CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

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209. NEW SPECIES OF FORAMINIFERA FROM THE LOWER OLIGOCENE OF ALABAMA*

By JOSEPH A. CUSHMAN and WINNIE MCGLAMERY

The following species are placed on record as they seem to be new and of interest to workers on the Oligocene of the Gulf Coastal Plain region of the United States and adjacent areas. A paper dealing with the complete foraminiferal fauna of this section is nearly completed and will be published by the U. S. Geological Survey.

The section is from a highway cut in Sec. 17, T. 8N., R. 3W., 1.40 miles N. of Millry, Alabama. The section is as follows:

	Ft.	In.
Pliocene:		
Red sandy clay	10	
Oligocene:		
1. Greenish-gray sandy, fossiliferous clay	1	
2. Hard cream-colored sandy limestone		6
3. Greenish-gray fossiliferous clay with lime nodules	3	
4. Hard cream-colored, very fossiliferous, sandy limestone, carrying Bryozoa and *Lepidocyclina* sp., *Pecten* sp. frag.		6–8
5. Greenish-gray fossiliferous, sandy clay, with Bryozoa, *Lepidocyclina* sp., barnacle plates	2	
6. Hard cream-colored limestone in road ditch, with scattered glauconite, *Lepidocyclina* sp.	1	

DENTALINA PSEUDOINVOLVENS Cushman and McGlamery, n. sp. (Pl. 9, figs. 1, 2)

Test elongate, slender, slightly arcuate, very gently tapering,

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

Holotype (Cushman Coll. No. 25765) from bed 5 of section, 1.40 miles N. of Millry, Ala.

This species differs from the Cretaceous species *D. involvens* Cushman in the more separate and inflated chambers, deeper and more limbate sutures and less prominent costae. It is very similar to a form figured from the Miocene of Florida as *Dentalina* sp? (Florida State Geol. Survey Bull. 9, pl. 9, figs. 3, 4, 1932).

GLOBULINA ALABAMENSIS Cushman and McGlamery, n. sp. (Pl. 9, figs. 3 a, b)

Polymorphina spinosa CUSHMAN (not D'ORBIGNY), U. S. Geol. Survey Prof. Paper 129-F, 1922, pl. XXXI, fig. 5.

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

Holotype (Cushman Coll. No. 25815) from bed 3 of section, 1.40 miles N. of Millry, Ala.

This species differs from *Globulina gibba* d'Orbigny, var. *tuberculata* d'Orbigny in the much more distinctive spines and more elongate test, which is also slightly compressed.

NONION DECORATUM Cushman and McGlamery, n. sp. (Pl. 9, figs. 4 a, b)

Nonion advenum CUSHMAN and MCGLAMERY (part) (not CUSHMAN), U. S. Geol. Survey Prof. Paper 189-D, 1938, p. 106, pl. 24, fig. 23 (not 24).

Test planispiral, involute, periphery rounded, lobulate, umbilical area somewhat depressed but with a central boss; chambers very distinct, eight to ten in the adult whorl, slightly in-

flated, increasing rather evenly in size as added; sutures very distinct, deeply excavated, limbate, very slightly curved in the earlier stages, nearly straight and radial in the last-formed portion; wall mostly smooth, finely perforate, the inner portion of the sutures toward the umbilical region, and the central boss, ornamented with fine, granular projections; aperture low, elongate, at the base of the last-formed chamber. Length 0.40-0.45 mm.; breadth 0.30-0.40 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 25829) from bed 5 of the section, 1.40 miles N. of Millry, Ala.

This species differs from *N. advenum* Cushman in the more lobulate and more rounded periphery, less deeply excavated sutures, and fewer chambers.

The holotype has two supplementary chambers near the periphery between the last two chambers of the main coil, but this is entirely an accidental feature.

NONIONELLA OLIGOCENICA Cushman and McGlamery, n. sp. (Pl. 9, figs. 5 a-c)

Nonionella danvillensis CUSHMAN and MCGLAMERY (not HOWE and WALLACE), U. S. Geol. Survey Prof. Paper 189-D, 1938, p. 106, pl. 25, fig. 1.

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

Holotype (Cushman Coll. No. 25831) from bed 1 of section, 1.40 miles N. of Millry, Ala.

This species differs from *Nonionella danvillensis* Howe and Wallace in the less prominent umbo on the dorsal side, lack of the elongate projection on the ventral side and thinner test.

ANGULOGERINA HISPIDULA Cushman and McGlamery, n. sp. (Pl. 9, figs. 6 a, b)

Test elongate, about twice as long as broad, tapering, greatest width formed by the last whorl, early portion triangular in sec-

tion, angles in later portion broadly rounded; chambers distinct, later ones strongly inflated, increasing rapidly in size as added; sutures distinct, later ones strongly depressed; wall finely hispid, especially in the earlier portion; aperture terminal, elongate, with a distinct, collar-like lip. Length 0.35 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 25909) from bed 1 of section, 1.40 miles N. of Millry, Ala.

This species differs from *Angulogerina byramensis* (Cushman) in the more inflated chambers, more flaring shape, and the surface finely hispid instead of costate.

VIRGULINA ALABAMENSIS Cushman and McGlamery, n. sp. (Pl. 9, figs. 7 a, b)

Test elongate, somewhat compressed, about three times as long as broad, sides for the most part nearly parallel or decreasing in breadth toward the apertural end which is somewhat truncate, initial end triserial, bluntly pointed, periphery rounded; chambers numerous, very distinct, about three pairs of biserial ones in the adult, slightly inflated; sutures distinct, curved, slightly depressed; wall thin and nearly transparent, very finely perforate, smooth and polished; aperture rather large, comma-shaped, oblique, with a slight lip. Length 0.45-0.50 mm.; breadth 0.12-0.15 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 25854) from bed 5 of section, 1.40 miles N. of Millry, Ala.

This species differs from *Virgulina bramlettei* Galloway and Morrey in the shorter chambers, less coarsely perforate wall, and larger aperture.

This is probably the same as the species referred to *V. bramlettei* from Choctaw Bluff (Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189-D, 1938, p. 107, pl. 25, fig. 10), and probably also the same as that from the Meson, Oligocene of Mexico (Cushman, Special Publ. No. 9, Cushman Lab. Foram. Res., 1937, pl. 3, fig. 8).

DISCORBIS SUBPATELLIFORMIS Cushman and McGlamery, n. sp. (Pl. 9, figs. 8 a-c)

Discorbis patelliformis CUSHMAN (not H. B. BRADY), U. S. Geol. Survey Prof. Paper 133, 1923, p. 38, pl. 6, figs. 2-4.

Test plano-convex, dorsal side moderately but evenly convex, ventral side flattened or slightly concave, periphery slightly rounded without a keel; chambers distinct, five or six in the adult whorl, of uniform shape, very gradually and regularly in-

creasing in size as added, not inflated; sutures distinct, not depressed, those of the dorsal side strongly oblique, slightly curved, sigmoid on the ventral side; wall on the dorsal side smooth, finely perforate, on the ventral side with numerous, distinct, fine beads, more strongly developed in the ventral region but not arranged in any definite pattern; aperture, a low opening on the ventral border of the last-formed chamber. Diameter 0.30-0.35 mm.; height 0.10 mm.

Holotype (Cushman Coll. No. 25929) from bed 6 of section, 1.40 miles N. of Millry, Ala.

This species differs from *Discorbis patelliformis* H. B. Brady in the very flattened spire, sharp periphery, less definitely beaded ventral side, mostly confined to the umbilical region and not arranged in radial lines.

210. EOCENE FORAMINIFERA FROM SUBMARINE CORES OFF THE EASTERN COAST OF NORTH AMERICA*

By JOSEPH A. CUSHMAN

During the work of the Woods Hole Oceanographic Institution ship *Atlantis* in taking cores from off the Atlantic Coast of North America, two cores were found to have penetrated sediments of Eocene age. These two cores will be referred to in this paper as "Core 12-36" taken at a depth of 880 meters, N. Lat. 39° 50′; W. Long. 70° 58′, and "Core 21-38" taken at a depth of 1,565 meters, N. Lat. 38° 58′; W. Long. 72° 28.5′. The Eocene material in Core 12-36 was much richer in species than that in Core 21-38 but both have *Hantkenina alabamensis* Cushman, a typical upper Eocene species. The two faunas are somewhat unlike and evidently represent different conditions, as Core 21-38 is very rich in Radiolaria while in Core 12-36 they are very rare. The fauna represented in the two cores is very interesting in its relationships with other known Eocene material. It is an area far removed from

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outcrops of upper Eocene age, and so the correlations with such widely separated areas as Cuba, Venezuela, Mexico and California are unusually interesting. The fauna is described and figured here and some notes given on the distribution of the species elsewhere. A number of species are undescribed.

Family TEXTULARIIDAE

Genus VULVULINA d'Orbigny, 1826

VULVULINA ADVENA Cushman (Pl. 9, figs. 9, 10)

Vulvulina advena CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 32, pl. 4, figs. 9 *a*, *b*; vol. 8, 1932, p. 84, pl. 10, fig. 14; U. S. Geol. Survey Prof. Paper 181, 1935, p. 9, pl. 2, figs. 1 *a*, *b*.—BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 12, 1938, p. 26.

The types of this species are from the upper Eocene of Alabama, but it has also been recorded from the Eocene of Cuba. Few of the specimens show many uniserial chambers although several have three uniserial ones. In some respects it resembles *V. spinosa* Cushman, but a comparison with the types shows that our specimens should be placed with *V. advena*. The specimen figured by Nuttall as *V. spinosa* (Journ. Pal., vol. 9, 1935, p. 123, pl. 14, fig. 6) from the Eocene of Venezuela should also probably be placed under *V. advena*. The species is fairly common in Core 12-36 but rare in Core 21-38.

Family VERNEUILINIDAE

Genus PSEUDOCLAVULINA Cushman, 1936

PSEUDOCLAVULINA COCOAENSIS Cushman (Pl. 9, fig. 17)

Pseudoclavulina cocoaensis CUSHMAN, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 18, pl. 3, figs. 6 *a*, *b*; Special Publ. No. 7, 1937, p. 114, pl. 15, figs. 29-31.

Several specimens occurred in Core 21-38. Most of the specimens are immature. The types are from the upper Eocene of Alabama, and as in the type material our specimens show considerable variation in the roughness of the wall.

Family VALVULINIDAE

Genus GOËSELLA Cushman, 1933

GOËSELLA TRINITATENSIS Cushman (Pl. 9, fig. 16)

Goësella trinitatensis CUSHMAN, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 33, pl. 5, fig. 10; Special Publ. No. 8, 1937, p. 114, pl. 13, figs. 7, 8.

Specimens of this species are fairly common in Core 12-36. As will be seen from the figures, they seem to be identical with the Eocene species described from Trinidad.

