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UPPER CRETACEOUS FORAMINIFERA OF THE GULF COASTAL REGION OF THE UNITED STATES AND ADJACENT AREAS

BY
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UPPER CRETACEOUS FORAMINIFERA OF THE GULF COASTAL REGION OF THE UNITED STATES AND ADJACENT AREAS

By Joseph A. Cushman

ABSTRACT

This paper describes the Foraminifera (except those belonging to *Globigerina* and related genera) from the Upper Cretaceous of the Gulf Coastal Plain of the United States. The collections are largely from Texas, Mississippi, and Alabama, but Louisiana and Tennessee also are represented. Records from related areas of Kansas, Nebraska, and South Dakota are included, as well as those from Canada, Mexico, the West Indies, and northern South America. Charts show the vertical distribution of the species. Many of the species are excellent index fossils for use either in surface work or in the study of cores. Nearly 600 species and varieties are recorded, and nearly all are figured.

INTRODUCTION

Collections on which the present paper is based are largely from the Upper Cretaceous of Texas, where excellent sections are exposed and where the relationships of the succession of Foraminifera-bearing strata can be seen. In addition, much carefully collected material has been available from Mississippi, Alabama, and Tennessee, with lesser amounts from Arkansas and Louisiana.

In order to make the work more nearly complete, records have been included from adjacent areas, the interior basin extending northward from Kansas to Canada, the southern areas of Mexico, the West Indies, and northern South America. In the more southern areas exposed rocks contain Upper Cretaceous Foraminifera closely related to species found in well samples from the Gulf Coastal Plain but not known from outcrops.

The material available represents differing degrees of hardness, from rather compact limestones, that are difficult to break down, to clays and marls from which excellent series of cleaned Foraminifera may be obtained. Even with the limestones some softer layers and shaly partings yield a representative fauna.

A considerable range of ocean-bottom conditions is represented in the samples. As a result, it is necessary in correlation to note these conditions in the several parts of the area, for they may have been quite different, even though representing the same time interval. The high percentage of pelagic Foraminifera in some parts of the section—even those that may represent epochs where the bottom conditions were changing—is another factor that must be taken into account in correlation. On the whole, it has seemed that the bottom-living Foraminifera are probably more sensitive to change and perhaps shorter-lived than some of the larger organisms. This should be considered when discrepancies between groups seem to give different results as to age of beds.

The fauna is a large one. The nearly 600 species and varities described and figured here do not represent the entire fauna, as other species are present but represented by material too meager or too poorly preserved to warrant descriptions and figures of them at the present time. Further study will undoubtedly bring to light numerous additions to the fauna described and figured here.

Many of our American Cretaceous species have been referred to species already described from Europe. In order to make this work more accurate, the author has spent two summers in Europe studying type collections and comparing our American specimens directly with the actual types of species in European museums. Much topotype material was collected in Europe, and numerous specimens were kindly furnished by various institutions and workers in this field. As a result of these studies it has been possible to work intelligently with the species of the two rather widely removed areas. The results of these detailed studies will be found in the synonymy and notes under the various species.

Although the main purpose of this paper is to present the descriptions and figures of the Upper Cretaceous species of Foraminifera in the Gulf Coastal Plain of the United States, it has seemed wise to include records from related regions. Papers by Morrow and Loetterle have given numerous records for the interior Cretaceous basin of the United States, including particularly Kansas, Nebraska, and South Dakota. Some of the species they have described from that area occur also in the Gulf Coastal Plain. Likewise, the records for the northward extension into Canada given by Wickenden are included here, as some of the species occur also in our area.

Many species described from the Upper Cretaceous of Mexico, the West Indies, and northern South America are included in this paper. Some of them are found in our Gulf Coastal Plain in outcrop material, and others are found there in well samples. It has therefore seemed wise to include these species for the benefit of those who may come in contact with them.

The records from the Atlantic region are not included here, as many of the species are more closely related to species of Europe than to those of the Gulf region. Likewise, the species from the Pacific coast, though in the upper beds related to the species of Mexico and Trinidad, are not yet sufficiently well known to warrant inclusion here.

The economic importance of the Foraminifera hardly needs lengthy discussion here. Their great abundance in most Cretaceous samples and their small size make them invaluable as stratigraphic markers in drillings for oil or water. Likewise, in the study and correlation of surface outcrops the Foraminifera have demonstrated their great usefulness. The gathering together in one paper of the species known from these areas, with adequate illustrations, should be of sufficient use to warrant the time spent in the preparation of this paper.

In the systematic descriptions the various genera and species are arranged according to the latest accepted ideas in regard to the classification of the Foraminifera. The references to the American literature as well as to the earlier European records will be found in the synonymy under the various species. Usually when there is a question as to the identity, only those references are given that are accompanied by recognizable figures. Comparisons with other known species are frequently given in the notes under the species as an aid in identification. An abbreviated list of localities will be found under each species, representing the specimens actually seen and studied and deposited in our collections for future reference.

Several hundred separate localities are represented in our material. These have been numbered for convenience in reference, and an attempt has been made to group the localities by State and county as well as to keep them in a geologic sequence. A detailed list of all localities is given so that the condensed list under each species may be expanded if desired.

The material for the present paper has been obtained from many sources. The names of the collectors are given if known. Much of the material was collected in connection with other geologic work by members of the Federal Geological Survey, particularly by Dr. L. W. Stephenson and those associated with him in the field. Through the kindness of Messrs. J. A. Waters and N. L. Thomas, I have collected much material from Texas. Mrs. Helen J. Plummer and Dr. C. I. Alexander also have furnished excellent material from Texas. Dr. C. G. Lalicker collected a series of fine Cretaceous samples from the entire Upper Cretaceous section exposed in the Dallas region.

The illustrations are from American material. Illustrations in previous papers have been used, for which acknowledgment is here made to the Geological Survey of Tennessee and to the United States National Museum. Photographs have been used to illustrate a number of species, and many drawings have been made by Miss Patricia G. Edwards and Miss Ann Shepard, whose careful work is much appreciated.

I wish to express my appreciation for helpful suggestions to Drs. T. W. Stanton and G. F. Loughlin, who as former chief geologists of the Federal Geological Survey have directed this work; to Dr. John B. Reeside, Jr., for his help as geologist in charge of the Section of Paleontology and Stratigraphy; and to Dr. L. W. Stephenson under whose supervision as geologist in charge of the Section of Coastal Plain Investigations the work was initiated. To Miss Frances L. Parker I am greatly indebted for long and painstaking work in preparing much of the material for study and in charting the distribution of the various species.

LIST OF LOCALITIES

NAVARRO AGE

KEMP CLAY.

1. 1 foot below Midway group. Ditch in field, ¾ mile S. 45° W. of Peerless, Hopkins County, Tex. H. J. Plummer. Station 646.
2. Old U. S. Highway 175, west of railroad, 2.6 miles north-northwest of Kemp, Kaufman County, Tex. Exposure in ditch below culvert. L. W. Stephenson.
3. Huber Stone lease (now Witherspoon lease) 6 miles due east of Corsicana, in bank of Post Oak Creek near bridge, Navarro County, Tex. O. B. Hopkins. U.S.G.S. 9548.
4. Near Roane, center of southwest line of M. G. Slade 91-acre tract, Ralph Tandy survey, Navarro County, Tex.
5. On road to Roane, southwest corner of W. T. Holly 196 acres, W. M. Bartels survey, Navarro County, Tex.
6. North corner of John A. Thompson estate, 1,500 feet east of west line of Wm. Fisher survey, about 3½ miles northwest of Bazette and 4 miles northeast of Roane, Navarro County, Tex. L. W. Stephenson and C. W. Cooke. U.S.G.S. 12922.
7. Upper part of Kemp clay. Branch ½ mile south of McLeod School and 6½ miles southwest of Currie, Navarro County, Tex. L. W. Stephenson.
8. 90 feet below base of Midway group. Wortham road 5 miles due east of Cooledge, Limestone County, Tex. L. W. Stephenson.
9. Black Bluff, or Brazos River 2 miles above falls, Milam County line in Falls County, Tex. J. A. Gardner. U.S.G.S. 13776.
10. 10 feet below basal Midway greensand, along Walker Creek about 1 mile west of main highway and 6½ miles north of Cameron, Milam County, Tex. H. J. Plummer. Station 644.
11. Mustang Creek about 6 miles east-southeast of Taylor, Williamson County, Tex. L. W. Stephenson and W. P. Popenoe.
12. 1 foot above base of Kemp clay. Branch of Mustang Creek 1 mile west-southwest of Noack, 900 feet downstream from road and 0.2 mile southwest of Christ Evangelical Lutheran Church, Williamson County, Tex. L. W. Stephenson.
13. Bluff on Colorado River at Webberville, Travis County, Tex. L. W. Stephenson. U.S.G.S. 7601.
14. Bluff on Colorado River at Webberville, Travis County, Tex. T. W. Vaughan and C. H. Stuver. U.S.G.S. 1642.
15. Bank of Colorado River below old ferry at Webberville, Travis County, Tex. J. A. Gardner. U.S.G.S. 13910.
16. Colorado River at ferry at Webberville, Travis County, Tex. U.S.G.S. 7602.
17. 65 to 73 feet in Tom Thrasher's well, on road from Bastrop to Delvalle ¾ mile from Old Garfield, Travis County, Tex. T. W. Vaughan. U.S.G.S. 1641.
18. Sandy marl, 6 to 8 feet above bottom of pit of Seguin Brick & Tile Co., 0.8 mile south of McQueeney Station, Guadalupe, Tex. L. W. Stephenson.
19. Pit of Seguin Vitrified Paving & Face Brick Co., ½ mile south of McQueeney, Guadalupe County, Tex. L. W. Stephenson. U.S.G.S. 7638.
20. 2 miles southeast of Marion, Guadalupe County, Tex. J. A. Gardner. U.S.G.S. 13389.
21. Bluff on small creek entering York Creek 4 miles southeast of Zorn, Guadalupe County, Tex. L. W. Stephenson. U.S.G.S. 10877.

ESCONDIDO FORMATION (upper part)

22. Bluff on Rio Grande, Indio Cattle Co.'s ranch, 36 to 85 feet above water level, about 30 miles southeast of Eagle Pass and 4 miles a little south of west of Jacal ranch house, Maverick County, Tex. L. W. Stephenson. U.S.G.S. 8239.

CORSICANA MARL.

23. Base of marl. 2.6 miles north by east of Malta, Bowie County, Tex. U.S.G.S. 12934.
24. Small branch below road 2½ miles north of Tona siding and about 5 miles southwest of Quinlan, Hunt County, Tex. L. W. Stephenson.
25. Within 1 foot of top of Corsicana marl. Road ditch 3.5 miles northwest of Union Seminary School, 4.3 miles south-southeast of Corbet, Navarro County, Tex. L. W. Stephenson.
26. Pit at Corsicana Brick Co., 2 miles south of courthouse at Corsicana, Navarro County, Tex. L. W. Stephenson.
27. Pit at Corsicana Brick Co., 2 miles south of Corsicana, Navarro County, Tex. J. A. Cushman and J. A. Waters.
28. Clay pit near Corsicana, Navarro County, Tex. H. J. Plummer.
29. Deep ditch on Wortham road near junction with Mexia road (U.S. Highway 84) 2.8 miles east of Cooledge, Limestone County, Tex. L. W. Stephenson.
30. Mexia Highway at forks of Wortham road 2.8 miles east-southeast of Cooledge, Limestone County, Tex. J. A. Cushman and N. L. Thomas. Station 22.
31. Mexia road 2.75 miles east of Cooledge on east-facing slope of Elm Creek Valley, Limestone County, Tex. L. W. Stephenson and C. H. Dane.
32. Road ditch on west-facing slope of Big Creek Valley 3 miles southwest of Stranger and 1.3 miles southeast of Parsons Bridge, Falls County, Tex. L. W. Stephenson.
33. Buckholtz road 7.7 miles (by road) west of courthouse at Cameron, Milam County, Tex. L. W. Stephenson.
34. Gully in west-facing slope of Cottonwood Creek Valley ¼ mile west of Kimbro and 2 miles south of Manda, Travis County, Tex. L. W. Stephenson. U.S.G.S. 14129.
35. 35 feet above base of bluff on Onion Creek 2¼ miles west of Garfield, Travis County, Tex. L. W. Stephenson.
36. About 17 feet above base of bluff on Onion Creek, 2¼ miles west of Garfield, Travis County, Tex. L. W. Stephenson.

37. 30 feet above base of bluff on Onion Creek ¼ mile below Bastrop road crossing and 2½ miles west of old Garfield, Travis County, Tex. L. W. Stephenson.
38. 40 feet above base of bluff on Onion Creek ¼ mile below Bastrop road crossing and 2½ miles west of old Garfield, Travis County, Tex. L. W. Stephenson.
39. 23 feet above base of bluff on Onion Creek ¼ mile below Bastrop road crossing and 2½ miles west of old Garfield, Travis County, Tex. L. W. Stephenson.
40. 18 feet above base of bluff on Onion Creek ¼ mile below Bastrop road crossing and 2½ miles west of old Garfield, Travis County, Tex. L. W. Stephenson.
41. 13 feet above base of bluff on Onion Creek ¼ mile below Bastrop road crossing and 2½ miles west of old Garfield, Travis County, Tex. L. W. Stephenson.
42. 2 feet above base of bluff on Onion Creek ¼ mile below Bastrop road crossing and 2½ miles west of old Garfield, Travis County, Tex. L. W. Stephenson.
43. Jones crossing on Onion Creek just east of Austin-Bastrop Highway and 9 miles in a straight line southeast of Capitol in Austin, Travis County, Tex. H. J. Plummer. Station 226–T–9.
44. Left bank of San Marcos River, 100 yards below a ford ½ mile below Martindale, Caldwell County, Tex. L. W. Stephenson. U.S.G.S. 7621.
45. West-facing bluff of Guadalupe River 1.3 miles above McQueeney, Guadalupe County, Tex. L. W. Stephenson. U.S.G.S. 7637.
46. 3 feet below base of *Exogyra-Gryphaea* bed, San Antonio road 6 miles east of Castroville, Bexar County, Tex. L. W. Stephenson.

NACATOCH SAND.

47. 2 miles south of Oak Grove, Bowie County, Tex. J. A. Gardner. U.S.G.S. 12932.
48. Right bank of Red River 200 yards west of Lewis Ferry and 8 miles north of New Boston, Bowie County, Tex. U.S.G.S. 12935.
49. Ditch on second-class road 1.7 miles northeast of Ardis Heights and 3.5 miles east-northeast of the courthouse at Greenville, Hunt County, Tex. L. W. Stephenson.

NEYLANDVILLE MARL.

50. Paris Highway 2.4 miles west by north of Bogota, Red River County, Tex. L. W. Stephenson.
51. Branch east of Texas Midland railroad ¼ mile north of Cooper, Delta County, Tex. L. W. Stephenson.
52. Wash west of Paris Highway 7¼ miles northeast of Cooper, Delta County, Tex. L. W. Stephenson.
53. Type locality. Abandoned cut of Texas Midland Railroad 0.2 mile southwest of the site of Neylandville Station, 6.4 miles northeast of the courthouse at Greenville, Hunt County, Tex. L. W. Stephenson.
54. Bankhead Highway 4.3 miles (air line) northeast of public square at Greenville, Hunt County, Tex. L. W. Stephenson.
55. Southeast of Greenville, near Dixon road 0.3 mile south of fair grounds, Hunt County, Tex. L. W. Stephenson and W. P. Popenoe.
56. Two thousand feet northeast of Hunt-Kaufman County corner, 1,000 feet east by south of road, Hunt County, Tex.
57. Dallas road 2.5 miles northeast of Royse City, Rockwall County, Tex. L. W. Stephenson and W. P. Popenoe.
58. Basal. Clay below glauconitic marl. Gullies east of road 4¼ miles west of Kaufman on road to Crandall, Kaufman County, Tex. C. H. Dane.
59. U. S. Highway 175, 3.8 miles west of the courthouse at Kaufman, Kaufman County, Tex. From zone of *Placenticeras*—bearing concretions, 30 feet above the level of Big Creek bottom. L. W. Stephenson.
60. On south side of U. S. Highway 80, 2 feet above pavement, 12.5 miles east of Dallas-Kaufman County line and 0.6 mile east of Lawrence, Kaufman County, Tex. C. G. Lalicker. No. 43.
61. At contact with Taylor marl in ditch on south side of U.S. Highway 80, 3 feet below pavement, 10.3 miles east of Dallas-Kaufman County line, Kaufman County, Tex. C. G. Lalicker. No. 41.
62. Roadside ditch north of Forney-Terrell road 7.3 miles east of Forney, Kaufman County, Tex. C. I. Alexander. No. 2469.
63. Basal. Two and one-tenth miles southeast of Drane on road to Corbet, Navarro County, Tex. L. W. Stephenson.
64. Corsicana road 2½ miles north of Corbet, Navarro County, Tex. L. W. Stephenson.
65. Drane road 2.2 miles (air line) northwest of Corbet on north-facing slope of Briar Creek Valley, Navarro County, Tex.
66. 2.1 miles southeast of Drane on road to Corbet, Navarro County, Tex. (30 feet higher than locality 68). C. H. Dane.
67. 2.1 miles southeast of Drane on road to Corbet, Navarro County, Tex. (2 feet higher than locality 66). C. H. Dane.
68. 2.1 miles southeast of Drane on road to Corbet, Navarro County, Tex. C. H. Dane.
69. Roadside ditch south of dirt road 5.4 miles west of Navarro Hotel, Corsicana, Navarro County, Tex. C. I. Alexander. No. 2484.

ARKADELPHIA MARL.

70. Near base. Seven miles north by west of Hope, Hempstead County, Ark. U.S.G.S. 13411.
71. Small branch east of the Nashville road 4½ miles (air line) northwest of Hope, Hempstead County, Ark. L. W. Stephenson.
72. Branch east of road ½ mile north by west of Reed's store (SW¼ sec. 29, T. 11 S., R. 24 W.), 6 miles north by west of Hope, Hempstead County, Ark. L. W. Stephenson.
73. Lower part. 4.5 miles east of Washington in creek ½ mile north of Reed's store, Hempstead County, Ark. U.S. G.S. 8211.

NACATOCH SAND.

74. Arkadelphia, Clark County, Ark. L. W. Stephenson.
75. 200 yards north of hotel at Washington, Hempstead County, Ark. U.S.G.S. 5435.
76. Cyrus Heller's marl bed, Beebe, White County, Ark. U.S. G.S. 976.
77. Clay from a well known as "Nursery well," owned by George P. Murrell, Cabot, Lonoke County, Ark. A. F. Crider. U.S.G.S. 8293.

SARATOGA CHALK.

78. Big Decipher Creek on road to Okalona 5 miles southwest of Arkadelphia, Clark County, Ark. U.S.G.S. 7460.
79. Saratoga, Howard County, Ark. N. L. Thomas.
80. Upper part. Saratoga road 2½ miles west of Columbus, Hempstead County, Ark. U.S.G.S. 9728.
81. 3⅛ miles northwest of Washington, Hempstead County, Ark. U.S.G.S. 7480.
82. 2 miles north of Washington, Hempstead County, Ark. U.S.G.S. 5433.

OWL CREEK FORMATION.

83. On Owl Creek 3½ miles northeast of Ripley, Tippah County, Miss. H. J. Plummer.

PRAIRIE BLUFF CHALK.

84. 17 feet down north-facing slope of Cane Creek Valley in sec. 10, T, 15 S., R. 3 E., 1.3 miles north by east of Sparta, Chickasaw County, Miss. W. H. Monroe.
85. In a shallow gully west of road near foot of large hackberry tree about 10 feet below top of chalk in nearby road cut, Houston road 1.4 miles north by east of Sparta, Chickasaw County, Miss. L. W. Stephenson and W. H. Monroe. U.S.G.S. 17235.
86. In road cut on Houston road about 8 feet below top of section, 7.4 miles north by east of Sparta, Chickasaw County, Miss. L. W. Stephenson and W. H. Monroe.
87. Chalklike rock 1½ miles south of Houston, Chickasaw County, Miss. L. W. Stephenson.
88. 4 feet above base of formation, cut in U. S. Highway 45, 0.6 mile south of Running Water Creek and 5 miles south of Noxubee River Bridge at Macon, Noxubee County, Miss. L. W. Stephenson and W. H. Monroe.

RIPLEY FORMATION.

89. Coon Creek tongue. Cut of Southern Railway ¼ mile southeast of the Tennessee State line and ½ mile northwest of Wenasoga, Alcorn County, Miss. L. W. Stephenson and W. H. Monroe. U.S.G.S. 17234.
90. Two and one-half miles east of Pontotoc, Pontotoc County, Miss. G. W. Ponton.

SELMA CHALK (UPPER PART).

91. Gully near public road 3½ miles northwest of Booneville, Prentiss County, Miss. L. W. Stephenson. U.S.G.S. 9505.
92. Alpina road 2 miles south of Graham, Union County, Miss. L. W. Stephenson. U.S.G.S. 9507.

RIPLEY FORMATION.

93. Coon Creek tongue. At road level 1.7 miles west of Camden,

Benton County, Tenn. I. G. Reimann.
94. New Corinth Highway 13½ miles south of Selmer, McNairy County, Tenn. I. G. Reimann.
95. Blue cut on Mobile and Ohio Railroad at State line, McNairy County, Tenn. I. G. Reimann.
96. 1½ miles west of Sardis on Sardis-Henderson road, Henderson County, Tenn. I. G. Reimann.
97. Coon Creek tongue. Dave Weeks place on Coon Creek, ⅛ mile east of main Hendersonville-Adamsville road, 3½ miles south of Enville, and 7½ miles north of Adamsville, McNairy County, Tenn.

SELMA CHALK (UPPER PART).
98. One-half mile west of Guys, McNairy County, Tenn. I. G. Reimann.

PRAIRIE BLUFF CHALK.
99. Old Canton Landing on Alabama River ¼ mile downstream from landing, Wilcox County, Ala. (5–6 feet below Cretaceous-Eocene contact). L. W. Stephenson and W. H. Monroe.
100. Old Canton Landing, Wilcox County, Alabama River, Ala. U.S.G.S. 6439.
101. U.S. Highway 80, 2.4 miles east-southeast of Southern Railway underpass at Livingston, Sumter County, Ala. L. W. Stephenson and W. H. Monroe.
102. U.S. Highway 80, 0.35 mile east of Southern Railway underpass at Livingston, Sumter County, Ala. L. W. Stephenson and W. H. Monroe.
103. Moscow Landing on the Tombigbee River, Sumter County, Ala. U.S.G.S. 6438.

SELMA CHALK (UPPER PART).
104. Bartons Bluff on the Tombigbee River, Marengo County, Ala. U.S.G.S. 6437.

TAYLOR AGE

TAYLOR MARL (UPPER PART).
105. Rugby road 1.9 miles east of Deport, Red River County, Tex. L. W. Stephenson.
106. Lower part. Branch of Kickapoo Creek 1,200 feet south of public road and 1.8 miles northwest of Annona, Red River County, Tex. C. H. Dane.
107. Lower part. Gully north of road west of iron bridge over branch of Kickapoo Creek 1.9 miles northwest of Annona, Red River County, Tex. L. W. Stephenson.
108. Lower part. Paris Highway 1.8 miles east of Deport on west-facing slope of Mustang Creek Valley, Red River County, Tex. L. W. Stephenson.
109. Lower part. South-flowing branch of Scatter Creek 3.5 miles southwest of Clarksville and 2.1 miles east of McCoy, Red River County, Tex. L. W. Stephenson.
110. Basal part. Milton road on west-facing slope of a branch valley 1 mile west of Deport, Lamar County, Tex. L. W. Stephenson.
111. Lower part. Deport road 0.3 mile east of Milton, Lamar County, Tex. L. W. Stephenson.
112. Lower part. Mulberry Creek 1,100 feet south of road crossing and ½ mile south of Milton, Lamar County, Tex. L. W. Stephenson.
113. North fork of Sulphur Creek ½ mile south of Gober, Fannin County, Tex. U. S. G. S. 9566.
114. Lower part. Paris-Greenville Highway ½ mile south of north fork of Sulphur River, Delta County, Tex. L. W. Stephenson.
115. Dallas road 4.3 miles southwest of Greenville, Hunt County, Tex. L. W. Stephenson and W. P. Popenoe.
116. Greenville road 7 miles south by west of Wolfe City, Hunt County, Tex. L. W. Stephenson.
117. U. S. Highway 67 at underpass of Missouri-Kansas-Texas Railroad 2.2 miles (air line) southwest of the courthouse at Greenville, Hunt County, Tex.
118. 2 miles north of Nevada, Collin County, Tex. L. W. Stephenson.
119. 1.2 miles southeast of Farmersville on road to Josephine, Collin County, Tex. C. H. Dane.
120. 1.2 miles southeast of Farmersville on road to Josephine, Collin County, Tex. L. W. Stephenson.
121. 5.1 miles from Josephine along highway to Nevada and about 2 miles north 15° east from Nevada, Collin County, Tex. C. H. Dane.
122. Ditch 3.9 miles east of Farmersville on Greenville road, Collin County, Tex. C. I. Alexander. No. 2467.
123. 2¾ miles east of Rockwall, Rockwall County, Tex. U.S.G.S. 9724.
124. Chalky shale 2.1 miles from Forney, Kaufman County, on road to Heath, Rockwall County, Tex. C. H. Dane.
125. 7.5 miles from Terrell on road to Crandall, Kaufman County, Tex. C. H. Dane.
126. East of Crandall and 2.7 miles (by road) northwest of Gastonia, Kaufman County, Tex. J. A. Cushman and J. A. Waters.
127. 0.3 mile (by road) southeast of Gastonia, Kaufman County, Tex. J. A. Cushman and J. A. Waters.
128. Road cuts just east of small station of Gastonia, on Southern Pacific Railroad, 6.15 miles from Kaufman on road to Crandall, Kaufman County, Tex. C. H. Dane.
129. Ditch on north side of road 4.9 miles east of Forney on Forney-Terrell Highway, Kaufman County, Tex. C. I. Alexander. No. 2468.
130. Ditch 5 feet below pavement on north side of U.S. Highway 80, 6.5 miles east of Dallas-Kaufman County line, Kaufman County, Tex. C. G. Lalicker. No. 38.
131. Ditch 5 feet below pavement on north side of U.S. Highway 80, 8.7 miles east of Dallas-Kaufman County line, Kaufman County, Tex. C. G. Lalicker. No. 39.
132. 2.6 miles east of Barry on road to Corsicana, Navarro County, Tex. C. H. Dane.
133. 2.6 miles east of Barry on road to Corsicana, Navarro County, Tex. L. W. Stephenson.
134. 1.4 miles north of Emhouse on road toward Ennis, Navarro County, Tex. C. H. Dane.
135. 20 feet above top of Pecan Gap chalk member of Taylor marl. Waco road 1 mile west-southwest of Prairie Hill, Limestone County, Tex. L. W. Stephenson.
136. 20 feet above Pecan Gap chalk. Ditch on north side of road 1.9 miles west-southwest of Prairie Hill, Limestone County, Tex. J. A. Cushman and N. L. Thomas. No. 23.
137. 10 feet above top of Pecan Gap chalk member of Taylor. Cooledge road 1¼ miles east-northeast of Delia, Limestone County, Tex. L. W. Stephenson.
138. Marquez salt dome, Leon County, Tex. J. A. Waters.
139. Road ditch 1.8 miles north 20° west of San Gabriel, Milam County, Tex. L. W. Stephenson.
140. Brushy Creek 2.3 miles west by north of Coupland, Williamson County, Tex. L. W. Stephenson.
141. 12 feet below bentonite, Brushy Creek 2.3 miles west by north of Coupland, Williamson County, Tex. L. W. Stephenson and P. W. Popenoe.
142. From crest of north-facing slope of Mustang Creek, public road 5 miles southeast of Taylor and 1.1 miles southeast of bridge over Mustang Creek, Williamson County, Tex. L. W. Stephenson and W. P. Popenoe.
143. Road ditch, Mustang Creek Valley just south of Taylor, Williamson County, Tex. U.S.G.S. 12894.
144. North-facing slope of Mustang Creek Valley on the Elgin road ½ mile south of Taylor, Williamson County, Tex. L. W. Stephenson and W. P. Popenoe.
145. Bluff of creek 200 feet southeast of concrete bridge where Pierce's lane crosses stream, southeast of Delvalle, Travis County, Tex. C. I. Alexander.
146. Gully in west-facing slope of Cottonwood Creek Valley ½ mile west of Kimbro and 2 miles south of Manda, Travis County, Tex. L. W. Stephenson.
147. High, steep 100-foot bank on south side of Onion Creek about ¼ mile upstream from the bridge at Moores Crossing southeast of Austin, Travis County, Tex. H. J. Plummer.
148. Right bank of Onion Creek near bridge at Moores and Berrys Crossing, 8½ miles (air line) southeast of Capitol at Austin, Travis County, Tex.
149. From 13½ to 15 feet above water level, left bank of Onion Creek, just above road crossing 0.75 mile south-southeast of Delvalle, Travis County, Tex. L. W. Stephenson and H. B. Stenzel.
150. Bank of a small branch in a field ⅛ mile east of San Marcos-Staples road and 2¼ miles south of courthouse at San Marcos, Hays County, Tex. L. W. Stephenson.
151. Gully south of New Braunfels-Clear Springs road 4 miles southeast of New Braunfels, Guadalupe County, Tex. L. W. Stephenson.
152. Ditch on second-class road leading down Saltillo Creek Valley 3½ miles (air line) southeast of Converse, Bexar County, Tex. L. W. Stephenson.
153. Bluff on Salado Creek 3½ miles east of Alamo Heights, Bexar County, Tex. U.S.G.S 7649.

