas, Pulaski County (24, 25).

Midway formation. Arkansas, Pulaski County (27); Clark County (29–31).

Midway group. Texas, Limestone County (39, 42); Navarro County (40); Hunt County (41); Caldwell County (44); Travis County (46); Van Zandt County (47); Bastrop County (49).

Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Mexia member. Texas, Limestone County (36).

Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Anomalina midwayensis (Plummer) Cushman var. trochoidea (Plummer) Kline

Plate 18, figures 1, 2

Truncatulina midwayensis Plummer var. *trochoidea* Plummer, Texas Univ. Bull. 2644, p. 142, pl. 9, fig. 8, 1927.

Anomalina midwayensis (Plummer) Cushman var. *trochoidea* Kline, Mississippi Geol. Survey Bull. 53, p. 61, pl. 6, figs. 15, 16, 1943.

From the type this variety is distinguished by the more strongly trochoid dorsal coiling of the convolutions Diameter up to 0.6 mm.; usually less.—Plummer.

The types are from the Paleocene, exposure along a small branch about ¾ mile northwest of Tehuacana, and 0.2 mile north of the Tehuacana-Waco road on the first road turning north, Limestone County, Tex.

Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30).

Midway group. Texas, Caldwell County (44).

Anomalina acuta Plummer

Plate 18, figures 3–6

Anomalina ammonoides (Reuss) var. *acuta* Plummer, Texas Univ. Bull. 2644, p. 149, pl. 10, fig. 2, 1927.

Anomalina acuta Glaessner, Moscow Univ. Problems of Paleontology, vol. 2–3, p. 386, pl. 5, fig. 40, 1937.
Toulmin, Jour. Paleontology, vol. 15, p. 608, pl. 82, figs. 9, 10, 1941.
Cushman and Renz, Cushman Lab. Foram Research Contr., vol. 18, p. 12, pl. 3, fig. 6, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 59, pl. 5, figs. 3, 4, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 353, pl. 54, figs. 3–5, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 64, pl. 11, figs. 13, 14, 1946.

Test involute, much compressed, almost equally biconvex but slightly more flattened above; peripheral margin subacute; chambers numerous, about 13–15 to the final convolution, narrow, and slightly curving; sutures marked by more or less distinct limbations, which on the ventral face terminate along the inner edge of the convolution in a series of fine beads that surround a thick spiral or irregular filling of translucent shell material in the umbilical recess, and on the dorsal face merge at the center into a more or less prominently developed elevated boss; shell wall distinctly but not coarsely punctate; aperture an arched opening over the peripheral margin and extending

toward the umbilicus. Diameter up to 0.4 mm.; average 0.25 mm.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2); Butler County (3).
Clayton formation, Chalybeate limestone member. Mississippi, Noxubee County (16).
Midway formation, lower part. Arkansas, Saline County (20, 22); Pulaski County (23).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway formation. Arkansas, Saline County (26); Pulaski County 27; Clark County (30).
Midway group. Texas, Hunt County (41); Bastrop County (43, 49); Caldwell County (44); Travis County (45).
Wills Point formation. Texas, Travis County (33).
Mexia member. Texas, Limestone County (36).
Kincaid formation. Texas, Hunt County (37); Bastrop County (38).

Anomalina basilobata Cushman and Renz

Plate 18, figure 7

Anomalina basilobata Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 12, pl. 3, fig. 7, 1942.

Test nearly equally biconvex, periphery rounded, central region of each side somewhat depressed, ventral side umbilicate; chambers about 9 in the adult whorl, increasing gradually and rather regularly in size as added, very slightly if at all inflated, at the base on both sides with a projection toward the center; sutures distinct, gently curved; wall smooth; aperture at the base of the last-formed chamber at the median line. Diameter of holotype 0.40 mm., thickness 0.10 mm.

The types are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. It has not been recorded elsewhere.

Anomalina clementiana (D'Orbigny) Franke

Plate 18, figures 8–11

Rosalina clementiana D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 37, pl. 3, figs. 23–25, 1840.
Anomalina clementina Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 85, pl. 7, figs. 12a-c, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 179, pl. 16, figs. 9a-c, 1928.
Cushman, Tennessee Div. Geology Bull. 41, p. 61, pl. 13, figs. 1a-c, 1931; Cushman Lab. Foram. Research Contr., vol. 7, p. 46, pl. 6, figs. 10a-c, 1931.
Jennings, Bull. Am. Paleontology, vol. 23, no. 78, p. 38, pl. 5, figs. 2a, b, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 29, pl. 5, figs. 7, 8, 1940.
Cushman and Goudkoff, idem, vol. 20, p. 63, pl. 10, fig. 12, 1944.
Cushman and Todd, idem, vol. 22, p. 64, pl. 11, figs. 16, 17, 1946.
Cushman, U. S. Geol. Survey Prof. Paper 206, p. 155, pl. 63, figs. 12, 13, 1946.

Test somewhat tending toward planispiral in the adult, trochoid in the young, variable, compressed, periphery rounded; chambers distinct, 7 to 9 in the last-formed whorl; sutures on the dorsal side curved, limbate and strongly raised except in the last few chambers of the adult, which are smooth, in many specimens slightly depressed; sutures on the ventral side nearly radial, depressed, the ends of the chambers raised between the sutures; wall smooth except for the ornamentation already noted in the earlier portions; aperture peripheral and extending onto the dorsal side. Diameter 0.30 to 0.40 mm., thickness 0.10 to 0.15 mm.

Porters Creek clay. Mississippi, Kemper County (17).
Midway formation, upper part. Arkansas, Pulaski County (25).
Midway formation. Arkansas, Pulaski County (27).
Midway group. Texas, Caldwell County (44).
Wills Point formation, Mexia member. Texas, Limestone County (36).

Anomalina clementiana (D'Orbigny) Franke var. assimilis Cushman and Bermúdez

Plate 21, figures 10–12

Anomalina clementiana (D'Orbigny) var. *assimilis* Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 74, pl. 12, fig. 17, 1948.

Variety differing from the typical form in the slightly narrower chambers and slightly thicker test.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

The variety (*A. clementiana assimilis*) is very closely related to the species which is from the Upper Cretaceous.

Anomalina welleri (Plummer) Plummer

Plate 18, figure 12

Truncatulina welleri Plummer, Texas Univ. Bull. 2644, p. 143, pl. 9, fig. 6, 1927.
Anomalina welleri Plummer, idem, Bull. 3201, pp. 54, 62 (lists), 1933.
Nonionella welleri Kline, Mississippi Geol. Survey Bull. 53, p. 44, pl. 4, fig. 21, 1943.

Test small, equally biconvex, considerably compressed; chambers 10–11 in final whorl, strongly punctate, narrow, curved increasing gradually in size; sutures distinct, narrow tapering slightly elevated, and curved in a broad gentle swing, those on the ventral side being joined in a low ridge about the small umbilical depression; aperture a low arch very close to the periphery and narrowing toward the umbilicus under a narrow lip. Diameter up to 0.35 mm.; usually about 0.25 mm.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Midway group. Texas, Travis County (46).

Anomalina martinezensis Cushman and Bermúdez

Plate 21, figures 7–9

Anomalina martinezensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 74, pl. 12, figs 14–16, 1948.

Test trochoid, biconvex, both dorsal and ventral sides depressed in the median portion, periphery broadly rounded, tending to become slightly angular in the adult; chambers distinct, somewhat inflated, about 8 in the adult whorl, increasing very gradually in size as added; sutures distinct, limbate and slightly raised, dorsally oblique and somewhat curved, ventrally nearly radial; wall very coarsely perforate; aperture at the peripheral margin extending onto the ventral side at the base of the last-formed chamber, with a distinct lip. Diameter 0.65–0.80 mm.; thickness 0.32–0.40 mm.

The types are from the Paleocene, San Juan y Martinez, Pinar del Rio Province, Cuba.

This species resembles *A. midwayensis* (Plummer) but differs in the more coarsely perforated wall, larger size, and much rougher surface. It also resembles *Cibicides vulgaris* (Plummer).

Anomalina cubana Cushman and Bermúdez

Plate 21, figures 13–15

Anomalina cubana Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 86, pl. 15, figs. 7–9, 1948.

Test unequally biconvex, dorsal side nearly flattened in the central area or slightly convex, ventral side more strongly convex, with a distinct umbilical depression, periphery broadly rounded; chambers fairly distinct, slightly inflated on the dorsal side, strongly so on the ventral side, 5 or 6 in the adult whorl, increasing rather rapidly but uniformly in size as added; sutures fairly distinct and slightly depressed on the dorsal side, strongly depressed ventrally, sinuous; wall smooth, distinctly perforate; aperture at the base of the final chamber extending from near the periphery slightly onto the ventral side, without a definite lip. Length of holotype 0.85 mm.; breadth 0.70 mm.; thickness 0.40 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *A. madrugaensis* Cushman and Bermúdez in the smoother wall, more sinuous sutures, and the largely ventral and lipless aperture.

Anomalina madrugaensis Cushman and Bermúdez

Plate 22, figures 1–3

Anomalina madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 86, pl. 15, figs. 4–6, 1948.

Test of medium size, nearly bilaterally symmetrical, dorsal and ventral sides both depressed in the middle area, periphery rounded; chambers distinct, somewhat inflated, about 6 in the adult whorl, of uniform shape, very gradually increasing in size as added; sutures distinct, depressed, very slightly curved; wall smooth, coarsely perforate; aperture at the base of the peripheral margin of the last-formed chamber, extending slightly onto the ventral side, with a slight lip. Length of holotype 0.70 mm.; breadth 0.57 mm.; thickness 0.30 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species resembles some of the forms that have been referred to *A. grosserugosa* (Gümbel) but differs from the typical form of that species in the bilaterally symmetrical test and fewer chambers.

Anomalina praespissiformis Cushman and Bermúdez

Plate 22, figures 7–9

Anomalina praespissiformis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 86, pl. 15, figs. 1–3, 1948.

Test fairly small, strongly compressed, about equally biconvex, periphery rounded, ventral side umbilicate, dorsal side slightly depressed in the earlier portion; chambers distinct, 10–12 in the adult whorl, of uniform shape, increasing very gradually in size as added, very slightly inflated; sutures distinct, very slightly depressed, curved; wall smooth; aperture at the base of the peripheral margin of the last-formed chamber extending over onto the ventral side, with a very slight lip. Length of holotype 0.47 mm.; breadth 0.40 mm.; thickness 0.15 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species strongly resembles *A. alazanensis* Nuttall var. *spissiformis* Cushman and Stainforth from the Oligocene of Trinidad but differs in the smaller size, fewer chambers, and more strongly curved sutures.

Anomalina sp. A

Plate 18, figure 13

Anomalina sp. Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 13, pl. 3, fig. 8, 1942.

The figured specimen is one of a series of a rather variable form which, from the material, is difficult to describe. It does not seem identical with any of the species described from the Midway group. It is like some of the Tertiary forms that have been referred to *Anomalina grosserugosa* (Gümbel).—Cushman and Renz.

The specimens are from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I.

Anomalina sp. B

Plate 18, figures 14, 15

Anomalina sp. Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 45, pl. 8, figs. 11, 12, 1942.

A compressed species with a very coarsely perforate wall occurs in the Naheola material, but it is difficult to identify it

with any of the species described from this part of the Eocene.—Cushman and Todd.

The specimens are from the Naheola formation, Naheola Landing, Tombigbee River, Ala. (7).

Genus BOLDIA Van Bellen, 1946

Boldia vandersluisi Van den Bold

Plate 23, figure 1

Boldia vandersluisi Van den Bold, Thesis Univ. Utrecht, p. 124, pl. 18, fig. 6, 1946.

Van Bellen, Cushman Lab. Foram. Research Contr., vol. 22, p. 122, text fig. 1, 1946.

Test large, slightly biconcave, ventral side with a heavy keel. Periphery broadly truncate. About 6 chambers in the last formed whorl visible dorsally. Sutures very indistinct. Aperture ventral. Diam.: 1.00; T: 0.60.—Van Bellen.

The types are from the lower Eocene or Paleocene of Guatemala and questionable specimens have been recorded from British Honduras.

Boldia carinata Cushman and Bermúdez

Plate 22, figures 4–6

Boldia carinata Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 75, pl. 11, figs. 11–13, 1948.

Test trochoid in the early stages, becoming planispiral in the adult, periphery in the adult truncate with a median depression, the dorsal angle carinate, both dorsal and ventral sides concave in the adult, ventral side somewhat umbilicate; chambers fairly distinct, inflated ventrally, very slightly so dorsally, usually 8 chambers in the adult whorl; sutures indistinct dorsally, ventrally distinct and depressed, somewhat sinuous; wall coarsely perforate, slightly roughened, not papillate, dorsal side with a slight stellate appearance owing to the lip above the aperture; aperture extending from the periphery along the dorsal margin of the last-formed chamber, with a slight lip. Diameter 0.50–0.60 mm.; thickness 0.38–0.43 mm.

The types are from the Paleocene Madruga formation, under highway bridge, Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *B. vandersluisi* Van den Bold in the smaller size, and more definitely keeled and more concave periphery.

The original description of the genus gives the aperture as ventral but in this and the following two species it is largely peripheral and extending over onto what is regarded as the dorsal side. There is a question as to which is the dorsal side, and in these three species from Cuba the dorsal side is opposite to what it is stated to be in the other known species of the genus. To determine the dorsal and ventral sides either young specimens or sections should be studied.

Boldia madrugaensis Cushman and Bermúdez

Plate 22, figures 10–12

Boldio madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 75, pl. 12, figs. 4–6, 1948.

Test trochoid in the young, nearly planispiral in the adult, periphery in the adult becoming somewhat truncate in the last portion, earlier portion rounded, both dorsal and ventral sides somewhat concave, ventral side somewhat umbilicate; chambers fairly distinct, 7 or 8 in the adult whorl, distinctly inflated on the ventral side; sutures distinct and depressed ventrally, slightly curved, nearly radial, dorsally indistinct; wall coarsely perforate, smooth on the ventral side, dorsal side with numerous, irregular raised portions radiating out toward the periphery; aperture peripheral and extending over onto the dorsal side as a narrow slit at the inner margin of the last-formed chamber, with a distinct lip. Diameter 0.45–0.65 mm.; thickness 0.30–0.45 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *B. vandersluisi* Van den Bold in the much smaller size, less truncate border, umbilicate ventral side, and irregularly papillate dorsal side.

Boldia cubensis Cushman and Bermúdez

Plate 22, figures 13, 14

Boldia cubensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 74, pl. 11, figs. 15, 16, 1948.

Test in the early stages trochoid, in the adult becoming nearly planispiral, periphery in the adult becoming truncate, earlier portion with a narrowly rounded border, both dorsal and ventral sides somewhat concave; chambers fairly distinct, about 6 in the adult whorl, slightly inflated, increasing very gradually in size as added; sutures rather indistinct, curved, little if at all depressed; wall smooth except for the umbilical area of the dorsal side, which has a stellate thickening; aperture a low opening at the peripheral margin, extending over on the dorsal side, with a slight lip. Diameter of holotype 0.70 mm.; thickness 0.45 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

The species differs from *B. vandersluisi* Van den Bold in the smaller size, less truncate periphery, and the more curved sutures.

Genus CIBICIDES Montfort, 1808

Cibicides praecursorius (Schwager) Cushman and Ponton

Plate 19, figures 1–6

Discorbina praecursoria Schwager, Palaeontographica, vol. 30, Pal. Theil, p. 125, pl. 24 (4), fig. 12; pl. 29 (6), fig. 16, 1883.

Cibicides praecursorius Cushman and Ponton, Cushman Lab. Foram. Research Contr., vol. 8, p. 72, pl. 9, fig. 14, 1932.

Cushman and Garrett, idem, vol. 15, p. 88, 1939.

Toulmin, Jour. Paleontology, vol. 15, p. 610, pl. 82, figs. 19–21, 1941.

Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 13, pl. 3, fig. 9, 1942.

Cushman and Todd, idem, vol. 18, p. 45, pl. 8, figs. 17–20, 1942.
Kline, Mississippi Geol. Survey Bull. 53, p. 62, pl. 5, figs. 5, 6, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 28, pl. 4, fig. 28; p. 49, pl. 8, figs. 17–20, 1944; Am. Jour. Sci., vol. 242, p. 18, pl. 2, figs. 23, 24, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 65, pl. 11, figs. 20, 21, 1946.

Test with the dorsal side flat or slightly concave, ventral side convex, periphery subacute; chambers distinct, slightly inflated on the ventral side, 6 to 8 in the adult whorl, increasing gradually in size as added; sutures distinct, curved, slightly limbate; wall smooth, coarsely perforate; aperture extending from the peripheral margin over onto the dorsal side beneath the somewhat extended lip of the last-formed chamber. Length up to 0.50 mm., breadth 0.40 mm., thickness 0.12 mm.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation. Alabama, Barbour County (10).
Pine Barren member. Alabama, Wilcox County (11).
Porters Creek clay. Tennessee, Hardeman County (13, 14).
Midway formation, lower part. Arkansas, Saline County (18, 19A, 20–22); Pulaski County (23).
Midway formation, upper part. Arkansas, Pulaski County (24, 25).
Midway group. Texas, Van Zandt County (47).

Cibicides alleni (Plummer) Plummer

Plate 18, figures 16, 17

Truncatulina alleni Plummer, Texas Univ. Bull. 2644, p. 144, pl. 10, fig. 4, 1927.
Cibicides alleni Plummer, idem, Bull. 3201, pp. 54, 61 (lists), 1933.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 73, pl. 12, fig. 19, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 61, pl. 6, figs. 21, 22, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 354, pl. 54, figs. 24, 25, 1944.

Test almost equally biconvex, the ventral side of most specimens being the more rounded; periphery subacute and bordered by a band of clear shell material, faintly lobate in its latest development; chambers 10–11 in last convolution, very coarsely punctate, previous whorls concealed by strong elevations of shell matter that follow the base of the chambers on the dorsal face; sutures on dorsal side marked by conspicuous elevations of transparent shell matter that taper and curve gently toward the periphery; sutures of the ventral face very slightly elevated and curving outward from the large smooth umbilical boss; aperture a large arched opening over the periphery and extending farther downward on the ventral side. Diameter up to 0.7 mm.; average about 0.4 mm.—Plummer.

The types are from the Paleocene, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Navarro County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (2, 4–6).
Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9)
Pine Barren member. Alabama. Butler County (12).
Porters Creek clay. Mississippi, Kemper County (17).
Midway formation. Arkansas, Saline County (26); Pulaski County (27); Clark County (30).
Midway group, Texas, Limestone County (39); Navarro County (40); Hunt County (41); Bastrop County (43); Travis County (45).

Cibicides vulgaris (Plummer) Cushman

Plate 19, figures 7–11

Truncatulina vulgaris Plummer, Texas Univ. Bull. 2644, p. 145, pl. 10, fig. 3, 1927.
Cibicides vulgaris Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 73, pl. 12, fig. 21, 1940.
Kline, Mississippi Geol. Survey Bull. 53, p. 63, pl. 6, figs. 19, 20, 1943.
Cooper, Jour. Paleontology, vol. 18, p. 354, pl. 54, figs. 28, 29, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 22, p. 65, pl. 11, figs. 22, 23, 1946.

Test almost equally biconvex, the ventral face being slightly the more elevated; peripheral margin broadly rounded, frequently somewhat lobate; chambers 7–9 in last whorl, last two or three distinctly turgid; sutures marked by strong elevations of clear shell material curving gently toward the periphery from a very high ridge of irregularly disposed mass of shell matter that follows the inner edge of the whorl and produces a more or less well-developed spiral on both faces; shell wall more coarsely punctate than any other species in the fauna; aperture a long, arched slit extending from the periphery toward the umbilicus under a narrow lip. Diameter up to 0.6 mm.—Plummer.

The types are from the Paleocene, road cut near top of hill on Corsicana-Navarro Road just south of junction with the Mildred Road, Navarro County, Tex.

Clayton formation, Chalybeate limestone member. Alabama, Sumter County (9).
Porters Creek clay. Mississippi, Kemper County (17).
Midway formation, lower part. Arkansas, Saline County (19A).
Midway formation, upper part. Arkansas, Pulaski County (25).
Wills Point formation. Texas, Travis County (33); Caldwell County (34).
Midway group. Texas, Limestone County (39); Bastrop County (43); Caldwell County (44); Van Zandt County (48).

Cibicides newmanae (Plummer) Cushman and Todd

Plate 19, figures 12–14

Discorbis newmanae Plummer, Texas Univ. Bull. 2644, p. 138, pl. 9, fig. 4, 1927.
Cibicides newmanae Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 46, pl. 8, fig. 16, 1942.

Test slightly oval, dorsal face being somewhat convex and the ventral face flat or slightly concave; peripheral margin sharp and thin; chambers smooth, distinctly punctate, moderately curved, increasing rather rapidly in size, usually 8 in final whorl; sutures on both sides curved and marked by tapering dark lines; aperture a distinct slit extending from a point near the margin into the small excavated umbilical depression under an apertural lip. Greatest diameter up to 0.4 mm.; average 0.3 mm.—Plummer.

The types are from the Paleocene, ditch along Elgin-Austin road 1.4 miles northeast of Littig close to the county line (Bastrop quadrangle), Bastrop County, Tex.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (1, 2, 4); Butler County (3); Choctaw County (7).
Porters Creek clay. Tennessee, Hardeman County (14).
Midway formation, lower part. Arkansas, Saline County (18).
Midway group. Texas, Hunt County (41).

Cibicides howelli Toulmin

Plate 19, figures 15–17

Cibicides howelli Toulmin, Jour. Paleontology, vol. 15, p. 609, pl. 82, figs. 16–18, 1941.
Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 13, pl. 3, fig. 10, 1942.
Cushman, Am. Jour. Sci., vol. 242, p. 18, pl. 2, figs. 21, 22, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 28, pl. 4, fig. 29; p. 50, pl. 8, fig. 9, 1944.
Cibicides cf. *C. pseudoungerianus* Cushman and Garrett, Cushman Lab. Foram. Research Contr., vol. 15, p. 88, pl. 15, figs. 25, 26, 1939.

Test plano-convex, subcircular in outline, earlier whorls on dorsal surface obscured by growth of shell material, ventral surface very convex, almost conical, capped by an elevated, low, rounded, smooth umbonal boss of clear to translucent shell material, periphery narrowly angled in the early portion of the last whorl, becoming bluntly angled or rounded in the later portion; chambers 9 or 10 in number in the final whorl, increasing gradually in size as added; dorsal sutures moderately curved, ventral sutures more gently curved than the dorsal, early sutures on dorsal and ventral sides flush with the surface, later sutures slightly depressed; wall coarsely perforate; aperture a slit-like opening at the base of the final chamber, arching across the periphery and extending onto the dorsal side. Length up to 0.55 mm.; width up to 0.42 mm.; thickness up to 0.24 mm.

The types are from the Eocene Salt Mountain limestone, from Richmond Branch, ½ mile north of Salt Mountain, Clarke County, Ala.

Porters Creek clay. Mississippi, Kemper County (17).
Porters Creek formation, Matthews Landing marl member. Alabama, Butler County (3); Wilcox County (5).
Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Clayton formation. Alabama, Barbour County (10).
Pine Barren member. Alabama, Wilcox County (11).
Midway formation, lower part. Arkansas, Saline County (22).
Midway formation, upper part. Arkansas, Pulaski County (24).
Midway formation. Arkansas, Saline County (26).
Midway group. Texas, Hunt County (41).

Cibicides blanpiedi Toulmin

Plate 20, figures 1–5

Cibicides blanpiedi Toulmin, Jour. Paleontology, vol. 15, p. 609, pl. 82, figs. 11–13, 1941.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 18, p. 46, pl. 8, figs. 13–15, 1942.
Cushman, Am. Jour. Sci., vol. 242, p. 18, pl. 2, fig. 20, 1944; Cushman Lab. Foram. Research Contr., vol. 20, p. 50, pl. 8, fig. 10, 1944.

Test subcircular, plano-convex, non-lobate, with acute peripheral angle; dorsal side flat, somewhat evolute, the final whorl of chambers partially embracing the preceding whorl; ventral side very convex, subconical, involute; chambers distinct, eight or nine in the final whorl, on the dorsal side curved and uninflated, on the ventral side curved and strongly produced ventrally, with the ventral end of each chamber extending beyond that of the preceding; sutures on the dorsal side distinct, flush with the surface, moderately curved, somewhat limbate in the early portion of the test but becoming non-limbate in the latest portion, sutures on the ventral side distinct, flush with the surface, somewhat sigmoid; wall smooth, very finely perforate, polished; aperture a slit on the dorsal side at the inner margin of the last two or three chambers, arching across the periphery. Diameter up to 0.31 mm.; height up to 0.22 mm.—Toulmin.

The types are from the Eocene Salt Mountain limestone, in bed of Richmond Branch, Clarke County, Ala.

Porters Creek formation, Matthews Landing marl member. Alabama, Wilcox County (5); Choctaw County (7).
Naheola formation. Coal Bluff marl member. Alabama, Wilcox County (8).

Cibicides browni Kline

Plate 20, figures 6–8

Cibicides browni Kline, Mississippi Geol. Survey Bull. 53, p. 67, pl. 7, figs. 18–20, 1943.

Test plano-convex, ventral side convex, dorsal side flat, frequently showing signs of attachment, periphery subacute but not keeled; chambers usually 5 in the last-formed whorl, distinct, increasing rapidly in size, inflated on ventral side; sutures distinctly curved on dorsal and ventral sides, depressed on ventral side; aperture near periphery, small.—Kline.

The types are from the Paleocene Clayton formation, test hole M 49, surface to 8.7 feet below, 2½ miles north of Pheba, Clay County, Miss.

Naheola formation, Coal Bluff marl member. Alabama, Wilcox County (8).
Porters Creek clay. Tennessee, Hardeman County (14).
Midway formation, lower part. Arkansas, Saline County (18, 22).
Midway group. Texas, Hunt County (41).

Cibicides cf. C. williamsoni Garrett

Plate 20, figure 9

Cibicides williamsoni Garrett, Jour. Paleontology, vol. 15, p. 156, pl. 26, fig. 15, 1941.
Cibicides cf. *C. williamsoni* Cushman and Renz, Cushman Lab. Foram. Research Contr., vol. 18, p. 14, pl. 3, fig. 12, 1942.

Specimens from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, are smaller than autotypes with which they have been compared, but seem to be related. The typical form is recorded from the middle Eocene of southern Alabama and Mississippi.

Cibicides cf. C. semiplectus (Schwager) Cushman and Ponton

Plate 20, figure 10

Pulvinulina semiplecta Schwager, Palaeontographica, vol. 30, Pal. Theil, p. 130, pl. 27 (4), fig. 16, 1883.
Cibicides cf. *C. semiplectus* Cushman and Renz, idem, vol. 18, p. 14, pl. 3, fig. 11, 1942.

The figured specimen is from the Paleocene Soldado Rock formation, Soldado Rock, Trinidad, B. W. I. The specimen is not entirely typical as the last-formed

chamber has not reached the full development that sometimes occurs in this species.

This form is not the same as that recorded as *C. semiplectus* from the Eocene Wilcox group of Alabama and later found to be *Ammocibicides pontoni* Earland, an arenaceous species belonging in the Trochamminidae.

Cibicides mirificus Cushman and Bermúdez

Plate 20, figures 14–16

Cibicides mirificus Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 88, pl. 16, figs. 1–3, 1948.

Test compressed, nearly equally biconvex, ventral side slightly more convex than the dorsal side, periphery angled, subacute, ventral side with a small but distinct umbonal boss, dorsal side with the central portion depressed in a close spiral; chambers distinct, 11 to 13 in the adult whorl, of uniform size, very gradually increasing in size as added, little if at all inflated; sutures distinct, not depressed except the last few on the ventral side, slightly curved; wall smooth, finely perforate; aperture at the base of the last-formed chamber, a small but distinct raised opening at the periphery, then extending over onto the dorsal side, with a very slight lip near the periphery. Length of holotype 0.52 mm.; breadth 0.47 mm.; thickness 0.23 mm.

The types are from the Paleocene Madruga formation, San Juan y Martinez, Pinar del Rio Province, Cuba.

This species differs from *C. madrugaensis* Cushman and Bermúdez in the more compressed test, sharper peripheral angle, larger number of chambers, and larger proportion of the dorsal side taken up by the last-formed whorl.

Cibicides reprimatus Cushman and Bermúdez

Plate 20, figures 17, 18

Cibicides reprimatus Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 87, pl. 15, figs. 13, 14, 1948.

Test plano-convex, dorsal side flattened, ventral side strongly convex, periphery subacute, ventral margins slightly concave, ventral side with a slight umbilical boss; chambers fairly distinct, especially in the later portion, increasing very gradually in size as added, on the dorsal side with a distinct oral depression in the middle of the inner margin; sutures fairly distinct, very slightly depressed in the later portion of the ventral side and all of the dorsal side, ventrally curved, slightly sinuous, dorsally irregular with distinct lobular projections; wall smooth except for the depressions of the dorsal side; aperture at the peripheral margin extending onto the dorsal side, with a slight lip at the peripheral portion. Length of holotype 0.77 mm.; breadth 0.70 mm.; thickness 0.40 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species is peculiar in its dorsal side, differing from *C. madrugaensis* Cushman and Bermúdez in the more plano-convex form, very small umbilical boss, and the indentations of the dorsal side.

Cibicides madrugaensis Cushman and Bermúdez

Plate 21, figures 1–3

Cibicides madrugaensis Cushman and Bermúdez, Cushman Lab. Foram. Research Contr., vol. 24, p. 87, pl. 15, figs. 10–12, 1948.

Test rather small, nearly equally biconvex, ventral side slightly more convex than the dorsal, periphery angled, but slightly rounded, ventral side distinctly umbonate; chambers fairly distinct, little if at all inflated, 6 to 8 in the final whorl, of rather uniform size and shape; sutures distinct, strongly curved, little if at all depressed, distinctly limbate on the ventral side; wall smooth, finely perforate; aperture narrow, at the basal margin of the last-formed chamber, extending very slightly on the ventral side but nearly the length of the chamber on the dorsal side. Length of holotype 0.40 mm.; breadth 0.37 mm.; thickness 0.25 mm.

The types are from the Paleocene Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *C. alleni* (Plummer) in the smaller size, more umbonate ventral side and smooth dorsal side.