Genus KARRERIELLA Cushman, 1933

KARRERIELLA HALKYARDI Cushman (Pl. 9, fig. 11)

Karreriella halkyardi CUSHMAN, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 36, pl. 5, figs. 16 *a*, *b*; Special Publ. No. 8, 1937, p. 124, pl. 14, fig. 33.

A single specimen from Core 12-36 has been compared with the types of *K. halkyardi* from the upper Eocene, Blue Marl, of Biarritz, France, and seems to be identical.

KARRERIELLA ARENASENSIS Cushman and Bermudez (Pl. 9, figs. 14, 15)

Karreriella arenasensis CUSHMAN and BERMUDEZ, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 5, pl. 1, figs. 20, 21.—CUSHMAN, Special Publ. No. 8, Cushman Lab. Foram. Res., 1937, p. 125, pl. 14, fig. 24.

A few specimens seem to be identical with this species from the Eocene of Cuba. They occur in both cores, but most of them are immature. The shorter, younger specimens resemble the figure given by Nuttall from the Eocene of Trinidad (Journ. Pal., vol. 9, 1935, pl. 14, fig. 5) referred by him to *Textularia martini* Pijpers.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

QUINQUELOCULINA EOCENICA Cushman, n. sp. (Pl. 9, figs. 12 a-c)

Test about twice as long as broad, one side strongly convex, opposite side nearly flat, periphery broadly rounded, basal end slightly projecting, rounded, apertural end very slightly extended, without a definite neck; chambers tubular or very slightly triangular in section, of uniform diameter in the adult, fairly distinct; sutures very slightly depressed, later ones distinct; wall finely arenaceous, with occasional larger grains, smoothly finished, surface matte; aperture rounded, terminal, without a definite neck. Length 0.45-0.55 mm.; breadth 0.23-0.28 mm.; thickness 0.20-0.25 mm.

Holotype (Cushman Coll. No. 26028) from Core 12-36, where it is abundant. It did not occur in material from the other core.

This species differs from *Quinqueloculina goodspeedi* Hanna and Hanna from the Eocene of Washington in the more elongate form and the slightly greater projection of the apertural end.

Genus MASSILINA Schlumberger, 1893

MASSILINA DECORATA Cushman (Pl. 9, fig. 13)

Massilina decorata CUSHMAN, U. S. Geol. Survey Prof. Paper 129-F, 1922, p. 143, pl. 34, fig. 7; Prof. Paper 133, 1923, p. 55.—CUSHMAN and G. D. HANNA, Proc. Calif. Acad. Sci., ser. 4, vol. 16, 1927, p. 224. —COLE and PONTON, Bull. 5, Florida State Geol. Survey, 1930, p. 29, pl. 10, fig. 5.—HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 20, pl. 2, fig. 6.—CUSHMAN and MCMASTERS, Journ. Pal., vol. 10, 1936, p. 510, pl. 74, fig. 8.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 13, pl. 3, figs. 14-16.

Specimens referable to this species are very rare in the material from Core 12-36, and are not well preserved. The species has been recorded from the Oligocene and upper Eocene of the Gulf Coastal Plain region of the United States, and also from the Eocene of California.

Family LAGENIDAE

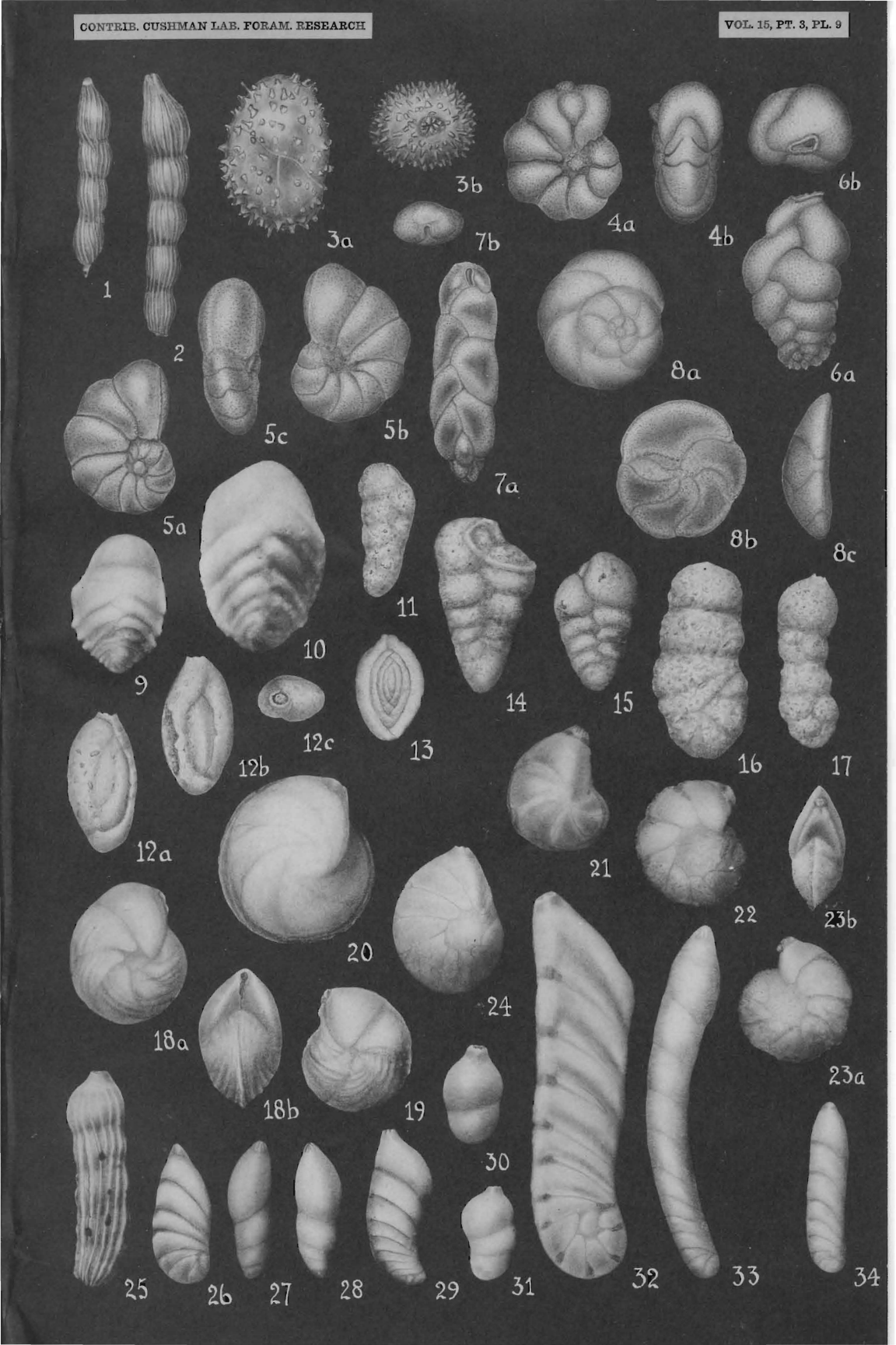
Genus ROBULUS Montfort, 1808

ROBULUS LIMBOSUS (Reuss) (Pl. 9, fig. 20)

Robulina limbosa REUSS, Sitz. Akad. Wiss. Wien, vol. 48, pt. 1, 1863

EXPLANATION OF PLATE 9

FIGS. 1, 2. *Dentalina pseudoinvolvens* Cushman and McGlamery, n. sp. × 48. 1, Holotype. 2, Paratype. 3. *Globulina alabamensis* Cushman and McGlamery, n. sp. × 45. *a*, front view; *b*, apertural view. 4. *Nonion decoratum* Cushman and McGlamery, n. sp. × 60. *a*, side view; *b*, apertural view. 5. *Nonionella oligocenica* Cushman and McGlamery, n. sp. × 60. *a*, *b*, opposite sides; *c*, apertural view. 6. *Angulogerina hispidula* Cushman and McGlamery, n. sp. × 85. *a*, front view; *b*, apertural view. 7. *Virgulina alabamensis* Cushman and McGlamery, n. sp. × 80. *a*, front view; *b*, apertural view. 8. *Discorbis subpatelliformis* Cushman and McGlamery, n. sp. × 85. *a*, dorsal view; *b*, ventral view; *c*, apertural view. 9, 10. *Vulvulina advena* Cushman. × 33. 11. *Karreriella halkyardi* Cushman. × 25. 12. *Quinqueloculina eocenica* Cushman, n. sp. × 38. *a*, *b*, opposite sides; *c*, apertural view. 13. *Massilina decorata* Cushman. × 45. 14, 15. *Karreriella arenasensis* Cushman and Bermudez. × 45. 16. *Goësella trinitatensis* Cushman. × 22. 17. *Pseudoclavulina cocoaensis* Cushman. × 45. 18, 19. *Robulus submarinus* Cushman, n. sp. × 30. 18, Holotype. *a*, side view; *b*, apertural view. 19, Paratype. 20. *Robulus limbosus* (Reuss). × 15. 21. *Robulus limbosus* (Reuss), var. *hockleyensis* (Cushman and Applin). × 30. 22, 23. *Robulus atlantisae* Cushman, n. sp. × 40. 23, Holotype. *a*, side view; *b*, apertural view. 22, Paratype. 24. *Lenticulina convergens* (Bornemann). × 27. 25. *Marginulina cocoaensis* Cushman. × 30. 26. *Marginulina triangularis* d'Orbigny, var. *panamensis* Coryell and Embich (?). × 48. 27, 28. *Marginulina eximia* Neugeboren (?). × 40. 29. *Marginulina* sp. (?). × 27. 30, 31. *Marginulina subbullata* Hantken. × 25. 32. *Marginulina gladius* Philippi. × 53. 33, 34. *Marginulina tenuis* Bornemann. × 50.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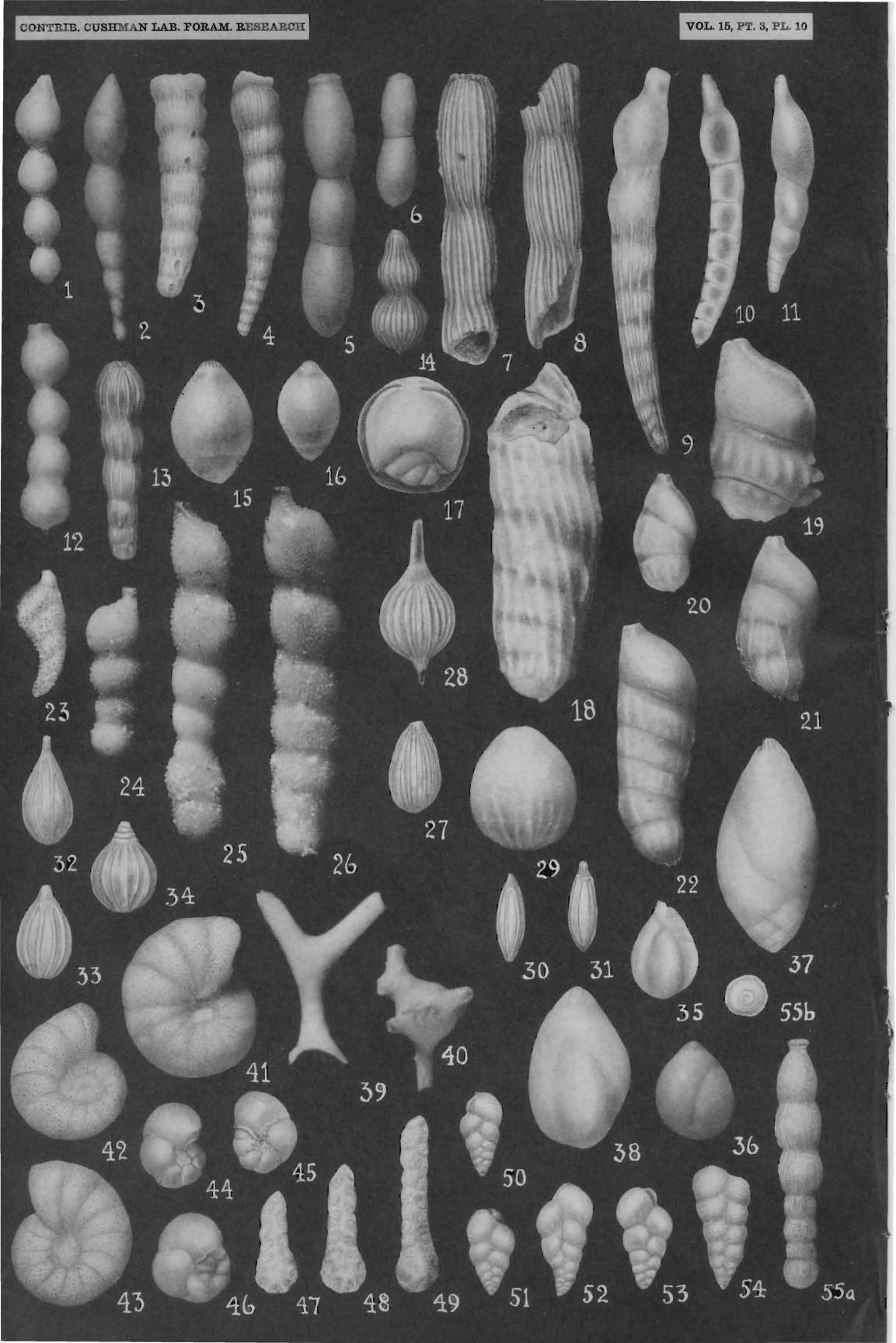
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(1864), p. 55, pl. 6, figs. 69 *a*, *b*.—HANTKEN, A. magy. kir. földt. int. évkönyve, vol. 4, 1875 (1876), p. 48, pl. 6, fig. 11; Jahrb. k. ungar. geol. Anstalt Mitt., vol. 4, 1875 (1881), p. 57, pl. 6, fig. 11.