154. Road cut 5.3 miles west of intersection of Medina Lake road and Larzamora Avenue, San Antonio, Bexar County, Tex. C. I. Alexander. No. 2426.
155. Castroville road 2.8 miles east of Medina County line and 17 miles east of San Antonio, Bexar County, Tex. L. W. Stephenson.
156. Potranca Creek 0.75 mile south of Castroville road, Bexar County, Tex. L. W. Stephenson.
157. 12 feet below base of *Exogyra-Gryphaea* bed. San Antonio road 6 miles east of Castroville, Bexar County, Tex. L. W. Stephenson.
158. Gully in west-facing slope of Medio Creek Valley below second-class road ¼ mile north of Castroville road, Bexar County, Tex. L. W. Stephenson.
159. Castroville road 0.35 mile east of Medio Creek Bridge, Bexar County, Tex. L. W. Stephenson.
160. 5 or 6 feet below base of *Exogyra-Gryphaea* zone. East bank of Medio Creek 0.85 mile below crossing of Castroville road, Bexar County, Tex. L. W. Stephenson.
161. Ditch of Seguin road, east—facing slope of Martinez Creek, Bexar County, Tex. L. W. Stephenson.
162. Cut in Seguin road, west—facing slope of Salado Creek Valley about 4.2 miles (air line) east-northeast of Alamo Plaza, San Antonio, Bexar County, Tex. L. W. Stephenson.
163. Second-class road south of Potranca road 2.3 miles southeast of junction with Culebra road, Bexar County, Tex. L. W. Stephenson.

ANACACHO LIMESTONE.

164. Upper part. Bed of Salado Creek about 3½ miles east by north of Alamo Heights, and 1 mile below crossing of Austin road, Bexar County, Tex. L. W. Stephenson. U.S.G.S. 7650.

PECAN GAP CHALK MEMBER OF TAYLOR MARL.

165. Type locality. Railroad cut ½ mile east of Pecan Gap, Delta County, Tex. J. A. Cushman and J. A. Waters. No. 32. (About 6 feet above locality 166.)
166. Type locality. Railroad cut ½ mile east of Pecan Gap, Delta County, Tex. J. A. Cushman and J. A. Waters. No. 31.
167. Type locality. Pecan Gap, Delta County, Tex. N. L. Thomas.
168. Greenville road 5.1 miles south by west of Wolfe City, Hunt County, Tex. L. W. Stephenson.
169. In road ditches 1.35 miles north from Lavon on road to Farmersville, Collin County, Tex. L. W. Stephenson.
170. Cut in Gulf Colorado & Santa Fe Railway at north edge of Farmersville, Collin County, Tex. U.S.G.S. 12912.
171. Quarry 1 mile southeast of Farmersville, Collin County, Tex. L. W. Stephenson.
172. Abandoned quarry 1 mile east of Farmersville, on Farmersville-Greenville road, Collin County, Tex. C. I. Alexander. No. 2466.
173. Road ditch on north side of Forney-Mesquite road 0.7 mile west of Forney, Kaufman County, Tex. C. I. Alexander. No. 2455.
174. 2.1 miles north of Forney on road to Heath, Kaufman County, Tex. L. W. Stephenson.
175. Basal. On road to Lavon, Collin County, 0.75 mile W. of secondary road and 0.75 mile north of Rockwall, Rockwall County, Tex. C. H. Dane.
176. Roadside ditch 1.8 miles by road east-northeast of the courthouse in Rockwall, on the old Greenville-Dallas highway, Rockwall County, Tex. H. J. Plummer.
177. On secondary road to Otto at crossing of "Big Creek," 3.2 miles southwest of Mart, McLennan County, Tex. C. H. Dane.
178. Road ditch 3.5 miles (air line) south-southwest of Lott, Falls County, Tex. L. W. Stephenson.
179. Falls of the Brazos, Falls County, Tex.

WOLFE CITY SAND MEMBER OF TAYLOR MARL.

180. One and two-tenths miles north of Lavon on road to Farmersville, Collin County, Tex. C. H. Dane.
181. Basal. McKinney road 3 miles west of Farmersville, Collin County, Tex. L. W. Stephenson.
182. Small quarry on north road about 2 miles west of Farmersville, off main road from Farmersville, Collin County, Tex. J. A. Cushman and J. A. Waters. Nos. 28, 29.
183. Basal. In contact with Taylor clay below, roadside ditch north of McKinney-Farmersville road 13.85 miles east of Houston & Texas Central Railroad tracks in McKinney, Collin County, Tex. C. I. Alexander. No. 2465.
184. Greenville road 4.8 miles south by west of Wolfe City, Hunt County, Tex. L. W. Stephenson.
185. Ditch east of Wolfe City-Greenville Highway 0.5 mile south of South Fork of Sulphur River and 4.3 miles south of Wolfe City, Hunt County, Tex. C. I. Alexander. No. 24130.
186. Road ditch on west side of road 1 mile out of Wolfe City on road to Pecan Gap, Hunt County, Tex. J. A. Cushman and J. A. Waters. No. 30.
187. Roadside ditch south of Hillsboro-Corsicana road 24.1 miles east of Hillsboro, Navarro County, Tex. C. I. Alexander. No. 2473.
188. Middle or upper part. 3 miles west of Barry, Navarro County, Tex. L. W. Stephenson.

ANNONA CHALK.

188a. Type location of Annona chalk. Two miles northwest of Annona, Red River County, Tex.
189. Spring near edge of hills 1.5 miles northwest of Green Hill School and 10 miles north by east of DeKalb, Bowie County, Tex. L. W. Stephenson.
190. 10 miles west by south of DeKalb, Bowie County, Tex. (From its locality on the map of Texas this would seem to be Navarro, but the fauna is rather definitely Annona. Some error may have been made in labels).
191. Lower part. Blue brittle chalky facies. White Rock, Red River County, Tex. L. W. Stephenson.
192. Basal. Ditch north of Paris-Clarksville Highway 5.45 miles southeast of Bagwell and 3.1 miles west of Clarksville, Red River County, Tex. C. I. Alexander. No. 24114.
193. Chalky marl layer in branch 2½ miles northwest of Clarksville, Red River County, Tex. L. W. Stephenson.
194. Near middle. Bank of branch west of Madras road 2.2 miles northeast of Clarksville, Red River County, Tex. L. W. Stephenson.
195. Upper part. Youngs Creek 0.8 mile below Texarkana road and 4 miles east of Clarksville, Red River County, Tex. L. W. Stephenson.
196. Upper part. In creek south of Texarkana road 6.5 miles east of Clarksville, Red River County, Tex. L. W. Stephenson. U.S.G.S. 13559.
197. Upper part. Four miles east of Clarksville, Red River County, Tex. U.S.G.S. 5437.
198. 0.75 mile north toward White Rock from Clarksville-Texarkana highway at a point 6.95 miles east of Clarksville, Red River County, Tex. C. I. Alexander. No. 24115.

TAYLOR MARL (LOWER PART).

199. U.S. Highway 82, 2.8 miles south-southeast of Bagwell Station, Red River County, Tex. L. W. Stephenson.
200. Cooper road 6 miles south of Paris, Lamar County, Tex. L. W. Stephenson.
201. Ditch southeast of Commerce-Paris Highway 6 miles south of Texas and Pacific Railway Station in Paris, Lamar County, and 9.3 miles north of Lake City, Delta County, Tex. C. I. Alexander. No. 24109.
202. Ditch east of Commerce-Paris Highway 6.9 miles north of Lake City and 8.4 miles south of Paris, Lamar County, Tex. C. I. Alexander. No. 24108.
203. Wolfe City road 2.5 miles south of Gober, Fannin County, Tex. U.S.G.S. 9566.
204. North fork of Sulphur Creek 2 to 3 miles southeast of Gober, Fannin County, Tex. U.S.G.S. 9563.
205. Just below Wolfe City sand member. Ditch on left of Honey Grove-Ladonia Highway 0.6 mile south of Sulphur River, 1.7 miles north of Ladonia, 2.4 miles south of Bagby, and 10.8 miles south of Honey Grove, Fannin County, Tex. C. I. Alexander. No. 24128.
206. Road cut, east bank, near crest of hill, 0.9 mile north of Lake City, Delta County, and 14.4 miles south of Paris, Lamar County, Tex. C. I. Alexander. No. 24107.
207. Bear Creek 0.8 mile south by east of Lavon, Collin County, Tex. L. W. Stephenson.
208. Farmersville road 4.9 miles east of McKinney, Collin County, Tex. L. W. Stephenson and W. P. Popenoe.
209. Basal. Farmersville road 5 miles east of McKinney, Collin County, Tex. L. W. Stephenson.
210. Branch north of Farmersville road 6.1 miles east of McKinney, Collin County, Tex. L. W. Stephenson.
211. Ditch south of McKinney-Farmersville road 7.2 miles east of Houston and Texas Central Railroad tracks in McKinney, Collin County, Tex. C. I. Alexander. No. 2463.
212. Ditch on south side of road 7.7 miles east from McKinney on road to Farmersville, Collin County, Tex. J. A. Cushman and J. A. Waters. No. 24.

213. Farmersville road 8 miles east of McKinney, Collin County, Tex. L. W. Stephenson.
214. Ditch on north side of road 9.5 miles east of McKinney Courthouse on Farmersville road, Collin County, Tex. J. A. Cushman and J. A. Waters. No. 25.
215. North side of road 14 miles east of McKinney Courthouse on Farmersville road, Collin County, Tex. J. A. Cushman and J. A. Waters. No. 26.
216. Basal. Just above Austin-Taylor contact. Northeast corner of "Y" intersection 0.3 mile north of intersection of U.S. Highway 80 and Buckner Boulevard, 2 feet below pavement, east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 29.
217. Basal. Just above Austin-Taylor contact. East side of Buckner Boulevard, 2 feet below pavement, 0.1 mile north of intersection of U.S. Highway 80 and Buckner Boulevard near Buckner Orphans Home, east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 28.
218. Basal. Terrell road 2 miles east of Buckner Orphans Home, east of Dallas, Dallas County, Tex. J. A. Cushman and J. A. Waters.
219. South side of U.S. Highway 80, 2 feet below pavement, 2.2 miles east of Buckner Orphans Home, east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 30.
220. Ditch on north side of U.S. Highway 80, 8 feet below pavement, 3.5 miles east of Buckner Orphans Home, east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 31.
221. Five feet below pavement, south side of U.S. Highway 80, 5.6 miles east of Buckner Orphans Home, east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 32.
222. North side of U.S. Highway 80, 5 feet below pavement, 7.7 miles east of Buckner Orphans Home and 200 feet northwest of intersection of U.S. Highway 80 and Texas State Highway 183 east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 33.
223. Ditch on south side of U.S. Highway 80, 3 feet below pavement, 9.4 miles east of Buckner Orphans Home, east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 34.
224. Within 20 feet of base. At subway under Missouri-Kansas-Texas Railroad, Dallas road 1.5 miles east of Garland, Dallas County, Tex. L. W. Stephenson and W. P. Popenoe.
225. At base. Dallas-Corsicana road 0.6 mile north of Wilmer, Dallas County, Tex. L. W. Stephenson and W. P. Popenoe.
226. Clay pit of Dallas Brick Co., ½ mile west of Mesquite, Dallas County, Tex. H. J. Plummer.
227. Basal. Branch of Prairie Creek just north of east-west road 1.15 miles east of Pleasant Grove and 3.2 miles north-northwest of Rylie, Dallas County, Tex. L. W. Stephenson. From 1 foot above a thin limestone lens.
228. Ditch on south side of U.S. Highway 80, 5 feet below pavement, 3 miles east of Dallas-Kaufman County line, Kaufman County, Tex. C. G. Lalicker. No. 36.
229. Ditch on south side of U.S. Highway 80, 3 feet below pavement, 1.7 miles east of Dallas-Kaufman County line, Kaufman County, Tex. C. G. Lalicker. No. 35.
230. Ferris clay pit, Ferris, Ellis County, Tex.
231. Clay pit at Palmer, Ellis County, Tex. J. A. Cushman and J. A. Waters.
232. 1 mile north of Palmer, Ellis County, Tex. U.S.G.S. 12900.
233. 2.3 miles by road north of Palmer, Ellis County, Tex. J. A. Cushman and J. A. Waters.
234. Upper part. One and nine-tenths miles east of Bristol, Ellis County, Tex., on road to State rock ferry on Trinity River. C. H. Dane.
235. Below Wolfe City sand member. Ditch south of highway from Ennis to Waxahachie (not the regular Ennis-Waxahachie Highway) 4.25 miles west of Ennis, Ellis County, Tex. C. I. Alexander. No. 2480.
236. Road ditch, south of Hillsboro-Corsicana road, at turn 20.3 miles east of Hillsboro, Navarro County, Tex. C. I. Alexander. No. 2472.
237. Bank of small stream about 45 feet north of Hillsboro-Corsicana road 14.2 miles east of Hillsboro, Hill County, Tex. C. I. Alexander. No. 2470.
238. North Flat Creek, left bank, 350 feet east of the new U.S. Highway 81 about 5 miles south of Waco, McLennan County, Tex. L. W. Stephenson.
239. About 2 feet above phosphate layer at base of Taylor marl. North Flat Creek 1,500 feet west of new U.S. Highway 81 about 5 miles south of Waco, McLennan County, Tex. L. W. Stephenson.
240. Basal. Branch of creek 1½ miles southeast of Lorena, McLennan County, Tex. L. W. Stephenson.
241. Road ditch on north-facing slope of Bullhide Creek Valley 5½ miles east by south of Lorena, McLennan County, Tex. L. W. Stephenson.
242. Chilton road 10 miles south-southeast of Waco, McLennan County, Tex. L. W. Stephenson.
243. Main Chilton road 14 miles south by east of Waco, McLennan County, Tex. L. W. Stephenson.
244. 2½ feet above base. A small branch west of Mooreville road 1⅝ miles east-southeast of Eddy, Falls County, Tex. L. W. Stephenson.
245. On road to Little River and Temple 3 miles west of Rogers, Bell County, Tex. C. H. Dane.
246. Near base. Bluff on San Gabriel River 1 mile below Jonah, Williamson County, Tex. L. W. Stephenson and W. P. Popenoe.
247. Bluff on Walnut Creek 1½ miles below Sprinkle road crossing, Travis County, Tex. U.S.G.S. 7583.
248. Ditch on Austin-Manor road 0.2 mile east of Big Walnut Creek and 5.8 miles west by south of Manor, Travis County, Tex. U.S.G.S. 12893.
249. About 7 feet above top of Burditt marl. Little Walnut Creek, 13-foot bank about 0.2 mile below the Manor road crossing (State Highway 20), 4¾ miles east-northeast of the Capitol at Austin, Travis County, Tex. L. W. Stephenson.
250. Blue Bluff, on Colorado River at Hornsbys Bend, Travis County, Tex. L. W. Stephenson.
251. Right bank of Guadalupe River, a few hundred yards above the International-Great Northern Railroad bridge, 1 mile east of New Braunfels, Comal County, Tex. L. W. Stephenson. U.S.G.S. 7625.

MARLBROOK MARL.

252. Railroad cut ½ mile north of Okolona, Clark County, Ark. H. J. Plummer.

OZAN FORMATION.

253. 2 miles south of Ben Lomond, Sevier County, Ark. U.S.G.S. 12885.
254. White Cliffs, Little River County, Ark. U.S.G.S. 7490, 7488, 13501.

SELMA CHALK (MIDDLE PART) OF UPPER TAYLOR AGE.

255. Jim Wilkin's property, 300 yards northwest of Union Church, Hardin County, Tenn. I. G. Reimann.

SELMA CHALK (MIDDLE PART) OF PECAN GAP AGE.

256. Upper end of bluff on Tombigbee River, Demopolis, Marengo County, Ala. U.S.G.S. 6435.

SELMA CHALK (MIDDLE PART) OF UPPER TAYLOR AGE.

257. Bridge near cemetery, Corinth, Alcorn County, Miss. I. G. Reimann.
258. Just above Coffee sand. Illinois Central Railroad cut 1½ miles southeast of Southern Railway crossing, Corinth, Alcorn County, Miss. L. W. Stephenson. U.S.G.S. 9496.
259. 10½ miles south of Corinth, Alcorn County, Miss. G. M. Ponton. No. S–513.
260. 1 mile east of Booneville, Prentiss County, Miss. G. M. Ponton. No. S–515.
261. Just above Coffee sand. About 16 feet above track level, cut of Mobile and Ohio Railroad, ¼ mile south of station, Booneville, Prentiss County, Miss. L. W. Stephenson. U.S.G.S. 9504.
262. 10 miles east of Blue Springs, Union County, Miss. G. M. Ponton. No. S–516.
263. Tupelo tongue of Coffee sand. One mile east of Tupelo, Lee County, Miss. G. M. Ponton. No. S–522.
264. 1 mile west of Tupelo, Lee County, Miss. G. M. Ponton. No. S–518.
265. 2 miles west of Guntown, Lee County, Miss. G. M. Ponton. No. S–519.
266. 7¼ miles east of Blue Springs, Lee County, Miss. G. M. Ponton. No. S–514.
267. 11½ miles east of Blue Springs, Lee County, Miss. G. M. Ponton. No. S–517.

SELMA CHALK (MIDDLE PART) OF LOWER TAYLOR AGE.

268. Mooreville tongue. From bed of gully 40 feet below top of hill on Fulton road ¾ mile west of Mooreville, Lee County, Miss. L. W. Stephenson. U.S.G.S. 9520.

AUSTIN AGE

BURDITT MARL (OF ADKINS).

269. Zone of *Exogyra tigrina*. Little Elm Creek 1 mile below the Missouri-Kansas-Texas Railroad bridge, 2.7 miles northeast of the public square at Temple, Bell County, Tex. L. W. Stephenson.
270. Near top. Little Walnut Creek, right bank, ¾ mile below the old Sprinkle road bridge (iron, now abandoned), 5¼ miles northeast of the Capitol at Austin, Travis County, Tex. L. W. Stephenson.
271. 5 feet above *Exogyra tigrina* layer. Little Walnut Creek, left bank, 1,200 feet downstream from the old Sprinkle road bridge (iron, now abandoned), 5½ miles northeast of the Capitol at Austin, Travis County, Tex. L. W. Stephenson.

GOBER TONGUE OF AUSTIN CHALK.

272. Upper part. Quarry in small branch on the edge of the town of Gober, Fannin County, Tex. L. W. Stephenson.
273. Upper part. Taken 1 foot below the top of the Gober chalk. Rock quarry 0.4 mile northwest of the stores at Gober, Fannin County, Tex. L. W. Stephenson.
274. Taken 12 feet below the top of the Gober chalk. Rock quarry 0.4 mile northwest of the stores at Gober, Fannin County, Tex. L. W. Stephenson.
275. Upper part. West bank of Moss Creek about 150 yards south of bridge on Honey Grove-Ladonia Highway 4.7 miles south of Honey Grove, Fannin County, Tex. C. I. Alexander. No. 24126.
276. Lower part. Bonham road 0.8 mile north of Randolph, Fannin County, Tex. L. W. Stephenson and W. P. Popenoe.
277. Middle part. Randolph road 4 miles north of Leonard, Fannin County, Tex. L. W. Stephenson and W. P. Popenoe.
278. Near middle. Public road just east of its junction with U.S. Highway 69, in east-facing slope 1 mile east of Trenton, Fannin County, Tex. L. W. Stephenson.
279. Bonham road 0.6 mile west of Windom, Fannin County, Tex. L. W. Stephenson and W. P. Popenoe.
280. Public road south of railroad 3¼ miles northwest of Bailey, Fannin County, Tex. L. W. Stephenson and W. P. Popenoe.
281. Near top. Small branch 0.2 mile south of St. Louis Southwestern Railway, 0.3 mile southeast of Bailey, Fannin County, Tex. L. W. Stephenson.
282. Lower part. Clay marl on Bonham road 2.3 miles west of Petty, Lamar County, Tex. L. W. Stephenson and W. P. Popenoe.
283. Middle part. Ditch north of Paris-Bonham Highway 3.9 miles east of Honey Grove and 2.2 miles west of Petty, Lamar County, Tex. C. I. Alexander. No. 24122.
284. Lower part. East bank of small stream at north end of concrete culvert 2.8 miles west of High and 1.1 miles east of Petty, on Paris-Bonham Highway, Lamar County, Tex. C. I. Alexander. No. 24121.
285. Ditch south of Greenville-Paris Highway 10.15 miles north of Lake City and 5.15 miles south of Paris, Lamar County, Tex. C. I. Alexander. No. 24110.
286. North-facing scarp on road to High 3 miles south of main highway from Sherman to Paris, Lamar County, Tex. J. A. Cushman and J. A. Waters. No. 33.
287. Lower part. Railroad cut 0.8 mile west of the town of High on Paris-Bonham highway, Lamar County, Tex. C. I. Alexander. No. 24120.
288. Lower part. Cut on Texas and Pacific Railway 2.2 miles west of High, Lamar County, Tex. L. W. Stephenson and W. P. Popenoe.

AUSTIN CHALK.

289. Taken 5 to 6 feet above the *Inoceramus undulato-plicatus* zone. Small east-flowing creek 150 feet west of U.S. Highway 69, 0.7 mile northwest of the business center of Whitewright, Grayson County, Tex. L. W. Stephenson.
290. Chalk on road 0.7 mile north of Whitewright, north-facing slope of branch valley, Grayson County, Tex.
291. From the *Inoceramus undulato-plicatus* zone. Small east-flowing creek 150 feet west of U.S. Highway 69, 0.7 mile northwest of the business center of Whitewright, Grayson County, Tex. L. W. Stephenson.
292. Upper part. Ditch 1.4 miles north of Melissa on Sherman-McKinney Highway, Collin County, Tex. C. I. Alexander. No. 2411.
293. Upper part. Road cut 1.5 miles south of Anna on Sherman-Dallas highway, Collin County, Tex. C. I. Alexander. No. 2412.
294. Upper part. Road cut 3.7 miles east of Southern Railway (Houston and Texas Central) tracks in McKinney, on McKinney-Farmersville road, Collin County, Tex. C. I. Alexander. No. 2421.
295. Upper part. West side of road 3.4 miles toward Farmersville from McKinney Courthouse, Collin County, Tex. J. A. Cushman and J. A. Waters. No. 22.

295a. Upper part. Public road 6.5 miles east by north of Allen, Collin County, Tex.

296. West side of Haines Avenue 200 feet south of Colorado Boulevard, 5 feet above road and below massive limestone, Dallas (west of Trinity River), Dallas County, Tex. C. G. Lalicker. No. 11.
297. Bluff facing Trinity River, east side of Missouri-Kansas-Texas Railroad tracks 400 feet northwest of the end of Randall Street, 4 feet above tracks on the east side of Trinity River, Dallas, Dallas County, Tex. C. G. Lalicker. No. 12.
298. West side of Maple Avenue 60 feet north of west end of Missouri-Kansas-Texas Railroad underpass, 3 feet above sidewalk, Dallas, Dallas County, Tex. C. G. Lalicker. No. 13.
299. Five feet above pavement, northeast corner of Fitzhugh Street and Glenwood Avenue, Dallas, Dallas County, Tex. C. G. Lalicker. No. 14.
300. In creek, 10 feet above bed, 50 feet north of Houston and Texas Central Railroad bridge at intersection of Mockingbird Lane and railroad on the northeast edge of Dallas, Dallas County, Tex. C. G. Lalicker. No. 16.
301. On north side of northwest highway 100 feet north of highway and 15 feet above pavement, 3 miles east of Greenville road and northwest highway underpass northeast of Dallas, Dallas County, Tex. C. G. Lalicker. No. 18.
302. On north side of northwest highway, 3 feet above pavement, 3 miles east of Greenville road and northwest highway underpass northeast of Dallas, Dallas County, Tex. C. G. Lalicker. No. 17.
303. Upper part. In ditch on south side of Texas State Highway 114, 5 miles east of Greenville road and northwest highway underpass northeast of Dallas, Dallas County, Tex. C. G. Lalicker. No. 19.
304. Upper part. On northwest highway at southeast side of underpass of northwest highway and Greenville road, 5 feet above pavement, northeast edge of Dallas, Dallas County, Tex. C. G. Lalicker. No. 20.
305. Upper part. North side of northwest highway, pavement level, 5.3 miles east of Greenville road and northwest highway underpass northeast of Dallas, Dallas County, Tex. C. G. Lalicker. No. 21.
306. Upper part. Near top. South side of Buckner Boulevard at curve west of underpass, pavement level, 2.7 miles north of Buckner Orphans Home, northeast of Dallas, Dallas County, Tex. C. G. Lalicker. No. 22.
307. Upper part. Six feet below spillway and 300 feet west of White Rock Dam, on White Rock Creek east of Dallas, Dallas County, Tex. C. G. Lalicker. No. 23.
308. Upper part. On south side of Grand Avenue, pavement level, 350 feet west of intersection of Grand Avenue and Gaston Avenue, east edge of Dallas, Dallas County, Tex. C. G. Lalicker. No. 26.
309. Uppermost part. Just below Austin-Taylor contact. Southeast side of underpass, 2 feet above pavement, on south side of Buckner Boulevard 2.5 miles north of Buckner Orphans Home, northeast of Dallas, Dallas County, Tex. C. G. Lalicker. No. 27.
310. Upper part. From 1 foot below a thin limestone lens. Branch of Prairie Creek just north of east-west road 1.15 miles east of Pleasant Grove and 3.2 miles north-northwest of Rylie, Dallas County, Tex. L. W. Stephenson.
311. Upper part. Road cut near top of north-facing hill 2.3 miles north of Dallas on Dallas-Sherman Highway about 100 yards south of gateway to Vickery Park, Dallas County, Tex. C. I. Alexander. No. 2417.
312. Upper part. One mile west of Bynum on road to Hillsboro, Hill County, Tex. J. A. Cushman and N. L. Thomas.
313. Upper part. Gully south of Hillsboro-Corsicana road 10 miles east of Hillsboro, Hill County, Tex. C. I. Alexander. No. 2425.

314. Upper part. East bank of tributary to White Rock Creek, 30 yards west of Hillsboro-Corsicana road and 7.75 miles east of Hillsboro, Hill County, Tex. C. I. Alexander. 2424.
315. Upper part. At bridge across Elm Creek 2½ miles east by south of Troy, Bell County, Tex. L. W. Stephenson and W. P. Popenoe.
316. Upper part. Pecan Creek 3.4 miles south by East of Troy and 1 mile southwest of Childer's School, Bell County, Tex. L. W. Stephenson and W. P. Popenoe.
317. Upper part. In bed of Blanco River just below crossing of San Marcos and Kyle roads about 5 miles northeast of San Marcos, Hays County, Tex. L. W. Stephenson. U.S.G.S. 7639.

BROWNSTOWN MARL.

318. Near base. Ditch at north end of culvert on Paris-Clarksville Highway 1.85 miles southeast of Bagwell, Red River County, Tex. C. I. Alexander. No. 24113.

BROWNSTOWN MARL (?)

319. About 20 feet below phosphate layer. Bed of small branch just east of U.S. Highway 82, 1¾ miles south-southeast of Bagwell Station, Red River County, Tex. L. W. Stephenson.

BROWNSTOWN MARL.

320. Middle part. Ditch east of Commerce-Paris Highway 12.4 miles north of Lake City and 2.9 miles south of Paris, Lamar County, Tex. C. I. Alexander.
321. Upper part. Ditch south of Greenville-Paris Highway 11.4 miles north of Lake City and 3.9 miles south of Paris, Lamar County, Tex. C. I. Alexander. No. 24112.

BLOSSOM SAND.

322. Ditch west of road leading northward from Honey Grove to Monkstown 6.5 miles north of Honey Grove, Fannin County, Tex. C. I. Alexander. No. 24125.

AUSTIN CHALK.

323. Middle part. Argillaceous chalk on east bank of small stream at south end of bridge on Van Alstyne-Gunther road 2.3 miles west of Van Alstyne, Grayson County, Tex. C. I. Alexander.
324. Middle part. Ditch south of highway leading west from McKinney 3.1 miles west of McKinney, Collin County, Tex. C. I. Alexander. No. 2420.
325. Middle part. Road cut north side of West Dallas pike 5.3 miles northeast of Austin-Eagle Ford contact at Chalk Hill, Dallas County, Tex. C. I. Alexander. No. 2404.
326. Middle part. Southeast corner of Mockingbird Lane and Abrams Street in ditch 4 feet below pavement, northeast edge of Dallas, Dallas County, Tex. C. G. Lalicker. No. 15.

BONHAM MARL.

327. U.S. Highway 271, 4.5 miles north of Paris and 0.7 mile south of Hinckley, Lamar County, Tex. L. W. Stephenson.
328. Road ditch on east side of road 7.8 miles south of Sherman, Grayson County, Tex. J. A. Cushman and J. A. Waters. No. 21.
329. Road ditch on east side of road 4 miles north of Paris on road to Hugo, Lamar County, Tex. J. A. Cushman and J. A. Waters. No. 35.
330. Ditch on west side of road 7 miles north of Paris on road to Hugo, Lamar County, Tex. J. A. Cushman and J. A. Waters. No. 36.
331. U.S. Highway 271, 2.15 miles north of Hinckley and 7.3 miles north of Paris, Lamar County, Tex. L. W. Stephenson.

ECTOR TONGUE OF AUSTIN CHALK.

332. Cut in east bank of road 2.3 miles south of Sherman, Grayson County, Tex. J. A. Cushman and J. A. Waters. No. 17, No. 19.

AUSTIN CHALK.

333. Lower part. Ditch west of road 2 miles north of Sherman, Grayson County, Tex. C. I. Alexander. No. 2406.
334. Basal part. Ditch on west side of Sherman-Dennison Highway 3 miles north of Sherman, Grayson County, Tex. C. I. Alexander. No. 2405.
335. Lower part. East slope of road cut between two Railroad underpasses near north edge of town of Howe, Grayson County, Tex. C. I. Alexander. No. 24141.
336. Basal part. Dallas road 2 miles south of Sherman, Grayson County, Tex. L. W. Stephenson and W. P. Popenoe.
337. Lower part. Ditch west of road 300 feet north of intersection of Frisco-Prosper Highway and highway leading west from McKinney, Collin County, Tex. C. I. Alexander. No. 2418.
338. Lower part. Ditch east of road 2.5 miles east of Austin-Eagle Ford contact at Chalk Hill, on West Dallas pike, Dallas County, Tex. C. I. Alexander. No. 2403.
339. Basal part. Road cut at Chalk Hill, on Fort Worth-Dallas pike, Dallas County, Tex. C. I. Alexander. No. 2441.
340. Basal part. Just above Eagle Ford contact on north side of Mansfield-Cedar Hill road, 1 foot above roadbed, 2 miles west of railroad station in Cedar Hill, Dallas County, Tex. C. G. Lalicker. No. 6–A.
341. Basal part. 6 feet above Eagle Ford contact on south side of U. S. Highway 80, 7 miles west of Union Station, Dallas, Dallas County, Tex. C. G. Lalicker. No. 6.
342. Basal part. 10 feet above Eagle Ford contact on south side of U.S. Highway 80, 7 miles west of Union Station, Dallas, Dallas County, Tex. C. G. Lalicker. No. 7.
343. Lower part. 20 feet above Eagle Ford contact on south side of U.S. Highway 80, 6.9 miles west of Union Station, Dallas, Dallas County, Tex. C. G. Lalicker. No. 8.
344. Lower part. Cut on south side of U.S. Highway 80, 2 feet above sidewalk, opposite Catholic school 3.8 miles west of Union Station, Dallas, Dallas County, Tex. C. G. Lalicker. No. 9.
345. Lower part. North side of Colorado Boulevard between Woodlawn Avenue and Haines Avenue, west side of Trinity River, Dallas, Dallas County, Tex. C. G. Lalicker. No. 10.
346. Basal part. Road cut on Corsicana road 2.7 miles east of Hillsboro, Hill County, Tex. C. I. Alexander. No. 2422.