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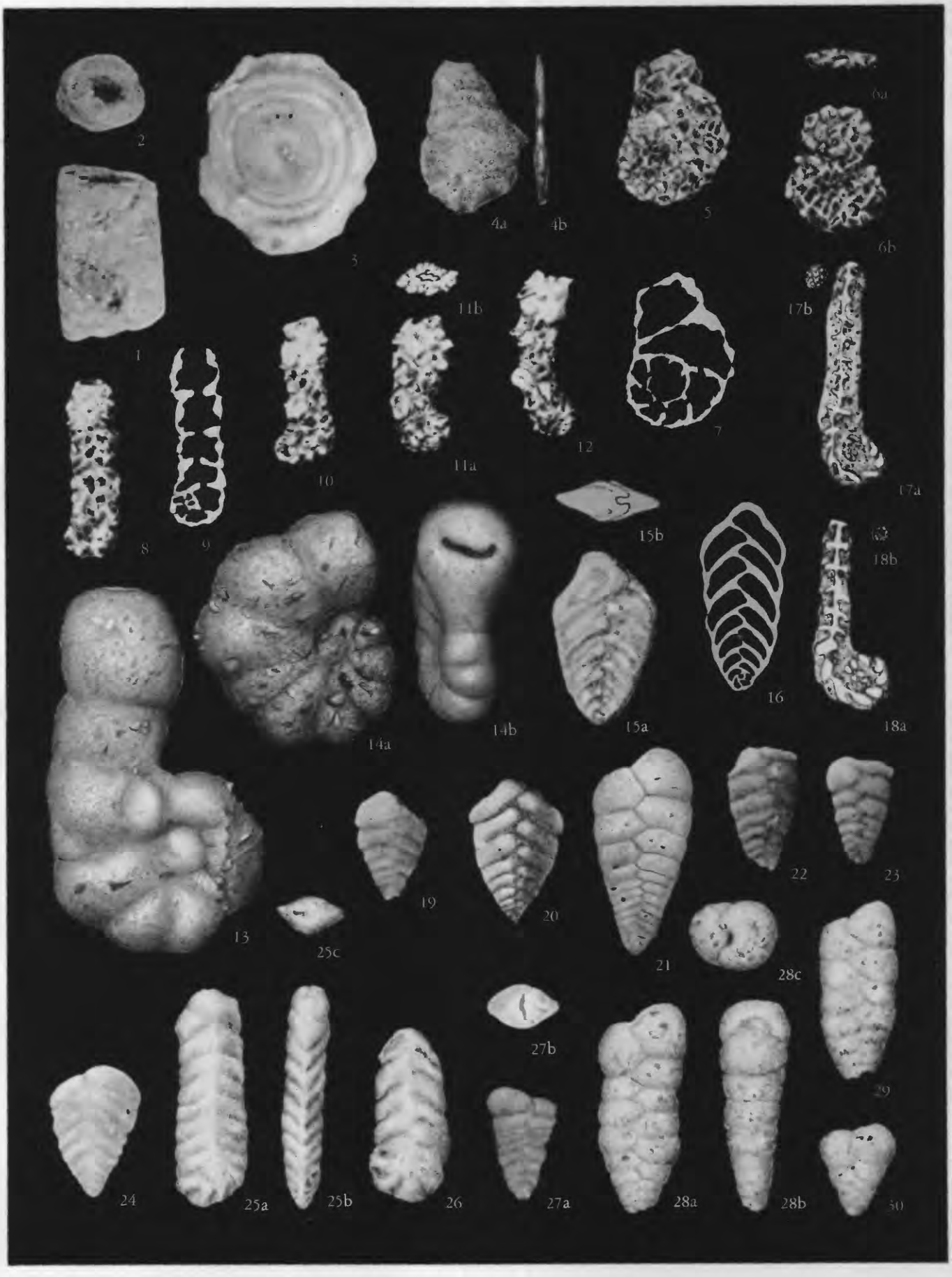

RHIZAMMINIDAE, AMMODISCIDAE, LITUOLIDAE, TEXTULARIIDAE

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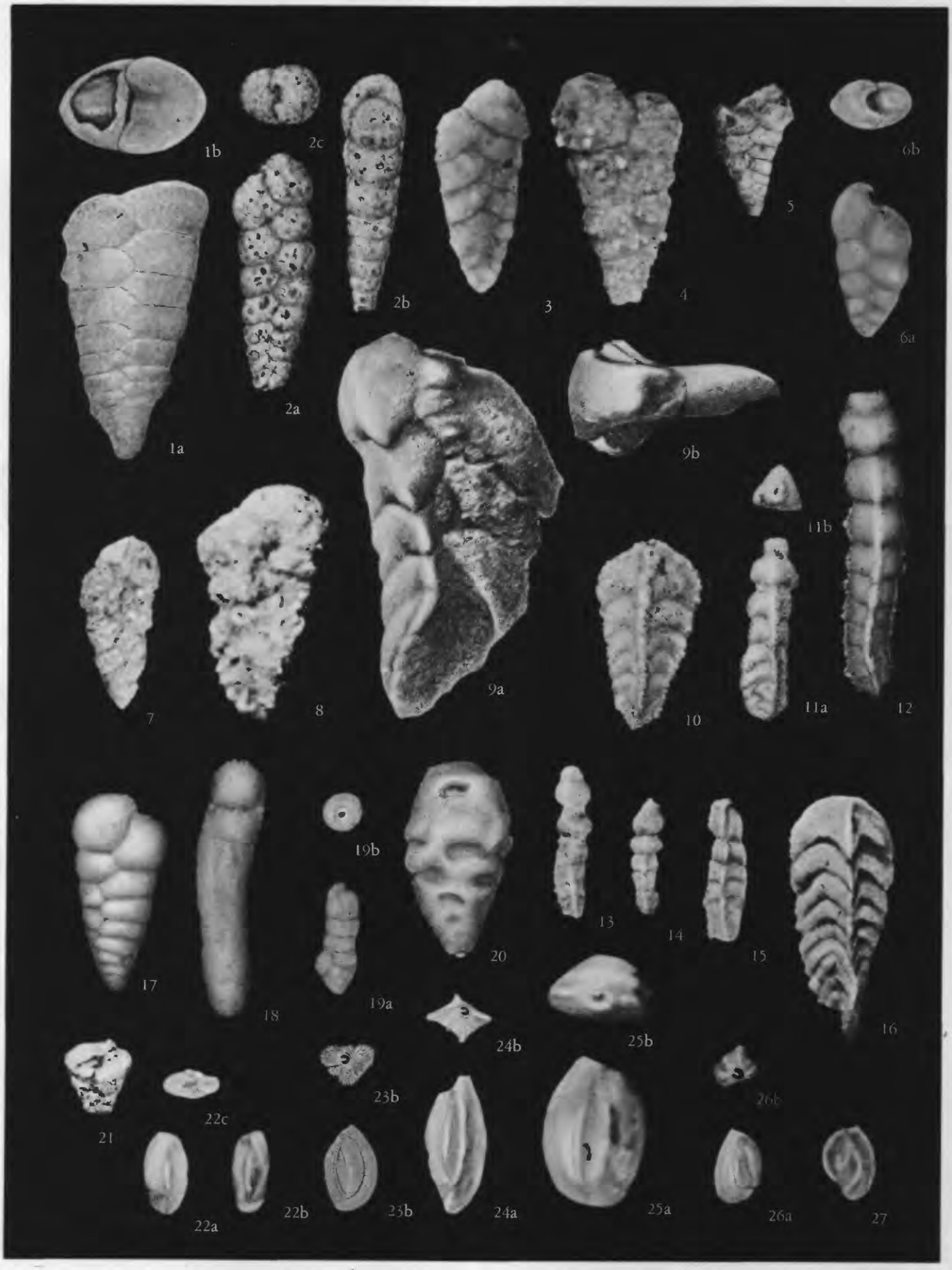

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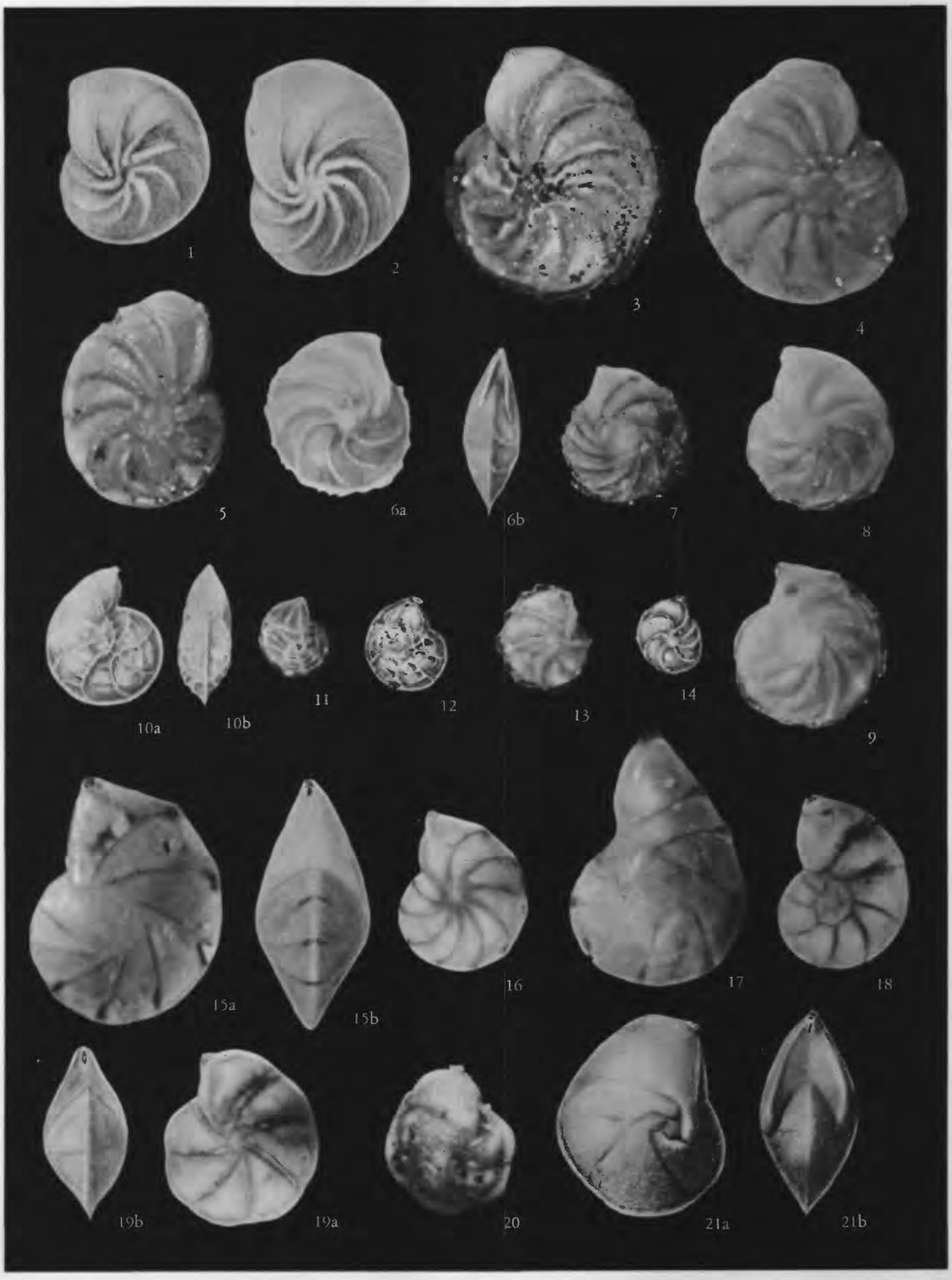
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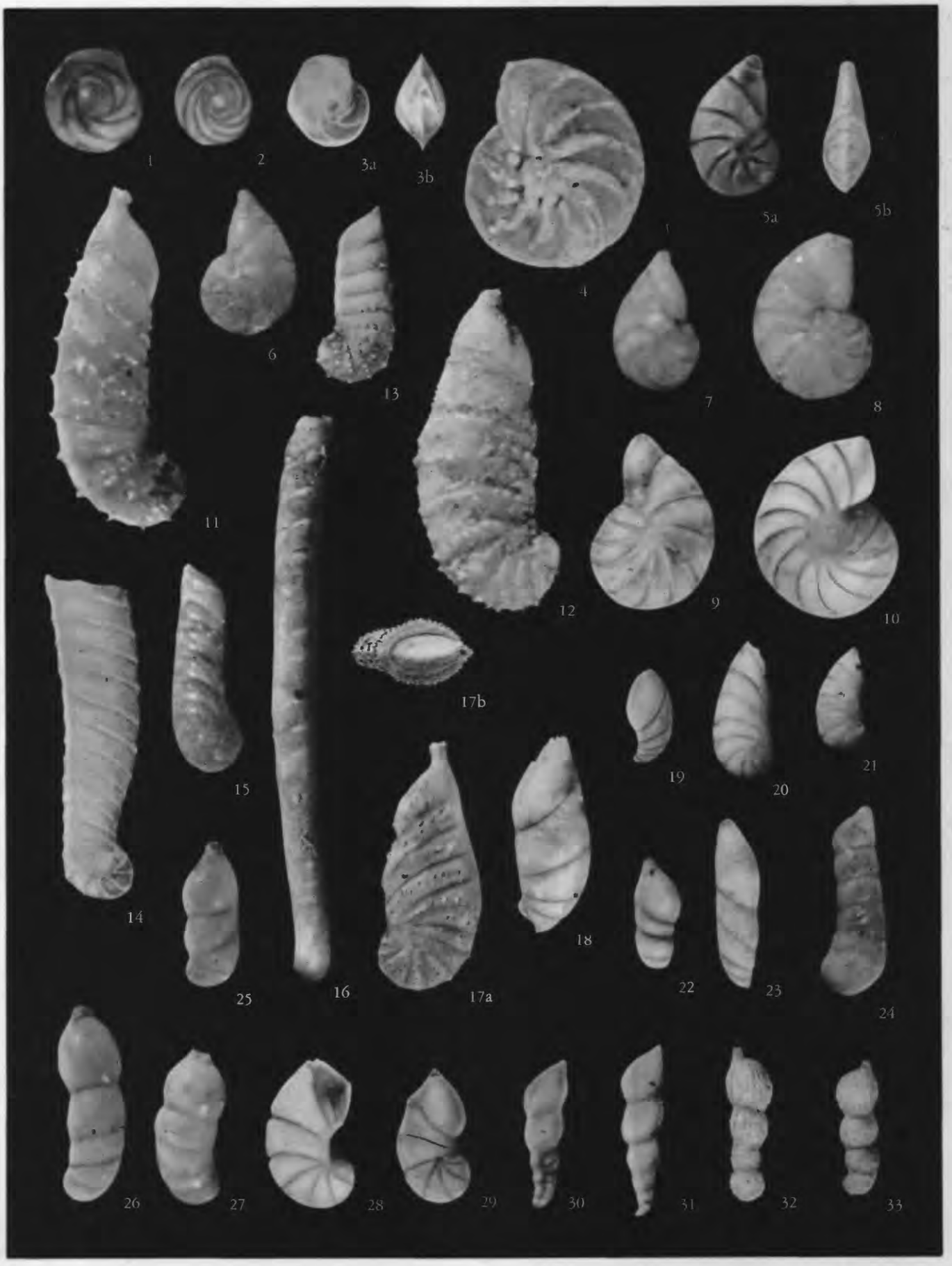
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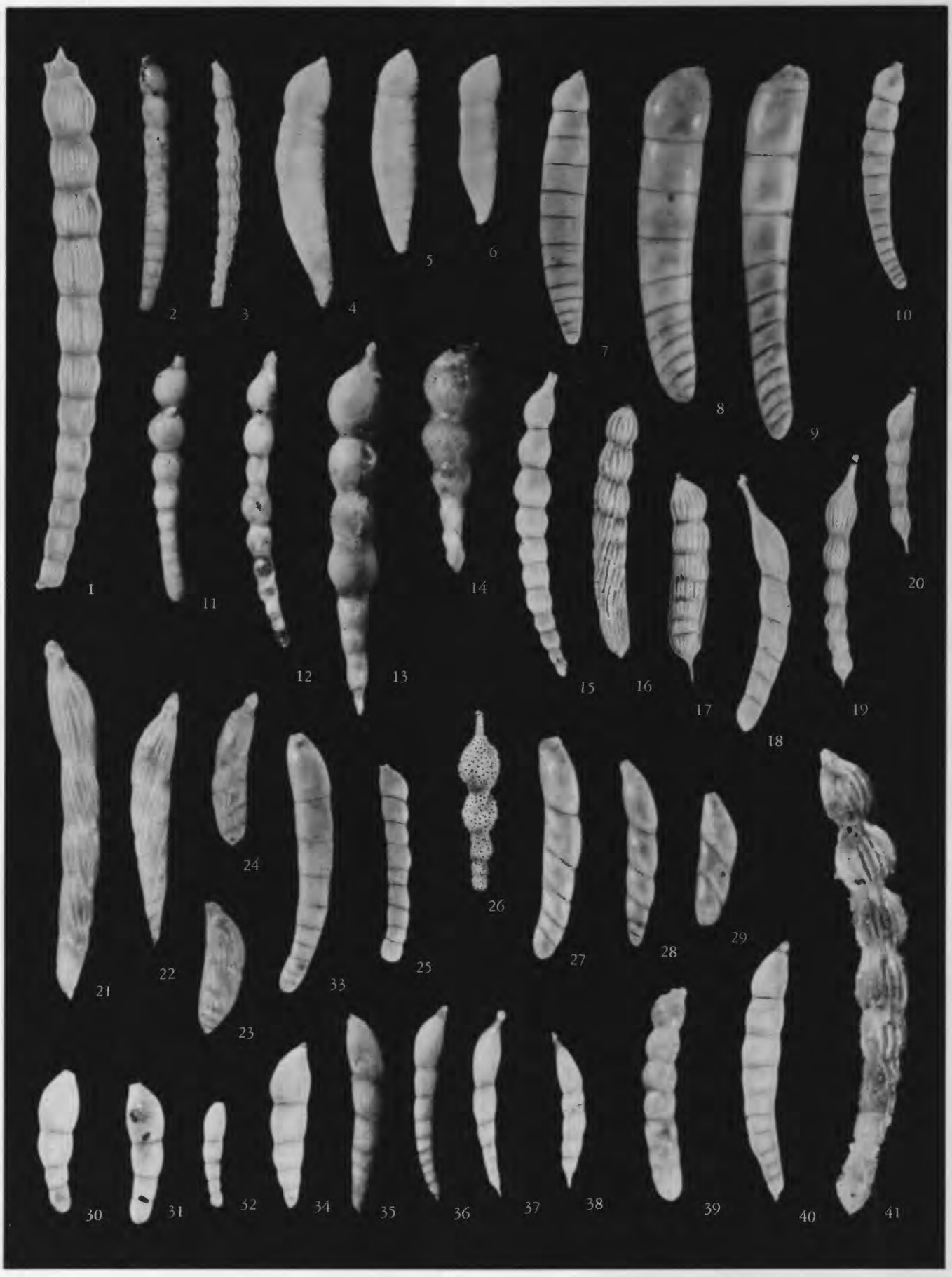
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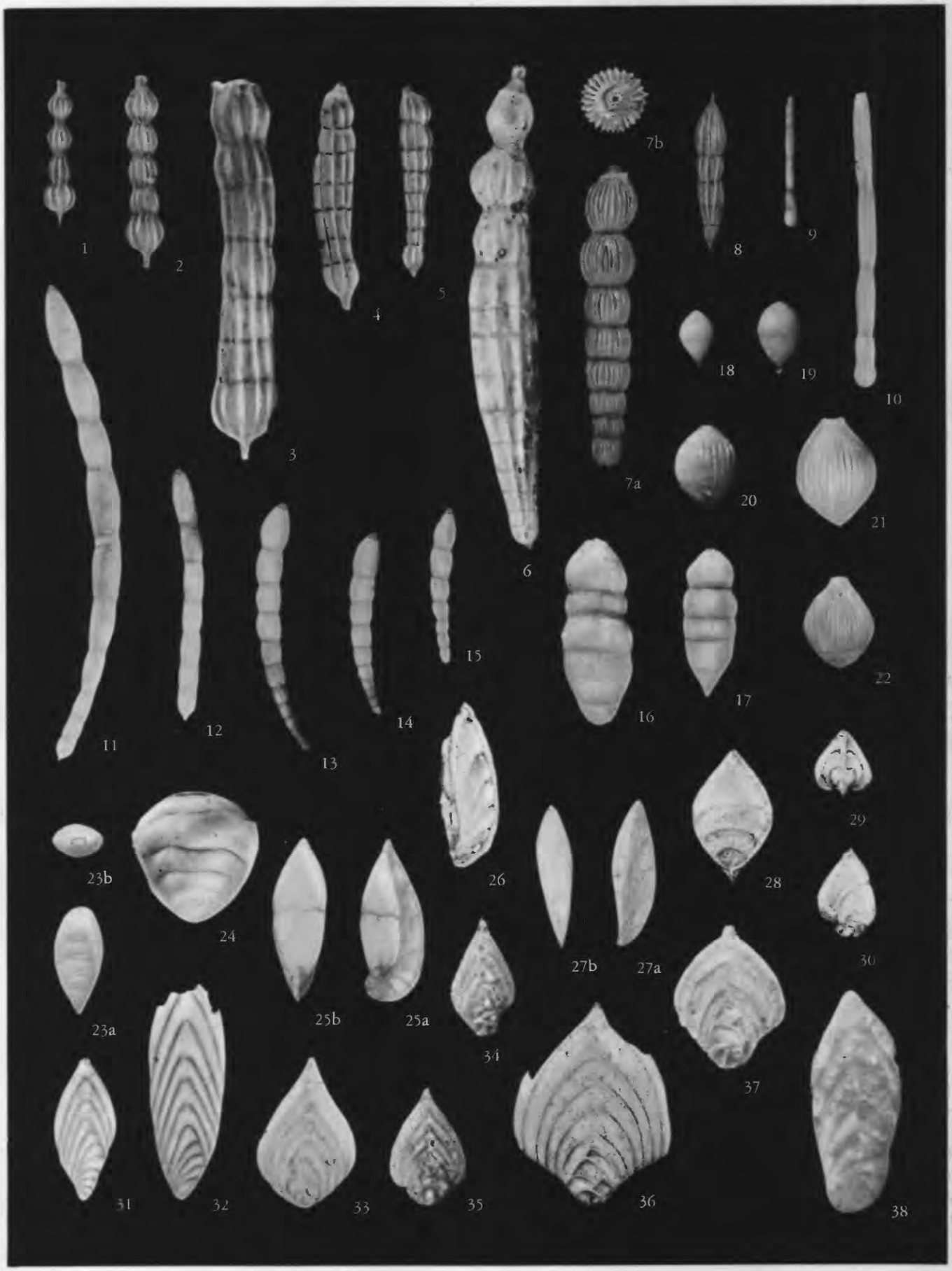
8. *Nodosaria* cf. *N. amphioxys* Reuss (p. 24). × 40.
9, 10. *Nodosaria*? cf. *N. longiscata* D'Orbigny (p. 24). 9. × 40. 10. × 55.
11, 12. *Chrysalogonium arkansasanum* Cushman and Todd (p. 25). × 27. 11. Holotype. 12. Paratype.
13–15. *Chrysalogonium eocenicum* Cushman and Todd (p. 25). × 40. 13. Holotype. 14, 15. Paratypes.
16, 17. *Pseudoglandulina manifesta* (Reuss) Cushman (p. 25). × 40.
18, 19. *Pseudoglandulina* cf. *P. caudigera* (Schwager) Cushman (p. 26). × 40.
20–22. *Pseudoglandulina pygmaea* (Reuss) Cushman (p. 26). × 40.
23. *Lingulina naheolensis* Cushman (p. 26). × 60. Holotype. *a*, Front view; *b*, apertural view.
24. *Lingulina* cf. *L. wilcoxensis* Cushman and Ponton (p. 27). × 15.
25, 26. *Saracenaria trigonata* (Plummer) Cushman (p. 27). 25. (After Plummer.) × 50. Holotype. *a*, Oblique side view; *b*, front view. 26. (After Kline.) × 33.
27. *Saracenaria sublatifrons* (Plummer) Kline (p. 27). (After Plummer.) × 45. Holotype. *a*, Side view; *b*, front view.
28–30. *Saracenaria midwayensis* Kline (p. 27). (After Kline.) × 33. 28, Front view; 29, rear view; 30, side view.
31, 32. *Palmula budensis* (Hantken) Cushman (p. 27). × 40.
33–35. *Palmula delicatissima* (Plummer) Cushman (p. 29). 33. (After Plummer.) × 50. Holotype. 34, 35. × 40.
36, 37. *Palmula rugosa* (D'Orbigny) Cushaman (p. 29). 36. (After Plummer.) × 45. 37. × 40.
38. *Palmula primitiva* Cushman var. *paleocenica* Cushman (p. 30). × 40. Holotype.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LAGENIDAE