Robulus limbosus ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 2, figs. 1 *a*, *b*.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 16, pl. 6, fig. 5.

Specimens referable to this species are fairly common in the material from Core 12-36. It is recorded from the upper Eocene of Alabama and Mississippi as well as from the upper Eocene of Europe.

ROBULUS LIMBOSUS (Reuss), var. HOCKLEYENSIS (Cushman and Applin)
(Pl. 9, fig. 21)

Cristellaria limbosa (REUSS), var. *hockleyensis* CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol,, vol. 10, 1926, p. 171, pl. 8, figs. 3, 4.

Robulus limbosus (REUSS), var. *hockleyensis* ELLISOR, l. c. vol. 17, No. 11, 1933, pl. 1, figs. 11 *a*, *b*.

A number of specimens in Core 12-36 are apparently referable to this variety known from various localities in the Jackson Eocene from North Carolina to Texas.

ROBULUS SUBMARINUS Cushman, n. sp. (Pl. 9, figs. 18, 19)

Test close coiled, planispiral, completely involute, periphery very slightly keeled; chambers 6 or 7 in the adult coil, not inflated; sutures rather indistinct, very slightly curved, tangential;

EXPLANATION OF PLATE 10

FIGS. 1. *Dentalina* cf. *soluta* Reuss. × 27. 2. *Dentalina* sp. (?) A. × 35. 3, 4. *Dentalina* sp. (?) B. × 25. 5, 6. *Dentalina* sp. (?) C. × 35. 7, 8. *Dentalina* sp. (?) D. × 25. 9. *Dentalina* cf. *pungens* Reuss. × 50. 10, 11. *Dentalina nasuta* Cushman, n. sp. × 50. 10, Holotype. 11, Paratype. 12. *Nodosaria cookei* Cushman. × 50. 13. *Nodosaria* sp. (?) B. × 50. 14. *Nodosaria* sp. (?) A. × 40. 15, 16. *Pseudoglandulina laevigata* (d'Orbigny). × 27. 17. *Lingulina cubensis* Cushman and Bermudez. × 40. 18-22. *Vaginulina deprofunda* Cushman, n. sp. × 27. 22, Holotype. 18-21, Paratypes. 23-26. *Vaginulina atlantisae* Cushman, n. sp. × 30. 26, Holotype. 23-25, Paratypes. 23, Microspheric. 24-26, Megalospheric. 27. *Lagena* cf. *costata* (Williamson). × 60. 28. *Lagena sulcata* (Walker and Jacob), var. *apiculata* Cushman. × 55. 29. *Lagena* sp. (?) × 50. 30, 31. *Lagena* sp. (?) × 60. 32-34. *Lagena acuticosta* Reuss. × 53. 35. *Guttulina irregularis* (d'Orbigny). × 50. 36. *Globulina inaequalis* Reuss. × 30. 37. *Pyrulina* cf. *cylindroides* (Roemer). × 27. 38. *Globulina münsteri* (Reuss). × 60. 39, 40. *Ramulina* (?) sp. (?) × 33. 41-43. *Nonion chapapotense* Cole. × 60. 44-46. *Nonion micrum* Cole. × 53. 47-49. *Spiroplectoides attenuata* Cushman, n. sp. × 40. 49, Holotype. 47, 48. Paratypes. 50-53. *Gümbelina venezuelana* Nuttall. × 50. 54. *Gümbelina cubensis* Palmer. × 85. 55. *Nodogenerina sculpturata* Cushman, n. sp. × 50. *a*, front view; *b*, apertural view.

wall in the early stages nearly covered by the ornamentation, consisting of several costae starting nearly parallel to the periphery on each chamber, then toward the apertural end curving away from the periphery, in later chambers with the costae becoming obsolescent and confined to the peripheral portion of the chamber, in the last-formed ones smooth and polished; aperture slightly protuberant, radiate. Diameter 0.75-0.90 mm.; thickness 0.55-0.60 mm.

Holotype (Cushman Coll. No. 26038) from Core 12-36.

The species differs from *Robulus costatus* (Fichtel and Moll) in its less prominent sutures and the costae which have a different arrangement, and finally die out.

ROBULUS ATLANTISAE Cushman, n. sp. (Pl. 9, figs. 22, 23)

Test comparatively small, planispiral, close coiled, flattened in the umbonal region, the periphery acute but not truly keeled; chambers somewhat indistinct, about 8 in the adult coil, of uniform shape and size, increasing very gradually in size as added, not inflated; sutures tangential, slightly limbate, not depressed, only those of the last portion distinct; wall peculiarly roughened, with a crystalline texture, especially developed toward the periphery; aperture radiate, distinctly projecting. Diameter 0.45-0.55 mm.; thickness 0.25-0.30 mm.

Holotype (Cushman Coll. No. 26043) from Core 12-36 where it is fairly common.

In some respects this species resembles *Robulus budensis* (Hantken), but the aperture is distinctly protruding, the sides flattened or sometimes slightly concave, and the surface has a peculiar, roughened appearance.

Genus LENTICULINA Lamarck, 1804

LENTICULINA CONVERGENS (Bornemann) (Pl. 9, fig. 24)

Cristellaria convergens BORNEMANN, Zeitschr. Deutsch. geol. Gesell., vol. 7, 1855, p. 327, pl. 13, figs. 16, 17.

Lenticulina convergens CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 17, pl. 6, figs. 4 *a*, *b*.

A few specimens from Core 12-36 seem to be referable to this species.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA GLADIUS Philippi (Pl. 9, fig. 32)

Marginulina gladius PHILIPPI, Beitr. Kennt. Nordwest Deutschlands, 1843, p. 40, pl. 1, fig. 37.

The single specimen here figured from Core 12-36 is strikingly like the figure given by Philippi from Germany.

MARGINULINA COCOAENSIS Cushman (Pl. 9, fig. 25)

Marginulina cocoaensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 3, 1925, p. 67, pl. 10, figs. 9, 10.—HOWE and WALLACE, Louisiana Dept. Conservation Geol. Bull. 2, 1932, p. 33, pl. 7, fig. 5.—ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 6, fig. 6.—CUSHMAN, U. S. Geol. Survey Prof. Paper 191, 1935, p. 18, pl. 7, figs. 6, 7.

Specimens that are typical occur in the material from Core 12-36, although some of them are perhaps tending toward the var. *venezuelana* described by Nuttall from the Eocene of Venezuela. The typical form of the species is known from the upper Eocene of the Coastal Plain region from South Carolina to Mississippi.

MARGINULINA SUBBULLATA Hantken (Pl. 9, figs. 30, 31)

Marginulina subbullata HANTKEN, A. magy. kir. földt. int. évkönyve, vol. 4, 1875 (1876), p. 39, pl. 4, figs. 9, 10; Mitth. Jahrb. ungar. geol. Anstalt, vol. 4, 1875 (1881), p. 46, pl. 4, figs. 9, 10.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 3, 1925, p. 62, pl. 10, figs. 3 *a*, *b*.—CUSHMAN and G. D. HANNA, Proc. Calif. Acad. Sci., ser. 4, vol. 16, 1927, p. 216, pl. 13, fig. 11.—COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 14, pl. 5, fig. 10.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 85, pl. 12, fig. 20.—NUTTALL, Journ. Pal., vol. 9, 1935, p. 125, pl. 14, fig. 16.—CORYELL and EMBICH, l. c., vol. 11, 1937, p. 297, pl. 42, fig. 2.

Test composed of a very few chambers, the earlier ones, especially in the microspheric form, showing a partial coil; chambers increasing rapidly in size, the last two in the adult nearly spherical, making up most of the test; sutures distinct, depressed; wall smooth; aperture slightly projecting, usually at one side of the center of the end, radiate.

The species was described from the upper Eocene, "*Clavulina-Szaboi* beds" of Hungary. It is widely recorded, but only those records which have typical figures are given above. They include records from the upper Eocene and lower Oligocene of Venezuela, Mexico, Panama and California. It is also recorded from the Oligocene and Eocene of Cuba. Our specimens are all from Core 12-36.