BROWNSTOWN MARL.

347. On State Highway 27, 2.2 miles east of Ben Lomond, Sevier County, Ark.
348. 40 to 50 feet above the base of the marl. Nashville road 1 mile east of Ben Lomond, Sevier County, Ark. L. W. Stephenson.
349. Upper part. Hollywood road 8.1 miles west of Arkadelphia, Clark County, Ark. L. W. Stephenson.

SELMA CHALK (LOWER PART).

350. Lower part of Mooreville tongue. Bank of branch south of Fulton road ½ mile east of Mooreville, Lee County, Miss. U.S.G.S. 9521.
351. Lower part of Mooreville tongue just above Tombigbee sand. Probably upper Austin age. Exposure in east-facing slope of Mantachie Creek Valley, Mantachie road 5 miles northeast of Mooreville, Itawamba County, Miss. L. W. Stephenson. U.S.G.S. 9518.

SELMA CHALK (LOWER PART) OF UPPER AUSTIN AGE.

352. Basal part. Old Fairfield Bluff, Tombigbee River near Cochrane, Pickens County, Ala. U.S.G.S. 6419. (This may be Taylor.)
353. Basal part. Choctaw Bluff, Warrior River, Ala. U.S.G.S. 6425–B. (The species seem to be Taylor, although according to the map the area should be Selma.)

EAGLE FORD AGE

EAGLE FORD SHALE.

354. Lower part, clay near base. Public road 2.3 miles west by south of Pottsboro, Grayson County, Tex. L. W. Stephenson and W. P. Popenoe.
355. Upper part. North side of road, 2 feet above roadbed, 0.6 mile southwest of railroad station in Eagle Ford, Dallas County, Tex. C. G. Lalicker. No. 1-A.
356. Upper part. North side of road, 6 feet above roadbed, 1.3 miles southwest of railroad station in Eagle Ford, Dallas County, Tex. C. G. Lalicker. No. 2-A.
357. Middle part. North side of Mansfield-Cedar Hill road, level with roadbed, 4 miles west of railroad station in Cedar Hill, Dallas County, Tex. C. G. Lalicker. No. 4-A.
358. Southwest side of road, 3 feet below pavement, 6 miles northwest of Irving, Dallas County, Tex. C. G. Lalicker. No. 7-A.
359. South side of road, pavement level, 6.2 miles northwest of Irving, Dallas County, Tex. C. G. Lalicker. No. 8-A.
360. South side of road, pavement level, 6.2 miles northwest of Irving, Dallas County, Tex. C. G. Lalicker. No. 10-A.
361. U.S. Highway 80, 10.1 miles west of Union Station, Dallas, on northeast side of Texas and Pacific Railway, underpass, 3 feet above pavement, Dallas County, Tex. C. G. Lalicker. No. 2.

362. Just below Austin contact in road cut on south side of U.S. Highway 80, 7 miles west of Union Station, Dallas, Dallas County, Tex. C. G. Lalicker. No. 5.
363. Upper part. Three-tenths mile north of Eagle Ford—Austin contact at Chalk Hill, west of Dallas, Dallas County, Tex. C. I. Alexander. No. 2402.
364. Shale about 175 feet below *Metoicoceras whitei* zone, 3 miles west of Midlothian, Ellis County, Tex. W. L. Moreman.
365. Lower part. Branch east of Fort Worth road about 2¼ miles north of Itasca, Hill County, Tex. W. L. Moreman.
366. Lower part. Branch east of Fort Worth road about 2¼ miles north of Itasca, Hill County, Tex. L. W. Stephenson.
367. Lower part. South bank of small stream 100 yards east of highway 2.1 miles north of Itasca, Hill County, Tex. C. I. Alexander. No. 24102.
368. South branch of small stream ⅛ mile west of road to Fort Worth 9 miles north of Hillsboro, Hill County, Tex. J. A. Cushman and N. L. Thomas. No. 19.
369. Middle or upper part. 1 mile north of Lovelace, Hill County, Tex. L. W. Stephenson.
370. Lower part. Just below *Metoicoceras whitei* zone, 2 miles west of Britton, Tex. W. L. Moreman.

Vertical distribution of Upper Cretaceous Foraminifera in the Gulf Coastal region

Species	Eagle Ford shale	Austin age: Ector tongue (of Austin chalk)	Bonham marl	Selma chalk (lower part)	Austin chalk	Brownstown marl	Gober tongue (of Austin chalk)	Taylor age: Taylor marl (lower part)	Ozan formation	Selma chalk (middle part)	Wolfe City sand member	Pecan Gap chalk member	Annona chalk	Taylor marl (upper part)	Navarro age: Saratoga chalk	Neylandville marl	Selma chalk (upper part)	Ripley formation	Nacatoch sand	Prairie Bluff chalk	Owl Creek formation	Corsicana marl	Arkadelphia marl	Kemp clay
Rhabdammina discreta																				×				
Bathysiphon taurinensis					×									?										
alexanderi					×	×																		
Proteonina difflugiformis																	×	×						
Pelosina complanata							×	×																
Reophax texanus																				×		×	×	×
dentalinoides									×				×	×										
constrictus								×			×			×						×				
clavulinus				×									×											
Ammodiscus pennyi																						×		
cretaceus							×	×					×	×				×				×		
Glomospira gordialis					×									×										
Haplophragmoides calculus			×		×			×			×	×		×					×	×		×		×
eggeri													×							×		×		
glabra																			×			×		×
rugosa										×				×						×			×	
excavata								×		×	×					×			×			×	×	×
Ammobaculites alexanderi														×										
arenatus																							×	
coprolithiformis	×								×				×				×					×	×	
fragmentarius			×					×			×	×	×					×						
subcretaceus	×																							
texanus																						×		
stephensoni	×		×					×			×	×	×	×										
Flabellammina saratogaensis									×						×									
clava					×																			
rugosa					×									×										
magna												×												×
compressa								×					×	×										
Frankeina taylorensis								×					×	×	?									
cushmani												×		×										
rugosissima								×																
Haplophragmium taylorense					×			×																
Lituola taylorensis					×								×	×										
irregulariter								×																
Spiroplectammina navarroana																								×
laevis var. cretosa						×	×	×			×	×	×	×										
semicomplanata														×			×	×		×		×		×
semicomplanata var. juncea									×						×		×		×					
lalickeri					×			×					×	×										
Textularia ripleyensis								×	×	×	×	×	×	×	×	×	×	×						
subconica					×			×	×	×			×	×										
subglabra								×				×												
Ammobaculoides navarroensis																								×
Verneuilina cretosa														×										
Tritaxia ellisorae												×												
Gaudryina foeda								×	×					×						×				
faujasi														×										
bentonensis	×		×	×		×		×			×	×	×	×										
navarroana																			×				×	×
io											×													
rudita					×					×				×		×	×	×		×	×	×		
quadrans														×										
austinana					×		×	×																
stephensoni					×			×		×	×	×		×			×	×						
ellisorae				×				×																
Gaudryinella pseudoserrata																			×			×	×	×
Pseudoclavulina clavata		×		×	×	×	×	×	×	×	×	×	×	×		×	×	×		×		×		
amorpha var. incrustata															×									
arenata																							×	
Clavulinoides trilatera															×							×		
trilatera var. concava								×		×	×		×	×	×	×	×	×	×	×				
trilatera var. plummerae								×		×	×	×	×	×	×	×	×			×		×		
aspera		×		×	×		×	×	×	×	×	×	×	×	×							×		×
compressa																		×				×	×	
insignis																				×		×	×	×
disjuncta											×		×	×										
Pseudogaudryinella capitosa					×			×	×	×	×	×	×	×										
capitosa var. serrulata					×	×	×	×																
mollis					×																			

Species		Austin age						Taylor age							Navarro age									
	Eagle Ford shale	Ector tongue (of Austin chalk)	Bonham marl	Selma chalk (lower part)	Austin chalk	Brownstown marl	Gober tongue (of Austin chalk)	Taylor marl (lower part)	Ozan formation	Selma chalk (middle part)	Wolfe City sand member	Pecan Gap chalk member	Annona chalk	Taylor marl (upper part)	Saratoga chalk	Neylandville marl	Selma chalk (upper part)	Ripley formation	Nacatoch sand	Prairie Bluff chalk	Owl Creek formation	Corsicana marl	Arkadelphia marl	Kemp clay
Heterostomella austinana		X			X	X	X	X																
americana								X	X	X	X	X	X	X				X		X		X		
foveolata								X																
cuneata															X		X							
cuneata var. curvata															X		X							
Arenobulimina americana				X	X	X	X	X			X	X	X	X	X		X			X				
Eggerella ? trochoides								X		X	X	X	X	X	X		X	X						
Marssonella oxycona		X			X		X	X				X	X	X	X					X				
ellisorae												X												
Dorothia concinna														X										
conula													X											
stephensoni					X		X	X	X		X	X	X	X	X		X							
alexanderi					X	X	X	X																
glabrella				X				X		X				X										
pontoni										X								X						
bulletta				X	X			X		X				X			X	X	X	X		X	X	X
glabrata														X		X				X		X		
Plectina watersi																	X	X	X	X	X	X	X	X
Goësella rugulosa															X	X				X			X	X
Rzehakina epigona var. lata								X																
Quinqueloculina antiqua var. angusta									X					X				X		X		X		
sp.																	X					X		X
moremani	X																							
Massilina texasensis																								X
sp.																						X		
Spiroloculina cretacea								X																
sp.														X										
Triloculina circularis																		X						
Trochammina diagonis										X					X	X					X	X		X
texana															X	X						X		X
gyroides																						X	X	
taylorana								X																
sp.																		X						
Polyphragma sp.					X				X					X	X									
Robulus navarroensis															X	X	X	X	X	X	X	X	X	X
navarroensis var. extruatus																				X		X	X	X
pondi								X		X				X	X	X	X	X		X		X		
spisso-costatus																	X			X		X	X	X
taylorensis					?			X		X	X	X	X	X										
münsteri					X	X	X	X					X	X				X						
pseudo-secans										X						X								
alexanderi																		X						
aldrichi																		X						
stephensoni										X				X	X	X	X	X	X					
Lenticulina jonesi																		X						
rotulata			X				X	X		X	X	X	X	X		X								
Planularia dissona																			X			X	X	X
tricarinella												X												
sp A																X								
Saracenaria triangularis				?	X		X	X			X	X	X	X				X		X				
saratogana															X					X		X	X	X
Marginulina austinana					X	X	X																	
austinana var. acescens							X																	
austinana var. directa			X		X		X	X			X													
inconstantia								X																
juncea								X																
stephensoni					X			X						X				X						
pseudomarcki														X										
dorsata													X											
armata														X										
munda														X										
cf. M. recta														X										
cf. M. elongata													X											
taylorana														X	X	X		X						
cretacea								X	X			X	X	X		X								
texasensis									X			X	X	X	X		X							
cf. M. tripleura								X						X		X								
bullata								X	X	X	X	X		X				X						
silicula																				X		X		X
navarroana																				X		X		
plummerae																				X		X	X	X
curvatura																						X	X	
siliqua																						X		X
jarvisi																								X
sp. A																						X		
sp. B														X										
sp. C														X										
Dentalina involvens					X																			
alternata				X	X	X	X	X	X	X		X	X	X	X	X	X	X						
legumen				X	X	X	X	X		X		X	X	X	X	X	X	X		X		X	X	
gracilis			X		X	X	X	X					X	X						X		X	X	X
lorneiana					X	X	X	X		X			X	X		X		X	X					
lorneiana var. spirans																		X						
fallax														X										
basitorta								X		X				X			X							
aculeata													X											
multicostata								X						X										
megalopolitana										X		X	X	X	X	X								
catenula								X	X	X	X	X	X	X		X								
basiplanata								X		X	X	X	X	X	X	X	X	X	X	X		X	X	X
confluens								X						X	X	X	X			X		X		
solvata							X						X	X			X							
crinita					?			X		X			X	X	X	X	X	X	X	X		X	X	X
cf. D. consobrina										X				X				X					X	X

Species		Austin age						Taylor age							Navarro age									
	Eagle Ford shale	Ector tongue (of Austin chalk)	Bonham marl	Selma chalk (lower part)	Austin chalk	Brownstown marl	Gober tongue (of Austin chalk)	Taylor marl (lower part)	Ozan formation	Selma chalk (middle part)	Wolfe City sand member	Pecan Gap chalk member	Annona chalk	Taylor marl (upper part)	Saratoga chalk	Neylandville marl	Selma chalk (upper part)	Ripley formation	Nacatoch sand	Prairie Bluff chalk	Owl Creek formation	Corsicana marl	Arkadelphia marl	Kemp clay
Dentalina pertinens														×			×							
delicatula																						×		×
angusticostata																						×		
Nodosaria affinis				×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		×		×	×	×
distans					×		×	×																
alternistriata					?																			
fusula					×	×		×	×	×			×											
aspera								×			×	×	×	×										
naumanni								×						×										
gracilitatis								×																
proboscidea										×				×										
amphioxys										×				×		×								×
obscura													×	×			×	×					?	
navarroana																				×		×		
corsicanana																						×		
limonensis												×												
Chrsyalogonium texanum					×		×	×					×	×										
eximium												×					×							
Pseudoglandulina manifesta				?	×		×	×				×	×	×	×	×		×		×		×	×	×
pygmaea								×	×	×		×	×	×		×	×				×		×	
lagenoides										×				×			×	×				×		
Lingulina taylorana								×																
pygmaea											×													
Vaginulina texana			×		×	×	×																	
recta	×				×		×																	
wadei					×	×		×		×	×	×				×	×	×						
selmaensis																	×							
multicostata								×		×		×	×	×	×	×	×	×		×		×	×	×
simondsi																×		×		×		×	×	×
cretacea															×			×		×		×	×	×
navarroana																			×	×		×		×
suturalis								×		×	×	×		×		×			×			×		×
webbervillensis																			×	×		×	×	×
subgracilis																		×				×		
taylorana								×						×										
Palmula cushmani					×																			
suturalis			×		×		×	×	×	×		×	×	×	×	×	×							
rugosa							×	×	×	×	×	×	×	×	×	×	×		×			×		
reticulata														×					×	×		×	×	×
primitiva												×		×										
pilulata			×																					
Frondicularia lanceola			×	?	×	×	×	×				×	×	×						×		×		
lanceola var. bidentata					×	×	×	×						×						×				
austinana	×				×		×	×																
inversa					×	×	×							×				×					×	
dunbari					×		×																	
aelis					×	×	×	×																
undulosa				×	×	×	×	×				×		×										
mucronata							×	×						×										
goldfussi					×		×	×		×		×	×	×										
cordata					×		×	×		×		×	×	×										
linearis			×		×		×	×				×	×	×										
intermittens								×	×	×		×	×	×										
frankei								×		×	×	×		×		×	×	×						
cuspidata								×				×		×				×						
cuspidata var. costifera														×			×							
linguiformis													×	×										
microdisca												×												
verneuiliana					×			×	×			×	×	×			×					×		
verneuiliana var. fossata					×		×			×		×		×										
striatula							×					×		×										
glabrans																		×						
watersi								×		×		×		×	×		×							
archiaciana								×	×	×	×	×	×	×				×				×		
arkadelphiana																				×			×	
clarki															×					×		×		
dimidia																×								
Kyphopyxa christneri				×	×	×	×	×	×	×	×	×	×	×										
cushmani														×										
Lagena hispida		×		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		×		×		×
acuticosta					×	×	×	×		×	×	×	×	×	×	×	×	×		×		×		
amphora var. paucicosta					×			×				×		×				×						
apiculata										×				×		×								
sulcata var. semiinterrupta																	×	×						
hexagona																	×	×						
lineata																		×						
plumigera																	×							
substriata																		×						×
laevigata				×				×		×		×		×			×	×						
cf. L. globosa						×		×					×	×			×	×		×		×		
alveolata																	×	×						
vulgaris															×									
semilineata														×										

Species		Austin age						Taylor age							Navarro age									
	Eagle Ford shale	Ector tongue (of Austin chalk)	Bonham marl	Selma chalk (lower part)	Austin chalk	Brownstown marl	Gober tongue (of Austin chalk)	Taylor marl (lower part)	Ozan formation	Selma chalk (middle part)	Wolfe City sand member	Pecan Gap chalk member	Annona chalk	Taylor marl (upper part)	Saratoga chalk	Neylandville marl	Selma chalk (upper part)	Ripley formation	Nacatoch sand	Prairie Bluff chalk	Owl Creek formation	Corsicana marl	Arkadelphia marl	Kemp clay
Guttulina trigonula									×									×						
adhaerens																		×		×		×	×	
Globulina lacrima					×			×	×	×			×	×	×		×	×	×	×		×		
lacrima var. subsphaerica										×				×			×	×			×	×	×	
lacrima var. horrida					×				×			×	×				×			×		×	×	
prisca													×				×			×				
Pyrulina cylindroides										×				×			×	×		×		×	×	×
Pseudopolymorphina incerta														×				×						
cuyleri																				×		×	×	
mendezensis																						×		
Sigmomorphina semitecta var. terquemiana										×								×						
Bullopora laevis			×			×	×	×				×		×								×		
tuberculata														×										
Ramulina navarroana																						×		
arkadelphiana																				×			×	×
globo-tubulosa					×							×	×					×						
aculeata				×	×		×	×	×			×	×	×										
Nonionella austinana	×				×	×	×	×				×		×										
robusta																×				×		×		×
cretacea								×					×	×			×	×						
ansata																				×				
Bolivinopsis rosula					×	×	×	×		×	×	×	×	×		×	×	×		×		×		
papillata								×						×				×						
Gümbelitria cretacea																	×	×		×		×		×
Gümbelina moremani	×				×																			
reussi		×	×	×	×	×	×	×	×	×			×											
plummerae				×	×			×		×	×	×	×	×		×	×					×		
striata		×		×	×	×		×		×		×		×		×		×				×		
planata														×										
carinata								×			×		×											
globulosa								×		×	×			×	×	×	×	×	×	×	×	×	×	×
pseudotessera			×		×	×	×	×		×		×	×	×										
semicostata								×						×		×								
globocarinata					×		×	×		×	×	×		×		×	×							
costulata								×			×	×		×		×		×	×	×		×		×
punctulata											×		×	×		×								
spinifera																		×						
excolata														×								×	×	×
glabrans																	×			×		×		×
Rectogümbelina texana	×				×																			
hispidula					×																			
minuta								×																
cretacea																							?	
Pseudotextularia varians																								×
Planoglobulina taylorana								×																
acervulinoides																				×				
Ventilabrella austinana	×				×	×	×	×																
eggeri				×	×	×	×	×						×										
eggeri var. glabrata							×	×						×		×								
carseyae																			×	×		×	×	×
Bolivinoides austinana					×	×	×	×																
texana								×				?												
decorata							×	×	×		×	×	×	×	×		×	×			×			
decorata var. delicatula								×	×	×		×	×	×	×			×						
Bolivinita elcyi					×	×	×	×			×	×	×	×										
planata								×			×	×		×		×		×						
selmensis																		×						
costifera																							?	
Eouvigerina americana		×					×	×			×		×	×				×						
gracilis								×				×		×										
hispida														×			×							
austinana					×	×	×	×																
plummerae		×			×		×																	
aculeata					×	×	×	×																
Pseudouvigerina plummerae					×		×	×			×	×		×	×	×	×	×						
cretacea					×									×			×	×			×			
seligi																		×		×	×	×	×	×
Siphogenerinoides plummeri																		×		×			×	×
brevispinosa																							?	
Buliminella fabilis	×				×	×	×	×				×												
vitrea					×				×									×						
cushmani					×										×					×		×		×
carseyae		×	×	×	×		×	×	×	×	×	×	×	×		×	×							
carseyae var. plana																×		×		×		×		
Bulimina reussi			×		×	×	×	×		×	×	×	×	×	×	×		×				×		
reussi var. navarroensis																×		×				×		×
quadrata								×		×	×	×	×	×	×	×	×	×		×		×	×	×
trihedra										×			×											
exigua			×		×	×	×	×																
prolixa										×				×		×		×				×		
triangularis								×		×	×			×								×		
rudita		×			×		×	×			×			×						×				
kickapooensis					×			×			×	×	×	×	×	×		×		×				
kickapooensis var. pingua																				×		×		×
pectinata														×										
taylorensis														×										
arkadelphiana																							×	
Neobulimina canadensis	×		×		×	×	×	×		×	×	×	×	×		×	×	×				×		
irregularis	×	×			×		×	×																
spinosa								×		×	×	×	×	×		×		×						
Entosolenia marginata																		×						
orbignyana																		×						

Species		Austin age						Taylor age							Navarro age									
	Eagle Ford shale	Ector tongue (of Austin chalk)	Bonham marl	Selma chalk (lower part)	Austin chalk	Brownstown marl	Gober tongue (of Austin chalk)	Taylor marl (lower part)	Ozan formation	Selma chalk (middle part)	Wolfe City sand member	Pecan Gap chalk member	Annona chalk	Taylor marl (upper part)	Saratoga chalk	Neylandville marl	Selma chalk (upper part)	Ripley formation	Nacatoch sand	Prairie Bluff chalk	Owl Creek formation	Corsicana marl	Arkadelphia marl	Kemp clay
Virgulina tegulata	×		×		×	×	×	×		×		×		×				×						
navarroana																						×		×
Bolivina incrassata								×	×	×	×	×	×	×	×	×	×	×						
decurrens																				×		×		×
cretosa								×		×		×		×			×	×						
watersi								×			×			×		×				×		×		×
pondi																		×						
selmaensis																		×						
Loxostoma cushmani		×		×	×	×	×	×			×	×	×	×	×									
gemmum																	×			×			×	×
clavatum		×					×	×										×						
plaitum								×		×				×	×	×	×	×	×	×	×	×	×	×
plaitum var. limbosum															×		×	×	×			×		×
minutissimum								×																
Pleurostomella austinana		×			×																			
watersi			×		×																			
nitida					×																			
subnodosa								×			×	×	×	×										
Nodosarella texana					×	×	×	×																
primitiva											×	×		×										
gracillima					×		×	×																
Ellipsonodosaria minuta								×																
stephensoni								×		×		×	×	×		×						×	×	×
stephensoni var. speciosa																							×	
pseudoscripta							×	×		×	×		×	×		×				×				
exilis								×				×	×											
alexanderi								×			×			×		×								
alexanderi var. impensia																				×		×	×	×
dentata-glabrata																×		×						
horridens										×								×						
? granti														×						×		×	×	×
sp.										×														
Patellina sp.																		×						
Lamarckina ripleyensis																		×			×			
Valvulineria plummerae					×	×	×	×	×	×		×		×	×	×	×					×		
infrequens			×		×	×		×	×															
allomorphinoides					×	×	×	×								×		×		×				
cretacea								×					×	×		×				×		×	×	×
cf. V. umbilicatula														×	×		×	×		×		×		×
Gyroidina depressa	×	×		×	×	×	×	×	×	×	×	×		×	×	×	×	×		×				
globosa					×		×	×	×	×	×	×	×	×	×	×	×							
girardana		×		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×				×		×
arkadelphiana																							×	
Stensiöina americana								×			×	×	×	×	×		×			×				
Eponides haidingerii										×														
Epistomina caracolla								×			×	×		×		×	×	×	×		×	×		×
Siphonina prima																		×		×	×	×	×	×
Ceratobulimina cretacea															×		×	×	×		×	×		×
Pulvinulinella texana								×				×	×	×	×	×								
glabrata														×				×				×	×	
navarroana																				×		×	×	×
ripleyensis																		×		×				
cf. P. alata												×			×									
Cassidulina cretacea																		×						
Allomorphina minuta					×		×																	
navarroana																						×		×
Pullenia americana									×	×	×	×	×	×	×	×	×	×		×		×		
cretacea								×	×	×	×			×	×	×	×	×						
minuta																				×		×		×
coryelli															×									
Hastigerinella moremani	×																							
alexanderi			×		×																			
watersi			×		×																			
Schackoina multispinata					×							×												
Globotruncana canaliculata			×	?	×		×	×			×	×	×	×		×						×		
fornicata								×		×	×	×	×	×		×								
marginata	×	×	×	×	×	×	×	×	×	×			×	×		×								
ventricosa			×	×	×		×																	
arca														×		×								
cretacea		×	×	?	×	×	×	×	×	×	×	×	×	×		×	×	×	×					
calcarata								×			×	×	×	×		×								
Globorotalia michelininiana		×		?	×		×	×	×	×	×	×	×	×										
cushmani	×				×																			
umbilicata				?	×	×	×	×				×												
subconica					×	×	×	×																
Anomalina nelsoni								×	×	×			×	×	×	×	×	×	×	×		×	×	×
ammonoides		×		×	×		×	×		×	×	×	×	×										
pseudopapillosa																		×	×	×	×	×	×	×
clementiana												×	×	×				×						
henbesti										×				×		×		×						
tennesseensis										×								×						
Planulina eaglefordensis	×																							
austinana					×																			
texana			×	?	×	×	×	×																
kansasensis		×	×		×	×																		
spissocostata								×						×		×								
taylorensis								×	×	×	×	×	×	×	×	×	×	×						
correcta																				×		×	×	×
nacatochensis																			×					
Cibicides stephensoni								×	×	×	×	×	×	×	×	×	×	×						
harperi																				×		×		×
subcarinatus								×		×				×		×	×	×				×		
beaumontianus										×	×	×	×	×	×									
constrictus															×									
coonensis																		×						

SYSTEMATIC DESCRIPTIONS

Family ASTRORHIZIDAE

Genus RHABDAMMINA M. Sars, 1869

Rhabdammina discreta H. B. Brady

Plate 1, figures 1, 2

Rhabdopleura? sp. G. M. Dawson, Canadian Naturalist, vol. 5, p. 177, fig. 7, 1870.

Rhabdopleura abyssorum G. M. Dawson, Am. Jour. Sci., 3d ser., vol. 1, p. 206, fig. 7, 1871; Annals and Mag. Nat. History, 4th ser., vol. 7, p. 86, fig. 7, 1871.

Rhabdammina discreta H. B. Brady, Quart. Jour. Micr. Sci., vol. 21, p. 48, 1881; *Challenger* Rept., Zoology, vol. 9, p. 268, pl. 22, figs. 11–13, 1884.

Goës, Harvard Coll. Mus. Comp. Zöology Bull., vol. 29, p. 21, pl. 1, figs. 13, 14, 1896.

Flint, U. S. Nat. Mus. Ann. Rept., 1897, p. 271, pl. 13 (1899).

Rhumbler, Archiv Protistenkunde, vol. 3, p. 263, text fig. 105, 1903.

Cushman, U. S. Nat. Mus. Bull. 71, pt. 1, p. 27, text fig. 13, 1910.

Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 4, pl. 1, figs. 1, 2, 1932.

Test free, straight, cylindrical, constricted somewhat at irregular intervals exteriorly, but the chamber within of nearly uniform diameter throughout; wall composed of sand grains firmly cemented, exterior rough but the interior rather smoothly finished; open ends of the tube serving as apertures.

Abundant broken specimens similar to those here figured occur in the Upper Cretaceous of Trinidad. They so closely resemble Brady's species, which now occurs living off this region, that they have been referred here without question. All the specimens show a roughened surface and constrictions typical of this species. Specimens also occur in the Navarro of Mississippi. Franke in his work on the Cretaceous of Germany has described a species as *Astrorhiza cretacea* Franke, and our fragmentary specimens may represent the arms of some such form, but until more nearly complete specimens can be obtained the general characters of the wall would seem to indicate that this species should be left under the genus *Rhabdammina.*

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Hobson clay. San Fernando, Trinidad.
Navarro age. Prairie Bluff chalk. Mississippi, Chickasaw County (84, 85).

Family RHIZAMMINIDAE

Genus BATHYSIPHON M. Sars, 1872

Bathysiphon taurinensis Sacco

Plate 1, figures 3, 4

Bathysiphon taurinensis Sacco, Soc. géol. France Bull., p. 168, text fig. 2, 1896.

Schubert, Beitr. Palaontologie Oesterr.-Ungarns u. des Orients, vol. 14, p. 18, pl. 1, figs. 14, 15, 1901; K. k. geol. Reichsanstalt Jahrb, vol. 53, p. 412, pl. 19, figs. 10–12, 1903.

Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 88, pl. 11, figs. 12, 13, 1931.

Frizzell, Jour. Paleontology, vol. 17, p. 336, pl. 55, fig. 2, 1943.

?Kalamopsis dubia White, Jour. Paleontology, vol. 2, p. 185, pl. 27, fig. 3, 1928.

Test elongate, subcylindrical; wall thick, of a whitish color, consisting of sponge spicules or amorphous material, the exterior usually with a very dark, thin coating; cavity of the test relatively small, the tubular test opening at both ends.

The only record for this species in America is from the Austin chalk of Texas. There are other less typical specimens, which may not be identical, in the Taylor marl. Those from the Austin chalk seem to be identical with those described by Sacco from the lower Tertiary of Europe. Occasionally there are constrictions that give the appearance of a jointed tube, but these do not seem to be anything but accidental structures and do not divide the tube into definite chambers.

This genus has already been described and figured from the Cretaceous of Europe by Egger, who referred his specimens to *Bathysiphon filiformis* Sars. Our specimens have some resemblances to this Recent species, but the canal in the fossil form is much smaller in comparison with the size of the test.

The form described by White from the Cretaceous of Mexico may be this species.

Mal Paso shale. Northwestern Peru.
(?) Taylor marl, upper part. Texas, Limestone County (137).
Austin chalk, lower part. Texas, Grayson County (335).

Bathysiphon alexanderi Cushman

Plate 1, figure 5

Bathysiphon alexanderi Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 49, pl. 5, fig. 1, 1933.