PLATE 8

FIGURES 1–3. *Vaginulina gracilis* Plummer (p. 27). 1. × 30. 2, 3. (After Plummer.) × 24.
4–9. *Vaginulina midwayana* Fox and Ross (p. 27). 4–7. × 30. 8, 9. (After Plummer.) × 24
10–15. *Vaginulina longiforma* (Plummer) Cushman (p. 28). 10, 14, 15. × 27. 11–13. × 50.
16–18. *Vaginulina plumoides* Plummer (p. 28). 16. (After Cushman and Renz.) × 50. *a*, Side view; *b*, peripheral view. 17, 18. × 40.
19. *Vaginulina* sp. (p. 29). × 40.
20–23. *Frondicularia* cf. *F. goldfussi* Reuss (p. 31). 20. (After Plummer.) × 25. 21, 22. × 55. 23. × 40.
24, 25. *Frondicularia naheolensis* Cushman and Todd (p. 30). 24. × 75. Holotype. *a*, Front view; *b*, side view; *c*, apertural view. 25. × 40.


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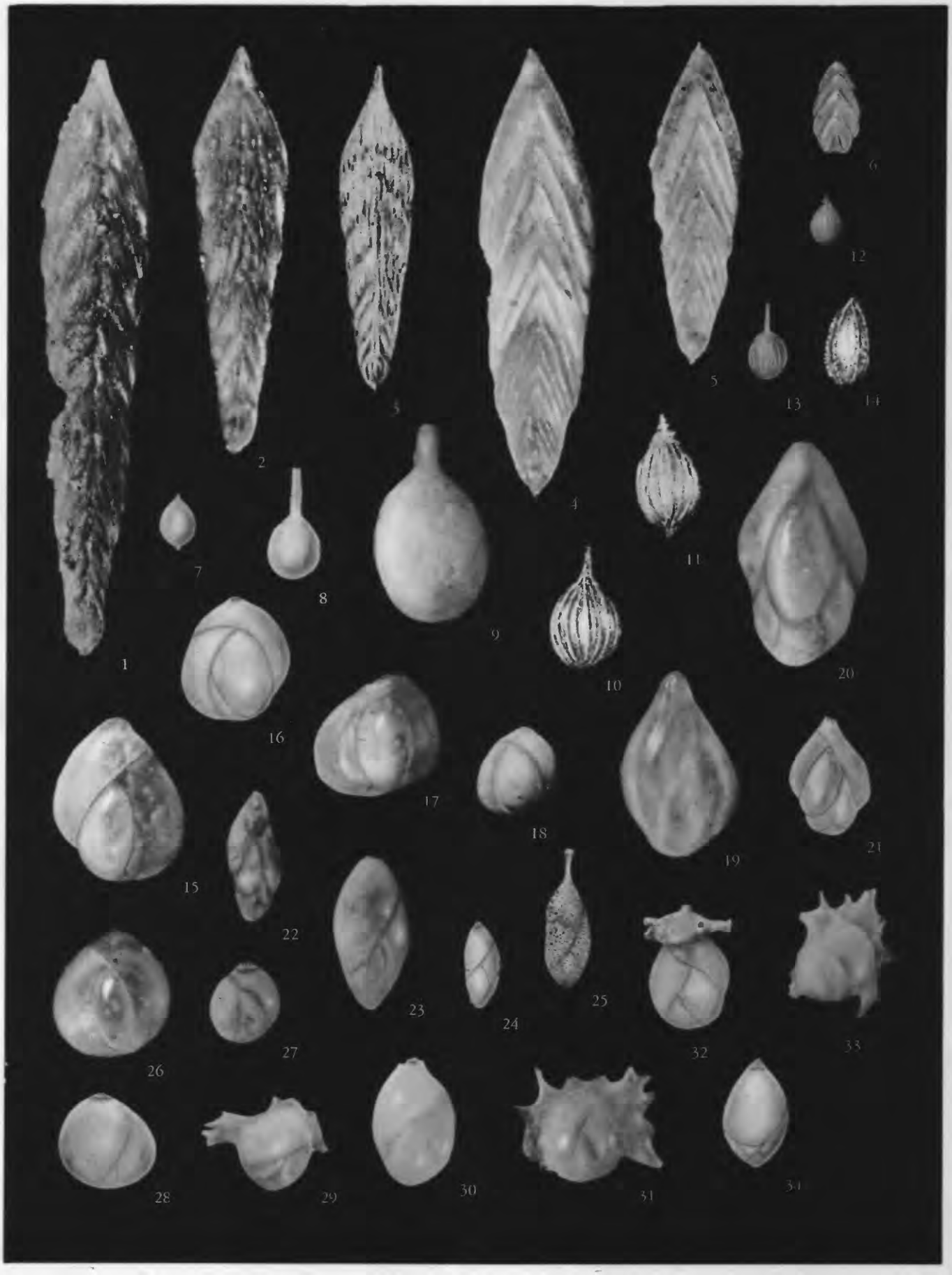
LAGENIDAE

PLATE 9

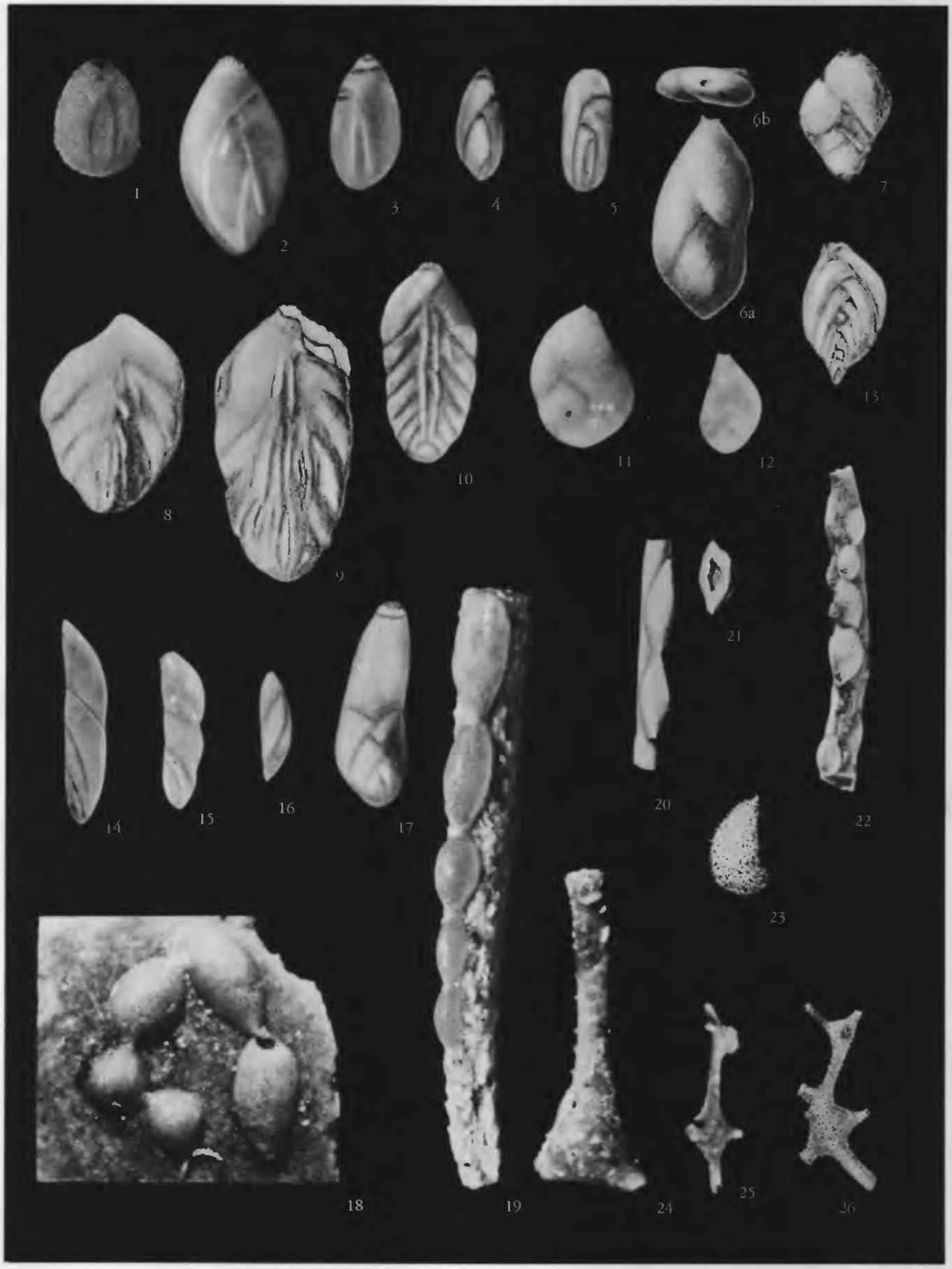
FIGURES 1–3. *Frondicularia* cf. *F. frankei* Cushman (p. 31). 1. × 30. 2. × 40. 3. (After Kline.) × 33.
4, 5. *Frondicularia midwayensis* Cushman (p. 30). × 40. 4. Holotype. 5. Paratype.
6. *Frondicularia* sp. A (p. 31). × 40.
7. *Entosolenia* cf. *E. apiculata* (Reuss) Cushman (p. 42). × 40.
8, 9. *Lagena* cf. *L. laevis* (Montagu) Williamson (p. 31). 8. × 40. 9. × 95.
10, 11. *Lagena sulcata* (Walker and Jacob) Parker and Jones var. *semiinterrupta* W. Berry (p. 31). (After Kline.) × 60.
12. *Lagena* cf. *L. acuticosta* Reuss (p. 32). × 40.
13. *Lagena* cf. *L. costata* (Williamson) Reuss (p. 32). × 40.
14. "*Lagena* cf. *L. primigera* H. B. Brady" (p. 32). (After Kline.) × 60.
15–18. *Guttulina problema* d'Orbigny (p. 32). 15. × 100. 16, 18. × 40. 17. × 55.
19–21. *Guttulina hantkeni* Cushman and Ozawa (p. 32). 19. × 95. 20. × 55. 21. × 40.
22. *Guttulina wilcoxensis* Cushman and Ponton (p. 32). × 50.
23, 24. *Pyrulina* cf. *P. cylindroides* (Roemer) Cushman and Ozawa (p. 33). 23. × 50. 24. × 40.
25. *Pyrulina extensa* (Cushman) Cushman and Ozawa (p. 34). × 40.
26–28. *Globulina gibba* D'Orbigny (p. 33). 26. × 95. 27. × 50. 28. × 40.
29–33. *Globulina rotundata* (Bornemann) Cushman and Ozawa (p. 33). 29, 31–33. × 50. Fistulose forms. 30. × 55.
34. *Globulina* cf. *G. minuta* (Roemer) Reuss (p. 33). × 40.