MARGINULINA TENUIS Bornemann (Pl. 9, figs. 33, 34)

Marginulina tenuis BORNEMANN, Zeitschr. deutsch. geol. Gesell., vol. 7, 1855, p. 326, pl. 13, fig. 14.

Test very elongate, slightly curved, especially in the later half, the earlier portion compressed, later circular in transverse section; chambers of the early portion very oblique and low, overlapping, increasing rapidly in height in the adult, the final ones inflated, longer than the diameter; sutures not much depressed, somewhat indistinct, very oblique in the early portion, nearly transverse in the adult; wall smooth; aperture nearly central, radiate. Length up to 1.25 mm.; diameter of adult 0.18 mm.

This species was described from the Oligocene of Hermsdorf, Germany. Our specimens are from Core 21-38, and very closely resemble topotypes in our collection.

MARGINULINA EXIMIA Neugeboren (?) (Pl. 9, figs. 27, 28)

Marginulina eximia NEUGEBOREN, Verh. Mitt. Siebenburg. Ver. Nat., Jahrb. 2, 1851, p. 129, pl. 4, fig. 17.

The figured specimen somewhat resembles Neugeboren's figure of this species, but the specimens are not in sufficient numbers to give the full characters or to make certain that these are adult specimens. They are from Core 12-36.

MARGINULINA TRIANGULARIS d'Orbigny, var. PANAMENSIS Coryell and Embich (?) (Pl. 9, fig. 26)

A very few specimens from Core 21-38 somewhat resemble the above form described from the upper Eocene of Panama.

MARGINULINA sp. (?) (Pl. 9, fig. 29)

The single specimen here figured is from Core 12-36. It somewhat remotely resembles the form described by Howe and Wallace as *Marginulina triangularis* d'Orbigny, var. *danvillensis*, but is evidently not identical.

Genus DENTALINA d'Orbigny

DENTALINA cf. SOLUTA Reuss (Pl. 10, fig. 1)

Fragmentary specimens of a smooth species resemble that of Reuss described from the Oligocene of Hermsdorf, Germany. Hantken records it from the upper Eocene of Hungary, and it is recorded by Halkyard from the upper Eocene, Blue marl, of Biarritz, France.

DENTALINA cf. PUNGENS Reuss (Pl. 10, fig. 9)

This form with its oblique costae somewhat resembles Reuss'

species, especially the form referred to it from the upper Eocene of Hungary by Hantken.

DENTALINA NASUTA Cushman, n. sp. (Pl. 10, figs. 10, 11)

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 0.15-0.25 mm.

Holotype (Cushman Coll. No. 26067) from Core 12-36.

This species differs from *Dentalina jacksonensis* (Cushman and Applin) in the less inflated and more elongate chambers and the very elongate, apertural extension of the last-formed chamber.

DENTALINA sp. (?) A (Pl. 10, fig. 2)

A slender form with pyriform chambers, more elongate than in *D. soluta* occurred very rarely in material from Core 21-38.

DENTALINA sp. (?) B (Pl. 10, figs. 3, 4)

The figured specimens from Core 12-36 are the best obtained from this material, but fail to show the apertural characters. The walls are peculiarly ornamented with somewhat twisted costae, often breaking up into a semi-spinose character. It is not easily identified with any described species.

DENTALINA sp. (?) C (Pl. 10, figs. 5, 6)

The two figured specimens show the early chambers of a species with a very large proloculum, but with the later chambers missing. From the broken apertures it is impossible to tell whether this should be placed under *Dentalina* or *Ellipsonodosaria*.

DENTALINA sp. (?) D (Pl. 10, figs. 7, 8)

Fragments of a large species of the form figured occurred in the material from Core 12-36. The costae are numerous and

slightly spiral. Neither the apertural nor apical ends were found.

Genus NODOSARIA Lamarck, 1812

NODOSARIA COOKEI Cushman (Pl. 10, fig. 12)

Nodosaria cookei CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 9, pl. 1, fig. 21; U. S. Geol. Survey Prof. Paper 181, 1935, p. 22, pl. 9, fig. 1.

A single specimen from Core 12-36 seems identical with this species described from the upper Eocene, Ocala limestone, of Alabama. The chambers are well separated, and the surface is finely hispid.

NODOSARIA sp. (?) A (Pl. 10, fig. 14)

The single specimen figured is from Core 12-36. It evidently is a young, extremely megalospheric form, but more material is needed to allow a specific determination.

NODOSARIA sp. (?) B (Pl. 10, fig. 13)

A very few specimens of this species, mostly broken, were obtained from Core 12-36. The costae are few in comparison with the preceding, and the two evidently belong to different species, but more material is necessary to determine this.

Genus PSEUDOGLANDULINA Cushman, 1929

PSEUDOGLANDULINA LAEVIGATA (d'Orbigny) (Pl. 10, figs. 15, 16)

Nodosaria (Glandulina) laevigata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 252, pl. 10, figs. 1-3.

A number of specimens from Core 12-36 seem to belong to this species. The early stages are apparently not biserial, the wall is smooth and polished, and the aperture radiate.

Genus LINGULINA d'Orbigny, 1826

LINGULINA CUBENSIS Cushman and Bermudez (Pl. 10, fig. 17)

Lingulina cubensis CUSHMAN and BERMUDEZ, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 11, pl. 1, fig. 38.

A few specimens from Core 12-36 have been compared with the types of this species from the upper Eocene of Cuba, and seem to be identical.

Genus VAGINULINA d'Orbigny, 1826

VAGINULINA DEPROFUNDA Cushman, n. sp. (Pl. 10, figs. 18-22)

Test elongate, slightly compressed, early portion, especially in

the microspheric form, showing traces of coiling, inner margin keeled, the keel sometimes irregularly toothed; chambers distinct, only 6 or 7 in the megalospheric adult, slightly inflated, of rather uniform shape and size in the adult, increasing only slightly in size as added; sutures distinct, moderately oblique and slightly curved, usually not depressed, somewhat limbate; wall ornamented by a few, slightly oblique, longitudinal costae, independent of the sutures, the ventral keel sometimes ending in a blunt spine at the initial end; aperture at the dorsal margin, slightly projecting, radiate. Length up to 2.10 mm.; breadth 0.60-0.75 mm.; thickness 0.25-0.40 mm.

Holotype (Cushman Coll. No. 26082) from Core 12-36.

This species differs from *Vaginulina brukenthali* Neugeboren in the less compressed test, ventral instead of dorsal keel, fewer chambers, and less oblique sutures.

VAGINULINA ATLANTISAE Cushman, n. sp. (Pl. 10, figs. 23-26)

Test elongate, in the microspheric form somewhat laterally compressed, curved, rapidly increasing in breadth, megalospheric form of nearly uniform diameter, little or not at all compressed, not curved, adult circular in section; chambers distinct, inflated in the megalospheric form, overlapping, in the microspheric form with the early chambers compressed and not inflated; sutures in the microspheric form strongly oblique, not depressed, in the megalospheric form only slightly oblique, strongly depressed; wall ornamented with short, stout spines covering the entire surface, with a slight tendency to be arranged in longitudinal lines; aperture radiate, with a short, cylindrical neck at the periphery of the dorsal side. Length of megalospheric form up to 2.00 mm.; diameter 0.40-0.50 mm.

Holotype (Cushman Coll. No. 26085) from Core 12-36.

This species is somewhat like that referred to *Marginulina aculeata* Neugeboren from the Miocene of Buff Bay, Jamaica (Cushman and Jarvis, Journ. Pal., vol. 4, 1930, p. 358, pl. 32, fig. 11), but our Eocene species is not coiled at the base and is not flattened as in the Miocene form. Microspheric specimens are rare, but the megalospheric form is fairly common.

Genus LAGENA Walker and Jacob, 1798

LAGENA ACUTICOSTA Reuss (Pl. 10, figs. 32-34)

Specimens from both cores may be placed under this species.

They are somewhat variable, but have a few well developed, sharp costae raised well above the surface.

LAGENA cf. COSTATA (Williamson) (Pl. 10, fig. 27)

The figured specimen from Core 21-38 resembles Williamson's species, but not enough specimens were obtained to give an idea of its possible variation.

LAGENA SULCATA (Walker and Jacob), var. APICULATA Cushman (Pl. 10, fig. 28)

Lagena sulcata, apiculate forms, H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 58, figs. 4, 17(?).

Lagena sulcata (WALKER and JACOB), var. *apiculata* CUSHMAN, Bull. 71, U. S. Nat. Mus., vol. 56, 1919, p. 609; Bull. 100, l. c., vol. 4, 1921, p. 180; Bull. 104, l. c., pt. 4, 1923, p. 58, pl. 11, fig. 2.

This Eocene form from Core 12-36 is very similar to Recent specimens, and seems to belong to this variety. Although broken, there is a very definite, large spine at the basal end.

LAGENA sp. (?) (Pl. 10, fig. 29)

The form figured has a rounded test with distinct costae confined to the basal part of the test. These forms occur in Core 12-36 only.

LAGENA sp. (?) (Pl. 10, figs. 30, 31)

The small elongate forms figured are from Core 21-38. They somewhat resemble *Lagena gracilis* (Williamson).

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1839

GUTTULINA IRREGULARIS (d'Orbigny) (Pl. 10, fig. 35)

(For references to this species see Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 24.)

This is a very widely distributed species, and is common both in the lower Oligocene and Eocene of the Coastal Plain region of the United States. It is recorded from the upper Eocene of North Carolina, Georgia, Florida, Alabama and Mississippi. Our specimens are from Core 12-36.

Genus GLOBULINA d'Orbigny, 1826

GLOBULINA INAEQUALIS Reuss (Pl. 10, fig. 36)

(For references to this species see Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 26.)

The only Eocene records for this species from the Coastal Plain region are from South Carolina and Texas, and it is rare. In our material it occurred sparingly in Core 12-36.

GLOBULINA MÜNSTERI (Reuss) (Pl. 10, fig. 38)

(For references to this species see Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 27.)

There are records for this species from the upper Eocene of Georgia and Alabama. Our specimens are from Core 12-36.

Genus PYRULINA d'Orbigny, 1826

PYRULINA cf. CYLINDROIDES (Roemer) (Pl. 10, fig. 37)

Specimens from Core 12-36 seem referable to Roemer's species. According to the records, this is a long ranging species, recorded from the upper Eocene of Trinidad, but not from the Coastal Plain region of the United States.

Genus RAMULINA Rupert Jones, 1875

RAMULINA (?) sp. (?) (Pl. 10, figs. 39, 40)

The specimens from Core 12-36 are figured for reference. They may belong to *Ramulina* or may be only fistulose portions of some other of the Polymorphinidae.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION CHAPAPOTENSE Cole (Pl. 10, figs. 41-43)

Nonion chapapotensis COLE, Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 210(10), pl. 1, figs. 18, 19.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 30, pl. 11, figs. 9-13; Prof. Paper 191, 1939, p. 6, pl. 2, figs. 1-3.