Test small, slender, elongate, cylindrical; wall comparatively thin, fairly smooth on the exterior, apparently composed of fine amorphous material and fine sand grains with a considerable amount of cement, the wall slightly constricted at intervals, chamber opening comparatively large and undivided. Length of holotype specimen 1.00 mm.; breadth 0.20 mm.

The types of this species are from the Upper Cretaceous near the base of the Brownstown marl, Paris-Clarksville highway 1.85 miles southeast of Bagwell, Red River County, Tex.

This species is much smaller and more slender than the only other species recorded from the Texas Cretaceous, *B. taurinensis* Sacco.

Austin age.
Brownstown marl. Texas, Red River County (318, 319).
Austin chalk. Texas, Dallas County (310).

Family SACCAMMINIDAE

Genus PSAMMOSPHAERA Schulze, 1875

Psammosphaera laevigata White

Psammosphaera laevigata White, Jour. Paleontology, vol. 2, p. 183, pl. 27, fig. 1, 1928.

Test free, a flattened spheroid of rather finer arenaceous material than is generally found in this genus, very uniform in character and usually an olive green in color. Diameter of type specimen 0.37 mm.; thickness 0.19 mm.

The original description copied here is of a species recorded from the Velasco shale of Mexico. Similar rounded bodies have been found in our material from the Velasco, but none of them have shown any structure that would definitely place them as Foraminifera. The species is noted, however, as a matter of record.

Genus SACCAMMINA M. Sars, 1869

Saccammina rhumbleri (Franke) Cushman and Jarvis

Plate 1, figure 6

Saccammina rhumbleri (Franke) Cushman and Jarvis, U. S. Nat. Mus. Proc. vol. 80, art. 14, p. 5, pl. 1, fig. 3, 1932.

Renz, 8th Am. Sci. Congress Proc., p. 528 (list), 1942.

Small globular specimens with a smooth surface occur in Trinidad. The position of these is somewhat questionable, but they seem to belong to the genus *Saccammina.* In their general characters they resemble specimens from the Upper Cretaceous of Germany that Franke has named *"Orbulinaria rhumbleri."*

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Hobson clay. San Fernando, Trinidad.

Genus PROTEONINA Williamson, 1858
Proteonina difflugiformis (H. B. Brady) Rhumbler

Plate 1, figures 7, 8

Reophax difflugiformis H. B. Brady, Quart. Jour. Micr. Sci., new ser., vol. 19, p. 51, pl. 4, figs. 3a, b, 1879; *Challenger* Rept., Zoology, vol. 9, p. 289, pl. 30, figs, 2–4 (not 1, 5), 1884.
Proteonina difflugiformis Rhumbler, Archiv Protistenkunde, vol. 3, p. 245, text figs. 80a, b, 1903.
Cushman, U. S. Nat. Mus. Bull. 71, pt. 1, p. 42, text figs. 40, 41, 1910.
Cushman and Waters, Cushman Lab. Foram Research Contr., vol. 2, pt. 4, p. 82, pl. 10, fig. 1, 1927.
Cushman, idem, vol. 5, p. 78, pl. 12, fig. 2, 1929; Tennessee Div. Geology Bull. 41, p. 17, pl. 1, figs. 1, 2, 1931.

Test a single elongate oval or pyriform chamber with a more or less distinct tubular neck, usually tapering gradually from the body of the chamber, undivided; wall fairly thick, of sand grains of variable size, firmly cemented; aperture circular, simple, terminal. Height 0.50 mm., diameter 0.40 mm.

This is a widely distributed species and apparently ranges from Cretaceous to Recent. The grains are very variable in size according to the material available for the construction of the test, although there appears to be some power of selection by the animal.

Navarro age.
In cores from wells east of Richland, Navarro County, Tex.
Ripley formation. Tennessee, Benton County (93).
Selma chalk, upper part. Alabama, Marengo County (104).
Boyne beds, Pembina Valley, SE¼ sec. 4, T. 1, R. 6 W. of 1st meridian, Manitoba, Canada.

Subfamily PELOSININAE
Genus PELOSINA H. B. BRADY, 1879
Pelosina complanata Franke

Plate 1, figures 9–11

Pelosina complanata Franke, K. preuss. geol. Landesanstalt Jahrb., vol. 32, pt. 2, p. 107, pl. 3, figs. 1a, b, 1911; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 10, pl. 1, fig. 6, 1928.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 5, pl. 1, figs. 4–6, 1932.
Renz, 8th Am. Sci. Congress Proc., p. 528 (list), 1942.
Frizzell, Jour. Paleontology, vol. 17, p. 336, pl. 55, fig. 4, 1943.
Saccammina scruposum White (not *Haplophragmium scruposum* Berthelin), Jour. Paleontology, vol. 2, p. 183, pl. 27, fig. 5, 1928.
Pelosina scruposa Frizzell (not *Haplophragmium scruposum* Berthelin), idem, vol. 17, p. 337, pl. 55, fig. 3, 1943.

Test free, single, invariably crushed to a lenticular shape; wall replaced by amorphous silica, rough; aperture single, round, with short neck.

The typical specimens are from Trinidad, and it also occurs in the Velasco shale of Mexico. There are a few specimens from the Upper Cretaceous of Texas that may be referred here but are not typical.

Upper Cretaceous. Velasco shale. Hacienda el Limon, Mexico.
Hobson clay. San Fernando, Trinidad.
Mal Paso shale. Northwestern Peru.
Taylor marl, lower part. Texas, McLennan County (243?).
Austin chalk, Gober tongue. Texas, Fannin County (280?).

Family HYPERAMMINIDAE
Subfamily HYPERAMMININAE
Genus HYPERAMMINA H. B. Brady, 1878
Hyperammina elongata H. B. Brady

Plate 1, figures 12, 13

Hyperammina elongata H. B. Brady, Annals and Mag. Nat. History, ser. 5, vol. 1, p. 433, pl. 20, figs. 2a, b, 1878.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 86, pl. 12, fig. 1, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 6, pl. 1, figs. 7, 8, 1932.

Test elongate, with a bulbous proloculum and elongate, cylindrical, tubular second chamber open at the outer end; wall composed of rather fine arenaceous material, firmly cemented and with a fairly smooth surface.

The figured specimens give the general appearance of this species as it occurs in Trindad. As in Recent material, there is considerable variation in the relative amount of cement used in the test, and therefore the surface has a considerable range in the smoothness of the finish. Franke records *Hyperammina* from the German Upper Cretaceous but does not assign his material to a definite species. Incomplete specimens of this genus from the Cretaceous of the Coastal Plain region of the United States cannot be definitely placed specifically.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Hyperammina? sp.

Plate 1, figure 14

Hyperammina? sp. Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 6, pl. 1, fig. 9, 1932.

A number of specimens from Trinidad similar to that figured here, one end being closed and the other open, seem best assigned to this genus, but with some question, as the specimens are evidently distinctly collapsed and more or less distorted. There is, therefore, some doubt as to the actual appearance of this particular form in its normal condition.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Subfamily DENDROPHRYINAE
Genus SACCORHIZA Eimer and Fickert, 1899
Saccorhiza ramosa (H. B. Brady) Eimer and Fickert

Plate 1, figures 15–17

Hyperammina ramosa H. B. Brady, Quart. Jour. Micr. Sci., new ser., vol 19, p. 33, pl. 3, figs. 14, 15, 1879; Akad. Wiss. Wien, Math.-naturwiss. Kl., Denkschr., vol. 42, p. 98, 1881; *Challenger* Rept., Zoology, vol. 9, p. 261, pl. 23, figs. 15–19, 1884.
H. B. Brady, Parker, and Jones, Zool. Soc. London Trans., vol. 12, No. 7, p. 217, pl. 41, figs. 1–4, 13, 1888.
Egger, Bayer. Akad. Wiss., Math.-naturwiss. Abt., Abh. 1, vol. 18, p. 255, pl. 4, fig. 15, 1893.
Goës, K. svenska vetensk. akad. Handl., vol. 25, No. 9, p. 18, pl. 4, figs. 61, 62, 1894.
Flint, U. S. Nat. Mus. Ann. Rept., 1897, p. 270, pl. 11, fig. 1 (1899).
Rhumbler, Archiv Protistenkunde, vol. 3, p. 260, text figs. 101a, b, 1903.
Saccorhiza ramosa Eimer and Fickert, Zeitschr. Wiss. Zoologie, vol. 65, p. 670, 1899.
Cushman, U. S. Nat. Mus. Bull. 71, pt. 1, p. 65, text fig. 81, 1910; idem, Bull. 104, pt. 1, p. 81, pl. 30, figs. 3, 4, 1918.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 6, pl. 1, figs. 10–12, 1932.

In Trinidad there are numerous fragmentary specimens of a form having an irregularly shaped tube, the wall of which contains sponge spicules on the roughened surface. These tubes are usually somewhat collapsed but nevertheless have the characteristic irregular curvature of this species. No branching specimens were found, nor any specimens with the proloculum present. In this connection two other references may be noted, that of Franke, who has recorded very similar branching fragments from the German Cretaceous as *"Rhizammina algaeformis"* (Preuss, geol. Landesanstalt Abh., new ser., vol. 111, p. 12, pl. 1, fig. 13, 1928), and that of White, who records a tubular fragment from the Velasco shale of Mexico as *"Rhizammina indivisa"* (Jour. Paleontology, vol. 2, p. 184, pl. 27, fig. 2, 1928).

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Family REOPHACIDAE
Subfamily ASCHEMONELLINAE
Genus REOPHAX Montfort, 1808
Reophax texanus Cushman and Waters

Plate 1, figures 18–20

Reophax texana Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 82, pl. 10, fig. 2, 1927.
Wickenden, Jour. Paleontology, vol. 6, p. 204, pl. 29, fig. 1, 1932.

Test generally rectilinear or somewhat arcuate, uniserial; chambers spherical or nearly so, sometimes slightly overlapping; wall coarsely arenaceous, of angular sand grains with a minimum of cement, but the grains nevertheless firmly cemented, surface somewhat roughened; aperture small, rounded or angular, central, terminal. Length up to 1.25 mm., diameter 0.50 mm.

This is a widely distributed species, apparently limited to equivalents of the upper part of Navarro group above the Nacatoch sand, occurring in the Kemp clay and Corsicana marl of Texas, the Arkadelphia marl of Arkansas, and the Prairie Bluff chalk of Mississippi and Alabama. It is also recorded from the Alberta shale of Alberta, western Canada. It should be a good index fossil for the upper part of the Navarro.

Navarro age.
Kemp clay. Texas, Williamson County (11); Travis County (15, 17); Guadalupe County (18).
Corsicana marl. Texas, Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (85–87). Alabama, Wilcox County (100).
Riding Mountain beds. Manitoba, on Assiniboine River, south of Millwood, Canada.
Alberta shale. Ko-Top well No. 1, 790 foot sample. Sec. 2, T. 1, R. 17 W. of 4th meridian, Alberta, Canada.

Reophax dentalinoides (Reuss) Cushman

Plate 1, figures 24, 25

Haplostiche dentalinoides Reuss, in Geinitz, Palaeontographica, vol. 20, pt. 2, 1872–75, p. 121, pl. 24, figs. 4–6 (1874).
Olszewski, Sprawozd. Kom. Fizyj. Akad. Umiej., Krakowie, vol. 9, p. 130, 1875.
Perner, K. böhm. Gesell. Wiss. Prag Sitzungsber., p. 38, 1893.
Egger, K. bayer. Akad. Wiss., Math-naturh. Abt., Kl. 2, vol. 21, pt. 1, p. 19, pl. 15, fig. 41, 1899.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 8, pl. 1, fig. 6, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 20, pl. 2, fig. 6, 1928.

Test elongate, slightly tapering toward the apertural end; chambers fairly distinct, longer than broad, the apertural end somewhat tapering and in many specimens with the aperture slightly to one side; sutures slightly depressed, rather indistinct; wall arenaceous, roughly finished; aperture a small rounded opening at the end of a slight neck, often eccentric. Length up to 1.20 mm., breadth 0.40 mm.

Specimens from the middle part of the Taylor of Texas and Arkansas seem to be very similar to this species as figured by Reuss, but as the specimens figured here indicate, they do not come out of the matrix easily, and the characters are, therefore, not well shown.

Taylor age.
Upper part of Taylor marl. Texas, Bexar County (158).
Annona chalk. Texas, Red River County (194).
Ozan formation. Arkansas, Sevier County (253).

Reophax constrictus (Reuss) Cushman

Plate 1, figures 21, 22

Haplostiche constricta Reuss, in Geinitz, Palaeontographica, vol. 20, pt. 2, 1872–75, p. 121, pl. 24, figs. 9–12 (1874).
Perner, K. böhm. Gesell. Wiss. Prag Sitzungsber., p. 38, 1893.
Matouschek, Lotos, vol. 43, p. 125, 1895.
Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 260 (1913); Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 8, pl. 1, fig. 7, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 20, pl. 2, fig. 5, 1928.
Brotzen, Zeitschr. Deutschen Palästina-Vereins, Jahrg. 1934, p. 32, 1934.
Reophax constrictus (Reuss) Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 1, pl. 1, fig. 1, 1944.

Test composed of a few, usually 2 or 3, subglobular chambers, increasing very little if at all in diameter; chambers distinct, the later ones becoming constricted so that the sutures are much depressed; wall coarsely arenaceous, roughly finished; apertural end when perfect terminating in a definite neck. Length 0.75 mm., breadth 0.25 mm.

The American specimens referred to this species may be distinguished from *Reophax texanus* by the more elongate chambers and by the very definitely constricted necks between the chambers.

Navarro age. Prairie Bluff chalk. Alabama, Wilcox County (100).
Taylor age.
Upper part of Taylor marl. Texas, Kaufman County (124); Limestone County (137).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
Wolfe City sand member of Taylor marl. Texas, Navarro County (188).
Lower part of Taylor marl. Texas, Ellis County (235).

Reophax clavulinus (Reuss) Cushman

Plate 1, figure 23

Haplostiche clavulina Reuss, in Geinitz, Palaeontographica, vol. 20, pt. 2, 1872–75, p. 121, pl. 24, figs. 7, 8 (1874).
Perner, K. böhm. Gesell. Wiss. Prag Sitzungsber., p. 38, 1893.
Matouschek, Lotos, vol. 43, p. 126, 1895.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 20, pl. 2, fig. 4, 1928.
Schnetzer, Centralbl. Mineralogie, Jahrg. 1934, Abt. B, No. 2, p. 88, text fig. 4, 1934.
Reophax clavulinus (Reuss) Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 83, pl. 13, fig. 1, 1944.

Test elongate, slightly tapering, increasing in width gradually toward the apertural end; chambers numerous, short, usually broader than high; sutures slightly depressed; wall arenaceous, usually somewhat roughly finished; aperture terminal, rounded, sometimes with a trace of a slight neck. Length up to 2.00 mm., breadth 0.40 mm.

This species was originally described from the Upper Cretaceous of Saxony and was recorded by Perner and Matouschek from the Cretaceous of Bohemia and by Franke from the Upper Cretaceous of Germany. Specimens similar to those from Europe are found in the Annona chalk of Texas and in the basal Selma chalk of Alabama and Mississippi, a specimen from Mississippi being figured.

Taylor age. Annona chalk. Texas, Red River County (196).
Austin age. Selma chalk, lower part. Mississippi, Lee County (350). Alabama, Warrior River (353).

Reophax sp.

Plate 1, figure 26

Reophax sp. Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 86, pl. 12, fig. 2, 1928; U. S. Nat Mus. Proc, vol 80, art. 14, p. 7, pl. 1, fig. 13, 1932.

The peculiar form here figured is from Trinidad. The chambers are somewhat irregularly globular, and the test itself, so far as the figured specimen shows, is somewhat irregular. Owing to the rarity of this form and the rather poor material, no attempt has been made to determine it specifically.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Genus HORMOSINA H. B. Brady, 1879

Hormosina globulifera H. B. Brady

Plate 1, figure 27

Hormosina globulifera H. B. Brady, Quart. Jour. Micr. Sci., new ser., vol. 19, p. 60, pl. 4, figs. 4, 5, 1879; *Challenger* Rept., Zoology, vol. 9, p. 326, pl. 39, figs. 1–6, 1884.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 86, pl. 12, fig. 3, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 7, pl. 1, fig. 14, 1932.
Renz, 8th Am. Sci. Congress Proc., p. 529 (list), 1942.

Numerous specimens in the material from Trinidad represent a form that is usually collapsed and more or less distorted. A few of the specimens, however, seem to have escaped great deformation, and these very strongly resemble *Hormosina globulifera* H. B. Brady, which is found living in deep water in this same general region. The wall of the fossils consists of very fine arenaceous material with much cement, as in Recent specimens. It may be quite possible that some of the megalospheric forms with a single chamber, similar to those found in any large series of Recent material, may have already been noted under *Pelosina complanata*. This is one of the species that show the close relationships of the Upper Cretaceous material of Trinidad with the Recent forms now found living in comparatively deep water in that same general region.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; and from boulders in conglomerate on "Bon Accord" estate, ¼ mile from Pointe-á-Pierre Railroad Station, San Fernando, Trinidad.

Genus NODELLUM Rhumbler, 1913

Nodellum velascoense (Cushman) Cushman and Jarvis

Plate 1, figures 28–31

Nodosinella velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 583, pl. 20, fig. 9, 1926.
White, Jour. Paleontology, vol. 2, p. 309, pl. 41, fig. 15, 1928.
Nodellum velascoense Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 8, pl. 1, figs. 15–17, 1932.

Test elongate, consisting of several chambers of a pyriform shape tapering slightly toward the apertural end, slightly overlapping; sutures distinct, depressed; wall transparent, smooth, chitinous.

This species has already been recorded from the Velasco shale of Mexico, where it occurs in some abundance. It is also very abundant in the Hobson clay of Trinidad. While it is usually distorted, as in Mexico, specimens are so abundant that a certain proportion of them may be found that show the normal form of the species. The proloculum is always longer than broad, and somewhat pear-shaped. The following chambers in the megalospheric form increase very little if at all in diameter, while in the microspheric form they are much more numerous and increase rapidly in size as added. The wall seems to be almost entirely chitinous and nearly transparent, accounting for the fact that specimens are usually very much distorted. The other species of this genus are characteristic of comparatively deep water of the present oceans.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well, 116 feet near Lizard Springs, Trinidad.
Hobson clay. San Fernando, Trinidad.
Velasco shale. Hacienda el Limon, Mexico.

Family AMMODISCIDAE

Subfamily AMMODISCINAE

Genus AMMODISCUS Reuss, 1861

Ammodiscus glabratus Cushman and Jarvis

Plate 1, figure 32

Ammodiscus glabratus Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 86, pl. 12, figs. 6a, b, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 8, pl. 2, fig. 1, 1932.
Renz, 8th Am. Sci. Congress Proc., pp. 528, 529 (lists), 1942.

Test planispiral, much compressed, concave on both sides, periphery broadly curved; tubular chamber very gradually and uniformly increasing in size with succeeding coils; wall thin, composed almost entirely of cement, of a brownish color, very smooth and polished; aperture semicircular, at the end of the tubular chamber.

This species was originally described from Trinidad. The material of the test is almost entirely pure cement, although with a considerable magnification fragmentary material of small size can be seen.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Hobson clay. San Fernando, Trinidad.

Ammodiscus pennyi Cushman and Jarvis

Plate 1, figures 33, 34

Ammodiscus pennyi Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 37, pl. 12, figs. 4, 5, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 9, pl. 2, figs. 2, 3, 1932.

Test planispiral, comparatively large, periphery broadly rounded, of a few coils, the tubular chamber increasing gradually in diameter; suture deep and distinct; wall thick, conspicuously arenaceous but with fairly smooth finish; aperture semicircular, at the end of the tube.

This is one of the largest species of the genus and is represented by both megalospheric and microspheric specimens. In contrast to the preceding species, *A. glabratus*, the wall is very thick and has much arenaceous material.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well, 720 feet, Lizard Springs, Trinidad.
Velasco shale. Well samples, Hacienda el Limon, Mexico.
Colon shale. Near top of shale, Quebrada Honda, Venezuela.
Navarro age. Corsicana marl. Texas, Caldwell County (44).

Ammodiscus cretaceus (Reuss) Cushman

Plate 1, figure 35

Operculina cretacea Reuss, Versteinerungen böhm. Kreideformation, pt. 1, p. 35, pl. 13, figs. 64, 65, 1845.
Cornuspira cretacea Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 177, pl. 1, fig. 1, 1860; idem, vol. 46, pt. 1, 1862, p. 34, pl. 1, figs. 10a, b (not 11, 12), 1863; idem, vol. 52, pt. 1, p. 459, 1865; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 117 (1874).
Burrows, Sherborn and Bailey, Royal Micr. Soc. Jour., p. 552, pl. 8, figs. 5, 6, 1890.
Chapman, idem, p. 574, pl. 9, figs. 11a, b, 1891.
Perner, K. böhm. Gesell. Wiss. Prag Sitzungsber., p. 37, 1893.
Matouschek, Lotos, vol. 43, p. 125, 1895.

Schacko, Archiv Ver. Freunde Naturgeschichte Mecklenburg, Jahrg. 50, pp. 156 (list), 159, pl., fig. 2, 1896.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh. Kl. 2, vol. 21, pt. 1, p. 18, pl. 22, figs. 1, 2, 1899.
Franke, Naturh. Ver. preuss, Rheinlande u. Westfalens Vehr., 69 Jahrg., vol. 59, 1912, p. 259 (1913); Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 7, pl. 1, fig. 5, 1925.
Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 608, pl. 21, figs. 3a, b, 1926; Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 24, pl. 3, fig. 3, 1926; Royal Soc. Canada Trans., 3rd ser., vol. 21, Sec. 4, p. 132, pl. 1, fig. 12, 1927.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol 111, p. 16, pl. 1, fig. 22, 1928.
White, Jour. Paleontology, vol. 2, p. 188, pl. 27, fig. 9, 1928.
Storm, Lotos, vol. 77, p. 56 (list), 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 24, pl. 2, fig. 7, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 271, pl. 41, fig. 22, 1932.

Ammodiscus cretacea (Reuss) Cushman, Cushman Lab. Foram. Research Contr., vol. 10, p. 45, 1934.
Loetterle, Nebraská Geol. Survey Bull., 2d ser., Bull. 12, p. 56, pl. 10, fig. 1, 1937.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 51, pl. 9, fig. 1, 1943.
Cushman, idem, vol. 20, p. 2, pl. 1, fig. 2, 1944.

Cornuspira involvens W. Berry (not Reuss), in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 15, pl. 1, fig 15, 1929.

Test planispiral, closely coiled, slightly involute, chamber increasing gradually and uniformly in size as added, with many coils, often with distinct radial creases or constrictions and frequently distorted in fossilization; suture distinct, depressed; wall very finely arenaceous, with much cement, noncalcareous, smooth, usually white and fairly thick; aperture formed by the open end of the tube. Diameter averaging about 1.00 mm.

In Europe this species is recorded from the Lower Cretaceous Gault to the Upper Cretaceous Senonian but apparently is most characteristic of the Turonian and lower Senonian. Material is at hand from various localities, but all the specimens show a rather uniform character. It apparently has a wide range in the American Upper Cretaceous.

Upper Cretaceous. Canora Well, at 485–520 feet, sec. 25, T. 30, R. IV W. of 2d meridian, Saskatchewan, Canada; and Pelican Rapids Well, sec. 6, T. 79, R. XVII W. of 4th meridian, Alberta, Canada.
Riding Mountain beds. On Assiniboine River, south of Millwood, Manitoba, Canada.
Mendez shale. The following Mexican localities are all in the State of San Luis Potosi, and all but the first two in Hacienda el Limon: 10 km. south of Rancho Nuevo; 5 km. southeast of Guerrero; near Coco; 1 mile southeast of Taninul Tunnel; north of Las Palmas; river bank, Guerrero; near Huiches; near km. post 578, San Luis Potosi-Tampico Railroad; and hill 2 km. south 50° east of Huiches.
Navarro age.
Corsicana marl. Texas, Navarro County (26); Limestone County (30, 31).
Ripley formation. Tennessee, Henderson County (96).
Taylor age.
Upper part of Taylor marl. Texas, Bexar County (158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Annona chalk. Texas, Bowie County (189).
Lower part of Taylor marl. Texas, Dallas County (224); Bell County (245).
Lower part of Pierre shale. South of Lynch, Nebr.
Austin chalk, Gober tongue. Texas, Fannin County (280); Lamar County (282, 283).

Genus AMMODISCOIDES Cushman, 1909

Ammodiscoides turbinatus Cushman

Plate 1, figures 36, 37

Ammodiscoides turbinatus Cushman, U. S. Nat. Mus. Proc., vol. 36, p. 424, pl. 33, figs. 1–6, 1909.
Rhumbler, Ergebnisse der Plankton-Expedition der Humboldt-Stiftung, Foraminiferen, pt. 2, p. 388, text figs. 124a, d, 1913.
Cushman, U. S. Nat. Mus. Bull. 104, pt. 1, p. 98, pl. 36, figs. 3–6; pl. 37, 1918.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 9, pl. 2, figs. 4, 5, 1932.

Test in the microspheric form with a proloculum, followed by a long, coiled, undivided, tubular chamber; in the young stage forming a hollow cone, after which the whorls are nearly in one plane, gradually increasing in diameter toward the periphery, which is rounded or somewhat flattened; megalospheric form in many specimens without the early conical portion; wall of fine sand grains, smoothly and firmly cemented, the surface smooth.

This species was originally described from Recent material from the Gulf of Mexico and has a fairly wide distribution in the western tropical Atlantic. The Cretaceous material from Trinidad is identical with the Recent form, and if it were not for the differences due to fossilization it would be very difficult to tell the two apart.

The microspheric form is easily distinguished from the preceding genus by having a low cone on one side in the center and on the opposite side a distinct depression, the succeeding coils following in nearly a single plane.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well, 116 feet, near Lizard Springs, Trinidad.

Genus GLOMOSPIRA Rzehak, 1888

Glomospira gordialis (Jones and Parker) Cushman

Plate 1, figures 38–40

Trochammina squamata Jones and Parker, var. *gordialis* Jones and Parker, Quart. Jour. Geol. Soc., vol. 16, p. 304, 1860.
Parker and Jones, Philosophical Trans., vol. 155, p. 408, pl. 15, fig. 32, 1865.

Glomospira gordialis Cushman, U. S. Nat. Mus. Bull. 104, pt. 1, p. 99, pl. 36, figs. 7–9, 1918.
White, Jour. Paleontology, vol. 2, p. 187, pl. 27, fig. 8, 1928.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 87, pl. 12, figs. 7, 8, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 9, pl. 2, figs. 6, 7, 1932.
Renz, 8th Am. Sci. Congress Proc., p. 528 (list), 1942.

Test composed of a subglobular proloculum and a long, undivided tubular second chamber, the early turns planispiral or irregular, the later turns in constantly shifting planes, the coils increasing somewhat in size as added; wall very finely arenaceous, with a very large percentage of cement, giving a smooth appearance to the exterior of the test,

This species may be distinguished from the following in that the coils are in planes that never change greatly from a planispiral type of growth, whereas the following species has the coils arranged in an entirely different manner, giving a more or less globular shape to the test. The fossil specimens from Trinidad and Mexico are very similar indeed to Recent ones. Somewhat similar specimens also occur in Texas material but may not be identical.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Hobson Clay. San Fernando, Trinidad.
Velasco shale. Hacienda el Limon, Mexico.
Taylor marl, upper part. Texas, Delta County (114).
Austin chalk. Texas, Dallas County (310).

Glomospira charoides (Jones and Parker) Cushman var. corona Cushman and Jarvis
Plate 2, figures 1–3

Glomospira charoides (Jones and Parker) Cushman var. *corona* Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 89, pl. 12, figs. 9–11, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 10, pl. 2, figs. 8–10, 1932.
Renz, 8th Am. Sci. Congress Proc., pp. 528, 529 (lists), 1942.
Glomospira charoides White, Jour. Paleontology, vol. 2, p. 187, pl. 27, fig. 8, 1928.

Variety differing from the typical form in having the irregularly coiled later portion in a sort of irregular crown at the end of the test instead of coiling about the whole test, as in the typical form.

The types of this variety are from the Cretaceous of Lizard Springs, Trinidad. It is the form figured by White (Jour. Paleontology, vol. 2, pl. 27, fig. 7, 1928) from the Velasco shale of Mexico. Recent specimens seen, as well as those figured, have the later portion coiling in the long axis of the test after the spiral is completed.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare southeastern Trinidad; Calex C well, 116 feet, near Lizard Springs, Trinidad.
Hobson clay. San Fernando, Trinidad.
Velasco shale. Near Velasco, Hacienda el Limon, Mexico.
Riding Mountain beds. On Assiniboine River, south of Millwood, Manitoba, Canada.

Genus LITUOTUBA Rhumbler, 1895
Lituotuba lituiformis (H. B. Brady) Rhumbler
Plate 2, figures 4, 5

Trochammina lituiformis H. B. Brady, Quart. Jour. Micr. Sci., vol. 19, p. 59, pl. 5, fig. 16, 1879.
Lituotuba lituiformis Rhumbler, K. Gesell. Wiss. Göttingen Nachr., vol. 1, p. 84, 1895; Archiv Protistenkunde, vol 3, p. 279, text figs. 128a, b, 1903.
Cushman, U. S. Nat. Mus. Bull. 71, pt. 1, p. 114, text fig. 175, 1910.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 90, pl. 12, figs. 15a, b, 1928; U. S. Nat Mus. Proc., vol. 80, art. 14, p. 10, pl. 2, figs. 11a, b, 1932.
Ammodiscus pleurotomarioides Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 582, pl. 15, figs. 3a–c, 1926.

Test composed of a proloculum and long, tubular second chamber closely coiled in varying planes, finally becoming uncoiled in the adult; wall arenaceous, consisting of abundant sand grains but with a large proportion of cement, giving it a fairly smooth exterior.

The only record in the present material for this species is from the Cretaceous of Trinidad. Franke has described a somewhat similar species from the Upper Cretaceous of Germany. A study of further material when it can be obtained should be made in order to determine whether or not these American and European Cretaceous forms are identical, or whether they may not represent a distinct Cretaceous species that may be separated from the Recent one.

The material from the Velasco shale of the Tampico Embayment region referred to *Ammodicus pleurotomarioides* Chapman is apparently related to *Lituotuba lituiformis*.

Upper Cretaceous. Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco shale. Hacienda el Limon, Mexico.