LAGENIDAE, POLYMORPHINIDAE, BULIMINIDAE

PLATE 10

FIGURE 1. *Pseudopolymorphina wilcoxensis* Cushman and Ponton (p. 34). × 50.
2, 3. *Sigmomorphina semitecta* (Reuss) Cushman and Ozawa var. *terquemiana* (Fornasini) Cushman and Ozawa (p. 34). 2. × 110. 3. × 40.
4. *Sigmomorphina wilcoxensis* Cushman and Ponton (p. 34). × 40.
5. *Sigmomorphina* cf. *S. williamsoni* (Terquem) Cushman and Ozawa (p. 34). × 60.
6. *Sigmomorphina soldadoensis* Cushman and Renz (p. 35). (After Cushman and Renz.) × 55. Holotype. *a*, Front view; *b*, apertural view.
7. *Polymorphina* sp. (p. 35). (After Kline.) × 33.
8–12. *Polymorphina cushmani* Plummer (p. 35). 8. (After Plummer.) × 24. Holotype. 9. (After Kline.) × 33. 10. × 15. 11, 12. × 55. Young stages.
13. *Polymorphina frondea* (Cushman) Cushman (p. 35). (After Kline.) × 33.
14–16. *Polymorphinella* cf. *P. elongata* Toulmin (p. 36). × 55.
17. *Polymorphinella* sp. (p. 36). × 60.
18. *Bullopora laevis* (Sollas) Wickenden (p. 36). × 30.
19–22. *Bullopora chapmani* (Plummer) Cushman (p. 36). 19. × 40. 20, 21. (After Plummer.) × 24. 20. Holotype. 21. Paratype, detached chamber. 22. × 22.
23. *Bullopora chapmani* (Plummer) Cushman var. *hispida* Kline (p. 36). (After Kline.) × 33. Holotype.
24–26. *Ramulina* cf. *R. aculeata* (D'Orbigny) Wright (p. 36). 24, 25. × 35. 26. × 40.



POLYMORPHINIDAE

PLATE 11

FIGURE 1. *Nonionella insecta* (Schwager) Cushman and Ponton (p. 37). × 90.

2–4. *Nonionella soldadoensis* Cushman and Renz (p. 37). 2. (After Cushman and Renz.) × 55. Holotype. *a*, *b*, Opposite sides; *c*, peripheral view. 3. (After Plummer, "*Nonionina turgida*".) × 45. *a*, *b*, Opposite sides; *c*, peripheral view. 4. × 90.

5, 6. *Nonionella* sp. (p. 37). 5. × 55. 6. (After Plummer.) × 100. *a*, Side view; *b*, apertural view.

7, 8. *Gümbelina midwayensis* Cushman (p. 37). 7. × 155. Holotype. 8. × 100.

9. *Gümbelina trinitatensis* Cushman and Renz (p. 38). (After Cushman and Renz.) × 50. Holotype. *a*, Front view; *b*, side view.

10. *Gümbelina morsei* Kline (p. 38). (After Kline.) × 60. Holotype.

11. *Rectogümbelina alabamensis* Cushman (p. 38). × 120. Holotype.

12. *Eouvigerina excavata* Cushman (p. 38). × 120. Holotype.

13–15. *Pseudouvigerina naheolensis* Cushman and Todd (p. 39). 13. × 120. Holotype. 14. × 120. Paratype. 15. × 55.

16–19. *Siphogenerinoides eleganta* (Plummer) Cushman (p. 39). 16–18. (After Plummer.) × 45. 16. Holotype. 17, 18. Paratypes. 19. × 100.

20. *Buliminella elegantissima* (D'Orbigny) Cushman (p. 39). × 90.

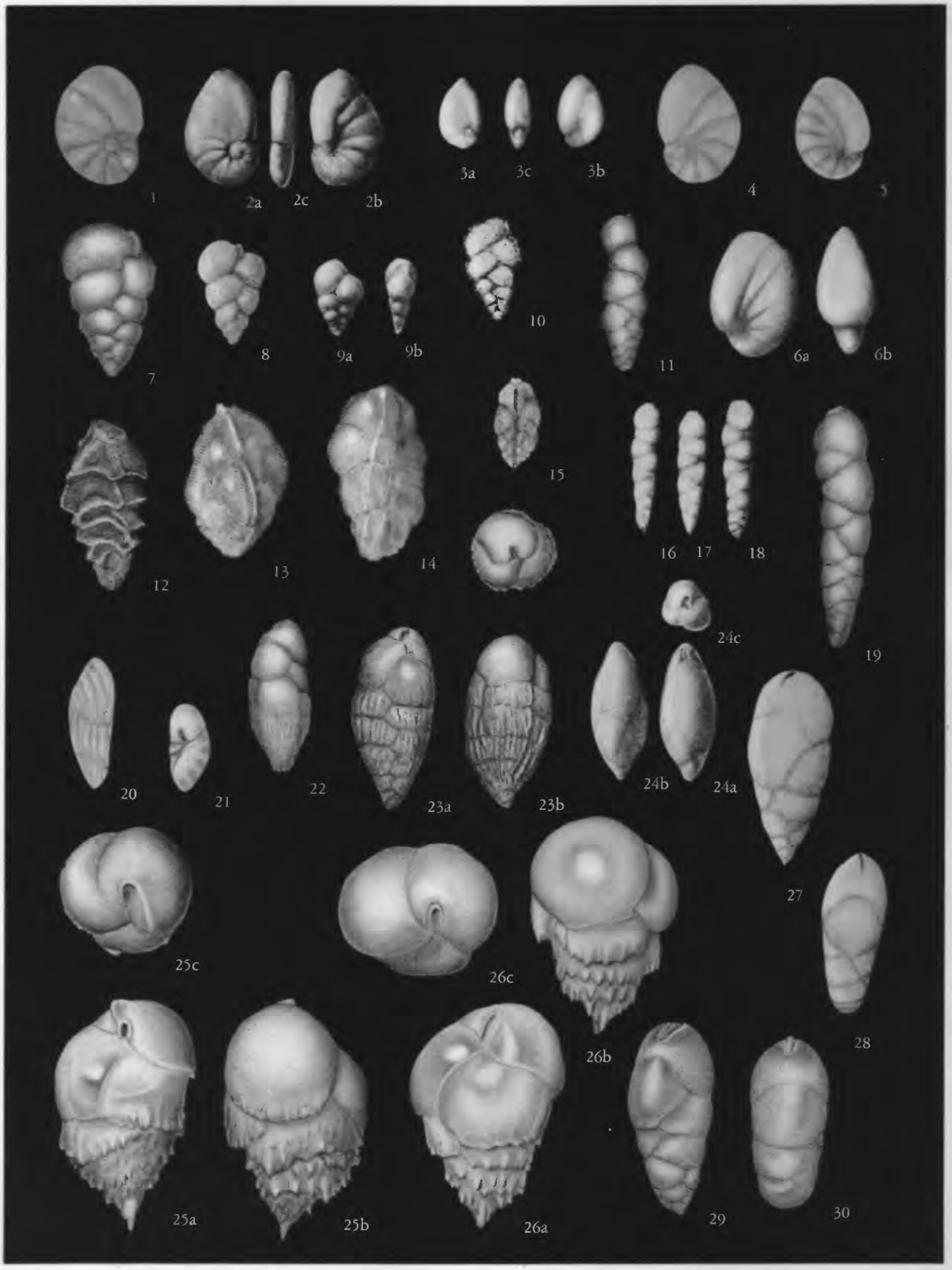
21. *Robertina wilcoxensis* Cushman and Ponton (p. 40). × 60.

22, 23. *Bulimina cacumenata* Cushman and Parker (p. 40). 22. × 125. 23. × 100. *a*, Front view; *b*, rear view; *c*, apertural view.

24. *Bulimina kugleri* Cushman and Renz (p. 41). (After Cushman and Renz.) × 55. Holotype. *a*, Front view; *b*, rear view; *c*, apertural view.

25, 26. *Bulimina arkadelphiana* Cushman and Parker var. *midwayensis* Cushman and Parker (p. 40). (After Cushman and Parker.) × 80. 25. Paratype. 26. Holotype. *a*, *a*, Front views; *b*, *b*, rear views; *c*, *c*, apertural views.

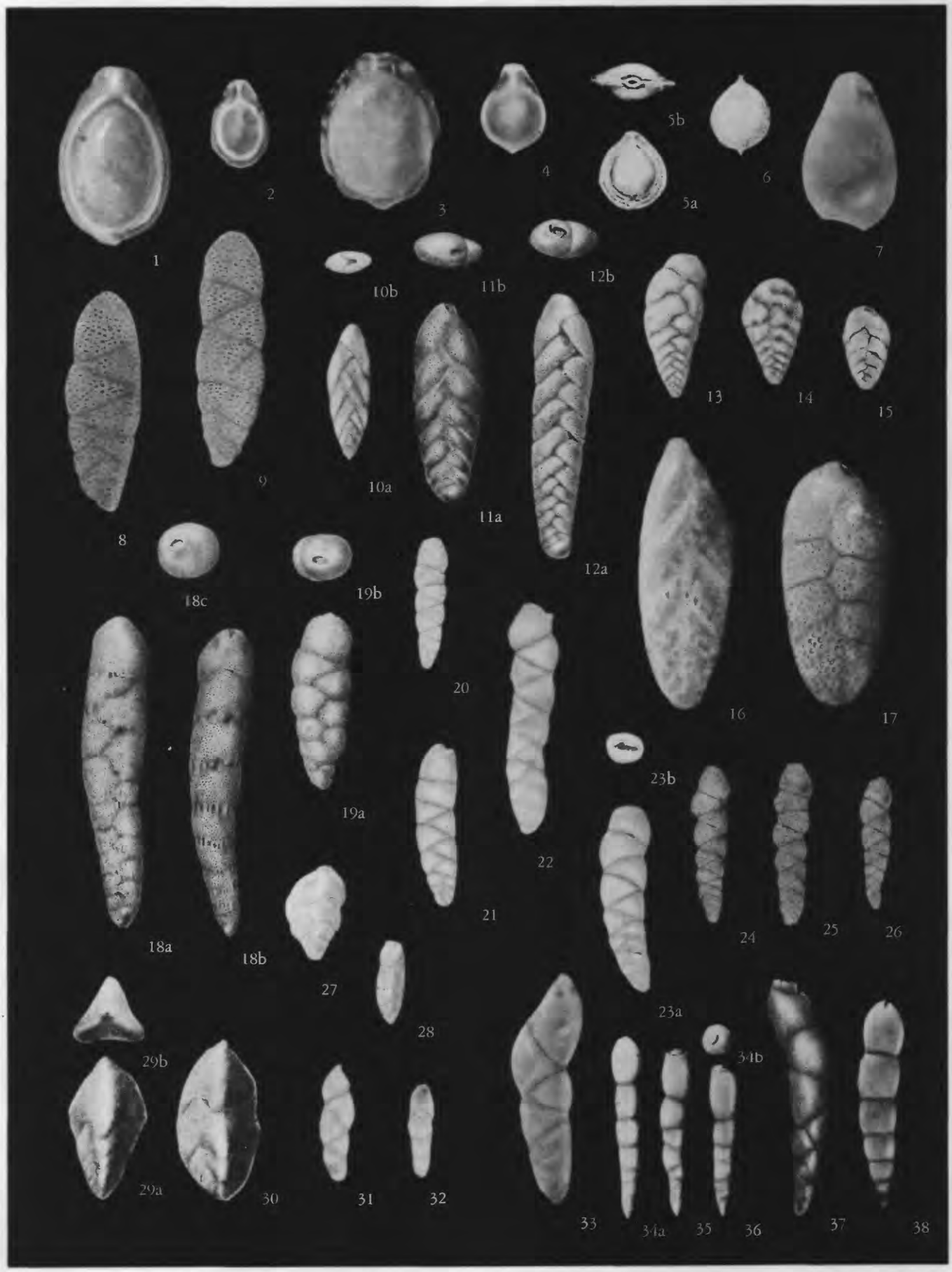
27–30. *Bulimina* (*Desinobulimina*) *quadrata* Plummer (p. 41). 27, 28. (After Plummer.) × 50. 29, 30. × 60. 27, 29. Microspheric forms. 28, 30. Megalospheric forms.