Specimens referable to this species occur in both cores, but are more numerous and more typical in Core 12-36. The species was originally described from the upper Eocene of Mexico, and is recorded from the upper Eocene of Georgia, Alabama, and Texas.

NONION MICRUM Cole (Pl. 10, figs. 44-46)

Nonion micrum COLE, Bull. Amer. Pal., vol. 14, No. 51, 1928, p. 22, pl. 5, fig. 12; vol. 14, No. 53, 1928, p. 211.—WEINZIERL and APPLIN, Journ. Pal., vol. 3, 1929, p. 400, pl. 43, figs. 6 *a-c*.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 30, pl. 11, figs. 14, 15; Prof. Paper 191, 1939, p. 5, pl. 1, figs. 20-22.

Specimens apparently identical with this species described from the Eocene of Mexico and recorded from the Eocene of

Texas occur in considerable numbers in the material from Core 12-36, but not in the other core.

Genus ELPHIDIUM Montfort, 1808

ELPHIDIUM sp. (?)

Poorly preserved specimens from Core 21-38 evidently belong to this genus, but cannot be specifically identified.

Family HETEROHELICIDAE

Genus SPIROPLECTOIDES Cushman, 1927

SPIROPLECTOIDES ATTENUATA Cushman, n. sp. (Pl. 10, figs. 47-49)

Test small, slender, much elongated, early portion planispirally coiled, broader and thicker than the succeeding biserial portion, periphery subacute but not keeled; chambers distinct, proloculum in the megalospheric form making the thickest portion of the entire test, followed by 7 or 8 chambers close coiled about it but not covering the center of the proloculum, adult chambers biserial, increasing slightly in height as added, consisting of as many as 8 or 9 pairs; sutures distinctly limbate but not raised, tangential in the coiled portion, oblique in the biserial portion forming an angle of less than 45° with the horizontal; wall calcareous, fairly smooth, but coarsely and conspicuously perforate; aperture elongate, in the terminal face of the last-formed chamber. Length up to 0.50 mm.; breadth 0.10-0.15 mm.; thickness 0.05-0.07 mm.

Holotype (Cushman Coll. No. 26110) from Core 21-38 where the species was rather rare. It was not found in the other core.

This species differs from *Spiroplectoides rosula* (Ehrenberg) which it most closely resembles, in the larger number of chambers in the coiled portion in our species and the somewhat lower chambers in the biserial portion.

Genus GÜMBELINA Egger, 1899

GÜMBELINA VENEZUELANA Nuttall (Pl. 10, figs. 50-53)

Gümbelina venezuelana NUTTALL, Journ. Pal., vol. 9, 1935, p. 126, pl. 15, figs. 2-4.

Nuttall described this species from the upper Eocene of Venezuela. Our specimens have been compared with the holotype and paratypes of Nuttall's species, and are identical. They also resemble some of the smooth Upper Cretaceous species in general appearance, but differ in details. This is one of the

species that definitely connects this submarine Eocene with the upper Eocene of Venezuela. It was found in Core 12-36 only.

GÜMBELINA CUBENSIS Palmer (Pl. 10, fig. 54)

Gümbelina cubensis PALMER, Mém. Soc. Cubana Hist. Nat., vol. 8, 1934, p. 74, text figs. 1-6.—PALMER and BERMUDEZ, l. c., vol. 10, 1936, p. 284.—BERMUDEZ, l. c., vol. 12, 1938, p. 11.

Our specimens have been compared with cotypes of this species kindly furnished by Mrs. Palmer, and seem to be identical. The species has been recorded from the upper Eocene and lower Oligocene of Cuba.

A normal specimen is figured, but there are others that show an irregular triserial arrangement in the last chambers. These are invariably longer than the typical ones, but have the same early stage and coarsely perforate wall.

Genus GÜMBELITRIA Cushman, 1933

GÜMBELITRIA sp. (?)

A single small specimen from Core 21-38 very definitely belongs to this genus.

Genus NODOGENERINA Cushman, 1927

NODOGENERINA SCULPTURATA Cushman, n. sp. (Pl. 10, figs. 55 a, b)

Test elongate, uniserial, straight, circular in transverse section; chambers distinct in the megalospheric form with the chambers following the proloculum reduced in size, then larger in the adult, in the microspheric form regularly tapering, inflated, somewhat overlapping, pyriform; sutures distinct, depressed, at right angles to the elongate axis; wall ornamented by very fine, raised, longitudinal lines, each slightly erose at its outer edge; aperture circular, terminal, with a very short, cylindrical neck and slightly flaring lip. Length 0.80-1.00 mm.; diameter 0.12-0.18 mm.

Holotype (Cushman Coll. No. 26120) from Core 21-38. There are other specimens from Core 12-36.

This species differs from *Nodogenerina laevis* Cushman and Bermudez from the upper Eocene of Cuba in the fine ornamentation of the test, the shorter, more inflated chambers, and much shorter neck.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA CORRUGATA Cushman and Siegfus

Bulimina corrugata CUSHMAN and SIEGFUS, Contr. Cushman Lab. Foram. Res., vol. 11, 1935, p. 92, pl. 14, figs. 7 *a*, *b*.

The types of this species are from the Eocene, Kreyenhagen shale, of California. Our specimens are all from Core 12-36, and agree well with the types.

BULIMINA DENTICULATA Cushman and Parker

Bulimina denticulata CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 42, pl. 7, figs. 7, 8.

Specimens which seem identical with this species occur in both cores. The types are from the Paleocene, Martinez shale, of California.

BULIMINA TARDA Parker and Bermudez

Bulimina tarda PARKER and BERMUDEZ, Journ. Pal., vol. 11, 1937, p. 514, pl. 58, figs. 6 *a-c*.—BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 11, No. 5, 1937, p. 342.

This species has been known previously only from the upper Eocene of Cuba. Specimens from both cores have been compared with the types, and are apparently identical.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA SUBMARINA Cushman, n. sp. (Pl. 11, figs. 8, 9)

Test 2 to 2½ times as long as broad, somewhat compressed, periphery subacute to bluntly rounded; chambers distinct, 6 or 7 pairs, increasing rapidly in height and size as added, very slightly overlapping, those of the adult higher than broad, slightly inflated in the later portion; sutures distinct, depressed, the inner end very strongly curved; wall unornamented, distinctly perforate; aperture, an elongate but rather broad opening at the inner margin of the last-formed chamber. Length 0.30-0.35 mm.; breadth 0.15-0.18 mm.; thickness 0.05-0.07 mm.

Holotype (Cushman Coll. No. 26126) from Core 12-36.

This species somewhat resembles *Bolivina bierigi* Palmer and Bermudez from the Miocene (?) of Cuba, but the chambers of that species are not so regular, the sutures not so definite, and the border is spinose. It also resembles slightly *B. capdevilensis*

BOLIVINA ATLANTISAE Cushman, n. sp. (Pl. 11, figs. 6, 7)

Cushman and Bermudez, from the Eocene of Cuba, but that is a shorter, broader form with raised costae.

Test small, distinctly tapering, about twice as long as broad, rhomboid in transverse section, periphery subacute; chambers distinct, numerous, low and strongly oblique, increasing only slightly in height as added; sutures strongly limbate, raised and thickened, increasingly oblique toward the apertural end; wall unornamented; aperture elongate. Length 0.25-0.30 mm.; breadth 0.12-0.15 mm.; thickness 0.04-0.05 mm.

Holotype (Cushman Coll. No. 26130) from Core 21-38.

This species differs from *Bolivina tectiformis* Cushman from the Alazan clays of Mexico in the unornamented surface, more tapering test, and lower chambers.

Genus BIFARINA Parker and Jones, 1872

BIFARINA ATLANTISAE Cushman, n. sp. (Pl. 11, figs. 10 a, b)

Test small, elongate, slender, 4 or 5 times as long as broad, only slightly compressed, broadly elliptical in transverse section, periphery broadly rounded, sides nearly parallel in the adult portion; chambers numerous, biserial in the early stages, becoming uniserial in the adult, slightly inflated in the later portion; sutures distinct, slightly limbate, later ones slightly depressed and less strongly oblique; wall smooth, distinctly perforate; aperture terminal, elliptical. Length 0.40-0.45 mm.; breadth 0.10 mm.; thickness 0.08-0.10 mm.

Holotype (Cushman Coll. No. 26133) from Core 12-36.

This species differs from *Bifarina vicksburgensis* (Cushman) from the lower Oligocene, in the somewhat fewer chambers which do not become sharply angled at the basal border, the less depressed sutures, and lack of a raised border about the aperture.

Genus UVIGERINA d'Orbigny, 1826

UVIGERINA ELONGATA Cole (Pl. 11, fig. 11)

Uvigerina elongata COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 26, pl. 4, figs. 2, 3.—CUSHMAN and EDWARDS, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 78, pl. 11, figs. 15, 16.

This species described from the Eocene, Guayabal formation, of Mexico occurs in both our cores. They seem very close to topotype specimens in our collections.

UVIGERINA RIPPENSIS Cole (Pl. 11, figs. 13, 14)

Uvigerina rippensis COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 27, pl. 2, fig. 16.—CUSHMAN and EDWARDS, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 81, pl. 12, fig. 6.

This species also has previously been known only from the Eocene, Guayabal formation, of Mexico. Like the preceding it occurs in both cores.

UVIGERINA SPINICOSTATA Cushman and Jarvis (Pl. 11, fig. 12)

Uvigerina spinicostata CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 12, pl. 3, figs. 9, 10.—CUSHMAN and EDWARDS, l. c., vol. 13, 1937, p. 83, pl. 12, figs. 11, 12.

The only previous records for this species are from the Eocene of Trinidad, B. W. I. Our specimens are from Core 12-36 only, and have been compared with the types which they closely resemble.

Genus TRIFARINA Cushman, 1923

TRIFARINA ADVENA Cushman (Pl. 11, fig. 15)

Trifarina bradyi CUSHMAN, var. *advena* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 87; U. S. Geol. Survey Prof. Paper 181, 1935, p. 42, pl. 16, figs. 10 *a*, *b*.

From a further comparison of the Eocene form with Recent material of *Trifarina bradyi* Cushman from the Pacific, it seems that our form should be given specific rank. It occurs in both cores in some numbers, but most of the specimens are immature and do not reach the length of the holotype. It is already recorded from the Eocene of Mississippi, Alabama and Florida.

Genus ENTOSOLENIA Ehrenberg, 1848

ENTOSOLENIA MARGINATA (Walker and Jacob) (Pl. 11, figs. 1, 3)

A few specimens from Core 12-36 may be placed under this species. It has a distinct keel about the periphery.

ENTOSOLENIA cf. LAEVIS (Reuss) (Pl. 11, fig. 2)

Rare specimens from Core 21-38 are placed provisionally under this species.