Genus AMMOLAGENA Eimer and Fickert, 1899
Ammolagena clavata (Jones and Parker) Eimer and Fickert
Plate 2, figure 6

Trochammina irregularis var. *clavata* Jones and Parker, Quart Jour. Geol. Soc., vol. 16, p. 304, 1860.
Webbina clavata H. B. Brady, Royal Soc. Edinburgh Proc., vol. 11, p. 711, 1882; *Challenger* Rept., Zoology, vol. 9, p. 349, pl. 41, figs. 12–16, 1884.
Ammolagena clavata Eimer and Fickert, Zeitschr. Wiss. Zoologie, vol. 65, p. 673, 1899.
Cushman, U. S. Nat. Mus. Bull. 71, pt. 1, p. 68, text figs. 86–89, 1910.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 80, pl. 12, fig. 14, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 11, pl. 2, fig. 12, 1932.

Test composed of a large proloculum and long, tubular second chamber not coiling about the proloculum but both chambers attached to other objects; wall finely arenaceous, with much cement, smoothly finished.

The only record for this species in the present material is from the Upper Cretaceous of Trinidad. Both microspheric and megalospheric forms were found, agreeing very closely with Recent material in all their characters. Specimens were found attached to *Ammodiscus pennyi*, *Glomospira gordialis*, and *Hyperammina elongata*. These show that the same general relationship of these genera has been kept from the Upper Cretaceous to the present time, for in the present oceans *Ammolagena clavata* is very often found attached to these same genera and to others of the arenaceous group, as well as to some of the flattened calcareous forms.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Hobson clay. San Fernando, Trinidad.

Family LITUOLIDAE
Subfamily HAPLOPHRAGMININAE
Genus TROCHAMMINOIDES Cushman, 1910
Trochamminoides velascoensis Cushman
Plate 2, figures 7, 8

Trochamminoides velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 583, pl. 15, figs. 2a, b, 1926.

Test closely coiled, compressed, slightly inequilateral, periphery rounded; chambers about 8 in the last-formed coil, slightly more overlapping on the ventral side than on the dorsal, slightly inflated, giving the periphery a lobulated appearance; sutures fairly distinct, especially in the last-formed coil, slightly depressed; wall slightly arenaceous but rather smoothly finished; aperture obscured, near the periphery. Diameter 0.50 mm., thickness 0.12 mm.

This species was described from the Velasco shale of Mexico and has not been observed elsewhere in the Upper Cretaceous. The chambers are somewhat broader on the ventral side, which may be due in part to the conditions of fossilization.

Velasco shale. Hacienda el Limon, Mexico.

Genus HAPLOPHRAGMOIDES Cushman, 1910
Haplophragmoides calcula Cushman and Waters
Plate 2, figures 11, 12

Haplophragmoides calcula Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 83, pl. 10, figs. 5a, b, 1927.
Cushman, Royal Soc. Canada Trans., 3rd ser., vol. 21, sec. 4, p. 129, pl. 1, fig. 3, 1927.

Test closely coiled, planispiral, very strongly compressed, periphery sometimes slightly lobulate; chambers and sutures usually indistinct; wall very coarsely arenaceous, roughly finished on the exterior in spite of the considerable amount of cement; color usually dark greenish-black. Length up to 1.25 mm., thickness 0.30 mm.

This species was originally described from the upper part of the Navarro group, where it is fairly common. Specimens of very similar character are found in the upper part of the Taylor and less typical ones extend into the Austin. These may be the young stages of an *Ammobaculites.*

Navarro age.
Kemp clay. Texas, Navarro County (3); Travis County (13, 14, 16).
Corsicana marl. Texas, Hunt County (24); Travis County (34); Caldwell County (44).
Prairie Bluff chalk. Mississippi, Chickasaw County (85, 86).
Nacatoch sand. Arkansas, Lonoke County (77).
Taylor marl.
Upper part. Texas, Rockwall County (124); Limestone County (136); Bexar County (163).
Pecan Gap chalk member. Texas, Kaufman County (173); Rockwall County (175).
Wolfe City sand member. Texas, Hunt County (184).
Lower part. Texas, Red River County (199); Collin County (207, 212); Dallas County (222, 223); Kaufman County (228, 229).
Austin age.
Austin chalk. Texas, Grayson County (291, 335).
Bonham clay. Texas, Lamar County (327).

Haplophragmoides coronata (H. B. Brady) Cushman
Plate 2, figures 20–22

Trochammina coronata H. B. Brady, Quart. Jour. Micr. Sci., vol. 19, p. 58, pl. 5, fig. 15, 1879; *Challenger* Rept., Zoology, vol. 9, p. 340, pl. 40, figs. 10–12, 1884.
Haplophragmoides coronata Cushman, U. S. Nat. Mus. Bull. 71, pt. 1, p. 99, text figs. 145–147, 1910.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 90, pl. 12, fig. 17, 1928; U. S. Nat. Mus Proc., vol. 80, art. 14, p. 11, pl. 2, figs. 13–15, 1932.
Renz, 8th Am. Sci. Congress Proc., pp. 528, 529 (lists), 1942.
Trochamminoides irregularis White, Jour. Paleontology, vol. 2, p. 307, pl. 42, fig. 1, 1928.
Trochamminoides proteus White (not Karrer), idem, vol. 2, p 308, pl. 42, fig. 2, 1928.

The Cretaceous specimens, though most of them are distorted and collapsed, have the general characters of the Recent species, which occurs at many places abundantly in the present ocean in this same general region. The color of the Recent and Cretaceous forms is usually very similar. It is somewhat difficult to distinguish this species from *Trochammina globigeriniformis,* noted later, because of the distortion that takes place in fossilization. Some very queerly shaped specimens result. The specimens described by White as *T. irregularis* and *T. proteus* are probably distorted forms of this species, the first being probably the megalospheric form and the second the microspheric form. These may, however, be much distorted forms of *T. globigeriniformis*, but without seeing the original specimens it is difficult to determine this, even if it might then be possible. The distortion produced is often so great as to obliterate very largely the original form.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Hobson clay. San Fernando, Trinidad.
Tarouba formation (upper part). Southern Trinidad.
Chaudière shale. Central Range, Trinidad.

Haplophragmoides eggeri Cushman
Plate 2, figures 9, 10

Haplophragmoides fontinense Egger (not Terquem), Naturwiss. Ver. Regensburg Ber., vol. 12, 1907–9, p. 10, pl. 3, figs. 16–18 (1910).
Haplophragmoides eggeri Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 583, pl. 15, figs. 1a, b, 1926.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 12, pl. 3, figs. 2a, b, 1932.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 51, pl. 9, fig. 2, 1943.
Haplophragmoides cf. *subglobosum* (G. O. Sars) Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 91, pl. 12, figs. 13a, b, 1928.

The specimens of this species are usually more or less distorted by fossilization and assume various shapes. There are usually but few chambers, 6 or 7 in the last-formed coil, of fairly uniform size and shape, increasing slightly as added. The wall is roughened, and the sutures are sometimes distinct but in many specimens more or less obscured. Such specimens occur in the Cretaceous of Trinidad and have also been described from the Velasco shale of Mexico. A few specimens from the Navarro beds of the Gulf Coastal Plain of the United States are very similar, others from the Taylor less so.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco shale. Hacienda el Limon, Mexico.
Navarro age.
Corsicana marl. Texas, Limestone County (30).
Prairie Bluff chalk. Mississippi, Chickasaw County (87).
Taylor age. Annona chalk. Texas, Red River County (194?).

Haplophragmoides glabra Cushman and Waters
Plate 2, figures 16, 17

Haplophragmoides glabra Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 83, pl. 10, figs. 6a, b, 1927.
Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 129, pl. 1, fig. 4, 1927.

Test closely coiled, planispiral, somewhat compressed, umbilicate, periphery rounded; chambers fairly distinct, 9 to 10 in the last-formed coil in the adult, rounded; sutures slightly curved, slightly depressed; wall finely arenaceous, smoothly finished; color dark gray. Diameter up to 0.55 mm., thickness 0.12–0.18 mm.

This species seems to be characteristic of the upper part of the Navarro group. It is found in well samples from Canada.

Navarro age.
Kemp clay. Texas, Kaufman County (2); Navarro County (7); Travis County (13, 15).
Corsicana marl. Texas, Caldwell County (44); Hunt County (24).
Nacatoch sand. Arkansas, White County (76); Lonoke County (77).
Upper Cretaceous. Rush Lake well, sec. 30, T. 19, R. XI W. of 3d meridian, Saskatchewan, Canada.

Haplophragmoides rugosa Cushman and Waters
Plate 2, figures 18, 19

Haplophragmoides rugosa Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 83, pl. 10, figs. 4a, b, 1927.
Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 128, pl. 1, fig. 2, 1927; Tennessee Div. Geology Bull. 41, p. 17, pl. 1, figs. 3a, b, 1931; Cushman Lab. Foram. Research Special Pub. 5, pl. 4, fig. 27, 1933.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 328, pl. 50, fig. 1, 1944.

Test closely coiled, planispiral, only slightly compressed, deeply umbilicate, periphery broadly rounded; chambers 5 to 7 in the last-formed coil, subspherical; sutures slightly depressed, radial; wall coarsely arenaceous, of coarse but rather neatly fitted angular sand grains, usually dark colored. Diameter 0.50 to 0.60 mm.

The species is widely distributed, but most of the specimens at hand are from the Navarro group. Very similar specimens occur occasionally in the upper part of the Taylor formation.

Navarro age.
 Arkadelphia marl. Arkansas, Hempstead County (70, 72).
 Prairie Bluff chalk. Alabama, Wilcox County (100).
 Well AD-1 of Sun Oil Co., 840 feet in core, east of Richland, Navarro County, Tex.
Taylor age.
 Upper part of Taylor marl. Texas, Rockwall County (124).
 Selma chalk (middle part). Tennessee, Hardin County (225). Mississippi, Alcorn County (257).
 Marlbrook marl. Arkansas, Howard County; Hempstead County.

Haplophragmoides excavata Cushman and Waters
Plate 2, figures 13–15

Haplophragmoides excavata Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 82, pl. 10, figs 3a, b, 1927.
 Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 128, pl. 1, fig. 1, 1927.
 Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 12, pl. 3, fig. 1, 1932.
 Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 82, pl. 21, figs. 1a, b, 1941.
Haplophragmoides sp. Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 91, pl. 12, fig. 16, 1928.

Test closely coiled, planispiral, compressed, periphery subacute; chambers distinct, 10 in the last-formed coil in the adult, the borders of each chamber distinctly thickened, central portion depressed; sutures straight, radial, not usually distinct; wall finely arenaceous, with a relatively small amount of cement, smoothly finished; color usually light gray. Diameter usually about 1.00 mm., thickness 0.20 to 0.40 mm.

This species is most common in the Kemp clay member of the Navarro of Texas. It ranges, however, into the Taylor. Geographically the species has a wide distribution, occurring in Trinidad, Colombia, Texas, Arkansas, Mississippi, and western Canada.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare southeastern Trinidad; 720 feet in well at same locality. Santander del Norte, Colombia.
Navarro age.
 Kemp clay. Texas, Travis County (13–17); Guadalupe County (19).
 Corsicana marl. Texas, Caldwell County (44); Hunt County (24).
 Arkadelphia marl. Arkansas, Hempstead County (73).
 Nacatoch sand. Arkansas, Lonoke County (77).
 Neylandville marl. Texas, Hunt County (56).
Talyor age.
 Wolfe City sand member of Taylor marl. Texas, Hunt County (186).
 Selma chalk (middle part). Mississippi, Lee County (268).
 Lower part of Taylor marl. Texas, Fannin County (204); Collin County (207, 215); Ellis County (232, 233, 235); Hill County (237).
Canada. In well samples as follows: Misty Hills well, sec. 29, T. 32, R. IV W. of 4th meridian, Alberta; Canora well, sec. 25, T. 30, R. IV W. of 2d meridian, Saskatchewan; and Pelican Rapids well, sec. 6, T. 79, R. XVII W. of 4th meridian, Alberta.

Haplophragmoides gigas Cushman
Plate 3, figure 2

Haplophragmoides gigas Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 129, pl. 1, fig. 5, 1927.

Test large, planispiral, compressed; chambers about 10 with a tendency toward an umbilical lobe, umbilical area showing the inner ends of the chambers of the preceding coil; sutures somewhat sigmoid, slightly depressed; wall thin, composed largely of cement with a small proportion of arenaceous material, smooth; aperture peripheral, at the base of the apertural face, with a slight lip. Diameter up to 2.25 mm.

The types of this species are from the Upper Cretaceous of Canada, British Petroleum well No. 3 at 1,921 to 1,929 feet, sec. 29, T. 45, R. VI W. of 4th meridian, Alberta. It also occurred at Rush Lake, Saskatchewan, Muddy Lake, Misty Hills, Alberta; and in British Petroleum well No. 3 at 2,044 to 2,054 feet and at 2,080 to 2,086 feet. It is fairly common in this area and may represent a local species. Its large size and distinct characters, although often distorted in fossilization, should make it a good index fossil. It has not been recorded from the Gulf coastal region of the United States.

Haplophragmoides fraseri Wickenden
Plate 3, figure 1

Haplophragmoides fraseri Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 86, pl. 1, figs. 2a, b, 1932.

Test planispiral, umbilicate, not completely involute, each coil overlapping only the previous one; periphery broad and well rounded; chambers distinct, 9 or 10 in the last-formed coil; sutures slightly curved, nearly radial, slightly depressed; wall composed of a few rather fine, angular grains of arenaceous material and much cement, smooth; aperture a low arch a little to one side of the plane of coiling at the base of the apertural face of the last-formed chamber; colour white to yellowish. Diameter about 0.3 mm.; thickness 0.13 mm.

Occurrence: Upper Cretaceous, Bearpaw formation. Holotype in collection of National Museum of Canada from exposures of Bearpaw in bad lands east of Manyberries, sec. 14, T. 5, R. 5, W. of 4th meridian. Specimens were also found in samples from approximately a hundred feet above the base of the Bearpaw on the Oldman River near Lethbridge; on the Saint Marys River, sec. 7, T. 7, R. 21 W. of 4th meridian; and near the east end of long exposure of Bearpaw on creek about a mile due north of Lundbreck, Alberta.

Many specimens of this species are compressed when the chambers have not been filled with mineral matter. Under such circumstances they can be recognized by the transparency of the test and the loose coiling.

The figured specimen is a paratype in our collection. The wall of the test is thin and easily distorted. It has not as yet been recorded from outside the Canadian area from which it was described.

Haplophragmoides kirki Wickenden
Plate 2, figure 23

Haplophragmoides kirki Wickenden, Royal Soc. Canada Trans., 3d ser., sec. 4, p. 85, pl. 1, figs. 1a–c, 1932.

Test small, planispiral, close coiled; periphery fairly broad, rather well rounded; chambers distinct, completely involute, four or five in the last-formed coil; sutures distinct, straight, slightly depressed; walls smooth, of fine arenaceous material with much cement; aperture a low arch, at the base of the apertural face of the last-formed chamber; colour white to yellowish. Diameter 0.33 mm.; thickness about 0.20 mm.

Occurrence: Upper Cretaceous, Bearpaw shale, Alberta. Holotype in collection of the National Museum of Canada from exposures of Bearpaw east of Manyberries, Alberta, sec. 14, T. 5, R. 5 W. of 4th meridian. Other specimens were found in samples of Bearpaw from exposures on the Oldman River near Lethbridge; on the Saint Marys River, sec. 7, T. 7, R. 21 west of 4th meridian; and near the eastern end of the Bearpaw exposure north of Lundbreck, Alberta.

This species has also been found in the Riding Mountain beds near Millwood, Manitoba, and in well samples from the Lea Park and Pakowki in Alberta and Saskatchewan.

The figured specimen is a paratype in our collection. The species has not yet been found in the Cretaceous of the Coastal Plain region of the United States, but other species are common to the two regions and this species may later be found in Texas or adjacent areas.

Haplophragmoides flagleri Cushman and Hedberg
Plate 66, figure 1

Haplophragmoides flagleri Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 82, pl. 21, figs. 2a, b, 1941.

Test small, planispiral, mostly evolute, the sides depressed, periphery broadly rounded, test characteristically found with chambers collapsed or flattened in a plane at right angles to the axis of coiling; chambers of the later portion distinct, 8–10 in the adult coil, those of the earlier coils usually hidden under the accumulated matrix, increasing gradually in size as added but of rather uniform shape throughout, sutures very slightly if at all depressed; wall very finely arenaceous with much cement, smooth; aperture a low opening at the base of the apertural face at the periphery. Diameter 0.45 mm., thickness 0.22 mm.

This species differs from *H. glabra* Cushman and Waters in the much more evolute test, greatest thickness near the periphery, which is broadly rounded. The species is apparently confined to the lower zone of the Colon formation, where it is common and constitutes a good guide fossil.

The only record for this species is from the type locality in the Upper Cretaceous, Colon formation, lower zone at Quebrada Mito Juan, Department of Santander del Norte, Colombia.

Genus CRIBROSTOMOIDES Cushman, 1910

Cribrostomoides trinitatensis Cushman and Jarvis
Plate 3, figure 3

Cribrostomoides trinitatensis Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol 4, p. 91, pl. 12, figs. 12a, b, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 12, pl. 3, fig. 3, 1932.
Renz, 8th Am. Sci. Congress Proc., p. 528 (list), 1942.

Test subglobular, closely coiled, completely involute, periphery very broadly rounded; chambers 5 or 6, inflated, rather low; sutures distinct, very slightly depressed; wall coarsely arenaceous but smoothly finished; aperture consisting of a number of pores just above the base of the apertural face. Length 0.60 mm., breadth 0.50 mm., thickness 0.50 mm.

This is a somewhat broader and more globular form than the Recent species and is fairly abundant in Cretaceous material from Trinidad. The genus has apparently not been recorded elsewhere in the Cretaceous, and no other localities have so far yielded this species.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Genus AMMOBACULITES Cushman, 1910

Ammobaculites alexanderi Cushman
Plate 3, figure 4

Ammobaculites alexanderi Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 51, pl. 5, figs. 5a–c, 1933.

Test elongate, the sides nearly parallel in side view, in peripheral view much compressed in the early stages but becoming inflated toward the apertural end; chambers of the early portion indistinct, composed of only 4 or 5 chambers in a coil, later ones uncoiled, increasing rather rapidly in length as added; sutures not very distinct, very slightly depressed, those of the early portion nearly radial and straight, later ones slightly curved; wall arenaceous, composed largely of angular sand grains with a comparatively small amount of cement, the surface fairly smooth; aperture in the uncoiled portion small, terminal, nearly circular. Length 0.40 to 0.50 mm., breadth 0.20 to 0.25 mm., thickness of the adult chambers 0.12 to 0.15 mm.

This species may be distinguished from most of the others of the Upper Cretaceous by the very much compressed early chambers and increasing diameter of the later uncoiled ones. The only localities are from the upper part of the Taylor marl.

Taylor marl, upper part. Texas, Lamar County (202); Ellis County (231).

Ammobaculites arenatus Cushman
Plate 3, figure 5

Ammobaculites arenata Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 50, pl. 5, fig. 4, 1933.

Test elongate, in the adult about twice as long as broad, very much compressed; chambers and sutures very indistinct, but young specimens show that in the early stages chambers are coiled and the later ones uncoiled; wall coarsely arenaceous, somewhat roughened, composed of angular flaky fragments with a considerable amount of cement. Length of holotype 2.10 mm., breadth 1.00 mm., thickness 0.25 mm.

This is a very much compressed species, related somewhat to *Haplophragmoides calcula* Cushman and Waters and also to *Ammobaculites expansus* Plummer, the latter described from the Midway. *A. arenatus* has been found only at the type locality in the upper part of the Navarro group.

Navarro age. Arkadelphia marl. Arkansas, Hempstead County (72).

Ammobaculites colombianus Cushman and Hedberg
Plate 3, figure 6

Ammobaculites colombiana Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 6, p. 68, pl. 9, figs. 4a, b, 1930; idem, vol. 17, p. 83, pl. 21, fig. 3, 1941.

Test comparatively large, very much compressed, only the last 2 or 3 chambers uncoiled, the remainder forming a closely coiled, planispiral test; chambers fairly distinct, numerous, 8 to 10 in the last-formed whorl of the coiled portion, very slightly inflated in the adult; sutures fairly distinct, slightly depressed; wall rather coarsely arenaceous, with considerable cement, and rather smoothly finished on the exterior; aperture elliptical, terminal in the adult. Maximum length 1.10 mm., breadth 0.90 mm.

The only record for this fine, large species seems to be from the type locality in the Upper Cretaceous, Rio Lebrija, Department of Santander, Colombia.

Ammobaculites coprolithiformis (Schwager) Cushman
Plate 3, figures 7–9

Haplophragmium coprolithiforme Schwager, Benecke's Geogn.-paleont. Beiträge, vol. 1, p. 654, pl. 34, fig. 3, 1868.
Ammobaculites coprolithiforme Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 130, pl. 1, figs. 6, 7, 1927.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 13, pl. 3, figs. 4, 5, 1932.
Wickenden, Jour. Paleontology, vol. 6, pt. 2, p. 204, pl. 29, fig. 2, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 5, fig. 10, 1933.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 51, pl. 9, fig. 9, 1942; Jour. Paleontology, vol. 18, p. 328, pl. 50, fig. 2, 1944.

Test elongate, early portion closely coiled, later chambers rectilinear, of uniform width, generally circular in section; sutures distinct, depressed; wall arenaceous but smoothly finished; aperture circular, terminal. Length up to 1.50 mm., breadth 0.65 mm.

This species, originally described from the Cretaceous of Europe, has already been recorded from the Upper Cretaceous of western Canada. Identical specimens occur in the Cretaceous of Trinidad, and the very striking similarity of these may be seen by comparing the figures of the specimens from the two regions. It is quite probable that some of the European specimens referred to *Ammobaculites agglutinans* may belong to Schwager's species. The figures seem to be very similar. Such specimens occur from the Eagle Ford shale to the Navarro group, and are all included here under the one name. Further study of larger series from various parts of the Cretaceous section may show these to be divisible into several species.

Upper Cretaceous. 720 feet in well at Lizard Springs, near Guayaguayare, southeastern Trinidad. Western Canada, British Petroleum well No. 3, 2,044 to 2,054 feet, Alberta.
Hobson clay. San Fernando, Trinidad.
Velasco shale. Hacienda el Limon, Vera Cruz, Mexico.
Navarro age.
Corsicana marl. Texas, Travis County (34); Caldwell County (44).
Arkadelphia marl. Arkansas Hempstead County (70, 72).
Selma chalk (upper part). Alabama, Marengo County (104).
Taylor age.
Marlbrook marl. Arkansas, Clark County; Hempstead County.
Annona chalk. Texas, Red River County (194).
Ozan formation. Arkansas, Little River County (254).
Austin age.
Brownstown marl. Arkansas, Sevier County.
Blossom sand. Texas, Fannin County (322).
Eagle Ford shale. Texas, Dallas County (363).

Ammobaculites fragmentarius Cushman
Plate 3, figures 10–16

Ammobaculites fragmentaria Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 130, pl. 1, fig. 8, 1927; Tennessee Div. Geology Bull. 41, p. 18, pl. 1, figs. 4a, b, 1931.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 329, pl. 50, fig. 4, 1944.

Test large, compressed, early portion planispiral, later and larger portion uniserial, rectilinear, with the sides tapering; chambers distinct, gradually increasing in size as added, greatest width of the test made by the last-formed chamber; sutures distinct, depressed; wall of coarse sand, in flat flakes, rather neatly cemented; aperture elliptical, terminal. Length up to 1.50 mm.

This species was originally described from the Upper Cretaceous of western Canada. The wall is usually of a peculiar flaky character, which, with the tapering test and the considerable number of uncoiled chambers, makes it easily distinguishable from other species of the genus. It occurs in Texas in the middle and lower parts of the Taylor and at a single locality in the Austin chalk.

Upper Cretaceous. Western Canada, British Petroleum well No. 3, 1,896 to 1,904 feet, sec. 29, T. 45, R. VI W. of 4th meridian, Alberta.
Navarro age. Ripley formation. Tennessee, Benton County (93).
Taylor age.
Marlbrook marl. Arkansas, Clark County.
Pecan Gap chalk member of Taylor marl. Texas, Collin County (170).
Wolfe City sand member of Taylor marl. Texas, Hunt County (186).
Annona chalk. Texas, Red River County (192).
Lower part of Taylor marl. Texas, Ellis County (234).
Austin age. Bonham marl. Texas, Lamar County (329).

Ammobaculites taylorensis Cushman and Waters
Plate 3, figure 21

Ammobaculites taylorensis Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 5, p. 64, pl. 10, figs. 6a, b, 1929.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 5, fig. 12, 1933.

Test large, compressed, early portion closely coiled, completely involute, planispiral, composed of 4 or 5 chambers to each coil, later portion uncoiled, uniserial, rapidly increasing in breadth; chambers distinct, the later ones rapidly increasing in width as added; sutures distinct, slightly depressed, gently curved; wall coarsely arenaceous, but smoothly finished, firmly cemented; aperture in the adult terminal, elliptical, simple. Maximum length 1.25 mm., breadth 0.80 mm., thickness 0.25 mm.

This species was originally described from the Upper Cretaceous Taylor marl in the Sun Oil Co.'s well Martindale D-10, Caldwell County, Tex., at 760 feet in core. This is a rather striking species and should have a wider range in the Taylor than is apparent from the present records.

Ammobaculites subcretaceus Cushman and Alexander
Plate 3, figures 18–20

Ammobaculites subcretacea Cushman and Alexander, Cushman Lab. Foram. Research Contr., vol. 6, p. 6, pl. 2, figs. 9, 10, 1930.
Albritton, Jour. Paleontology, vol. 11, p. 20, pl. 4, figs. 3, 4, 1937.

Test small, compressed, earlier portion closely coiled, later 3 or 4 chambers uncoiled in a straight, linear series only slightly increasing in diameter as added, the greatest diameter of each chamber below the middle; sutures indistinct in the coiled portions, slightly depressed in the uncoiled portion; wall coarsely arenaceous, of angular, clear grains with a small amount of light-gray cement, surface somewhat roughened; aperture terminal, narrowly elliptical. Length 0.70 to 0.80 mm., diameter of coiled portion 0.35 to 0.45 mm., thickness 0.10 to 0.12 mm.

The types of this species were from the upper middle Goodland formation at Lake Worth, near Fort Worth, Tex. Numerous specimens of a very much flattened form in the Eagle Ford shale seem identical with the types. The microspheric form is slightly evolute, but the early stages of the megalospheric form are entirely involute. The later uncoiled chambers, however, are very similar in form.

Eagle Ford shale. Texas, Ellis County (364).

Ammobaculites texanus Cushman
Plate 3, figures 22, 23

Ammobaculites texana Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 50, pl. 5, fig. 3, 1933.

Test large, compressed, periphery lobulated and rounded, the umbilical region somewhat excavated and the test becoming somewhat evolute in the adult; chambers fairly distinct, especially in the adult, usually 5 or 6 in the coil in the younger stages, slightly more in the adult before the uncoiling takes place, slightly inflated, especially in the later development; sutures indistinct, very slightly depressed; wall very coarsely arenaceous, compressed, of rather large fragments with a considerable proportion of cement, somewhat roughly finished in the young stages, but becoming smoother in the adult. Diameter of adult holotype 2.65 mm., thickness 0.60 mm.

The types of this species are from the Navarro, 3 feet below the base of the *Exogyra-Gryphaea* bed, San Antonio road, 6 miles east of Castroville, Bexar County, Tex. At this particular locality the species is fairly common and well developed. It is one of the largest and most striking species of this genus in the Upper Cretaceous of America and has not been found elsewhere.

Navarro age. Corsicana marl. Texas, Bexar County (46).

Ammobaculites stephensoni Cushman
Plate 3, figure 17

Ammobaculites stephensoni Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 49, pl. 5, figs. 2a, b, 1933; idem, vol. 20, p. 2, pl. 1, fig. 3, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 329, pl. 50, fig. 3, 1944.

Test very much compressed, the earlier portion closely coiled and somewhat involute, later portion uncoiled, periphery rounded; chambers rather indistinct, comparatively few, 4 or 5 in a coil; sutures indistinct, nearly straight; wall rather coarsely arenaceous but with a large proportion of cement and with fairly smooth finish. Length of holotype 0.80 mm., breadth 0.50 mm., thickness 0.20 mm.

The types of this species are from the Taylor marl, main Chilton road 14 miles south by west of Waco, McLennan County, Tex.

The species also occurs rather widely distributed in beds of Taylor age, including the upper part of the Taylor marl, Wolfe City sand member, Pecan Gap chalk member, Annona chalk, and lower part of the Taylor marl. There are also specimens that seem to be similar from the Bonham marl, as well as one or two specimens from the Eagle Ford shale.

These specimens all seem to have a general similarity, but the number of specimens at any one station is not great, and more than one form may possibly be represented by the series.

Taylor age.
Upper part of Taylor marl. Texas, Travis County (145); Guadalupe County (151); Bexar County (154, 161, 162).
Marlbrook marl. Arkansas, Clark County; Hempstead County.
Pecan Gap chalk member of Taylor marl. Texas, Collin County (171); Delta County (166).
Wolfe City sand member of Taylor marl. Texas, Hunt County (184, 186).
Annona chalk. Texas, Red River County (192, 193).
Lower part of Taylor marl. Texas, Dallas County (218); Ellis County (231, 233); McLennan County (243); Travis County (250).
Austin age. Bonham marl. Texas, Lamar County (330).
Eagle Ford shale. Texas, Dallas County (363).

Ammobaculites lueckei Cushman and Hedberg
Plate 66, figure 2

Ammobaculites lueckei Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 83, pl. 21, figs. 4a, b, 1941.

Test with the early portion irregularly coiled, the later portion uncoiled and rectilinear; chambers few, inflated, earlier ones gradually increasing in size as added, later uncoiled ones rounded, slightly overlapping; sutures distinct, depressed; wall finely but distinctly arenaceous, smoothly finished; aperture terminal, elliptical, at the end of a short neck. Length 0.40 to 0.45 mm., diameter 0.08 to 0.10 mm.

This species differs from *A. coprolithiformis* (Schwager) in the irregular coiling of the early portion, nearly spherical chambers, and the finely arenaceous, smoothly finished wall.

The only record for this species is the type locality, Upper Cretaceous, lower zone of the Colon formation, Quebrada Mito Juan, Department of Santander del Norte, Colombia.