NONIONIDAE, HETEROHELICIDAE, BULIMINIDAE

PLATE 12

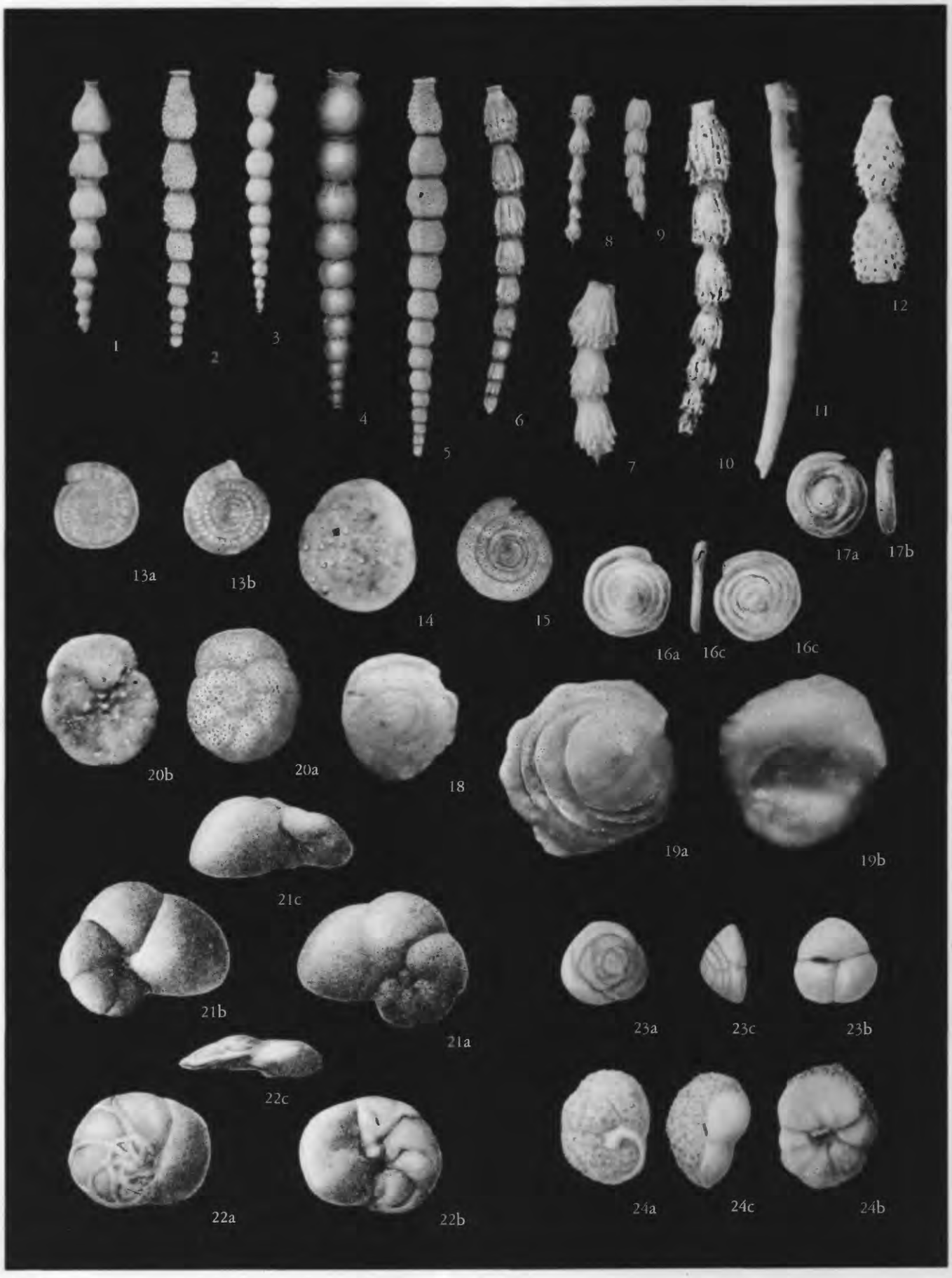
FIGURES 1, 2. *Entosolenia crumenata* Cushman (p. 41). 1. × 120. 2. × 60.
3, 4. *Entosolenia* cf. *E. laevigata* (Reuss) Cushman and McGlamery (p. 41). 3. × 115. 4. × 60.
5. *Entosolenia* cf. *E. orbignyana* (Seguenza) Cushman (p. 41). (After Kline.) × 45. *a*, Front view; *b*, apertural view.
6. *Entosolenia morsei* Kline (p. 42). (After Kline.) × 33. Holotype.
7. *Entosolenia* sp. (p. 42). × 90.
8, 9. *Virgulina wilcoxensis* Cushman and Ponton (p. 42). × 90.
10. *Virgulina naheolensis* Cushman (p. 42). × 60. Holotype. *a*, Front view; *b*, apertural view.
11, 12. *Bolivina midwayensis* Cushman (p. 43). × 85. 11. Holotype. 12. Paratype. *a*, *a*, Front views; *b*, *b*, apertural views.
13, 14. *Bolivina crenulata* Cushman (p. 43). × 60.
15. *Bolivina budensis* (Hantken) Cushman (p. 43). × 60.
16. *Bolivina* sp. A (p. 43). × 150.
17. *Bolivina* sp. B (p. 43). × 150.
18. *Loxostomum applinae* (Plummer) Nuttall (p. 43). × 85. *a*, Front view; *b*, side view; *c*, apertural view.
19, 20. *Loxostomum plummerae* Cushman (p. 44). 19. × 115. Holotype. *a*, Front view; *b*, apertural view. 20. × 40.
21–23. *Loxostomum deadericki* Cushman (p. 44). × 60. 21. Holotype. 22, 23. Paratypes. *a*, Front view; *b*, apertural view.
24–26. *Loxostomum deadericki* Cushman var. *exilis* Cushman (p. 44). × 60. 24. Holotype. 25, 26. Paratypes.
27. *Angulogerina wilcoxensis* (Cushman and Ponton) Cushman and Garrett (p. 44). × 60.
28. *Angulogerina virginiana* Cushman (p. 45). × 60.
29, 30. *Trifarina herberti* Cushman and Renz (p. 45). (After Cushman and Renz.) × 53. 29. Holotype. *a*, Side view; *b*, apertural view. 30. Paratype.
31–33. *Pleurostomella paleocenica* Cushman (p. 45). 31, 32. × 55. 31. Holotype. 32. Paratype. 33. × 90.
34–37. *Nodosarella attenuata* (Plummer) Cushman (p. 45). 34–36. (After Plummer.) × 50. 34. Holotype. 35, 36. Paratypes. *a*, Side view; *b*, apertural view. 37. × 95.
38. *Nodosarella paleocenica* Cushman and Todd (p. 46). × 30. Holotype.



BULIMINIDAE, ELLIPSOIDINIDAE

PLATE 13

FIGURES 1, 2. *Ellipsonodosaria plummerae* Cushman (p. 46). 1. (After Plummer.) × 50. 2. × 54.
3–5. *Ellipsonodosaria paleocenica* Cushman and Todd (p. 46). 3. × 40. 4. × 55. 5. × 40. Holotype.
6–10. *Ellipsonodosaria midwayensis* Cushman and Todd (p. 47). 6. × 24. Holotype. 7–9. (After Plummer.) × 24. 10. (After Kline.) × 33.
11. *Chrysalogonium granti* (Plummer) Toulmin (p. 24). × 40.
12. *Ellipsonodosaria alexanderi* Cushman (p. 47). (After Kline.) × 60.
13, 14. *Spirillina selseyensis* Heron-Allen and Earland (p. 47). 13. × 60. *a*, *b*, Opposite sides. 14. × 90.
15. *Spirillina* cf. *S. vivipara* Ehrenberg (p. 48). × 60.
16, 17. *Spirillina* sp. (p. 48). (After Cushman and Renz.) × 55. 16*a*, *b*, Opposite sides; *c*, peripheral view. 17*a*, Side view; *b*, peripheral view.
18. *Patellina* sp. (p. 48). × 60.
19. *Patellinoides*? sp. (p. 48). × 150. *a*, Dorsal view; *b*, ventral view.
20. *Discorbis midwayensis* Cushman (p. 48). × 40. Holotype. *a*, Dorsal view; *b*, ventral view.
21. *Discorbis midwayensis* Cushman var. *soldadoensis* Cushman and Renz (p. 48). (After Cushman and Renz.) × 55. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
22. *Discorbis midwayensis* Cushman var. *trinitatensis* Cushman and Renz (p. 48). (After Cushman and Renz.) × 55. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
23. *Discorbis infrequens* Plummer (p. 48). (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
24. *Lamarckina rugulosa* Plummer (p. 49). (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.



LAGENIDAE, ELLIPSOIDINIDAE, ROTALIIDAE

PLATE 14

FIGURES 1–3. *Lamarckina limbata* Cushman and Todd (p. 49). × 115. 1. Holotype. Dorsal view. 2. Paratype. Periphera view. 3. Paratype. Ventral view.

4–6. *Lamarckina naheolensis* Cushman and Todd (p. 49). × 150. 4. Holotype. Dorsal view. 5. Paratype. Peripheral view. 6. Paratype. Ventral view.

7. *Lamarckina paleocenica* Cushman (p. 49). × 90. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

8, 9. *Valvulineria allomorphinoides* (Reuss) Cushman (p. 50). 8. × 40. *a*, Dorsal view; *b*, ventral view. 9. × 55.

10–13. *Valvulineria wilcoxensis* Cushman and Ponton (p. 50). × 55.

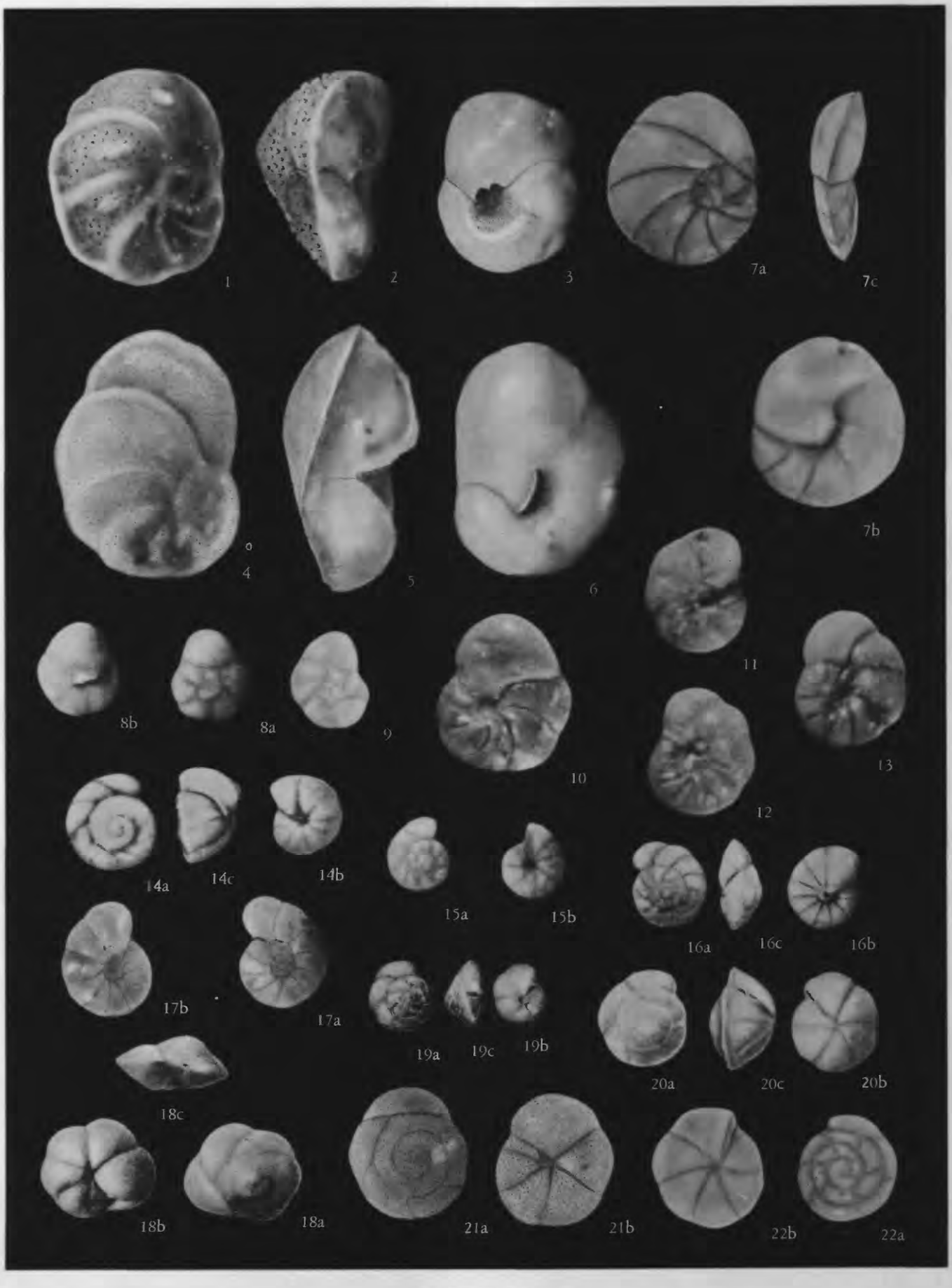
14, 15. *Gyroidina subangulata* (Plummer) Cushman (p. 51). 14. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 15. × 40. *a*, Dorsal view; *b*, ventral view.

16, 17. *Gyroidina aequilateralis* (Plummer) Cushman (p. 51). 16. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 17. × 60. *a*, Dorsal view; *b*, ventral view.

18, 19. *Eponides elevatus* (Plummer) Cushman and Renz (p. 52). 18. (After Cushman and Renz.) × 55. 19. (After Plummer.) × 50. *a*, *a*, Dorsal views; *b*, *b*, ventral views; *c*, *c*, peripheral views.

20, 22. *Eponides plummerae* Cushman (p. 52). 20. (After Plummer.) × 50. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 22. Holotype. *a*, Dorsal view, × 45; *b*, ventral view, × 55.

21. *Eponides lotus* (Schwager) Cushman and Ponton (p. 52). × 60. *a*, Dorsal view; *b*, ventral view.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ROTALIIDAE

PLATE 15

FIGURES 1–5. *Coleites reticulosus* (Plummer) Plummer (p. 54). (After Plummer.) 1. × 50. Holotype. *a*, Dorsal view; *b*, ventral view. 2–5. × 54. 2. Dorsal view. 3. Peripheral view. 4. Early coiled stage. 5. Young specimen with final chamber broken showing internal tube.

6. *Cancris mauryae* Cushman and Renz (p. 56). (After Cushman and Renz.) × 54. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

7–9. *Siphonina prima* Plummer (p. 55). 7. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 8, 9. × 55. 8. Dorsal view. 9. Ventral view.