ENTOSOLENIA CRUMENATA Cushman (Pl. 11, figs. 4, 5)

Entosolenia crumenata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 11, 1935, p. 31, pl. 4, figs. 9 *a*, *b*.—CUSHMAN and MCGLAMERY, U. S. Geol. Survey Prof. Paper 189, 1938, p. 109, pl. 26, fig. 11.

The figured specimens from Core 12-36 are very similar to this

species known from the lower Oligocene of our Coastal Plain region of Mississippi.

Family ELLIPSOIDINIDAE

Genus PLEUROSTOMELLA Reuss, 1860

PLEUROSTOMELLA BELLARDI Hantken (Pl. 11, figs. 16, 17)

Pleurostomella bellardi HANTKEN, Ertek. termesz. köreböl, vol. 13, No. 1, 1883, p. 25, pl. 2, figs. 1 *a-b*; Math. Nat. Ber. Ungarn, vol. 2, 1884, p. 146.—CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, pp. 131, 156, pl. 28, fig. 1.

The figured specimens are from Core 12-36. They are very similar to the species described by Hantken from the upper Eocene of Hungary. This Eocene form has probably been referred to *P. brevis* Schwager which is however a different species.

PLEUROSTOMELLA TENUIS Hantken (Pl. 11, figs. 18, 19)

Pleurostomella tenuis HANTKEN, Ertek. termesz. köreböl, vol. 13, No. 1, 1883, p. 25, pl. 1, figs. 5 *a, b*; Math. Nat. Ber. Ungarn, vol. 2, 1884, p. 145.—CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, pp. 131, 156, pl. 28, fig. 4.

The figured specimens are from Core 21-38. They seem identical with the species described by Hantken from the upper Eocene of Hungary. The Eocene form has been referred to *P. alternata* Schwager, but is not the same.

PLEUROSTOMELLA JACKSONENSIS Cushman and Applin (Pl. 11, fig. 20)

Pleurostomella jacksonensis CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 168, pl. 7, figs. 9 *a-c*.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 42, pl. 16, figs. 11 *a-c*.

The only published record for this species is from the upper Eocene of Texas. Very typical specimens have occurred in material from Core 21-38. The coarse perforations are present, but the chambers are somewhat longer than in the holotype. This character however is variable in the series of specimens both here and at the type locality.

PLEUROSTOMELLA CUBENSIS Cushman and Bermudez (Pl. 11, figs. 25, 26)

Pleurostomella alazanensis CUSHMAN, var. *cubensis* CUSHMAN and BERMUDEZ, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 17, pl. 1, figs. 64, 65.

These specimens from Core 12-36 have been compared with the holotype from the upper Eocene of Cuba, and seem identical.

They seem however to be specifically distinct from *P. alazanensis*.

Genus NODOSARELLA Rzehak, 1895

NODOSARELLA SUBNODOSA (Guppy) (Pl. 11, figs. 21, 22)

Ellipsoidina subnodosa GUPPY, Proc. Zool. Soc. London, 1894, p. 650, pl. 41, fig. 12.

Ellipsonodosaria subnodosa CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 102, pl. 14, figs. 15, 16.—NUTTALL, Journ. Pal., vol. 4, 1930, p. 287; Quart. Journ. Geol. Soc., vol. 84, 1928, p. 95, pl. 6, fig. 20.

Nodosarella subnodosa NUTTALL, Journ. Pal., vol. 6, 1932, p. 24, pl. 4, figs. 7, 10, 13.—PALMER and BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 10, 1936, p. 294.—BERMUDEZ, l. c., vol. 12, 1938, p. 16.

Microspheric forms show alternating chambers. There is considerable variation in the inflation of the chambers and their relative length. Guppy's type figure is much conventionalized as are all his figures, and show very rounded chambers. It is recorded from the Eocene of Mexico, Trinidad and Cuba, and from the Oligocene of Cuba also. Specimens occur in both cores.

NODOSARELLA sp. (?) (Pl. 11, figs. 23, 24)

A few specimens from Core 12-36 with very much inflated, subglobular chambers evidently belong to this genus. There are not enough for specific determination.

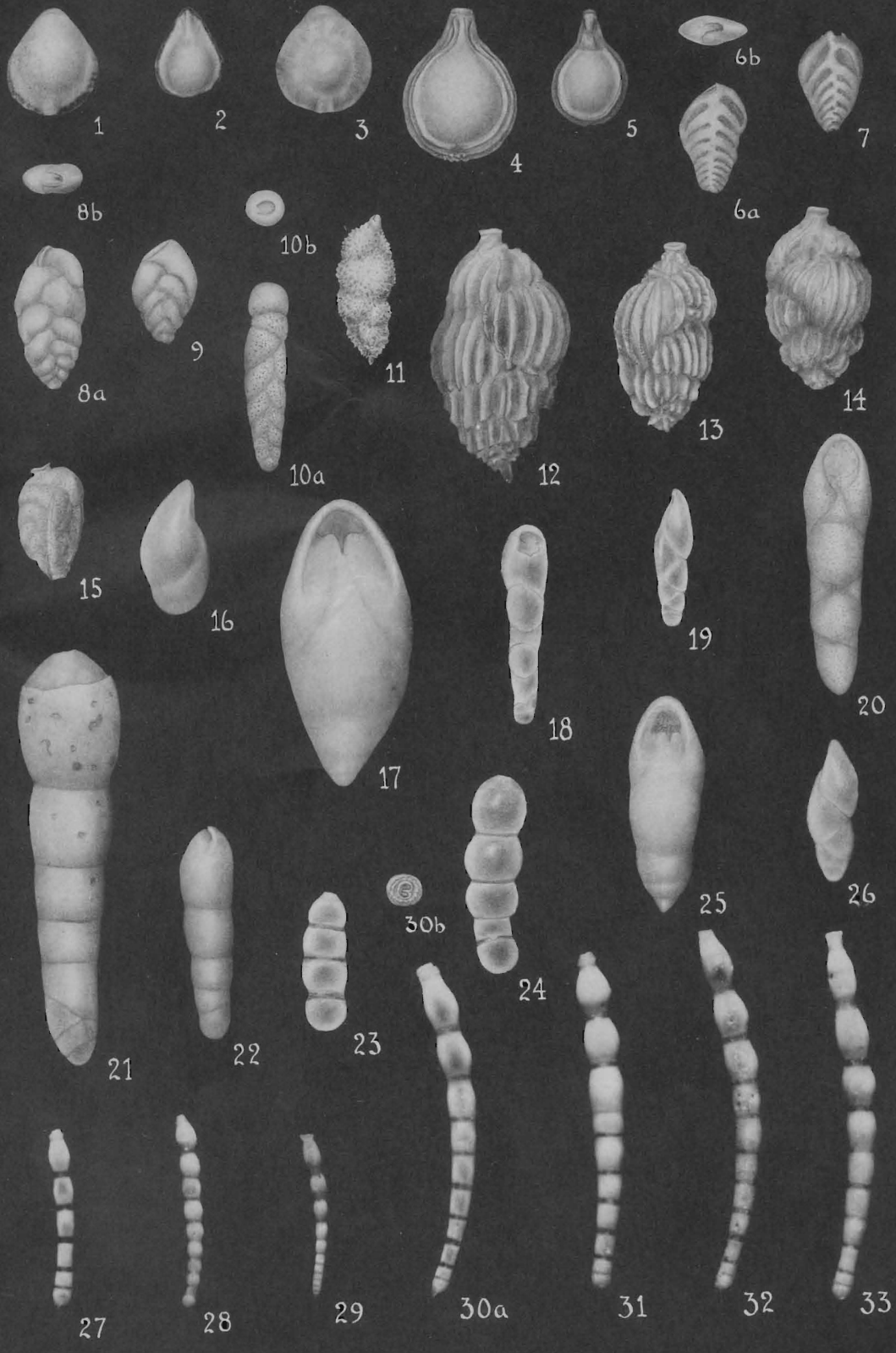
Genus ELLIPSONODOSARIA A. Silvestri, 1900

ELLIPSONODOSARIA COCOAENSIS (Cushman) (Pl. 11, figs. 27-33)

Nodosaria sp. CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 170, pl. 7, fig. 17.