Genus FLABELLAMMINA Cushman, 1928

Flabellammina saratogaensis Cushman
Plate 3, figures 24, 25

Flabellammina saratogaensis Cushman, Jour. Paleontology, vol. 5, p. 298, pl. 34, figs. 1a, b, 1931.
Alexander and Smith, idem, vol. 6, p. 305, pl. 46, fig. 4, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 10, figs. 8a, b, 1933; idem, Special Pub. 5, pl. 5, fig. 16, 1933.

Test much compressed, periphery rounded, early portion closely coiled and involute, later adult chambers uncoiled, the axis becoming straight; chambers fairly distinct especially those of the later portion, increasing very slightly in size as added; sutures fairly distinct, only slightly depressed; wall coarsely arenaceous, composed of large grains of various sorts firmly cemented and with a fairly smooth surface; aperture elongate, elliptical, terminal. Length of holotype 1.25 mm., breadth 0.95 mm., thickness 0.35 mm.

This species was described from the Saratoga chalk at its type locality. It occurs at other localities in the Saratoga and also in the Marlbrook marl.

Navarro age. Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80).
Taylor age. Ozan formation. Arkansas, Little River County (254).

Flabellammina clava Alexander and Smith
Plate 4, figures 1, 2

Flabellammina clava Alexander and Smith, Jour. Paleontology, vol. 6, p. 304, pl. 45, figs. 12, 14, 1932.

Test elongate, early portion coiled, somewhat compressed, thickened toward the apertural end, some individuals with the final chambers distinctly inflated, giving a clublike appearance to the test; chambers indistinct; sutures indistinct; wall coarsely arenaceous, largely composed of elongated fragments of *Inoceramus* prisms and other large angular fragments embedded in a ground mass of finer material, surface roughly finished. Length up to 2.00 mm., breadth 0.85 mm.

This species seems to be restricted to the upper part of the Austin chalk in the north Texas area, recorded by Alexander and Smith as follows:

Austin chalk, thick clay seam exposed in a road cut at the south edge of McKinney, on the Dallas-Sherman highway, Texas.

Flabellammina rugosa Alexander and Smith
Plate 4, figures 9, 10

Flabellammina rugosa Alexander and Smith, Jour. Paleontology, vol. 6, p. 302, pl. 45, figs. 6–9, text fig. 1, 1932.

Test compressed, elongate, narrow, periphery rounded, rough and irregular; chambers of uniserial portion few, high and only slightly recurved; sutures indistinct; wall very coarsely arenaceous, consisting of coarse fragments of various sorts with other foraminiferal tests often included, surface rough. Length of holotype 1.70 mm., breadth 0.80 mm.

The types of this species are from the Lower Cretaceous of Texas, but the authors also record it from the upper part of the Austin chalk on a bank of a small stream just west of a concrete culvert 3.4 miles northeast of White Rock Dam, on the Dallas–Garland road, Texas.

Specimens in our material that seem referable to this species are from the upper part of the Taylor marl.

Taylor marl, upper part. Texas, Limestone County (135).

Flabellammina magna Alexander and Smith
Plate 4, figures 7, 8

Flabellammina magna Alexander and Smith, Jour. Paleontology, vol. 6, p. 306, pl. 46, figs. 10, 11, 1932.

Test large, elongate, 2 to 3 times as long as broad, thick, moderately compressed, broad surface flat or slightly concave, periphery rounded; microspheric form increasing rapidly in width toward the apertural end, megalospheric form more slender, even somewhat contracted toward the apertural end; chambers numerous, up to 8 to 10 in the adult; sutures depressed, especially in the later portion and in the median line of the test; wall coarsely arenaceous, composed of large angular mineral fragments with a fine, light-gray ground mass. Microspheric form, length up to 3.65 mm., breadth 2.15 mm. Megalospheric form, length up to 4.20 mm., breadth 1.90 mm.

The authors record this species from the Pecan Gap chalk member of the Taylor marl (calcareous clay, roadside ditch 0.7 mile west of Forney, on the Forney-Mesquite road, Kaufman County, Tex.) and from the Escondido clay (road cut on San Antonio-Castroville highway 5 miles east of Castroville, Medina County, Tex.).

Flabellammina compressa (Beissel) Alexander and Smith
Plate 4, figures 3-6

Haplophragmium compressum Beissel, Preuss. geol. Landesanstalt Abh., new ser., vol. 3, p. 16, pl. 4, figs. 11-23, 1891.
Ammobaculites compressa Franke, idem, vol. 11, p. 166, pl. 15, fig. 10, 1928.
Flabellammina compressa Alexander and Smith, Jour. Paleontology, vol. 6, p. 305, pl. 46, figs. 2, 3, 5-9, 1932.
Brotzen, Sveriges geol. undersökning, ser. C, No. 396, p. 32, pl. 1, figs. 9a, b, text fig. 4, 1936.

Test strongly compressed, the flat surface rounded or elongate, elliptical or ovoid, periphery bluntly rounded; chambers few, somewhat indistinct, usually only 3 in the uniserial portion, sutures fairly distinct, slightly depressed, curved; wall coarsely arenaceous, composed of angular fragments, mostly of clear quartz grains but with other dark-colored minerals that give a speckled appearance, and a fine, light-gray groundmass. Length up to 2.40 mm., breadth 1.40 mm.

This species, which has been identified with that of Beissel from the Senonian of Europe, occurs in the Taylor marl of Texas. The European specimens from the type locality are somewhat thicker and usually more elongate than the American specimens.

Taylor age.
Upper part of Taylor marl. Texas, Travis County (145, 149).
Annona chalk. Texas, Red River County (195).
Lower part of Taylor marl. Texas, Kaufman County (228).

Genus FRANKEINA Cushman and Alexander, 1929

Frankeina taylorensis Cushman and Waters
Plate 5, figures 1, 2

Frankeina taylorensis Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 5, p. 63, pl. 10, figs. 3a, b, 1929.
Alexander and Smith, Jour. Paleontology, vol. 6, p. 310, pl. 47, figs. 7, 9, 1932.

Test large, the earliest portion planispirally coiled, later portion uncoiled, uniserial, triangular in section, the sides concave; chambers distinct, slightly inflated; sutures distinct, very slightly depressed, in the middle of the concave faces bent strongly toward the apertural end, at the angles bent downward toward the initial end; wall coarsely arenaceous, somewhat roughly finished, firmly cemented; aperture in the adult terminal, simple. Maximum length 2.25 mm., breadth 1.25 mm.

The holotype of this species is from the Taylor marl in a 360-foot core sample, Sun Oil Co.'s well Martindale D-10, Caldwell County, Tex. It occurs in several outcrop samples from the Taylor, and rare specimens resembling it occur in the Saratoga chalk of Arkansas.

This is a large, striking species with a rather coarse exterior, but the structure is well shown. The early planispiral portion is greatly reduced and appears only at the base of the test. The uncoiled portion, though gently triangular is not always symmetrical, the face in the line of the planispiral coiling of the young usually being narrower than are the lateral faces.

It would take but a little more acceleration for the coiled stage to be entirely left out, in which case the whole test would become uniserial and triangular, and such a test would be difficult to distinguish from rounded species of *Pseudoclavulina* unless the early portion were sectioned.

Navarro age. Saratoga chalk. Arkansas, Hempstead County (80) (?)
Taylor age.
Upper part of Taylor marl. Texas, Travis County (145, 149); Bexar County (158, 161, 162).
Annona chalk. Texas, Red River County (198).
Lower part of Taylor marl. Texas, Bell County (245).

Frankeina cushmani Alexander and Smith
Plate 4, figures 11, 12

Haplophragmium murchisoni Beissel (not Reuss), Preuss. geol. Landesanstalt Abh., new ser., vol. 3, p. 15, pl. 4, figs. 1-10, 1891.
Ammobaculites murchisoni Franke, idem, vol. 111, p. 165, pl. 15, fig. 5, 1928.
Frankeina cushmani Alexander and Smith, Jour. Paleontology, vol. 6, p. 309, pl. 47, figs. 10, 11, 1932.

Test 1½ to 2 times as long as broad, triangular in end view, with the sides concave, the angles rounded, early portion planispiral, well developed and distinct, uniserial portion with few (3 to 6) chambers; sutures depressed, more strongly so near the middle of the concave faces, less so toward the angles; wall coarsely arenaceous, composed of large angular mineral grains with occasional fragments of foraminiferal or molluscan shells, surface rather roughly finished. Length up to 1.50 mm., breadth 0.85 mm.

This species seems to be distinctive for the Pecan Gap chalk member of the Taylor marl. It is shorter and more roughly finished than *F. taylorensis*.

Taylor age.
Pecan Gap chalk member of Taylor marl. Texas, Collin County (172); Rockwall County (176).
Upper part of Taylor marl. Texas, Travis County (145).

Frankeina rugosissima Alexander and Smith
Plate 4, figures 13, 14

Frankeina rugosissima Alexander and Smith, Jour. Paleontology, vol. 6, p. 311, pl. 47, figs. 12, 13, 1932.

Test large, elongate, 2 to 3 times as long as broad, early planispiral portion well developed, compressed, uniserial portion enlarging rapidly at the start, thence with the sides nearly parallel, in end view triangular, the sides slightly concave, the angles bluntly rounded; sutures slightly depressed, particularly in the later portion; wall coarsely arenaceous, composed of coarse mineral fragments, irregular in size and shape, with numerous adventitious fragments of Foraminifera or shells of Mollusca, Ostracoda, etc., firmly cemented, roughly finished; aperture narrow, slitlike, at the end of a low terminal protuberance. Length up to 3.75 mm., breadth 1.85 mm.

This species has been found only in the Taylor marl and is recorded by the authors from the following locality: Taylor marl, chalky clays in gully north of Austin-Manor highway near the east end of a long bridge over Walnut Creek 6 miles northeast of Austin, Travis County, Tex.

Genus HAPLOPHRAGMIUM Reuss, 1860

Haplophragmium taylorense Cushman and Waters

Plate 5, figures 3, 4

Haplophragmium taylorensis Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 5, p. 64, pl. 10, figs. 4, 5, 1929.

Test large, cylindrical, early portion closely coiled and always completely involute, later and larger portion uncoiled, uniserial chambers in a rectilinear series; chambers distinct in the uncoiled portion but somewhat obscured in the early coiled portion; sutures somewhat indistinct, very slightly depressed; wall coarsely arenaceous but with a fairly smooth exterior, very firmly cemented; aperture in the early stages simple, in the later chambers becoming multiple. Length of the adult up to 3.00 mm., diameter 0.85 mm.

The holotype of this species is from the Upper Cretaceous Taylor marl in the Sun Oil Co.'s well Martindale D-10, Caldwell County, Tex.

This is a large, striking species with apparently a rather limited vertical distribution in the lower part of the Taylor marl. Somewhat similar specimens occur in the upper part of the Austin chalk. The chambers are simple, although the aperture becomes multiple. Complete specimens are rare, as the early portion is easily broken away, and more than one species may be included here.

Taylor marl, lower part. Texas, Williamson County (246).
Austin chalk. Texas, Dallas County (311, 314).

Subfamily LITUOLINAE

Genus CYCLAMMINA H. B. Brady, 1876

Cyclammina elegans Cushman and Jarvis

Plate 5, figure 5

Cyclammina elegans Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 13, pl. 3, figs. 6a, b, 1932.
Macfadyen, *Discovery* Repts., vol. 7, p. 7, text figs. m, n, 1933.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 6, fig. 2, 1933.

Test comparatively large, closely coiled, periphery somewhat lobulated and subacute or at least compressed; chambers numerous, usually 10 to 12 in the last-formed coil; sutures distinct, slightly depressed, usually sigmoid; wall smooth, distinctly arenaceous, thin, with the very even cancellated structure of the interior showing through; aperture consisting of a low, curved arch at the base of the apertural face with numerous supplementary, rounded openings scattered over the central portion of the apertural face, often with slightly raised borders. Length 2.00 mm., breadth 1.25 mm., thickness 0.85 mm.

This is a fairly common species in the Upper Cretaceous of Trinidad. It is fairly common in this material and is characterized particularly by the very thin outer wall and the distinct markings caused by the cancellated interior, which shows distinctly from the outside.

Macfadyen has recorded this species from the Cretaceous of the Antarctic.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Genus LITUOLA Lamarck, 1804

Lituola taylorensis Cushman and Waters

Plate 5, figure 6

Lituola taylorensis Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 5, p. 66, pl. 10, figs. 7a-c, 1929.
Reiter, Am. Assoc. Petroleum Geologists Bull., vol. 14, p. 323, 1930.
Cushman, Jour. Paleontology, vol. 6, p. 331, 1932; Cushman Lab. Foram. Research Special Pub. 5, pl. 6, figs. 1a-c, 1933.

Test large, somewhat compressed, the larger portion of the test planispirally coiled and involute, the later portion consisting of a few uncoiled chambers more or less in a rectilinear series; chambers labyrinthic, numerous, the number in the coil varying greatly in the microspheric forms and also in the young and adult stages; sutures distinct, slightly depressed; wall coarsely arenaceous, but with a large proportion of cement, and smoothly finished on the exterior, very firmly cemented; aperture in the earlier stages at the base of the apertural face quickly passing to the central portion of the apertural face and becoming multiple, in the uncoiled adult becoming terminal, the various openings taking up a large proportion of the face. Maximum length 5.00 mm., breadth 3.75 mm., thickness 1.25 mm.

The holotype of this species is from the upper part of the Taylor marl at the Marquez salt dome, Leon County, Tex. This is a fine, large species and is useful as a marker. The wall is very solid and firmly cemented, so that it is not easily broken. The labyrinthic walls have the opening small and the main cavity of the chambers nearly filled. Our records are chiefly from the upper part of the Taylor marl, with one from the Annona chalk. Very similar specimens occur in the Burditt marl (of Adkins), but they need further study.

Taylor age.
Upper part of Taylor marl. Texas, Collin County (121); Leon County (138); Travis County (145, 149); Hays County (150).
Annona chalk. Texas, Bowie County (190).
Austin age. Burditt marl (of Adkins). Texas, Bell County (269) (?)

Lituola irregulariter Cushman

Plate 5, figures 7, 8

Lituola irregulariter Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 89, pl. 16, figs. 9, 10, 1939.

Test large, the early portion closely coiled and broadly rounded, later becoming uncoiled, uniserial; chambers fairly distinct in some specimens, very indistinct in others, the early portion closely coiled, planispiral, later uncoiled and much inflated; sutures somewhat depressed, in many specimens obscure; wall coarsely arenaceous, composed of large angular fragments embedded in finer material with a considerable amount of cement, the surface fairly smoothly finished; aperture in the young simple, in many adults with several openings. Length up to 3.00 mm. or more; diameter up to 1.50 mm.

The types are from the lower part of the Taylor marl 1.9 miles east of Bristol, Ellis County, Tex.

This very large species is rather common in some lower parts of the Taylor marl, especially in cores. It is larger, more rounded, and more irregular than *Lituola taylorensis* Cushman and Waters. It is apparently close to or identical with the species described by Roemer as *Spiro-*

lina irregularis, but as *irregularis* has already been used under the genus *Lituola* another name must be used even if it is found to be identical with Roemer's species.

Taylor marl, lower part. Texas, Ellis County (234).

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

Spiroplectammina excolata (Cushman) Cushman and Jarvis

Plate 5, figures 9, 10

Textularia excolata Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 585, pl. 15, figs. 9a, b, 1926.
White, Jour. Paleontology, vol. 3, p. 50, pl. 4, figs. 1a, b, 1929.
Spiroplectammina excolata Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 14, pl. 3, figs. 9, 10, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 94, 1932.

Test as broad as long, the sides flattened or somewhat convex; periphery, of early portion at least, acute; chambers few, the sides somewhat concave; sutures distinct owing to the thickening of the peripheral edge, the surface below being somewhat concave; wall smoothly finished.

This species, originally described from the Velasco shale of Mexico and later recorded by White from the same formation, occurs in the Upper Cretaceous of Trinidad, where it is fairly common. Apparently this species lived in comparatively deep water, and it seems to be limited to the two regions. Two specimens are figured, one of which is a rather extreme form in which the excavations of the chambers are carried to a very unusual degree.

Velasco shale: Hacienda el Limon, Mexico.
Upper Cretaceous: Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Spiroplectammina dentata (Alth) Cushman and Jarvis

Plate 5, figure 11

Textularia dentata Alth, Haidinger's Naturwiss. Abh., vol. 3, p. 262, pl. 13, fig. 13, 1850.
Spiroplectammina dentata Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 14, pl. 3, figs. 7a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 91, pl. 11, figs. 7a, b, 1932.

Test much compressed, about 1½ times as long as broad, periphery subacute, the ends of the chambers extended out into short spinose processes; chambers distinct, low and broad, numerous, increasing very slightly in height but increasing rapidly in breadth as added; sutures distinct, very slightly if at all curved, making an angle of about 30° from the horizontal, very slightly if at all depressed; wall finely arenaceous, with much cement, and smoothly finished.

This species, described by Alth from the Upper Cretaceous of central Europe, occurs in the American Cretaceous in very typical form. The height and width of the chambers as well as the angle of the sutures and general form of the test seem to be identical in both the European and American specimens. In the original, the spinose projections of the chambers are drawn as though they came from the lower angle of the chambers, whereas this is a variable feature in our material, and in many specimens the spinose projection comes from the middle of the periphery of the chamber.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; and from boulders in conglomerate, "Bon Accord" estate, ¼ mile from Pointe-a-Pierre railroad station, San Fernando.

Spiroplectammina navarroana Cushman

Plate 5, figures 13, 14

Spiroplectammina navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 96, pl. 11, figs. 14a, b, 1932.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 329, pl. 50, fig. 5, 1944.

Test elongate, very slightly if at all tapering in the adult portion; chambers nearly as high as broad, rounded at the periphery, somewhat inflated; sutures distinct, slightly depressed, nearly at right angles to the periphery; wall rather coarsely arenaceous, with large fragments but with fairly smooth finish; aperture somewhat oblique, consisting of a narrow arched opening at the inner margin of the apertual face. Length 0.75 mm., breadth 0.20 mm., thickness 0.10 mm.

The type of this species is from the Kemp clay member of the Navarro 6 miles east of Corsicana, Navarro County, Tex. It also occurs in well samples of upper Navarro age in the Sun Oil Co. well AD1, at 780 feet in core, near Richland, Navarro County, Tex.

Navarro group, Kemp clay. Texas, Navarro County (3).
Taylor age. Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.

Spiroplectammina baudouiniana (D'Orbigny) Cushman

Plate 5, figure 12

Textularia baudouiniana D'Orbigny, Soc. géol. France Mém., ser. 1, vol. 4, p. 46, pl. 4, figs. 29, 30, 1840.
Spiroplectammina baudouiniana Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 87, pl. 11, figs. 1a, b, 1932.

Test large, broadly tapering, the greatest breadth near the apertural end, or in adult specimens sometimes with the sides nearly parallel in the later development; periphery subacute, in end view greatest thickness near the median line; chambers distinct, numerous, the early ones coiled, later ones biserial, rather uniformly increasing in size as added; sutures slightly curved but only slightly directed back toward the periphery, very slightly depressed; wall usually finely arenaceous and rather smoothly finished, with a considerable amount of cement; aperture a low opening at the inner margin of the last-formed chamber, in a slightly curved indentation of the margin. Length up to 2.10 mm., diameter 1.25 mm., thickness 0.65 mm.

This species, originally described by D'Orbigny from the Craie blanche of the Paris Basin, is found in other regions of Europe in deposits of similar age. It also occurs in rather typical form in the Cretaceous of Trinidad but does not seem to be present in the Upper Cretaceous of the Gulf Coastal Plain of the United States. It is a large, striking species.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Spiroplectammina laevis (Roemer) Cushman var. cretosa Cushman

Plate 6, figures 1–3

Spiroplectammina laevis (Roemer) Cushman var. *cretosa* Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 87, pl. 11, figs. 3a, b, 1932.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 12, pl. 1, figs. 2a, b, 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.
Cushman, idem, vol. 20, p. 2, pl. 1, fig. 4, 1944; idem, vol. 20, p. 84, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 329, pl. 50, fig. 6, 1944.

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 reentrant. Length up to 0.65 mm., breadth 0.45 mm., thickness 0.25 mm.

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

This variety with its many chambers, which are low and broad and only slightly curved, is characteristic of the upper part of the Taylor and is found apparently also in the Navarro beds at Jones Crossing on Onion Creek, near Austin, Tex. The specimen figured by Mrs. Plummer from Navarro beds as *Spiroplectammina semicomplanata* (Carsey) (Texas Univ. Bull. 3101, pl. 8, fig. 8, 1931) should probably be assigned to the present variety, as has been noted by Jennings (Bull. Am. Paleontology, vol. 23, No. 78, p. 12, 1936). Mrs. Plummer has kindly sent me material from her locality, collected by Miss Gene Ross, and this thicker form with narrower chambers, the walls of which are not collapsed, seems to occur in the same section with another form also figured by Mrs. Plummer as *Spiroplectammina semicomplanata* (Carsey) (Texas Univ. Bull. 3101, pl. 8, fig. 7, 1931). The varietal form is apparently very rare here, however, and it is common only in the Taylor and its equivalents over a wide area. Two rare occurrences have been noted in the upper part of the Austin chalk.

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (105, 106); Collin County (118, 121); Rockwall County (123, 124); Kaufman County (129); Limestone County (136); Williamson County (140); Hays County (150); Bexar County (158, 159, 161).
- Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (169, 170); McLennan County (177).
- Wolfe City sand member of Taylor marl. Texas, Collin County (180, 183).
- Annona chalk. Texas, Bowie County (189); Red River County (191, 196–198).
- Lower part of Taylor marl. Texas, Delta County (206); Kaufman County (229); Ellis County (234); Bell County (245).
- Ozan formation. Arkansas, Little River County (254).

Austin age.
- Gober tongue of Austin chalk. Texas, Lamar County (285).
- Brownstown marl. Texas, Lamar County (320).

Spiroplectammina mordenensis Wickenden
Plate 6, figure 4

Spiroplectammina mordenensis Wickenden, Royal Soc. Canada Trans., 3d. ser., vol. 26, sec. 4, p. 86, pl. 1, figs. 4a, b, 1932.

Test somewhat compressed, early portion planispiral, later biserial; chambers fairly distinct, especially in the biserial part, almost rectangular in the biserial portion; sutures distinct, straight in the biserial portion, slightly depressed; walls smooth, arenaceous, of fine-grained material, with a fair amount of cement; aperture a low, arched opening, in a slight reëntrant at the base of the inner margin of the last-formed chamber; color generally white. Length about 0.49 mm.

Occurrence: Upper Cretaceous, Morden beds of Manitoba. Holotype in collection of National Museum of Canada from Morden beds on the southwest bank of the Assiniboine River about a half mile above the mouth of the Cypress River, NE 1/4 sec. 29, T. 8, R. 11 W. of principal meridian. Other specimens were found in material from the Morden beds about a mile southwest of the town of Morden and near Leary, Manitoba.

Spiroplectammina semicomplanata (Carsey) Plummer
Plate 6, figures 5–14

Textularia semicomplanata Carsey, Texas Univ. Bull. 2612, p. 25, pl. 3, fig. 4, 1926.

Spiroplectammina semicomplanata Plummer, Texas Univ. Bull. 3101, p. 129, pl. 8, fig. 7 (not fig. 8), 1931.
Cushman, Cushman Lab. Foram. Research Contr., vol 8, pp. 94, 96, pl. 11, figs. 8, 9, 1932.
Cushman and Hedberg, idem, vol. 17, p. 83, pl. 21, figs. 5, 6, 1941.
Cushman and Todd, idem, vol. 19, p. 51, pl. 9, fig. 3, 1943.

Spiroplectammina anceps Cushman and Church (not Reuss), California Acad. Sci. Proc., 4th ser., vol. 18, p. 500, pl. 36, figs. 1, 2, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 18, pl. 1, figs. 5a, b, 1931.

Textularia sagittula Defrance var. *coonensis* W. Berry, in W. Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 3, pl. 2, fig. 3, 1929.

Test elongate, tapering, greatest breadth at the apertural end, thickest in the middle, periphery subacute, slightly lobulate; chambers distinct, not inflated, fairly high and considerably overlapping, the outer end broadly rounded; apertural face somewhat flattened; sutures distinct, very slightly depressed, distinctly but gently curved backward toward the periphery; wall distinctly arenaceous but rather smoothly finished, thin and delicate, easily collapsed; aperture a low narrow opening, at the inner margin of the apertural face, which is either slightly curved or rather deeply so. Length up to 0.50 or 0.60 mm., breadth 0.30 to 0.40 mm., thickness 0.10 to 0.12 mm.

This species was originally described from the Navarro exposure on Onion Creek near Austin, Tex. At that locality most of the specimens are somewhat crushed, making the sutures apparently stand out above the general surface of the test. Enough well-preserved specimens however, have been found so that it may be shown that this is an abnormal condition that is due to the weakness of the test. Well-preserved specimens from this and other localities are figured. The early portion shows a coiling and the general characters are fairly well preserved over a wide area. The species is characteristic of the Navarro, and it extends also into the upper Taylor. Somewhat similar forms occur in other parts of the Cretaceous section but are not entirely typical. A form very similar to this occurs in the lower part of the Taylor marl and has sutures that become almost entirely straight, giving the test a somewhat different appearance. *S. semicomplanata* is also represented in the Saratoga chalk of Arkansas by the variety *juncea*.

Navarro age.
- Kemp clay. Texas, Williamson County (12).
- Corsicana marl. Texas, Limestone County (30); Travis County (36, 39–43).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84, 86, 97). Alabama, Sumter County (101–103).
- Ripley formation. Tennessee, McNairy County (94, 97).
- Selma chalk (upper part). Tennessee, McNairy County (98).

Taylor marl, upper part. Texas, Kaufman County (130); Travis County (145, 148); Guadalupe County (151); Bexar County (153, 158, 159, 161). Colon shale, Department of Santander del Norte, Colombia.

Spiroplectammina semicomplanata (Carsey) Plummer var. juncea Cushman
Plate 6, figure 15

Spiroplectammina anceps Cushman, (not Reuss), Jour. Paleontology, vol. 5, p. 299, pl. 34, figs. 2a, b, 1931.
Spiroplectammina semicomplanata (Carsey) Plummer var. *juncea* Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 95, pl. 11, figs. 10a, b, 1932.

Variety with the test very elongate, sides nearly parallel for most of their length, with many chambers, the early ones decidedly spiral.

This very elongate form has been found at a number of stations in the Nacatoch sand and Saratoga chalk and equivalents in Arkansas and Alabama.

Navarro age.
Nacatoch sand. Arkansas, Lonoke County (77).
Saratoga chalk. Arkansas, Clark County (78); Howard County (79); Hempstead County (80, 81).
Selma chalk (upper part). Alabama, Marengo County (104).

Spiroplectammina jarvisi Cushman
Plate 6, figure 16

Spiroplectammina jarvisi Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 90, pl. 16, figs. 1a, b, 1939.
Spiroplectammina anceps (Reuss) Cushman and Church var., Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 14, pl. 3, figs. 8a, b, 1932.

Test about twice as long as broad, much compressed, periphery subacute, the early portion tapering, but in the adult with the sides nearly parallel; earliest portion planispiral; chambers of the biserial portion low and broad, of nearly equal height and shape throughout; sutures distinct, slightly raised, straight, strongly oblique; wall finely arenaceous, smoothly finished; aperture narrow, the inner end somewhat rounded. Length 1.00 mm., breadth 0.50 mm., thickness 0.15 mm.

The types are from the Upper Cretaceous of Lizard Springs, near Guayaguayare, Trinidad.

This species differs from *Spiroplectammina dentata* (Alth) Cushman and Jarvis in the straighter sutures and nearly parallel sides without the development of the strong spinose projections.

Spiroplectammina lalickeri Albritton and Phleger
Plate 6, figures 28, 29

Spiroplectammina lalickeri Albritton and Phleger, Jour. Paleontology, vol. 11, p. 353, text figs. 2, 3, 1937.

Test small, slender, elongate, slightly bent with sides converging toward an evenly rounded initial end; periphery narrowly rounded, initially smooth, lobulate in later portion of test; chambers numerous, first few in a planispiral coil, succeeding ones biserial, increasing gradually in height as added; sutures fairly distinct, limbate, slightly raised in initial half of test, thereafter slightly depressed; sutures oblique, forming an angle of 20° to 45° with the horizontal; wall arenaceous, smoothly finished, with a considerable amount of cement; aperture a low subrectangular opening at the flattened base of the last-formed chamber; color gray.

Length 0.50–0.65 mm., breadth 0.22–0.25 mm., thickness 0.08 mm.

The types of this species are from the Taylor marl in a clay pit at Ferris, Tex. From a study of our material the species seems to have a rather wide vertical range in the Taylor with specimens occurring in the Burditt marl (of Adkins), which has other species largely confined to the Taylor.

Taylor age.
Upper part of Taylor marl. Texas, Travis County (149).
Annona chalk. Texas, Red River County (198).
Lower part of Taylor marl. Texas, Ellis County (230); McLennan County (239, 240); Travis County (247, 249).
Austin age. Burditt marl (of Adkins). Texas, Bell County (269); Travis County (271).

Genus TEXTULARIA Defrance, 1824

Textularia ripleyensis W. Berry
Plate 6, figures 17–20

Textularia ripleyensis W. Berry, in W. Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 4, pl. 2, fig. 2, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 19, pl. 1, figs. 6, 7, 1931; Cushman Lab. Foram. Research Contr., vol. 8, p. 96, pl. 11, figs. 12, 13, 1932; Jour. Paleontology, vol. 6, p. 332, 1932.
Sandidge, idem, p. 267, pl. 41, figs. 6–8, 1932.
Cushman and Deaderick, idem, vol. 18, p. 329, pl. 50, figs. 7, 8, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 2, pl. 1, fig. 5, 1944.

Test compressed, slightly longer than broad, the apertural end broadly rounded, greatest width slightly above the middle, periphery subacute, serrate or only slightly lobed; chambers distinct, the outer end raised and depressed below, the raised portion usually roughened and the depressed portion smooth; sutures made distinct by the depressed areas but the sutural lines indistinct, nearly straight or slightly curved at the peripheral ends; wall roughened at the outer edge, smoother toward the base, distinctly arenaceous; aperture a very low opening in the median portion of the inner margin of the chamber with an elongate lobe at each side. Length up to 0.45 mm., breadth 0.35 mm., thickness 0.15 mm.