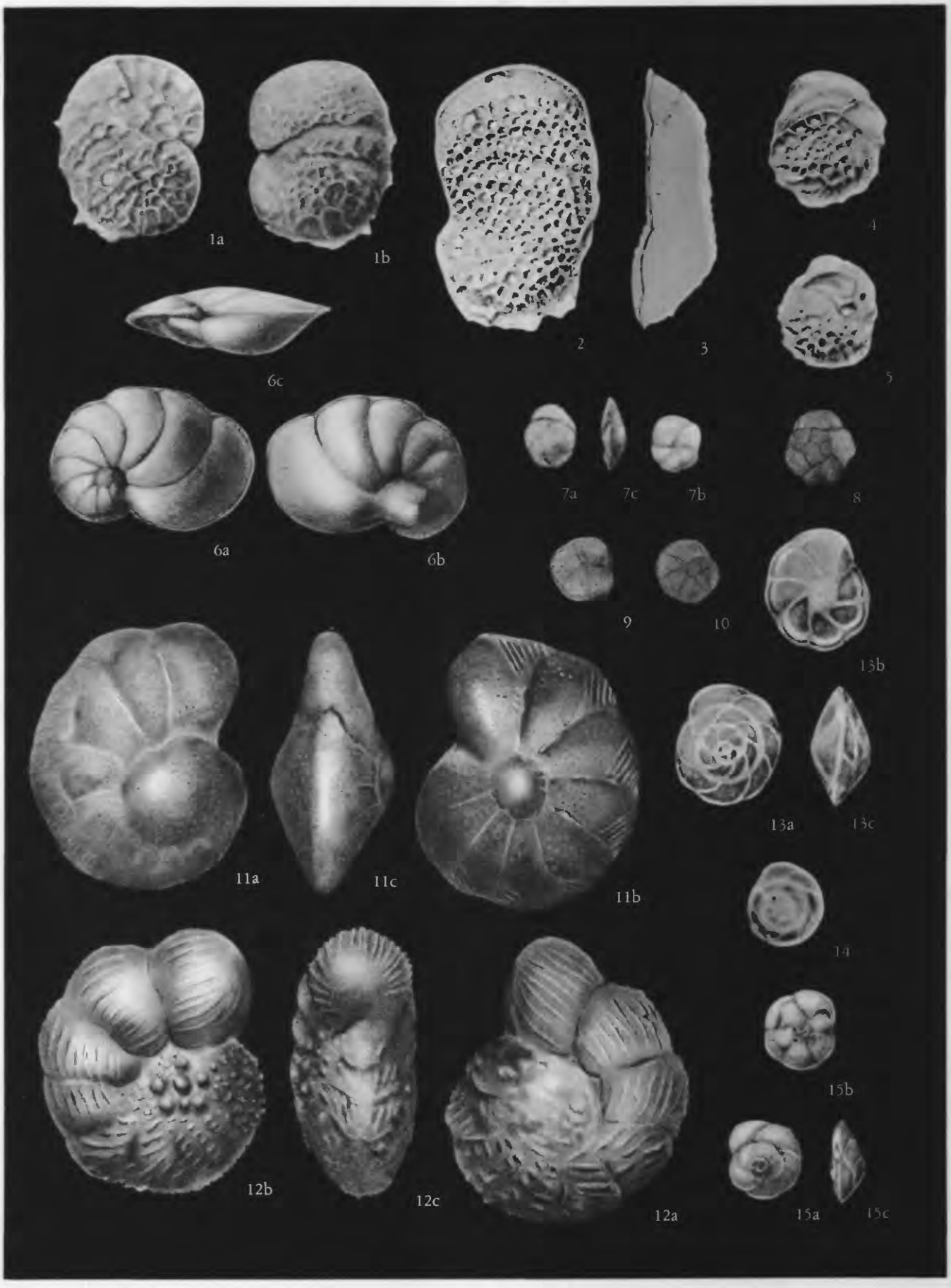
10. *Siphonina wilcoxensis* Cushman (p. 56). × 60. Dorsal view.

11. *Rotalia havanensis* Cushman and Bermúdez (p. 55). (After Cushman and Bermúdez.) × 100. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

12. *Rotalia madrugaensis* Cushman and Bermúdez (p. 55). (After Cushman and Bermúdez.) × 70. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

13, 14. *Epistomina eocenica* Cushman and M. A. Hanna (p. 55). 13. (After Plummer.) × 50. *a*. Dorsal view; *b*, ventral view; *c*, peripheral view. 14. × 27. Dorsal view.

15. *Asterigerina primaria* Plummer (p. 56). (After Plummer.) × 50. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.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ROTALIIDAE

PLATE 16

FIGURES 1–5. *Ceratobulimina perplexa* (Plummer) Cushman and Harris (p. 56). 1–3. (After Plummer.) × 50. 1. Dorsal view. 2. Peripheral view. 3. Ventral view. 4, 5. × 110. 4. Dorsal view. 5. Ventral view.

6, 7. *Alabamina wilcoxensis* Toulmin (p. 57). 6. (After Plummer.) × 50. 7. (After Cushman and Renz.) × 54. *a*, *a*, Dorsal views; *b*, *b*, ventral views; *c*, *c*, peripheral views.

8. *Alabamina wilcoxensis* Toulmin var. *limbata* (Plummer) Cushman (p. 57). (After Plummer.) × 100. Holotype *a*. Dorsal view; *b*, ventral view; *c*, peripheral view.

9, 10. *Pseudoparrella* cf. *P. exigua* (H. B. Brady) Cushman (p. 57). 9. (After Kline.) × 33. *a*, Dorsal view; *b*, ventral view. 10*a*, Dorsal view, × 54; 10*b*, ventral view, × 45.

11, 12. *Parrella expansa* Toulmin (p. 53). 11. (After Plummer.) × 50. *a*, Dorsal view; b, ventral view; *c*, peripheral view. 12. × 52. *a*, Dorsal view; *b*, ventral view.

13, 14. *Parrella macneili* Cushman (p. 53). × 60. 13. Holotype. 14. Paratype. *a*, *a*, Dorsal views; *b*, *b*, ventral views; *c*, peripheral view.

15, 16. *Epistominoides midwayensis* Plummer (p. 58). 15. (After Plummer.) × 73. Holotype. 16. × 60. *a*, *a*, Dorsal views; *b*, *b*, ventral views; *c*, peripheral view.

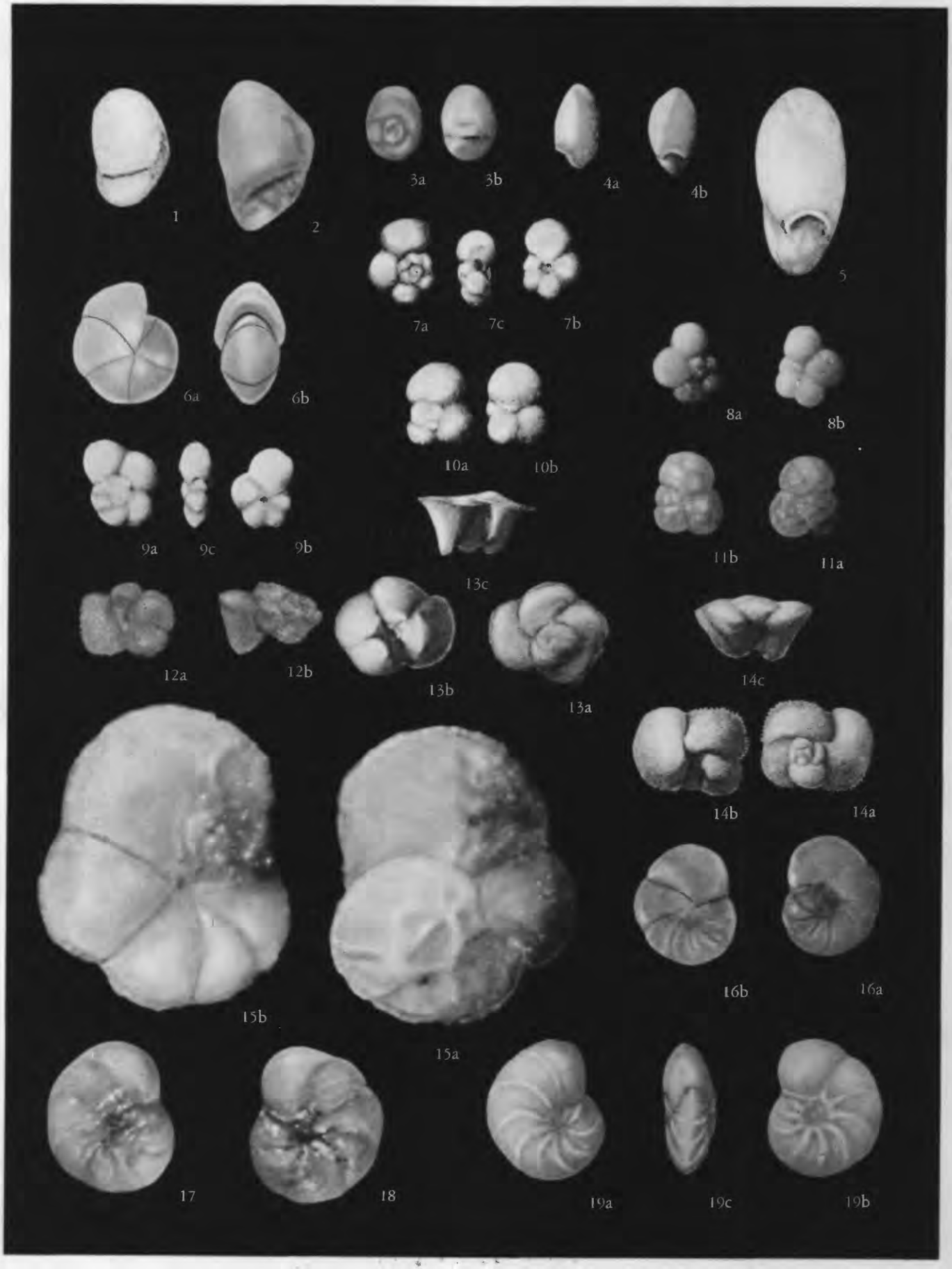
17, 18. *Epistominoides wilcoxensis* (Cushman and Ponton) Plummer (p. 58). (After Plummer.) × 73. 17. Specimen showing interior aperture. 18*a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

19–22. *Allomorphina paleocenica* Cushman (p. 58). 19. (After Kline.) × 33. *a*, Dorsal view; *b*, ventral view. 20. (After Plummer.) × 50. *a*, Dorsal view; *b*, ventral view. 21. × 60. Holotype. *a*, Dorsal view; *b*, ventral view. 22. × 40.

ROTALIIDAE, CASSIDULINIDAE, CHILOSTOMELLIDAE

PLATE 17

FIGURES 1, 2. *Allomorphina subtriangularis* (Kline) Cushman (p. 59). 1. (After Kline.) × 33. Holotype. 2. × 54.
3. *Allomorphina globulosa* Plummer (p. 59). (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view.
4, 5. *Chilostomelloides eocenica* Cushman (p. 59). 4. (After Plummer.) × 50. *a*, Side view; *b*, ventral view. 5. (After Kline.) × 30. Ventral view.
6. *Pullenia quinqueloba* (Reuss) Reuss var. *angusta* Cushman and Todd (p. 59). × 75. Holotype. *a*, Side view; *b*, apertural view.
7, 8. *Globigerina pseudo-bulloides* Plummer (p. 60). 7. (After Plummer.) × 50. Holotype. 8. × 40. *a*, *a*, Dorsal views; *b*, *b*, ventral views; *c*, peripheral view.
9. *Globigerina compressa* Plummer (p. 60) (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
10, 11. *Globigerina triloculinoides* Plummer (p. 61). 10. (After Plummer.) × 50. Holotype. 11. × 40. *a*, *a*, Dorsal views; *b*, *b*, ventral views.
12, 13. *Globorotalia wilcoxensis* Cushman and Ponton var. *acuta* Toulmin (p. 61). 12. × 60. *a*, Dorsal view; *b*, peripheral view. 13. (After Cushman and Renz.) × 54 *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
14. *Globorotalia crassata* (Cushman) Cole var. *aequa* Cushman and Renz (p. 61). (After Cushman and Renz.) × 54. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
15. *Globorotalia* cf. *G. membranacea* (Ehrenberg) White (p. 61). × 160. *a*, Dorsal view; *b*, ventral view.
16. *Anomalina umbonifera* (Schwager) Cushman and Ponton (p. 62). × 60. *a*, Dorsal view; *b*, ventral view.
17–19. *Anomalina midwayensis* (Plummer) Cushman (p. 62). 17, 18. × 54. 17. Dorsal view. 18. Ventral view. 19. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.



CHILOSTOMELLIDAE, GLOBIGERINIDAE, GLOBOROTALIIDAE, ANOMALINIDAE

PLATE 18

FIGURES 1, 2. *Anomalina midwayensis* (Plummer) Cushman var. *trochoidea* (Plummer) Kline (p. 62). 1. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 2. × 54. Dorsal view.

3–6. *Anomalina acuta* Plummer (p. 62). 3. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 4. (After Cushman and Renz.) × 54. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 5, 6. × 54. 5. Ventral view. 6. Dorsal view.

7. *Anomalina basilobata* Cushman and Renz (p. 63). (After Cushman and Renz.) × 54. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

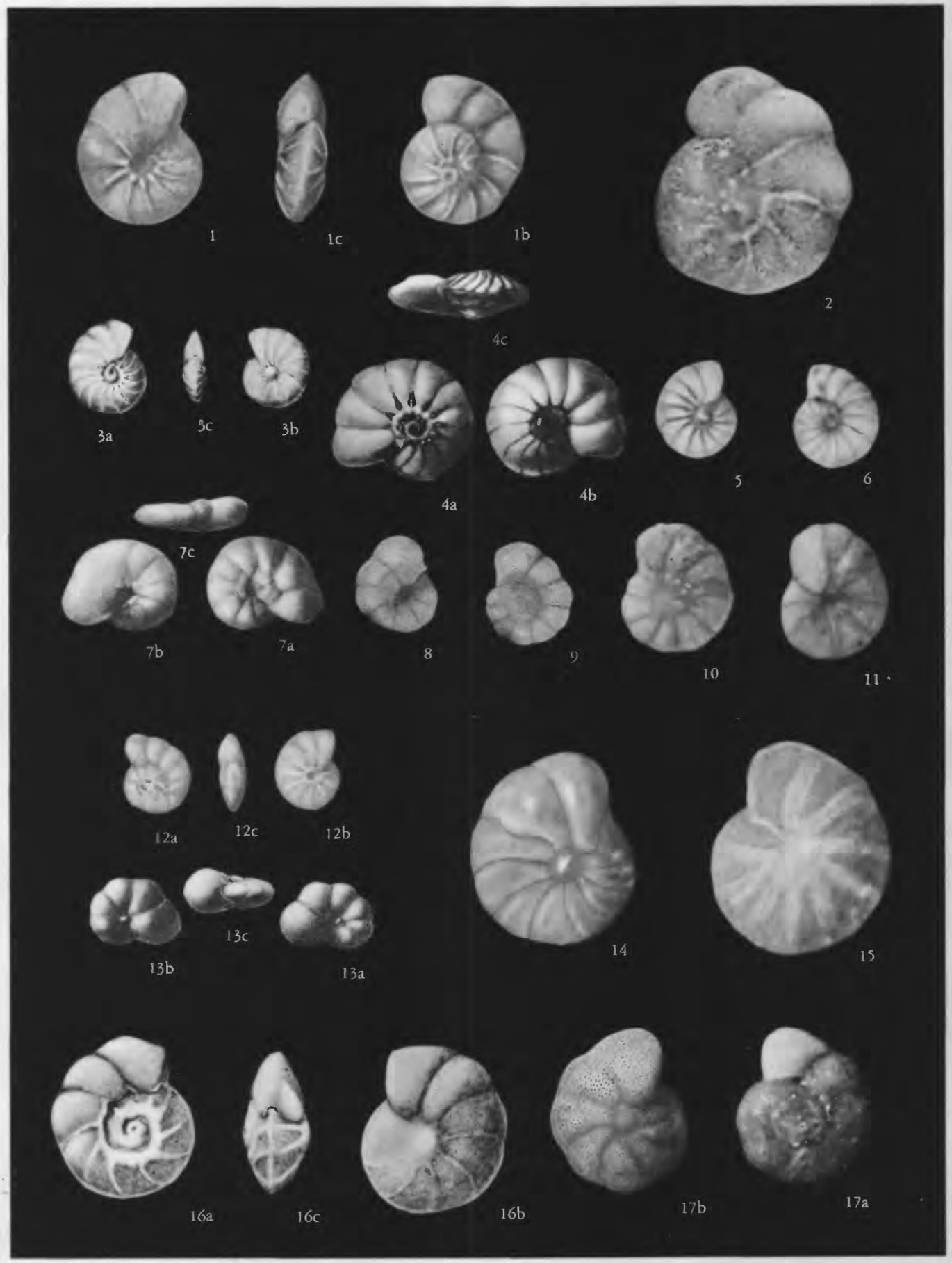
8–11. *Anomalina clementiana* (D'Orbigny) Franke (p. 63). 8, 9. × 40. 10, 11. × 54. 8, 11. Ventral views. 9, 10, Dorsal views.

12. *Anomalina welleri* (Plummer) Plummer (p. 63). (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

13. *Anomalina* sp. A (p. 64). (After Cushman and Renz.) × 54. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

14, 15. *Anomalina* sp. B (p. 64). (After Cushman and Todd.) × 112. 15. Dorsal view. 14, Ventral view.

16, 17. *Cibicides alleni* (Plummer) Plummer (p. 66). 16. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 17. × 40. *a*, Dorsal view; *b*, ventral view.