EXPLANATION OF PLATE 11

FIGS. 1, 3. *Entosolenia marginata* (Walker and Jacob). × 60. 2. *Entosolenia* cf. *laevis* (Reuss). × 60. 4, 5. *Entosolenia crumenata* Cushman. × 50. 6, 7. *Bolivina atlantisae* Cushman, n. sp. × 80. 6, Holotype. *a*, front view; *b*, apertural view. 7, Paratype. 8, 9. *Bolivina submarina* Cushman, n. sp. × 80. 8, Holotype. *a*, front view; *b*, apertural view. 9, Paratype. 10. *Bifarina atlantisae* Cushman, n. sp. × 65. *a*, front view; *b*, apertural view. 11. *Uvigerina elongata* Cole. × 60. 12. *Uvigerina spinicostata* Cushman and Jarvis. × 50. 13, 14. *Uvigerina rippensis* Cole. × 50. 15. *Trifarina advena* Cushman. × 80. 16, 17. *Pleurostomella bellardi* Hantken. × 50. 16, Side view, young specimen. 17, Front view, adult. 18, 19. *Pleurostomella tenuis* Hantken. × 45. 18, Front view. 19, Side view. 20. *Pleurostomella jacksonensis* Cushman and Applin. × 65. 21, 22. *Nodosarella subnodosa* (Guppy). × 50. 23, 24. *Nodosarella* sp. (?) × 50. 25, 26. *Pleurostomella cubensis* Cushman and Bermudez. × 50. 25, Front view. 26, Side view. 27-33. *Ellipsonodosaria cocoaensis* (Cushman). × 25. 30, *a*, front view; *b*, apertural view.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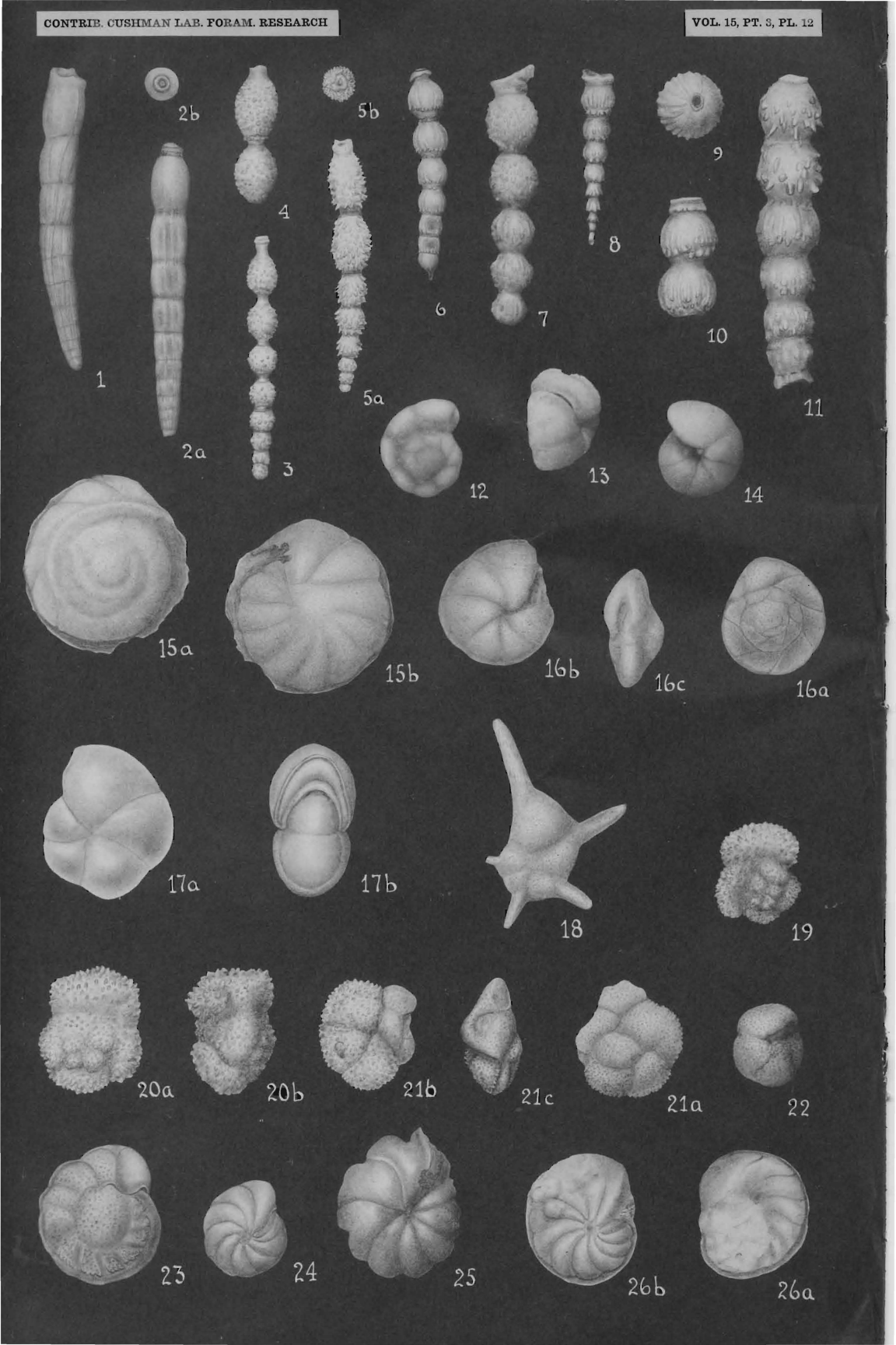
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Nodosaria cocoaensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, 1925, p. 66, pl. 10, figs. 5, 6; Journ. Pal., vol. 1, 1927, p. 153, pl. 24, fig. 1.

Dentalina cocoaensis ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 2, fig. 5.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 19, pl. 8, figs. 1, 2.

The apertures of numerous well preserved specimens of this species from Core 12-36 show that the species should be placed under *Ellipsonodosaria*. Our specimens resemble the form from the Eocene of Trinidad referred by Nuttall to *Ellipsonodosaria verneuilii* (d'Orbigny) (Journ. Pal., vol. 9, 1935, p. 127, pl. 14, fig. 20). They also resemble *E. annulifera* Cushman and Bermudez from the Eocene of Cuba, but are not the same. *E. cocoaensis* is known from the upper Eocene of South Carolina, Georgia, Alabama, Mississippi, Texas and Mexico.

ELLIPSONODOSARIA cf. ANNULIFERA Cushman and Bermudez

A very few specimens from Core 21-38 are close to this species described from the Eocene of Cuba. More specimens are needed to make the determination unquestioned.

ELLIPSONODOSARIA SEMIJUGOSA Cushman, n. sp. (Pl. 12, figs. 1, 2)

Test very elongate, slender, very gradually tapering, often

EXPLANATION OF PLATE 12

FIGS. 1, 2. *Ellipsonodosaria semijugosa* Cushman, n. sp. × 50. 2, Holotype. *a*, front view; *b*, apertural view. 1, Paratype. 3, 4. *Ellipsonodosaria atlantisae* Cushman, n. sp. × 55. 3, Holotype. 4, Paratype. 5. *Ellipsonodosaria atlantisae* Cushman, n. sp., var. *hispidula* Cushman, n. var. × 50. *a*, front view; *b*, apertural view. 6. *Ellipsonodosaria curvatura* Cushman, n. sp. × 30. 7-11. *Ellipsonodosaria curvatura* Cushman, n. sp., var. *spinea* Cushman, n. var. × 30. 11, Holotype. 7-10, Paratypes. 8, Microspheric form. 9, Apertural view. 12-14. *Gyroidina* cf. *soldanii* (d'Orbigny). × 25. 12, Dorsal view. 13, Peripheral view. 14, Ventral view. 15. *Pulvinulinella culter* (Parker and Jones), var. *mexicana* Cole. × 45. *a*, dorsal view; *b*, ventral view. 16. *Pulvinulinella atlantisae* Cushman, n. sp. × 65. *a*, dorsal view; *b*, ventral view; *c*, apertural view. 17. *Pullenia* cf. *quinqueloba* (Reuss). × 50. *a*, side view; *b*, apertural view. 18. *Hantkenina alabamensis* Cushman. × 50. 19. *Globorotalia crassata* (Cushman). × 50. 20. *Globorotalia crassata* (Cushman), var. *densa* (Cushman). × 60. *a*, dorsal view; *b*, peripheral view. 21. *Globorotalia spinulosa* Cushman. × 55. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 22. *Globorotalia kochi* Pijpers. × 25. 23, 24. *Cibicides pseudoungerianus* (Cushman). × 35. 23, Dorsal view. 24, Ventral view. 25. *Cibicides lobatulus* (Walker and Jacob). × 55. 26. *Cibicides cushmani* Nuttall. × 45. *a*, dorsal view; *b*, ventral view.

slightly curved; chambers numerous, slightly inflated in the later portion, considerably overlapping, increasing rather evenly in length as added; sutures distinct, slightly limbate, slightly depressed in the later portion; wall of the earlier half ornamented with longitudinal costae, only slightly raised, later half smooth; aperture terminal, rounded, with a distinct neck and apertural tooth. Length up to 1.00 mm.; diameter 0.12-0.15 mm.

Holotype (Cushman Coll. No. 26162) from Core 12-36.

This species differs from *Ellipsonodosaria modesta* Bermudez from the Eocene of Cuba, in the much finer costae, and more distinct and less rounded chambers.

ELLIPSONODOSARIA ATLANTISAE Cushman, n. sp. (Pl. 12, figs. 3, 4)

Test long and slender, very gradually tapering, straight; chambers very distinct, all except the very earliest ones strongly inflated, earliest ones somewhat overlapping, later ones gradually more and more separated by restricted stolon-like necks and becoming more pyriform; sutures of the earlier part strongly limbate and only slightly depressed, strongly depressed in the adult; wall ornamented except over the sutures, with slightly backwardly projecting spines becoming finer and much more numerous on the adult chambers; aperture rounded, with a distinctly tubular neck and slight lip, and an inwardly projecting tooth. Length up to 0.65 mm.; diameter 0.08-0.10 mm.

Holotype (Cushman Coll. No. 26165) from Core 12-36.

This species differs from *Ellipsonodosaria caribaea* Palmer and Bermudez from the Oligocene and Eocene of Cuba, in the more rounded and more distinctly separated chambers, and the more highly ornamented test.

ELLIPSONODOSARIA ATLANTISAE Cushman, n. sp., var. HISPIDULA Cushman, n. var. (Pl. 12, figs. 5 a, b)

Variety differing from the typical in the broader and more limbate sutures and the surface, which is covered with numerous fine spines, directed backward toward the initial end, rather uniformly scattered over the surface and sometimes forming a distinct fringe along the base of the later chambers.

Holotype of variety (Cushman Coll. No. 26169) from Core 12-36.

The general shape of the test and of the adult chambers is almost identical with those of the above species, but the surface is very distinct. The fine spines become more numerous as the

chambers increase in size toward the apertural end. The chambers in the adult are somewhat more separated than in the typical form, and the sutures are deeper and more limbate.

ELLIPSONODOSARIA CURVATURA Cushman, n. sp. (Pl. 12, fig. 6)

Test elongate, curved, with a basal spine, increasing very slightly in diameter in the megalospheric form, more so in the microspheric; chambers distinct, inflated, earlier ones much overlapping, later ones gradually less so, the adult ones with a large connecting area, generally spherical; sutures slightly limbate in the earlier portion and little depressed, gradually more strongly so; wall ornamented with low, spinose costae in the early portion, later reduced to one or two rows of short, backwardly projecting spines on the basal portion, and in the adult nearly smooth; aperture with a short, cylindrical neck and fairly wide collar-like flange which has backwardly projecting spines in well preserved specimens, rounded, with an inwardly projecting tooth. Length up to 1.25 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 26172) from Core 12-36.

This species is somewhat like *Ellipsonodosaria gracilis* Palmer and Bermudez from the Oligocene and Eocene of Cuba, but our species is more compact, and often has a double row of spines and a prominent basal spine.

ELLIPSONODOSARIA CURVATURA Cushman, n. sp., var. SPINEA Cushman, n. var. (Pl. 12, figs. 7-11)

Variety differing from the typical in the larger size, coarser and more prominent ornamentation, the ornamentation tending to increase rather than lessen in the later portion, and a less elongate neck.

Holotype of variety (Cushman Coll. No. 26175) from Core 12-36.

The variety seems to be more common than the typical form in our material.

Family ROTALIIDAE

Genus VALVULINERIA Cushman, 1926

VALVULINERIA sp. (?)

Very rare specimens of a minute, apparently undescribed species of *Valvulineria* were found in Core 21-38, but although the available material was thoroughly searched not enough specimens were obtained to warrant a description.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA cf. SOLDANII (d'Orbigny) (Pl. 12, figs. 12-14)

In core 12-36 there are numerous specimens, the early stages of which resemble *Gyroidina soldanii* (d'Orbigny), var. *octocamerata* Cushman and G. D. Hanna, but in the adult have the thickness almost equal to the diameter and the ventral side deeply umbilicate. In the number of chambers in the adult whorl they resemble the variety.

Genus EPONIDES Montfort, 1808

EPONIDES PYGMAEUS (Hantken)

Rare specimens from Core 12-36 resemble this species which has been recorded in America from the upper Eocene of Texas.

EPONIDES UMBONATUS (Reuss)

(For references to this species, see Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 48, pl. 19, figs. 10 *a-c.*)

Numerous typical specimens were found in Core 12-36. It is also recorded from the upper Eocene of South Carolina.