This species has proved to be very widely distributed, particularly in the upper Taylor of the general Gulf Coastal Plain region of the United States. The test is much compressed and the apertural end contracted in the middle line, then convex, so that the greatest width of each chamber is somewhat outside the middle line. There is much variation in the character of the wall, the raised areas being typically very much roughened, but these are often comparatively smooth in some specimens although all gradations exist between the two extremes. The end view is very characteristic, as the aperture is along a nearly straight line at the middle of the base of the apertural face, whereas the two sides are extended out into two narrow elongate processes.

This is an excellent index fossil for the upper and middle parts of the Taylor marl, as it is a common species and widely distributed. Specimens occur also in material from the lower part of the Navarro group, which has many species in common with the upper Taylor. It is widely distributed, as the list of localities will show.

Navarro age.
Neylandville marl. Texas, Red River County (50); Delta County (51); Rockwall County (57); Kaufman County (58); Navarro County (66, 68, 69).
Saratoga chalk. Arkansas, Hempstead County (80, 81).
Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Tennessee, McNairy County (98). Alabama, Marengo County (104).
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 106); Lamar County (110); Hunt County (116); Collin County (121, 122); Rockwall County (124); Kaufman County (125, 128, 129); Navarro County (134); Williamson County (140, 142, 144); Travis County (145, 148); Guadalupe County (151); Bexar County (154, 158, 159, 161, 162).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.

Anacacho limestone (upper part). Texas, Bexar County (164).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165); Hunt County (168); Collin County (169–172); Kaufman County (173).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Wolfe City sand member of Taylor marl. Texas, Collin County (181, 183); Hunt County (184); Navarro County (188).
Annona chalk. Texas, Bowie County (189); Red River County (192, 194–198).
Selma chalk (middle part). Mississippi, Alcorn County (257–259); Prentiss County (260, 261); Union County (262); Lee County (264, 265).
Lower part of Taylor marl. Texas, Delta County (206); Ellis County (234); Bell County (245).

Textularia subconica Franke
Plate 6, figures 21, 22

Textularia trochus D'Orbigny var. *subconica* Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 131, pl. 12, fig. 1, 1928.
Textularia subconica Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 95, pl. 11, figs. 11a, b, 1932.

Test short and stout, slightly longer than broad, periphery angled, slightly lobulate, apertural face flattened, truncate; chambers comparatively few, increasing rapidly in height toward the apertural end; sutures very slightly oblique, slightly depressed; wall finely arenaceous, rather smoothly finished; aperture an elongate low opening, at the inner margin of the last-formed chamber. Length 0.65 mm., breadth 0.60 mm., thickness 0.40 mm.

This form was described by Franke from the Upper Cretaceous of Germany. The types in Franke's collection were studied by the writer at Arnstadt, Germany, and seem to be true Textularias, whereas D'Orbigny's species is a *Gaudryina*. In the American Cretaceous, specimens that seem to be identical occur in the general range of the Taylor marl.

Taylor age.
Upper part of Taylor marl. Texas, Hays County (150); Guadalupe County (151).
Ozan formation. Arkansas, Little River County (254).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Annona chalk. Texas, Red River County (194).
Lower part of Taylor marl. Texas, Lamar County (200–202); Kaufman County (228).
Austin age. Burditt marl (of Adkins). Texas, Travis County (271).

Textularia subglabra Cushman
Plate 6, figure 23

Textularia subglabra Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 584, pl. 15, figs. 7a–c, 1926; Cushman Lab. Foram Research Contr., vol. 8, p. 94, 1932.

Test small, rhomboid, initial end much compressed, later increasing greatly in thickness toward the apertural end, periphery broadly rounded; chambers distinct, numerous, low and broad, later chambers somewhat inflated and somewhat higher than the earlier; sutures distinct, depressed, strongly so in the later portion, strongly oblique; wall finely arenaceous, smoothly finished; aperture low, narrow, at the inner margin of the last-formed chamber. Length up to 0.50 mm., breadth 0.30 mm., thickness 0.25 mm.

The types of this species are from the Cretaceous Velasco shale of the Tampico Embayment, Hacienda el Limon, Vera Cruz, Mexico. Somewhat similar specimens are found in the Taylor marl of Texas.

Taylor marl.
Pecan Gap chalk member. Texas, Kaufman County (173, 174).
Lower part. Texas, Bell County (245).

Textularia cf. subconica Franke

Textularia cf. *subconica* Franke, Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 84, pl. 21, figs. 7a, b, 1941.

A few specimens referred somewhat questionably to this species occur in the Cretaceous of Colombia. Specimens are usually somewhat distorted in fossilization.

Genus BIGENERINA D'Orbigny, 1826

Bigenerina hastata Cushman
Plate 6, figure 25

Bigenerina hastata Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 131, pl. 1, fig. 9, 1927.

Test elongate, strongly compressed, the early biserial portion tapering, later uniserial portion with the sides nearly straight, often slightly reduced in diameter toward the apertural end; chambers numerous, rather indistinct; sutures fairly distinct, very slightly if at all depressed; wall arenaceous, with a large proportion of light-gray cement with fine angular mineral fragments of a darker color, surface smoothly finished; aperture terminal, elliptical, sometimes slightly protruding. Length 1.00 to 1.25 mm., breadth 0.25 to 0.30 mm., thickness 0.10 to 0.12 mm.

This species was originally described from the Upper Cretaceous of Manitoba, from the Canora well, 375-foot sample, sec. 25, T. 30, R. IV W. of 2d meridian, Saskatchewan, Canada.

Bigenerina velascoensis Cushman
Plate 6, figure 26

Bigenerina velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 585, pl. 16, fig. 3, 1926.

Test much elongate, tapering, greatest width formed by the last chamber; the first few chambers biserial, later chambers uniserial, circular in transverse section; sutures distinct and depressed; wall arenaceous but smoothly finished; aperture circular, terminal. Length 0.85 mm., breadth 0.25 mm.

This species at first glance seems to be very similar to some of the species of *Rectogümbelina* described from the Cretaceous of Texas, but the wall in the Mexican specimens seems to be very distinctly arenaceous, as well as smoothly finished. The species, which is rare in the Velasco shale of Mexico, occurs in well samples from Hacienda el Limon, Vera Cruz, Mexico.

Genus AMMOBACULOIDES Plummer, 1932

Ammobaculoides navarroensis Plummer
Plate 6, figure 27

Ammobaculoides navarroensis Plummer, Am. Midland Naturalist, vol. 13, p. 87, text figs. 1a–d, 1932.
Cushman, Cushman Lab. Foram.. Research Special Pub. 4, pl. 11, figs. 2a, b, 1933; idem, Special Pub. 5, pl. 17, figs. 4a, b, 1933.

Test elongate, somewhat compressed, periphery rounded; early chambers planispiral, closely coiled; later biserial; and in the adult uniserial, distinct, slightly inflated; the biserial chambers about as high as broad, as are also the uniserial chambers, which are very slightly compressed; sutures distinct, slightly depressed, in the biserial portion slightly oblique; wall coarsely arenaceous, composed of coarse angular quartz grains firmly cemented, surface rough; aperture broadly elliptical, terminal. Length up to 0.75 mm., breadth 0.25 mm.

This species is known only from the upper part of the Navarro group, the Kemp clay, of Travis County, Tex. (15).

Family VERNEUILINIDAE
Genus VERNEUILINA D'Orbigny, 1840
Verneuilina polystropha (Reuss) H. B. Brady
Plate 7, figure 1

Bulimina polystropha Reuss, Versteinerungen böhmischen Kreideformation, pt. 2, p. 109, pl. 24, fig. 53, 1846.
Berthelin, Soc. Geol. France Mem., 3d ser., vol. 1, p. 30, pl. 2(25), figs. 3a, b, 1880.
Verneuilina polystropha Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 15, pl. 4, figs. 3a, b, 1932.
Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 10, p. 30, pl. 5, figs. 17a, b, 1934.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 11, pl. 1, figs. 14, 15, 1937.

Test elongate, triserial, gradually tapering, greatest breadth somewhat above the middle, thence often contracted slightly toward the apertural end; rounded triangular in end view, the sides broadly rounded; chambers numerous, somewhat inflated, gradually increasing in size as added; sutures distinct, slightly depressed; wall arenaceous, typically with a rough exterior, but sometimes rather smoothly finished; aperture a semicircular or semielliptical opening at the inner margin of the last-formed chamber.

The only American material that can be definitely referred to this species is from Trinidad. The specimens from the Cretaceous of Tennessee that the writer has referred to this species seem to be very close to *Verneuilina bearpawensis* Wickenden, from western Canada.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well, at 116 feet, near Lizard Springs, Trinidad.

Verneuilina canadensis Cushman
Plate 7, figures 2, 3

Verneuilina canadensis Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 131, pl. 1, fig. 11, 1927; Cushman Lab. Foram. Research Special Pub. 7, p. 13, pl. 1, figs. 16, 17, 1937.

Test fairly large, tapering, triserial throughout; chambers inflated, very distinct, those of each vertical series distinct, with a deep depression between; sutures distinct, much depressed; wall coarsely arenaceous, with much cement. Length 1.10 mm., breadth 0.65 mm.

This species was common at the type locality but has not been observed elsewhere. It is peculiar in the very inflated, distinct chambers and coarsely arenaceous wall. From the large amount of chitinous cement and the considerable distortion of specimens, it is probable that it lived under more or less brackish conditions.

Upper Cretaceous. British Petroleum well No. 3, 1,896 to 1,904 feet and 1,921 to 1,929 feet, sec. 29, T. 45, R. 6 W. of 4th meridian, Manitoba, Canada. (Type locality.)

Verneuilina bearpawensis Wickenden
Plate 7, figures 4–6

Verneuilina bearpawensis Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 87, pl. 1, fig. 8, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 13, pl. 1, fig. 18, 1937.

Test elongate, tapering, nearly circular in transverse section; chambers distinct, somewhat inflated, of rather uniform shape, gradually increasing in size as added; sutures distinct, somewhat curved, depressed; wall smooth, made of fine-grained arenaceous material with much cement; aperture a high arch at the base of the last-formed chamber; color generally brownish. Length 0.70 mm., breadth 0.20 mm.

The figured specimens from Canada are paratypes in the Cushman collection, available through the kindness of Doctor Wickenden.

Bearpaw shale. West bank of the Oldman River ½ mile north of the main highway running west from Lethbridge, SE¼ sec. 11, T. 9, R. 22 W. of 4th meridian, Alberta, Canada. (Type locality.) Further exposures on the Oldman River, on St. Marys River, and in the bad lands east of Manyberries, Alberta, Canada.
Ripley formation. Tennessee, McNairy County (94).

Verneuilina cretosa Cushman
Plate 7, figure 7

Verneuilina cretosa Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 31, pl. 5, figs. 7a, b, 1933; idem, Special Pub. 7, p. 14, pl. 1, fig. 20, 1937.

Test elongate, tapering, greatest breadth near the apertural end, initial end acute, triangular in transverse section, periphery serrate; chambers numerous, triserial, of rather uniform shape, increasing regularly in size as added; sutures distinct, very slightly depressed; wall finely arenaceous, with much cement, smoothly finished; aperture at the base of the inner margin of the last-formed chamber, low, elongate. Length of holotype 2.10 mm., breadth 1.10 mm., thickness 0.90 mm.

The species may be distinguished by its elongate form and strongly limbate sutures. The types are from the upper part of the Taylor marl. Somewhat similar specimens occur in the Burditt marl (of Adkins) at the top of the Austin chalk.

Taylor marl, upper part. Texas, Red River County (107).
Austin age. Burditt marl (of Adkins). Texas, Bell County (269).
Austin chalk. Texas, Bell County (316).

Genus TRITAXIA Reuss, 1860
Tritaxia manitobensis Wickenden
Plate 7, figure 8

Titaxia manitobensis Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 87, pl. 1, fig. 10, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 27, pl. 4, fig. 7, 1937.

Test elongate, triserial throughout; chambers distinct, triangular, rounded, overlapping, drawn out to a neck; sutures distinct, curved; wall smooth, finely arenaceous, with a moderate amount of cement; aperture terminal, at the end of the neck on the last-formed chamber; color white. Length about 0.40 mm., width about 0.19 mm.

The specimen figured here is a paratype kindly furnished by Dr. Wickenden. Length 0.45 mm., breadth 0.20 mm.

The species is small and evidently easily deformed in fossilization.

Upper Cretaceous. Lower Benton Ashville beds, near the east end of Thunder Hill, Manitoba, Canada. (Type locality.)

Tritaxia jarvisi Cushman
Plate 7, figure 9

Tritaxia pyramidata Cushman and Jarvis (not Reuss), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 16, pl. 4, figs. 4a, b, 1932.
Tritaxia jarvisi Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 4, 1936; idem, Special Pub. 7, p. 28, pl. 4, fig. 8, 1937.

Test large, elongate, tapering from the subacute initial end to the greatest breadth near the apertural end, triserial, triangular in transverse section, sides flat; chambers distinct, numerous, of rather regular shape, increasing gradually and regularly in size as added, not inflated, the last-formed in the adult terminal, nearly covering preceding chambers; sutures distinct, slightly depressed, strongly oblique, forming an angle of more than 45° with the long axis of the test; wall rather coarsely arenaceous but with fairly smooth finish; aperture in the adult terminal, rounded, with a slight neck. Length up to 2.20 mm., breadth up to 1.10 mm.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well, at 116 feet, near Lizard Springs, Trinidad.

Tritaxia ellisorae Cushman
Plate 7, figures 10, 11

Tritaxia ellisorae Cushman, Cushman Lab. Foram Research Special Pub. 6, p. 5, pl. 1, figs. 9a, b; idem, Special Pub. 7, p. 28, pl. 4, figs. 9, 10, 1937; idem, Contr., vol. 20, p. 3, pl. 1, fig. 6, 1944.

Test elongate, slender, slightly tapering, triangular in transverse section, with the sides flattened or slightly concave, the angles slightly keeled; chambers fairly distinct, rather high, of rather uniform shape, increasing gradually in size as added; sutures fairly distinct, slightly depressed; wall distinctly arenaceous but the surface only slightly roughened; aperture a low opening in a semicircular depression of the inner margin of the last-formed chamber. Length up to 1.25 mm., diameter 0.45 mm.

This species is very slightly tapering and usually has distinct keels at the angles. The last-formed chambers have a tendency to become biserial.

The only record for this species so far is from the Pecan Gap chalk.

Taylor marl, Pecan Gap chalk member. Texas, Delta County (165, 166); Rockwall County (175, 176 [type locality]).

Genus GAUDRYINA D'Orbigny, 1839
Gaudryina rugosa D'Orbigny

Gaudryina rugosa D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 44, pl. 4, figs. 20, 21, 1840; Prodrome de Paléontologie stratigraphique universelle des animaux mollusques et rayonnés, vol. 2, p. 282, No. 1406, 1850.
Reuss, Haidinger's Naturwiss. Abh., vol. 4, p. 25, 1851.
Beissel, Preuss. geol. Landesanstalt Abh., new ser., vol. 3, p. 69, pl. 13, figs. 30–37, 1891.
Franke, Greifswald Univ., Geol.-palaeont. Inst. Abh., vol. 6, p. 14, pl. 1, fig. 19, 1925.
Brotzen, Zeitschr. Deutschen Palästina-Vereins, Jahrg. 1934, p. 57, 1934.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 36, pl. 4, figs. 14–19; pl. 5, figs. 1, 2, 1937.

Test large, elongate, greatest width near the apertural end; early portion triserial, triangular in transverse section, the sides flat, angles in the early portion acute, becoming somewhat rounded later; biserial portion long, consisting of 4 or more pairs of chambers, in end view becoming quadrangular or even somewhat rounded; chambers fairly distinct except in very rough specimens; sutures slightly depressed, somewhat strongly so in the adult portion, in the early triserial portion strongly oblique, in the adult nearly horizontal; wall usually coarsely arenaceous, with sand grains of various sizes, in some specimens the surface very much roughened; aperture in the adult elongate, at the inner margin of the last-formed chamber. Length up to 2.00 mm., breadth 0.75 to 0.85 mm.

Though there are numerous American records for this species, the only specimens that can be definitely referred to it are those from the Upper Cretaceous of Vincentown, N. J. These are rather large and are numerous at that locality.

Jennings (Bull. Am. Paleontology, vol. 23, No. 78, p. 12, pl. 1, fig. 5, 1936) has recorded it from the Navesink marl and Mt. Laurel sand of New Jersey.

Gaudryina foeda (Reuss) Cushman
Plate 7, figures 12, 13

Textularia foeda Reuss, Versteinerungen böhm. Kreideformation, pt. 2, p. 109, pl. 43, figs. 12, 13, 1846.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 133, pl. 12, fig. 6, 1928.
Gaudryina foeda Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 90, 1932; Cushman Lab. Foram. Research Special Pub. 7, p. 38, pl. 5, figs. 8–16, 1937.
Gaudryina filiformis Cushman and Jarvis (not Berthelin), Cushman Lab. Foram. Research Contr., vol. 4, p. 92, pl. 13, fig. 2, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 16, pl. 4, fig. 5, 1932.
Textularia concinna Cushman and Jarvis (not Reuss), Cushman Lab. Foram. Research Contr., vol. 4, p. 91, pl. 13, fig. 1, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 15, pl. 4, figs. 1, 2, 1932.

Test elongate, tapering, greatest width near the apertural end, earliest chambers apparently triserial and somewhat triangular in section, later chambers forming the greater portion of the test, biserial, numerous; chambers fairly distinct, inflated, especially in the later portion, in many specimens distorted by compression in fossilization; sutures usually distinct, slightly depressed, forming an angle of less than 45° with the horizontal and usually becoming less oblique toward the apertural end; wall arenaceous, easily distorted, often of rather coarse sand grains with a large amount of cement; aperture terminal, elongate, at the inner margin of the last-formed chamber. Length up to 1.00 mm., breadth 0.25 to 0.30 mm.

This species is common in the European Cretaceous. In America specimens referable to it are found in the Upper Cretaceous of Trinidad and of the Tampico Embayment of Mexico. Similar specimens also occur in beds of Navarro and Taylor ages in Alabama, Arkansas, and Texas.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Mendez shale. On San Luis Potosi-Tampico Railroad 0.5 km. southwest of Coco, Hacienda el Limon, and also on the same railroad at km. 572.66, km. 572.86, and km. 577.20.
Navarro age. Prairie Bluff chalk. Alabama, Wilcox County (100).
Taylor age. Upper part of Taylor marl. Texas, Guadalupe County (151); Bexar County (158, 159).
Ozan formation. Arkansas, Little River County (254).
Lower part of Taylor marl. Texas, McLennan County (240).

Gaudryina faujasi (Reuss) Cushman
Plate 7, figure 14

Textilaria faujasi Reuss, Akad. Wiss. Wien, Math-naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, 1861, p. 320, pl. 3, figs. 9a, b (1862).
Gaudryina faujasi Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 91, 1932; Cushman Lab. Foram. Research Special Pub. 7, p. 39, pl. 5, figs. 17–20; pl. 6, figs. 1, 2, 1937.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 53, pl. 9, fig. 14, 1942.

Test large, elongate, the earliest portion triserial, triangular in transverse section, sides flattened or slightly concave, angles somewhat rounded, later and much the larger portion biserial, increasing gradually in breadth as added, periphery broadly rounded, sides somewhat flattened; chambers except those of the last-formed portion indistinct, latest somewhat inflated; sutures indistinct except toward the apertural end, where they are slightly depressed, nearly horizontal or very slightly oblique; wall arenaceous, somewhat roughly finished; aperture a somewhat rectangular opening at the inner margin of the last-formed chamber. Length up to 1.90 mm., breadth up to 0.80 mm., thickness 0.60 mm.

This species was originally described by Reuss from the Upper Cretaceous Maastrichtian stage of Maastricht, Holland, and it occurs elsewhere in Europe in the Senonian. In America is occurs in the Upper Cretaceous of New Jersey, Arkansas, and Texas. The specimens from the Texas locality are not altogether typical.

Vincentown marl. Vincentown, N. J.
Taylor marl, upper part. Texas, Bexar County (158).
Austin age. Brownstown marl. Arkansas, Sevier County.

Gaudryina bentonensis (Carmen) Cushman
Plate 7, figures 15, 16

Spiroplectammina bentonensis Carman, Jour. Paleontology, vol. 3, p. 311, pl. 34, figs. 8, 9, 1929.
Gaudryina bentonensis Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 96, 1932; Cushman Lab. Foram. Research Special Pub. 7, p. 42, pl. 6, figs. 21, 22, 1937.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 52, pl. 9, figs. 12, 13, 1942.

Test small, elongate, narrow, early portion apparently triserial, later and much the larger portion biserial, easily distorted in fossilization and usually twisted, the biserial portion with the chambers somewhat inflated, high, rather regularly increasing in size as added, the sides of the biserial portion nearly parallel; sutures more or less indistinct, usually nearly horizontal; wall rather coarsely arenaceous, with much cement, somewhat roughly finished; aperture at the inner margin of the last-formed chamber, low, narrow. Length 0.40–0.45 mm., breadth 0.15 mm.

This species was originally described from the Upper Cretaceous of Wyoming. It appears to range from the Austin to the Taylor and possibly to the Eagle Ford although specimens from the last formation are not well preserved.

Benton shale. East flank of Centennial syncline, west slope of Sheep Mountain, T. 15 N., R. 77 W., east of Centennial, Wyo.
Taylor age.
Upper part of Taylor marl. Texas, Williamson County (143, 144); Bexar County (153, 159).
Pecan Gap chalk member of Taylor marl. Texas, Rockwall County (175).
Wolfe City sand member of Taylor marl. Texas, Hunt County (186).
Annona chalk. Texas, Red River County (192, 194, 198).
Lower part of Taylor marl. Texas, Collin County (207); Ellis County (232); Hill County (237); McLennan County (239).
Austin age.
Brownstown marl. Texas, Red River County (318); Lamar County (321); Arkansas, Sevier County.
Blossom sand. Texas, Lamar County (322).
Bonham marl. Texas, Lamar County (327, 329, 330).
Selma chalk of upper Austin age. Alabama, Warrior River (353).
Eagle Ford shale. Texas, Dallas County (358, 359); Ellis County (364).

Gaudryina laevigata Franke
Plate 8, figure 4

Gaudryina laevigata Franke, Deutsche geol. Gesell. Zeitschr., vol. 66, p. 431, pl. 27, figs. 1, 2, 1914.
Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 587, pl. 17, figs. 1a, b(?), 1926.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 142, pl. 13, fig. 3, 1928.
Sandidge, Am. Midland Naturalist, vol. 13, p. 341, pl. 31, fig. 21 (?), 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 41, pl. 6, figs. 10–17, 1937.
Cushman and Hedberg, idem, Contr., vol. 17, p. 84, pl. 21, fig. 8, 1941.

Test tapering, more or less elongate, early portion triserial, sharply triangular in transverse section, the angles subacute, later portion enlarging rapidly, the chambers inflated and distinct, considerably overlapping; sutures distinct, somewhat depressed, those of the adult portion nearly horizontal; wall finely arenaceous with smooth finish, even when containing sand grains of considerable size; aperture usually elongate, low, at the inner margin of the last-formed chamber. Length up to 1.00 mm., breadth 0.50 to 0.70 mm.

This species is common in the Cretaceous of Europe but is rare in America. The figured specimen, which is fairly typical, is from the upper part of the Taylor marl, Red River County, Tex. (107).

Gaudryina navarroana Cushman
Plate 7, figure 17

Gaudryina navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 98, pl. 11, figs. 15, 16, 1932; Cushman Lab. Foram. Research Special Pub. 7, p. 43, pl. 7, fig. 1, 1937.

Test elongate, early portion triserial and sharply triangular, the edges bluntly angled, fusiform in front view; chambers of the later portion biserial and somewhat compressed, lobed; sutures fairly distinct in the early portion, distinct and depressed later; wall rather coarsely arenaceous but with fairly smooth finish; aperture a deep reentrant in the inner margin of the chamber with raised, rounded margins. Length up to 1.00 mm., breadth 0.50 mm., thickness 0.40 mm.

This species is an excellent index fossil for the upper Navarro. It is characterized by the large proportion of triserial chambers and the very short biserial stage consisting of a few chambers that are usually somewhat flattened. The wall of the test is thin and easily collapsed, so that the sutures usually appear as raised ridges.

Navarro age.
Kemp clay. Texas, core samples from upthrow side of fault in Mexia oil field, Mexia (type locality); Hopkins County (1); Kaufman County (2); Guadalupe County (18, 19).
Escondido formation. Texas, Maverick County (22).
Arkadelphia marl. Arkansas, Hempstead County (71).
Nacatoch sand. Arkansas, Lonoke County (77).

Gaudryina io Cushman
Plate 7, figure 19

Gaudryina io Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 51, pl. 5, figs. 6a–c, 1933; Cushman Lab. Foram. Research Special Pub. 7, p. 44, pl. 7, fig. 4, 1937.

Test elongate, tapering, early portion triserial, triangular in section, later portion biserial, the periphery angularly lobed; chambers inflated and rounded except at the angles; sutures distinct, slightly depressed in the early portion, strongly so in the adult chambers; wall distinctly arenaceous, composed of rather uniformly sized sand grains cemented into a fairly smooth surface; aperture elongate, at the base of the last-formed chamber, or tending to become terminal. Length 2.00 mm., breadth 0.70 mm., thickness 0.50 mm.

This species seems to be a characteristic one of the Wolfe City sand member of the Taylor. It may be found to be a definite index fossil for this particular member.

Taylor marl, Wolfe City sand member. Texas, Collin County (181, 182).

Gaudryina bearpawensis Wickenden
Plate 7, figures 20–22

Gaudryina bearpawensis Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 88, pl. 1, fig. 7, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 44, pl. 7, figs. 5–7, 1937.

Test elongate, early portion triserial, later twisting into a biserial part, tapering toward both ends, but more strongly toward the early portion; chambers distinct, almost globular, especially in the triserial part; biserial part only 5 or 6 altogether, triserial portion three rows of six chambers each; sutures distinct, slightly curved; walls rather coarsely arenaceous, with much brown cement; aperture comma-shaped, at the base of the last-formed chamber; color brownish. Length about 0.45 mm., breadth 0.18 mm.

This is a very small species, easily overlooked. The young stages are definitely triserial, and young specimens therefore may be easily confused with *Verneuilina*. As far as records show, this species has been recorded only from the Bearpaw formation of western Canada.

Bearpaw formation. Exposures on west bank of Oldman River about ½ mile north of main highway leading west from Lethbridge, SE¼ sec. 11, T. 9, R. 22 W. of 4th meridian, Alberta Canada. Exposures on Oldman River near Lethbridge, on St. Marys River east of Manyberries, and in valley due north of Lundbreck, Alberta, Canada.

Gaudryina painoides Wickenden
Plate 7, figure 18

Gaudryina painoides Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 88, pl. 1, figs. 3a–c, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 45, pl. 7, fig. 3, 1937.

Test minute, elongate, slender, several times as long as broad, the early and smaller portion triserial, later and larger portion biserial, compressed; chambers distinct, inflated, biserial ones increasing regularly in size as added, the last-formed pair being the largest; sutures distinct, strongly depressed, only slightly oblique; wall very finely arenaceous, with a large proportion of cement; aperture rounded, tending to become somewhat terminal. Length 0.25 to 0.30 mm., breadth 0.06 to 0.08 mm.

This species is very distinctive in its characters in spite of its very small size. It was described from the Upper Cretaceous of western Canada.

Boyne beds. Exposure on the Pembina escarpment 8 miles south of Morden, SE¼ sec. 32, T. 1, R. 5 W. of principal meridian; Boyne River 4½ miles west of Miami near Treherne; calcareous shales in the Vermilion River ½ mile above the crossing of the trail into the Riding Mountain Forest Reserve, Manitoba, Canada.

Gaudryina canadensis Cushman
Plate 6, figure 24

Bigenerina angulata Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec. 4, p. 131, pl. 1, fig. 10, 1927.
Gaudryina canadensis Cushman, Cushman Lab. Foram. Research Contr., vol. 19, p. 28, pl. 6, figs. 7, 8, 1943.

Test elongate, earliest portion triserial, becoming biserial early in the development and in some specimens tending to become uniserial; chambers distinct, inflated, 10 to 16 in the adult biserial portion, very gradually increasing in size as added; sutures distinct, depressed; wall arenaceous with a large proportion of cement, easily contorted in fossilization; aperture enlarged at the base, tending to become terminal and more rounded in the uniserial chambers. Length 0.80 to 1.25 mm.; breadth 0.22 to 0.25 mm.

The wall has an abundance of brownish cement, apparently chitinous, and was apparently flexible so that in fossilization very few specimens kept their original shape.

The species is evidently related to *Gaudryina bearpawensis* Wickenden, but that species has a much greater proportion of triserial chambers and the biserial stage much shorter with no apparent tendency to become uniserial.

This species was originally described from beds referred to the Upper Cretaceous of Manitoba, Canada, but later seen to be definitely Lower Cretaceous. Specimens from the Cretaceous of Bohemia are very similar indeed to this American species, but apparently it has not been described from Europe. The large amount of cement in both series of specimens probably accounts for the fact that the tests are usually collapsed.

"Upper Cretaceous" [Lower Cretaceous]. British Petroleum well No. 3, 2,044 to 2,054 feet, sec. 29, T. 45, R. 6 W. of 4th meridian, Manitoba, Canada.

Gaudryina rudita Sandige
Plate 7, figures 23, 24; plate 8, figure 1

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.
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.

Test elongate, slightly compressed, broad at the apertural end, initial end bluntly pointed; triserial portion small, short; biserial portion much longer, slightly inflated; chambers gradually increasing in size as added, rounded, overlapping; sutures somewhat depressed, sometimes partially concealed by the rough coating of sand; wall finely arenaceous, exterior covered with coarse sand grains, surface rough; aperture in a rounded depression extending from the inner margin well into the face of the last chamber. Length 0.60 to 0.90 mm., breadth 0.30 to 0.40 mm., thickness 0.20 to 0.30 mm.

This is a variable species, and, if all the forms recorded here belong to one species, it is rather widely distributed, occurring most commonly in the Navarro but with a few specimens referable to it in the Taylor and at a single locality in the Austin. The surface of the test at the type locality is covered with coarse sand grains, but in other localities this feature is much less definite. The general form of the test, however, seems to be rather constant. It has been recorded in the American Cretaceous both as *Gaudryina rugosa* and as *G. minima*, but now that the typical forms of those species are well known, our American species is seen to be very definitely distinct.