ANOMALINIDAE

PLATE 19

FIGURES 1–6. *Cibicides praecursorius* (Schwager) Cushman and Ponton (p. 65). 1, 6. × 60. *a*, *a*, Dorsal views; *b*, *b*, ventral views. 2–5. × 112. 2, 5. Dorsal views. 3, 4. Ventral views.

7–11. *Cibicides vulgaris* (Plummer) Cushman (p. 66). 7. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 8–10. × 40. 11. × 54. 8, 9, 11. Dorsal views. 10. Ventral view.

12–14. *Cibicides newmanae* (Plummer) Cushman and Todd (p. 66). 12. (After Plummer.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 13, 14. × 90.

15–17. *Cibicides howelli* Toulmin (p. 67). × 60. 15. (After Toulmin.) Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 16. Dorsal view. 17. Ventral view.

ANOMALINIDAE

PLATE 20

FIGURES 1–5. *Cibicides blanpiedi* Toulmin (p. 67). 1. (After Toulmin.) × 75. Holotype. 2. × 60. *a*, *a*, Dorsal views; *b*, *b*, ventral views; *c*, peripheral view. 3–5. × 120. 3. Dorsal view. 4. Peripheral view. 5. Ventral view.

6–8. *Cibicides browni* Kline (p. 67). (After Kline.) × 33. 6. Dorsal view. 7. Ventral view. 8. Peripheral view.

9. *Cibicides* cf. *C. williamsoni* Garrett (p. 67). (After Cushman and Renz.) × 54. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

10. *Cibicides* cf. *C. semiplectus* (Schwager) Cushman and Ponton (p. 67). (After Cushman and Renz.) × 54. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

11–13. *Eponides vanbelleni* (Van den Bold) Cushman and Bermúdez (p. 53). 11. (After Van den Bold.) × 25. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 12, 13. × 45. 12. Ventral view. 13. Dorsal view.

14–16. *Cibicides mirificus* Cushman and Bermúdez (p. 68). (After Cushman and Bermúdez.) × 80. 14. Holotype, dorsal view. 15, 16. Paratypes. 15. Ventral view. 16. Peripheral view.

17, 18. *Cibicides reprimatus* Cushman and Bermúdez (p. 68). (After Cushman and Bermúdez.) × 50. 17. Holotype, dorsal view. 18. Paratype. *a*, Ventral view; *b*, peripheral view.

ROTALIIDAE, ANOMALINIDAE

PLATE 21

FIGURES 1–3. *Cibicides madrugaensis* Cushman and Bermúdez (p. 68). (After Cushman and Bermúdez.) × 100. 1. Holotype, dorsal view. 2, 3. Paratypes. 2. Ventral view. 3. Peripheral view.

4. *Pseudoglandulina madrugaensis* Cushman and Bermúdez (p. 26). (After Cushman and Bermúdez.) × 37. Holotype.

5. *Vaginulina semilaevis* Cushman and Bermúdez (p. 28). (After Cushman and Bermúdez.) × 22. Holotype.

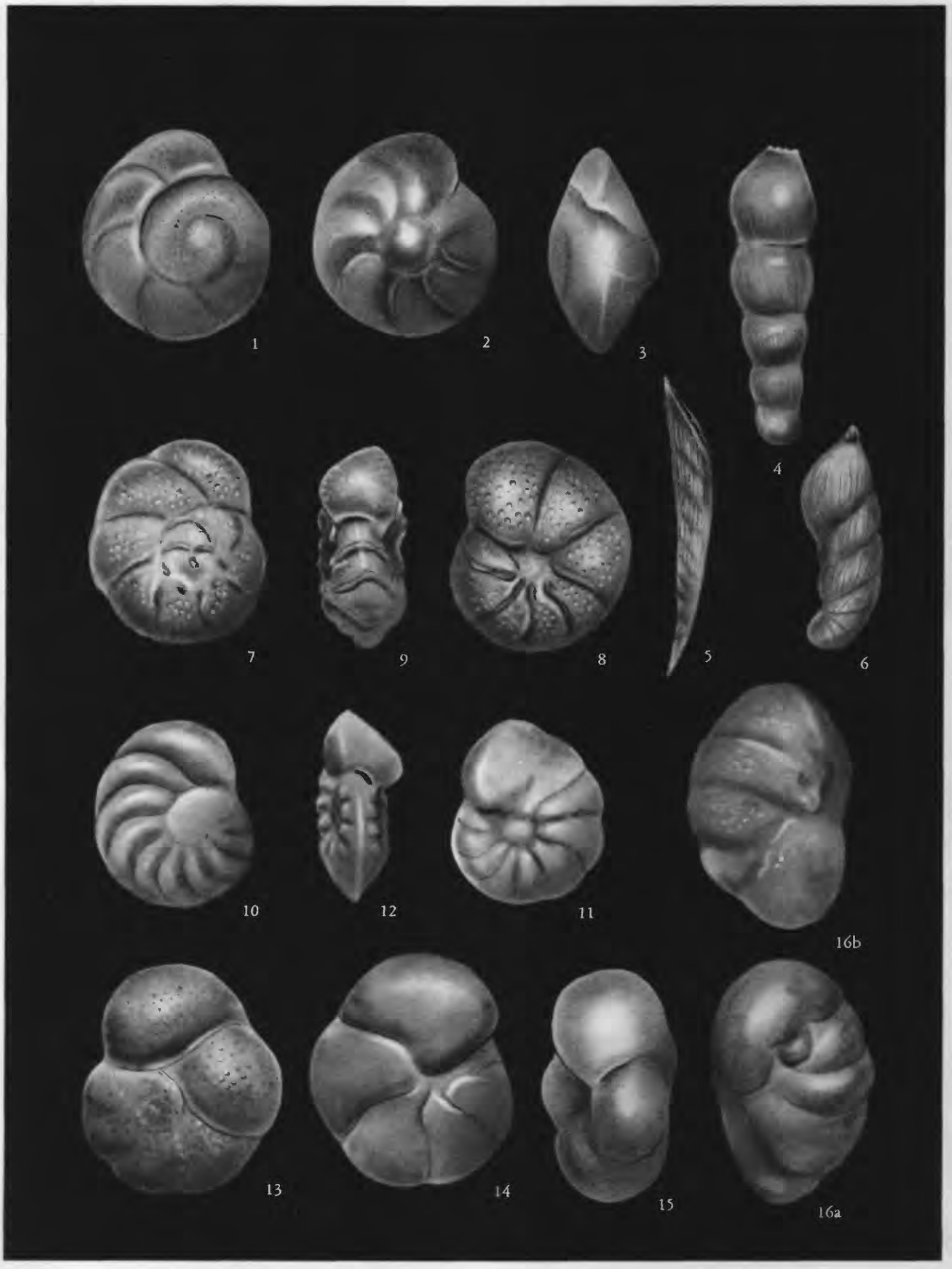
6. *Marginulina distincta* Cushman and Bermúdez (p. 18). (After Cushman and Bermúdez.) × 50. Holotype.

7–9. *Anomalina martinezensis* Cushman and Bermúdez (p. 64). (After Cushman and Bermúdez.) × 50. 7. Holotype, dorsal view. 8, 9. Paratypes. 8. Ventral view. 9. Peripheral view.

10–12. *Anomalina clementiana* (D'Orbigny) Franke var. *assimilis* Cushman and Bermúdez (p. 63). (After Cushman and Bermúdez.) × 70. 10. Holotype, dorsal view. 11, 12. Paratypes. 11. Ventral view. 12. Peripheral view.

13–15. *Anomalina cubana* Cushman and Bermúdez (p. 64). (After Cushman and Bermúdez.) × 55. 13. Holotype, dorsal view. 14, 15. Paratypes. 14. Ventral view. 15. Peripheral view.

16. *Valvulammina nassauensis* Applin and Jordan var. *cubana* Cushman and Bermúdez (p. 9). (After Cushman and Bermúdez.) × 30. Holotype. *a*, Dorsal view; *b*, ventral view.



VALVULINIDAE, LAGENIDAE, ANOMALINIDAE

PLATE 22

FIGURES 1–3. *Anomalina madrugaensis* Cushman and Bermúdez (p. 64). (After Cushman and Bermúdez.) × 65. 1. Holotype, ventral view. 2, 3, Paratypes. 2. Dorsal view. 3. Peripheral view.

4–6. *Boldia carinata* Cushman and Bermúdez (p. 65). (After Cushman and Bermúdez.) × 70. 4. Holotype, ventral view. 5, 6. Paratypes. 5. Dorsal view. 6. Peripheral view.

7–9. *Anomalina praespissiformis* Cushman and Bermúdez (p. 64). (After Cushman and Bermúdez.) × 95. 7. Holotype, dorsal view. 8, 9. Paratypes. 8. Ventral view. 9. Peripheral view.

10–12. *Boldia madrugaensis* Cushman and Bermúdez (p. 65). (After Cushman and Bermúdez.) × 45. 10. Holotype, dorsal view. 11, 12. Paratypes. 11. Ventral view. 12. Peripheral view.

13, 14. *Boldia cubensis* Cushman and Bermúdez (p. 65). (After Cushman and Bermúdez.) × 50. 13. Holotype. 14. Paratype. *a*, *a*, Dorsal views; *b*, *b*, ventral views; *c*, *c*, peripheral views.

ANOMALINIDAE

PLATE 23

FIGURE 1. *Boldia vandersluisi* Van den Bold (p. 65). (After Van den Bold.) × 27. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

2–4. *Valvulineria insueta* Cushman and Bermúdez (p. 51). (After Cushman and Bermúdez.) × 75. 2. Holotype, dorsal view. 3, 4. Paratypes. 3. Ventral view. 4. Peripheral view.

5. *Valvulineria madrugaensis* Cushman and Bermúdez (p. 51). (After Cushman and Bermúdez.) × 50. Holotype. *a*. Dorsal view; *b*, ventral view; *c*, peripheral view.

6–8. *Valvulineria extensa* Cushman and Bermúdez (p. 50). (After Cushman and Bermúdez.) × 70. 6. Holotype, ventral view. 7, 8. Paratypes. 7. Peripheral view. 8. Dorsal view.

9. *Eponides gratiosus* Cushman and Bermúdez (p. 53). (After Cushman and Bermúdez.) × 50. Holotype. *a*. Dorsal view; *b*, ventral view; *c*, peripheral view.

10. *Eponides vanbelleni* (Van den Bold) Cushman and Bermúdez (p. 53). (After Cushman and Bermúdez.) × 50. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

ROTALIIDAE, ANOMALINIDAE

PLATE 24

FIGURES 1–3. *Pseudoparrella madrugaensis* Cushman and Bermúdez (p. 58). (After Cushman and Bermúdez.) × 115. 1, 3. Paratypes. 1. Dorsal view. 3. Ventral view. 2. Holotype, peripheral view.

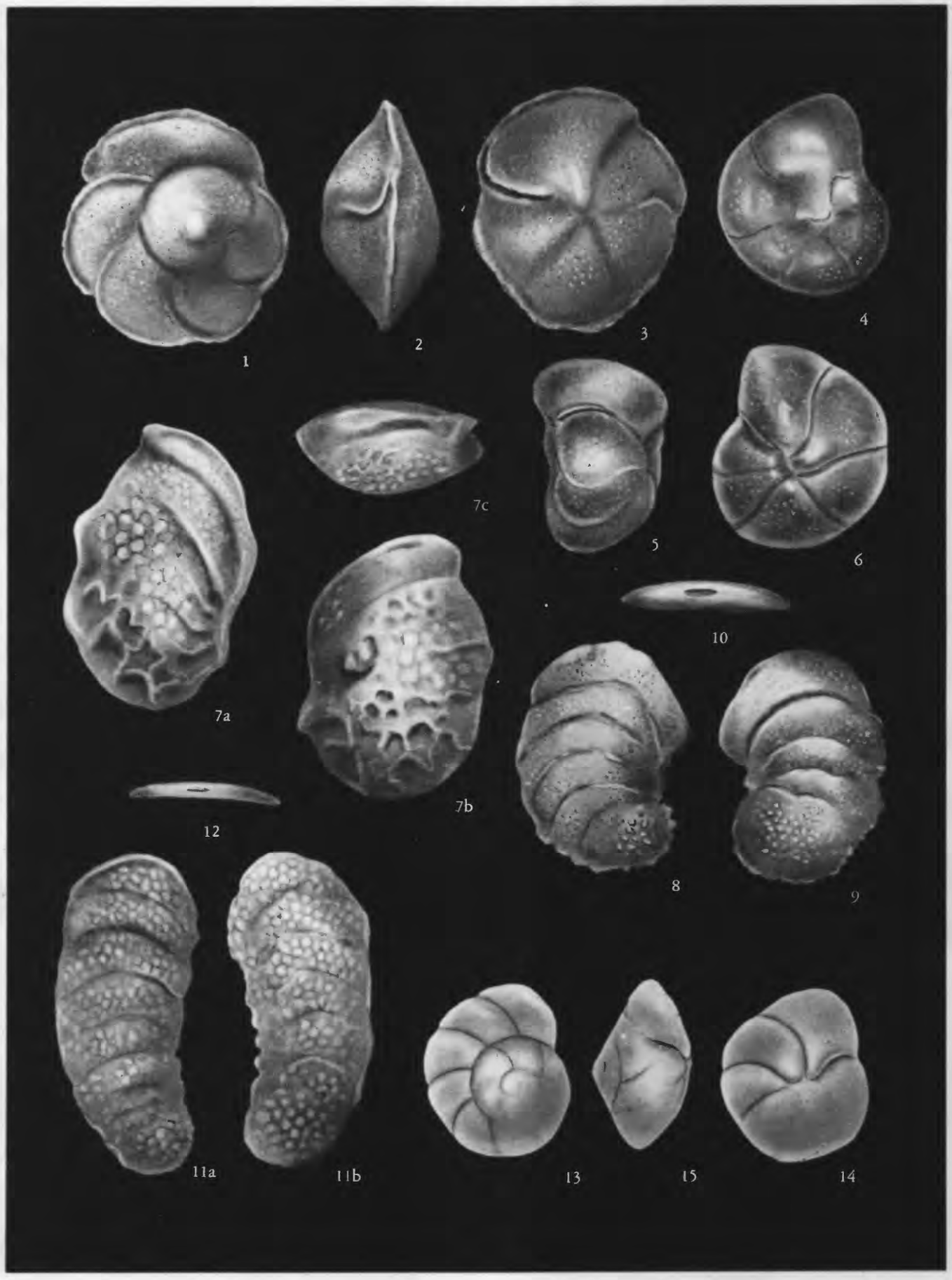
4–6. *Gyroidina madrugaensis* Cushman and Bermúdez (p. 52). (After Cushman and Bermúdez.) × 130. 4. Holotype, dorsal view. 5, 6, Paratypes. 5. Peripheral view. 6. Ventral view.

7. *Coleites pasionensis* Cushman and Bermúdez (p. 54). (After Cushman and Bermúdez.) × 50. Holotype. *a*, Dorsal view; *b*, ventral view; *c*, end view, showing aperture.

8–10. *Coleites guatemalensis* Cushman and Bermúdez (p. 54). (After Cushman and Bermúez.) × 50. 8. Holotype, dorsal view. 9, 10. Paratypes. 9. Ventral view. 10. Apertural view.

11, 12. *Coleites abuillotensis* Cushman and Bermúdez (p. 54). (After Cushman and Bermúdez.) × 56. 11. Holotype. *a*, Dorsal view; *b*, ventral view. 12. Paratype, apertural view.

13–15. *Globorotalia albeari* Cushman and Bermúdez (p. 61). (After Cushman and Bermúdez.) × 110. 13. Holotype, dorsal view. 14, 15. Paratypes. 14. Ventral view. 15. Peripheral view.



ROTALIIDAE, CASSIDULINIDAE, GLOBOROTALIIDAE