Family CASSIDULINIDAE

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA CULTER (Parker and Jones), var. MEXICANA Cole (Pl. 12, fig. 15)

Pulvinulinella culter (PARKER and JONES), var. *mexicana* COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 31, pl. 1, figs. 15, 16; l. c., vol. 14, No. 53, 1928, p. 215(15).—NUTTALL, Journ. Pal., vol. 4, 1930, p. 293; vol. 6, 1932, p. 27.—BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 12, 1938, p. 21.

Specimens of this form are common in Core 12-36, and rather rare in Core 21-38. It is recorded by Cole from the Eocene, Guayabal and Chapapote formations, of Mexico. Nuttall gives its range from the Alazan to the Aragon. Bermudez records it from the Eocene of Cuba.

PULVINULINELLA ATLANTISAE Cushman, n. sp. (Pl. 12, figs. 16 a-c)

Test minute, close coiled, nearly equally biconvex or slightly more convex on the ventral side, periphery acute but not keeled; chambers distinct, not inflated, six in the adult whorl, of uniform shape, increasing very regularly and gradually in size as added; sutures distinct, strongly oblique and tangential on the dorsal side, nearly radial on the ventral side, slightly limbate; wall generally smooth; aperture an elongate opening on the face of the

last-formed chamber in the axis of coiling. Diameter up to 0.35 mm.; thickness 0.15-0.18 mm.

Holotype (Cushman Coll. No. 26192) from Core 21-38.

This species resembles *Pulvinulinella harrisi* Hadley from the Eocene, Moodys marl, of Mississippi, but a comparison with autotypes shows our species to be very much smaller, not at all keeled, much less distinctly perforate and slightly umbilicate rather than umbonate on the ventral side.

Genus CASSIDULINA d'Orbigny, 1826

CASSIDULINA GLOBOSA Hantken

(For references to this species see Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 49, pl. 20, figs. 12 *a*, *b*.)

Specimens of this small species occur rather commonly in Core 12-36, less commonly in Core 21-38. The species was described by Hantken from the upper Eocene of Hungary. Cole has recorded it from the Eocene of Mexico. Church records it from the upper Eocene of California, and it occurs at numerous localities in the upper Eocene, Cooper marl, of South Carolina.

Specimens of other species of *Cassidulina* were found, but they are rare and not enough specimens are available for specific determination.

Family CHILOSTOMELLIDAE

Genus PULLENIA Parker and Jones, 1862

PULLENIA cf. SPHAEROIDES d'Orbigny

This species has been very widely recorded and from a long vertical range, but was not found in the upper Eocene material from the Coastal Plain region of the United States. Nuttall records it from the Eocene, Aragon formation, of Mexico, and Bermudez from the Eocene and Oligocene of Cuba. It occurred commonly in Core 12-36.

PULLENIA cf. QUINQUELOBA (Reuss) (Pl. 12, figs. 17 a, b)

This species has also been recorded widely and from a long vertical range. Nuttall records it from the Eocene, Aragon formation, of Mexico, and Bermudez from the Eocene and Oligocene of Cuba. It occurred fairly commonly in both cores.

Family GLOBIGERINIDAE

Numerous specimens belonging to this family were found in

both cores, but as the family is being studied in detail it seems best to leave these until the studies are completed.

Family HANTKENINIDAE

Genus HANTKENINA Cushman, 1924

HANTKENINA ALABAMENSIS Cushman (Pl. 12, fig. 18)

Hantkenina alabamensis CUSHMAN, Proc. U. S. Nat. Mus., vol. 66, Art. 3, 1924, p. 3, pl. 1, figs. 1-6, pl. 2, fig. 5; Contr. Cushman Lab. Foram. Res., vol. 1, 1925, pp. 7, 68, pl. 1, fig. 11.—CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 177, pl. 10, fig. 3.—CUSHMAN, Journ. Pal., vol. 1, 1927, p. 160, pl. 25, fig. 17.—HOWE, l. c., vol. 2, 1928, p. 14, text fig. 1.—HOWE and WALLACE, Louisiana Dept. Conservation, Geol. Bull. 2, 1932, p. 54, pl. 10, fig. 3.—ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 6, fig. 5.—HOWE and WALLACE, Journ. Pal., vol. 8, 1934, p. 35, pl. 5, fig. 13.—HADLEY, Bull. Amer. Pal., vol. 20, No. 70A, 1934, p. 15, pl. 2, fig. 4.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 49, pl. 13, figs. 1-5.—CORYELL and EMBICH, Journ. Pal., vol. 11, 1937, p. 299, pl. 43, fig. 10.—BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 12, 1938, p. 13.

This species occurs rather commonly in Core 12-36 and less so in Core 21-38. It is one of the key species to fix the age of this Eocene material. The species is known from the upper Eocene of Alabama, Mississippi and Texas, and from Cuba, Mexico and Panama.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA CRASSATA (Cushman) (Pl. 12, fig. 19)

Pulvinulina crassata CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 9, 1925, p. 300, pl. 7, fig. 4.

Globorotalia crassata COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 34, pl. 1, figs. 7, 8.—WEINZIERL and APPLIN, Journ. Pal., vol. 3, 1929, p. 408.—NUTTALL, l. c., vol. 4, 1930, pp. 276, 288.—CUSHMAN and BARKSDALE, Contr. Dept. Geol. Stanford Univ., vol. 1, 1930, p. 67, pl. 12, fig. 7.

This species has been mostly recorded from the Eocene of Claiborne age or its equivalents from Texas, Mexico and California. The species occurred rather commonly in Core 21-38, but did not occur in Core 12-36. This might seem to fix the age of Core 21-38 as slightly older than 12-36.

GLOBOROTALIA CRASSATA (Cushman), var. DENSA (Cushman) (Pl. 12, figs. 20 a, b)

Pulvinulina crassata CUSHMAN, var. *densa* CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 9, 1925, p. 301.

Globorotalia crassata CUSHMAN, var. *densa* CUSHMAN and BARKSDALE, Contr. Dept. Geol. Stanford Univ., vol. 1, 1930, p. 68, pl. 12, figs. 8 *a, b*.—?GLAESSNER, Studies in Micropaleontology, Moscow Univ., vol. 1, 1937, p. 32, pl. 1, figs. 8 *a-c*.

This variety has a more rounded, compact form, with a very large final chamber and rounded periphery. Such forms occurred in Core 21-38 only. It is known from the Eocene of Mexico and California. It has also lately been recorded from the Eocene of the Caucasus region.

GLOBOROTALIA SPINULOSA Cushman (Pl. 12, figs. 21 a-c)

Globorotalia spinulosa CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 114, pl. 23, figs. 4 *a-c*.—COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 34, pl. 2, fig. 9.—NUTTALL, Journ. Pal., vol. 4, 1930, pp. 276, 288.

This species is rare in Core 12-36, and did not occur in Core 21-38. It has previously been recorded only from the Eocene of Mexico.

GLOBOROTALIA KOCHI Pijpers (Pl. 12, fig. 22)

Globorotalia kochi PIJPERS, Geol. Pal. Bonaire, 1933, p. 71, text figs. 111-115.

"Test small, planoconvex; dorsal side flat or slightly concave, ventral side conical. Periphery lobulate, acute, not keeled. There are 2 to 2½ whorls visible on the dorsal side, with 5 or 6 chambers in the last whorl. Sutures fairly distinct; on the dorsal side flush, curved backwards: on the ventral side depressed, straight, radiate or nearly so. Surface rough. Aperture elongate, indistinct, from the umbilical area extending towards the periphery, widest near the umbilical area."

As the original description may not be easily available, it is copied here. The types are from the upper Eocene of a well near Porta Spaño (Columbia Plantation), Bonaire, D. W. I.

The figured specimen is from Core 21-38.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA AFFINIS (Hantken)

Pulvinulina affinis HANTKEN, A. magy. kir. földt. int. évkönyve, vol. 4, 1875 (1876), p. 68, pl. 10, fig. 6; Mitth. Jahrb. ungar. geol. Anstalt, vol. 4, 1875 (1881), p. 78, pl. 10, fig. 6.

Anomalina affinis CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 180, pl. 10, figs. 1, 2.—CUSHMAN and DUSENBURY,

Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 64, pl. 9, figs. 2 *a-c*.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 51, pl. 21, figs. 11, 12.

Hantken described this species from the upper Eocene of Hungary. It has been recorded from the upper Eocene of Texas and California. It is very rare in Core 21-38.

Genus CIBICIDES Montfort, 1808

CIBICIDES LOBATULUS (Walker and Jacob) (Pl. 12, fig. 25)

(For references to this species, see Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 52, pl. 22, figs. 4-6.)

This very widely recorded species occurred in Core 12-36. It is subject to much variation.

CIBICIDES PSEUDOUNGERIANUS (Cushman) (Pl. 12, figs. 23, 24)

Truncatulina ungeriana H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 94, figs. 9 *a-c* (not *Rotalina ungeriana* D'ORBIGNY).—CUSHMAN, U. S. Nat. Mus., Bull. 103, 1918, p. 69, pl. 24, fig. 1.

Truncatulina pseudoungeriana CUSHMAN, U. S. Geol. Survey Prof. Paper 129, 1922, pp. 97, 136, pl. 20, fig. 9; Prof. Paper 133, 1923, p. 40.

Cibicides pseudoungerianus COLE and GILLESPIE, Bull. Amer. Pal., vol. 15, No. 57b, 1930, p. 15, pl. 3, figs. 10, 11.—COLE and PONTON, Bull. 5, Florida State Geol. Survey, 1930, p. 50, pl. 10, fig. 4.—ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 5, figs. 3, 4.—PALMER and BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 256.—PARR, Trans. Roy. Soc. New Zealand, vol. 65, 1935, p. 79, pl. 19, figs. 4 *a-c*.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 52, pl. 23, figs. 1 *a-c*; Bull. Geol. Soc. Amer., vol. 47, 1936, p. 426, pl. 4, figs. 3 *a-c*.—CORYELL and EMBICH, Journ. Pal., vol. 11, 1937, p. 302, pl. 43, fig. 15.—BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 11, 1937, p. 345.

Specimens referable to this species were very common in Core 12-36, but rare in Core 21-38. It apparently has a wide range, but has been recorded from the upper Eocene of North and South Carolina, Georgia, Florida, Alabama, Mississippi and Texas as well as from Cuba and Panama.

CIBICIDES CUSHMANI Nuttall (Pl. 12, figs. 26 a, b)

Cibicides cushmani NUTTALL, Journ. Pal., vol. 4, 1930, p. 291, pl. 25, figs. 3, 5, 6; l. c., vol. 6, 1932, p. 32.—BERMUDEZ, Mém. Soc. Cubana Hist. Nat., vol. 11, 1937, p. 344.

This species is very rare in Core 21-38, and was not found in Core 12-36. It has been recorded from the Eocene of Mexico and Cuba, and also occurs in the lower part of the Kreyenhagen shale of California.