Navarro age.
Corsicana marl. Texas, Limestone County (29, 30).
Owl Creek formation. Mississippi, Tippah County (83).
Prairie Bluff chalk. Alabama, Wilcox County (100); Sumter County (101–103).
Ripley formation. Tennessee, McNairy County (94, 95, 97); Henderson County (96).

Selma chalk (upper part). Tennessee, McNairy County (98).
Neylandville marl. Texas, Delta County (51); Hunt County (53); Navarro County (64).
Taylor age.
Upper part of Taylor marl. Texas, Leon County (138); Williamson County (142).
Selma chalk (middle part). Tennessee, Hardin County (255).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Austin age.
Austin chalk. Texas, Grayson County (290).
Selma chalk (lower part). Mississippi, Lee County (350).

Gaudryina quadrans Cushman
Plate 8, figures 2, 3

Gaudryina quadrans Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 6, pl. 1, figs. 12a, b, 1936; idem, Special Pub. 7, p. 47, pl. 7, figs. 11, 12, 1937.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 330, pl. 50, figs. 11, 12, 1944.

Test elongate, sometimes slightly twisted, tapering more or less pyramidal, greatest breadth toward the quadrate apertural end, usually rhomboid, truncate; early portion triangular, triserial; later quadrate, biserial; chambers distinct except in the earliest portion, very slightly inflated, increasing gradually in size as added; sutures distinct, slightly depressed; wall arenaceous but the exterior usually with smooth finish; aperture a low opening in an indentation of the inner margin of the last-formed chamber. Length up to 1.20 mm., diameter 0.60 mm.

This is a distinctive species but so far has been found only at the type locality and in the Marlbrook marl of Arkansas.

Taylor age.
Upper part of Taylor marl. Texas, Bexar County (158).
Marlbrook marl. Arkansas, Howard County; Hempstead County.

Gaudryina (Siphogaudryina) austinana Cushman
Plate 8, figures 5–7

Gaudryina (Siphogaudryina) austinana Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 10, pl. 2, figs. 6a, b, 1936; idem, Special Pub. 7, p. 74, pl. 11, figs. 1–3, 1937.
Cushman and Deaderick, idem, Contr., vol. 18, p. 53, pl. 9, figs. 15, 16, 1942.
Cushman, idem, Contr., vol. 20, p. 84, pl. 13, fig. 2, 1944.

Test somewhat longer than broad, the early portion triserial and triangular, in the later portion biserial and somewhat compressed, the keel of one side dividing so that a generally quadrangular test results, angles sharp or somewhat rounded; chambers fairly distinct, especially in the later portion, where they are somewhat inflated; sutures fairly distinct, oblique, the later sutures slightly depressed; wall arenaceous, with much cement, either smooth or slightly roughened on the exterior; aperture a small, low opening in a rather deep, semicircular re-entrant of the inner margin of the last-formed chamber. Length up to 2.00 mm., breadth 1.00 mm.

This species shows the relationships between typical *Gaudryina* and the subgenus *Pseudogaudryina*, particularly *G. (P.) ellisorae* (p. 35). The early stages very closely resemble those of *Pseudogaudryinella*. The species also resembles *Gaudryina (Siphogaudryina) carinata* Franke, but the angles are less prominent, the surface is smoother, and the general appearance of the species is much less coarse. Our collections seem to show that this is a good index fossil for the Austin chalk, particularly the upper portion. The few localities from the Taylor all lie just above the Austin–Taylor contact.

Taylor marl, lower part. Texas, Dallas County (216, 217, 222, 224); Williamson County (246).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270, 271).
Gober tongue of Austin chalk. Texas, Fannin County (273, 276–278); Lamar County (285, 288).
Austin chalk. Texas, Grayson County (289–291); Collin County (292, 294, 295); Dallas County (296, 303, 305, 306, 309, 310); Bell County (316).
Selma chalk (lower part). Mississippi, Lee County (350).
Brownstown marl. Arkansas, Sevier County.

Gaudryina (Siphogaudryina) stephensoni Cushman
Plate 8, figures 8–11

Gaudryina stephensoni Cushman, Cushman Lab. Foram. Research Contr., vol. 4, p. 108, pl. 16, figs. 6–8, 1928; Tennessee Div. Geology Bull. 41, p. 20, pl. 1, figs. 11a, b, 1931; Jour. Paleontology, vol. 6, p. 332, 1932.
Sandidge, idem, p. 268, pl. 41, figs. 13, 14, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 74, pl. 11, figs. 4–6, 11, 1937.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 330, pl. 50, figs. 13, 14, 1944.

Test elongate, tapering, greatest width near the apertural end; the early portion triserial and tricarinate, rapidly increasing in size from the subacute initial end, later and larger portion biserial, with quadrate chambers, the angles distinct, the broader faces of the test flattened or slightly concave, the angles of each chamber marked by fistulose processes that are usually broken through at the tip, showing the hollow within; chambers fairly distinct in well preserved specimens; sutures very slightly depressed; wall finely arenaceous, somewhat rough on the exterior; aperture a low elongate opening, on the inner margin of the last-formed chamber. Length 0.70., breadth 0.25 mm., thickness 0.15 mm.

This species is related to *G. (S.) austinana* and probably is derived from it. It is characteristic of the Taylor marl in its various phases, and can, therefore, be used as an index fossil with *G. (S.) austinana* to distinguish these two parts of the Upper Cretaceous. There are a few records of a form from the lower Navarro as *G. (S.) stephensoni* that may not be the same species, but they are very closely allied. The single record from the Austin is from the Burditt marl (of Adkins), which has various elements of its foraminiferal fauna closely resembling the Taylor.

Navarro age.
Ripley formation. Tennessee, McNairy County (94, 95).
Selma chalk (upper part). Mississippi, Prentiss County (91). Alabama, Marengo County (104).
Taylor age.
Marlbrook marl. Arkansas, Clark County; Hempstead County.
Upper part of Taylor marl. Texas, Lamar County (110); Hunt County (116); Collin County (121); Kaufman County (129); Milam County (139); Williamson County (142); Bexar County (152, 159).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (170–172).
Wolfe City sand member of Taylor marl. Texas, Collin County (181–183).
Lower part of Taylor marl. Texas, Delta County (206); Collin County (212); Ellis County (234).
Selma chalk (middle part). Mississippi, Alcorn County (257); Union County (262).
Austin age. Burditt marl (of Adkins). Texas, Travis County (270).

Gaudryina (Pseudogaudryina) ellisorae Cushman
Plate 8, figures 12, 13

Gaudryina (Pseudogaudryina) ellisorae Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 13, pl. 2, figs. 12a, b, 1936; idem, Special Pub. 7, p. 87, pl. 12, figs. 15, 16, 1937; idem, Contr., vol. 20, p. 84, pl. 13, fig. 3, 1944.

Test slightly longer than broad; the earliest stage triserial and the test triangular, later becoming somewhat compressed so that the two sides that have the zigzag line between the chambers are much broader than the third side, which has horizontal sutures; angles usually sharp; chambers fairly distinct, slightly if at all inflated; sutures rather indistinct, later sutures sometimes slightly depressed; wall arenaceous, somewhat variable in texture according to the habitat, either coarsely arenaceous and somewhat roughened on the exterior or with much cement, finely arenaceous and smooth; aperture a rather high opening in an elongate, rounded re-entrant in the inner margin of the last-formed chamber. Length 0.80 mm., breadth 0.55 mm.

This species apparently represents the earliest occurrence of this subgenus. In the adult the face with the simple horizontal sutures is narrow and the two faces with the zigzag sutures are broad, each chamber of one series in the biserial portion having the periphery truncate, the other series with the periphery forming an acute angle. The species is closely related to *Gaudryina (Siphogaudryina) austinana* and to *Pseudogaudryinella capitosa.*

Taylor marl, lower part. Texas, Travis County (248).
Austin age. Selma chalk (lower part). Mississippi, Itawamba County (351); Lee County (350).

Gaudryina (Pseudogaudryina) pyramidata Cushman
Plate 8, figure 14

Gaudryina laevigata Franke var. *pyramidata* Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 587, pl. 16, figs. 8a, b, 1926.
White, Jour. Paleontology, vol. 2, p. 313, pl. 42, fig. 7, 1928.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 92, pl. 13, fig. 6, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 18, pl. 5, fig. 3, 1932.
Cushman, Jour. Paleontology, vol. 6, p. 333, 1932.
Gaudryina (Pseudogaudryina) pyramidata Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 87, pl. 12, fig. 13, 1937.
Cushman and Goudkoff, idem, Contr., vol. 20, p. 56, pl. 9, figs. 7, 8, 1944.

Test somewhat longer than broad, triangular in transverse section, the early chambers triserial, later biserial, angles acute; chambers distinct, slightly inflated, in the biserial portion with the series of one side with a squarely truncate periphery, those of the opposite series pointed; sutures distinct, slightly depressed; wall rather coarsely arenaceous but usually with a smooth surface; aperture a low opening in a semicircular re-entrant of the inner margin of the last-formed chamber. Length up to 1.25 mm., diameter 0.90 mm.

The species is particularly well developed in the Velasco shale in the Tampico Embayment region of Mexico and occurs also in Trinidad and in California.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco shale. Hacienda el Limon, Mexico.

Genus GAUDRYINELLA Plummer, 1931
Gaudryinella pseudoserrata Cushman
Plate 8, figures 15–21

Gaudryinella pseudoserrata Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 99, pl. 11, figs. 20, 21, 1932; Cushman Lab. Foram. Research Special Pub. 7, p. 105, pl. 14, figs. 16–22, 1937.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 51, pl. 9, fig. 5, 1943.

Test elongate, earliest portion triserial, then becoming biserial and somewhat compressed, in the adult tending to become uniserial; chambers distinct, later chambers inflated and lobulate; sutures distinct, later sutures deeply depressed; wall rather coarsely arenaceous, later portion in many specimens roughly finished; aperture in the adult rounded and subterminal. Length 1.00 mm. or more, diameter 0.50 mm., thickness 0.35 mm.

This species is an excellent marker for the Nacatoch sand and above. It is very abundant and rather widely distributed. There seems to be much variation, particularly in the later chambers, for in some specimens these chambers are much expanded and in others contracted to almost a cylindrical form. There is also considerable range in the coarseness of the exterior.

Navarro age.
Kemp clay. Texas, Navarro County (4, 5); Williamson County (11, 12); Travis County (13, 17).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–28); Limestone County (30, 31); Falls County (32); Travis County (34–43); Caldwell County (44); Guadalupe County (45); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (71, 72).
Nacatoch sand. Texas, Bowie County (47). Arkansas, Lonoke County (77).

Genus PSEUDOCLAVULINA Cushman, 1936
Pseudoclavulina clavata (Cushman) Cushman
Plate 8, figures 22–31; plate 9, figures 1, 2

Clavulina clavata Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 589, pl. 17, fig. 4, 1926; Jour. Paleontology, vol. 1, p. 149, pl. 28, fig. 3, 1927.
Clavulina amorpha Cushman (not 1926), Tennessee Div. Geology Bull. 41, p. 21, pl. 1, figs. 12, 13, 1931.
Clavulina parisiensis Sandidge (not D'Orbigny), Jour. Paleontology, vol. 6, p. 269, pl. 41, fig. 12, 1932.
Reophax cylindricus H. B. Brady var. *ripleyensis* W. Berry, in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 2, pl. 1, fig. 5, 1929.
Reophax coonensis W. Berry, idem, p. 2, pl. 3, fig. 23, 1929.
Pseudoclavulina clavata Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 108, pl. 15, figs. 1–13, 1937.
Cushman and Deaderick, idem, Contr., vol. 18, p. 53, pl. 9, figs. 17–22, 1942.
Cushman and Todd, idem, Contr., vol. 19, p. 52, pl. 9, fig. 6, 1943.
Frizzell, Jour. Paleontology, vol. 17, p. 340, pl. 55, fig. 14, 1943.
Cushman and Deaderick, idem, vol. 18, p. 330, pl. 50, figs. 15–17, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 3, pl. 1, fig. 8, 1944.

Test usually slender, comparatively large in the microspheric form, 2 to 4 times as long as broad; early portion triserial and somewhat swollen, later uniserial, generally rounded in transverse section in the adult and triangular in the early stages; chambers inflated in the adult, somewhat indistinct, increasing very slightly in size as added; sutures mostly indistinct but slightly depressed in the later portion; wall coarsely arenaceous, usually with fairly smooth finish but in some specimens with a rather rough exterior; aperture in the adult terminal, circular. Length up to 1.00 mm. or more.

The material from Mexico from which this species was originally described had been somewhat subjected to the action of acid and did not show the full characters. Specimens from the same locality have since been studied and the full characters determined. The microspheric form is usually large and decidedly stouter than the smaller and more slender megalospheric form, which has a nearly uniform diameter throughout instead of tapering, as does the microspheric form. There is a considerable difference in the texture of the wall and the roughness of the exterior, and this seems to be a variable character influenced more or less by local conditions of the environment. The species seems to develop in the upper part of the Austin chalk and appears in very considerable numbers in the Gober tongue. It is also widely distributed throughout the Taylor and into the Navarro.

Velasco shale. Hacienda el Limon, Vera Cruz, Mexico.
Mal Paso shale. Northwestern Peru.
Navarro age.
Corsicana marl. Texas, Limestone County (29, 30).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–87). Alabama, Wilcox County (99); Sumter County (101).
Selma chalk (upper part). Mississippi, Prentiss County (91). Alabama, Marengo County (104). Tennessee, McNairy County (98).
Ripley formation. Tennessee, McNairy County (94, 97); Henderson County (96).
Neylandville marl. Texas, Delta County (51); Hunt County (53–55).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–107); Delta County (114); Hunt County (115, 116); Collin County (121); Kaufman County (125, 128, 129, 131); Navarro County (132, 134); Limestone County (135); Williamson County (142, 144); Travis County (145, 149); Hays County (150); Guadalupe County (151); Bexar County (158, 159, 162, 163).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Ozan formation. Arkansas, Little River County (254).
Anacacho limestone (upper part). Texas, Bexar County (164).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (169); Kaufman County (173); Rockwall County (175); McLennan County (177); Delta County (165, 166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Wolfe City sand member of Taylor marl. Texas, Collin County (180–183); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (192–198).
Selma chalk (middle part). Mississippi, Alcorn County (258, 259); Prentiss County (260, 261); Lee County (264, 268)
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (200, 202); Delta County (206); Collin County (207, 209–212, 214, 215); Dallas County (222, 224, 225, 227); Kaufman County (228, 229); Ellis County 232, 234); Hill County (237); McLennan County (241–243); Bell County (245); Travis County (247–249).
Austin age.
Burditt marl (of Adkins). Texas, Travis County (270).
Gober tongue of Austin chalk. Texas, Fannin County (279, 281); Lamar County (282–288).
Austin chalk. Texas, Dallas County (304, 310).
Selma chalk of upper Austin age. Alabama, Pickens County (352).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (321). Arkansas, Sevier County (347).
Ector tongue of Austin chalk. Texas, Grayson County (332).
Selma chalk (lower part). Mississippi, Lee County (350).

Pseudoclavulina amorpha (Cushman) Cushman
Plate 9, figures 3, 4

Clavulina amorpha Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 589, pl. 17, fig. 3, 1926.
White, Jour. Paleontology, vol. 2, p. 315, pl. 42, fig. 12, 1928.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 93, pl. 13, fig. 9, 1928.
Pseudoclavulina amorpha Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 109, pl. 15, figs. 14, 15, 1937.

Test large, stout, 2 or 3 times as long as broad, early portion triserial; chambers indistinct, roughly triangular in section, the later portion uniserial, circular in transverse section, composed of a few large inflated chambers nearly as broad as the early triserial portion, with no abrupt break between the two parts; sutures in the last-formed portion slightly depressed, distinct; wall coarsely arenaceous but with a large proportion of cement and smoothly finished; aperture large, circular, terminal. Length 1.20 mm., breadth 0.50 mm., thickness 0.50 mm.

This species was originally described from the Upper Cretaceous of the Tampico Embayment region, Mexico. It also occurred in Trinidad. Other references for this species belong either to the following variety or to *Pseudoclavulina clavata* Cushman.

Velasco shale. Hacienda el Limon, Mexico.
Upper Cretaceous. At a depth of 720 feet in well at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Pseudoclavulina amorpha (Cushman) Cushman var. incrustata Cushman
Plate 9, figure 5

Clavulina amorpha Cushman (not 1926), Jour. Paleontology, vol. 5, p. 302, pl. 34, figs. 9a, b, 1931.
Pseudoclavulina amorpha (Cushman) Cushman var. *incrustata* Cushman, Cushman Lab. Foram, Research Special Pub. 6, p. 17, 1936; idem, Special Pub. 7, p. 109, pl. 15, fig. 16, 1937.

Variety differing from the typical form in the very coarsely arenaceous exterior, which obscures the arrangement of the chambers and structure.

This is characteristic of the Saratoga chalk of Arkansas.

Navarro age. Saratoga chalk. Arkansas, Howard County (79); Hempstead County (81).

Pseudoclavulina chitinosa (Cushman and Jarvis) Cushman
Plate 9, figures 6–8

Clavulina chitinosa Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 20, pl. 5, figs. 9–11, 1932.
Pseudoclavulina chitinosa Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 109, pl. 15, figs. 17–19, 1937.

Test elongate, slender, the early triserial portion often being of slightly greater diameter than the later uniserial portion; chambers numerous, fairly distinct; sutures distinct, depressed, especially in the last-formed part of the uniserial portion; wall almost entirely chitinous, clear, and translucent, very smooth; aperture terminal, with a slight neck and lip. Length up to 1.00 mm., diameter up to 0.30 mm.

The wall of the test is composed almost entirely of pure chitin, a character probably representing deep-water habitat. Owing to the thickness of the wall and its chitinous character, specimens are usually much distorted in fossilization, obscuring the earliest chambers.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. (Type locality.)

Pseudoclavulina arenata (Cushman) Cushman
Plate 9, figure 9

Clavulina arenata Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 54, pl. 6, figs. 5a, b, 1933.
Pseudoclavulina arenata (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 110, pl. 15, fig. 28, 1937.

Test elongate, cylindrical, early chambers triserial and somewhat triangular in section, later chambers uniserial; chambers rather indistinct, of rather uniform size except the final one, which is somewhat longer than the others; sutures mostly indistinct, very slightly depressed; wall rather coarsely arenaceous, surface rough; aperture terminal, rounded, without a neck. Length 0.65 mm., diameter 0.15 mm.

This is a small, roughly finished, cylindrical species, so far known only from horizons near the top of the Upper Cretaceous. It is very abundant at the type locality.

Navarro age. Arkadelphia marl. Arkansas, Hempstead County (72).

Genus CLAVULINOIDES Cushman, 1936

Clavulinoides trilatera (Cushman) Cushman

Plate 9, figures 10–16

Clavulina trilatera Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 588, pl. 17, fig. 2, 1926; Jour. Paleontology, vol. 1, p. 149, pl. 28, fig. 1, 1927.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 93, pl. 13, fig. 8, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 18, pl. 5, fig. 5, 1932.
Cushman, Jour. Paleontology, vol. 5, p. 302, pl. 34, figs. 10, 11, 1931; idem, vol. 6, p. 333, 1932.
Clavulinoides trilatera (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 121, pl. 16, figs. 12–18, 1937.
Cushman and Todd, idem, Contr., vol. 19, p. 52, pl. 9, fig. 7, 1943.
Cushman, idem, Contr., vol. 20, p. 3, pl. 1, fig. 7, 1944.

Test elongate, tapering, especially in the microspheric form; megalospheric form with the sides nearly parallel in the adult, triangular throughout or the last-formed chamber becoming more rounded, angles distinct but not definitely keeled; chambers fairly distinct, the uniserial portion consisting of 5 or more chambers, of rather uniform size and shape, increasing very slightly in size as added; sutures distinct, slightly depressed, becoming nearly horizontal in the adult, particularly the megalospheric form; wall arenaceous but usually rather smoothly finished; aperture rounded or with 3 distinct lobes pointing toward the angles of the test, slightly projecting. Length up to nearly 2.00 mm. in the microspheric form, breadth 0.35–0.50 mm.

The typical form is much less common than the following varieties.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco and Mendez shales. From well samples, Hacienda el Limon, Mexico; 2.5 km. northeast of Huiches, Mexico; 5 km. southeast of Guerrero, Mexico; on San Luis Potosi–Tampico Railroad at km. 576.82, 577.96, 577.20
Navarro age.
Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80).
Corsicana marl. Texas, Navarro County (27); Limestone County (30); Travis County (38).
Taylor marl, Pecan Gap chalk member. Texas, Delta County (165, 166).

Clavulinoides trilatera (Cushman) Cushman var. concava (Cushman) Cushman

Plate 9, figures 17–22

Clavulina trilatera Cushman var. *concava* Cushman, Jour. Paleontology vol. 5, p. 302, pl. 34, figs. 12a, b, 1931.
Clavulina trilatera Cushman (not 1926), Tennessee Div. Geology Bull. 41, p. 22, pl. 2, figs. 1–3, 1931.
Clavulina insignis Sandidge (not Plummer), Am. Midland Naturalist, vol. 13, p. 192, pl. 19, figs. 1–4, 1932.
Clavulinoides trilatera (Cushman) Cushman var. *concava* (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 121, pl. 16, figs. 19–25, 1937.
Cushman, idem, Contr., vol. 20, p. 3, pl. 1, fig. 9, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 330, pl. 50, figs. 18–21, 1944.

Variety differing from the typical form in the more acute angles, more concave sides, and usually somewhat higher chambers.

This variety grades into the typical form of the species, but for the most part may be distinguished by the very definite angles of the test throughout. It is much more widely distributed than the typical form, as will be seen by the accompanying list of localities.

Navarro age.
Prairie Bluff chalk. Alabama, Sumter County (103).
Nacatoch sand. Texas, Bowie County (47).
Saratoga chalk. Arkansas, Hempstead County (81, 82); Howard County (79).
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Alabama, Marengo County (104).
Neylandville marl. Texas, Red River County (50); Hunt County (55); Rockwall County (57); Kaufman County (58, 62); Navarro County (64, 68).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106, 107, 109); Lamar County (110); Delta County (114); Hunt County (115); Collin County (119, 121); Rockwall County (124); Kaufman County (125, 128); Navarro County (132); Limestone County (136); Leon County (138); Milam County (139); Williamson County (141); Travis County (145, 149); Bexar County (152, 153, 156, 158, 159, 161).
Selma chalk of Pecan Gap age. Alabama, Marengo County (256).
Marlbrook marl. Arkansas, Howard County; Hempstead County.
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165).
Wolfe City sand member of Taylor marl. Texas, Collin County (182).
Annona chalk. Texas, Bowie County (189, 190).
Selma chalk (middle part). Mississippi, Alcorn County (259); Prentiss County (260, 261); Union County (262); Lee County (266, 267). Tennessee, Hardin County (255).
Lower part of Taylor marl. Texas, Ellis County (234).

Clavulinoides trilatera (Cushman) Cushman var. plummerae (Sandidge) Cushman

Plate 9, figure 23

Clavulina plummerae Sandidge, Jour. Paleontology, vol. 6, p. 270, pl. 41, figs. 17, 18, 1932.
Clavulinoides trilatera (Cushman) Cushman var. *plummerae* (Sandidge) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 122, pl. 16, fig. 26, 1937.

Variety differing from the typical form in the somewhat sharper angles and in the last-formed chambers, which tend to become rounded and smooth.

This form was described from the Cretaceous Ripley formation of Barton's bluff on Tombigbee River, Ala. It is very close to the typical form of *Clavulinoides trilatera* (Cushman) Cushman. The megalospheric form in both has a rounded aperture, and the microspheric form usually shows 3 lobes.

Navarro age.
Corsicana marl. Texas, Travis County (38).
Prairie Bluff chalk. Alabama, Bartons Bluff, Tombigbee River.
Selma chalk (upper part). Alabama, Marengo County (104).
Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80).
Neylandville marl. Texas, Navarro County (63).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 107); Lamar County (110, 111); Hunt County (115, 116); Collin County (120, 122); Kaufman County (129–131); Bexar County (152).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (171, 172).
Wolfe City sand member of Taylor marl. Texas, Collin County (181); Hunt County (184); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (192).
Lower part of Taylor marl. Texas, Delta County (206); Ellis County (234).

Clavulinoides aspera (Cushman) Cushman

Plate 9, figures 24–30

Clavulina trilatera Cushman var. *aspera* Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 589, pl. 17, fig. 3, 1926,
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 93, pl. 13, fig. 5, 1928.
Clavulina aspera Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 19, pl. 5, fig. 4, 1932.
White, Jour. Paleontology, vol. 2, p. 315, pl. 42, fig. 14, 1928.

Clavulinoides aspera (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 122, pl. 16, figs. 27–31, pl. 17, figs. 1–3, 1937; idem, Contr., vol. 20, p. 3, pl. 1, fig. 10, 1944.

Test large, stout; microspheric form rather rapidly increasing in diameter toward the apertural end, megalospheric form with the sides parallel in the adult, triangular in section throughout; chambers fairly distinct; sutures fairly distinct, slightly curved, slightly depressed in the adult; wall coarsely arenaceous, usually rather roughly finished, thick; aperture a rounded opening at the end of a slight projection. Length up to 2.00 mm. or more, diameter 0.80–1.20 mm.

This species, which was originally described as a variety of *Clavulinoides trilatera*, seems to be distinctive. It is widely distributed in the Upper Cretaceous of the Tampico Embayment of Mexico and seems to have a somewhat lower range than *Clavulinoides trilatera*.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well 116 feet at Lizard Springs, Trinidad.
Lower Velasco and Mendez shales. Northeast of Huiches, Mexico; 5 km. S. 20° E. of Guerrero, Mexico; 1 km. N. 2 km. W. of Santa Elena, Mexico; on San Luis Potosi-Tampico Railroad, at km. 527.94, 575.25, 576.94.
Navarro age.
Kemp clay. Texas, Guadalupe County (20).
Corsicana marl. Texas, Guadalupe County (45).
Neylandville marl. Texas, Navarro County (63).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106, 109); Lamar County (110–112); Hunt County (115); Rockwall County (123); Williamson County (140, 142, 144); Travis County (149); Hays County (150); Guadalupe County (151); Bexar County (153–155).
Ozan formation. Arkansas, Little River County (254).
Anacacho limestone (upper part). Texas, Bexar County (164).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Kaufman County (173); McLennan County (177); Delta County (166).
Wolfe City sand member of Taylor marl. Texas, Collin County (180–182); Navarro County (188).
Annona chalk. Texas, Bowie County (190); Red River County (191–193, 195–198).
Selma chalk (middle part). Mississippi, Alcorn County (258); Prentiss County (260); Lee County (264–267).
Lower part of Taylor marl. Texas, Lamar County (200, 201); Delta County (206); Collin County (214); Ellis County (234); Bell County (245).
Austin age.
Gober tongue of Austin chalk. Texas, Lamar County (286).
Austin chalk. Texas, Hays County (317).
Selma chalk of upper Austin age. Alabama, Warrior River (353).
Ector tongue of Austin chalk. Texas, Grayson County (332).

Clavulinoides aspera (Cushman) Cushman var. whitei (Cushman and Jarvis) Cushman
Plate 9, figures 31–33

Clavulina aspera Cushman var. *whitei* Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 19, pl. 5, figs. 6–8, 1932.
Clavulinoides aspera (Cushman) Cushman var. *whitei* (Cushman and Jarvis) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 123, pl. 17, figs. 4–6, 1937.

Variety differing from the typical form in the shape of the test, which in the megalaspheric form has the triangular portion confined to the early part of the test, after which a series of rounded chambers of nearly uniform size is developed; in the microspheric form with the triangular form continued throughout or becoming quadrangular in section, test increasing gradually in diameter to the apertural wall; wall roughened.

This very distinctive variety seems to appear only in the Upper Cretaceous of Trinidad, where it is well developed and fairly common. The microspheric form generally becomes quadrangular in transverse section instead of triangular and develops to a large size. The aperture usually has three distinct lobes in the triserial forms, each lobe pointing to the angle of the test, but in the quadrangular forms it often becomes irregular.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern, Trinidad.

Clavulinoides compressa (Cushman) Cushman
Plate 10, figures 1–7

Clavulina compressa Cushman, Cushman Lab. Foram. Research Contr., vol. 4, p. 61, pl. 8, figs. 1, 2, 1928; Tennessee Div. Geology Bull. 41, p. 22, pl. 2, figs. 4a, b, 1931.
Clavulinoides compressa (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 123, pl. 17, figs. 7–13, 1937.
Cushman and Todd, idem, Contr., vol. 19, p. 52, pl. 9, fig. 8, 1943.

Test elongate, about twice as long as broad, all but the early portion much compressed; the early portion triangular in section, pointed at the initial end; later portion uniserial, planoconvex, one side continuing the flat side of the early portion, the opposite side slightly convex; chambers distinct; sutures distinct, slightly depressed; wall finely arenaceous, with much cement, the surface smoothly finished; aperture elongate, elliptical or crescentic. Length up to 1.60 mm., breadth 0.80 mm.

The types are from the Navarro group, upthrow side of fault, 482 feet in core, Mexia oil field, Mexia, Tex.

This is a very specialized species and makes an excellent index fossil for the upper part of the Navarro above the Nacatoch sand. It is particularly well developed in the Corsicana marl of Limestone County, Tex., and is extremely abundant there. It also occurs in the Arkadelphia clay of Arkansas and in core material from wells in Texas. A single record from the Ripley formation of Tennessee may be open to some question, as the single specimen from that locality is somewhat deformed.

Navarro age.
Corsicana marl. Texas, Navarro County (25); Limestone County (30, 31).
Arkadelphia marl. Arkansas, Hempstead County (73).
Ripley formation. Tennessee, Henderson County (96).

Clavulinoides insignis (Plummer) Cushman
Plate 10, figures 8–11

Clavulina insignis Plummer, Texas Univ. Bull. 3101, p. 138, pl. 8, figs. 1–4, 1931.
Tritaxia tricarinata Carsey? (not Reuss), idem, Bull. 2612, p. 27, pl. 6, fig. 4, 1926.
Clavulinoides insignis (Plummer) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 124, pl. 17, figs. 14–17, 1937.
Cushman and Todd, idem, Contr., vol. 19, p. 52, pl. 9, fig. 9, 1943.

Test in the megalospheric form with the sides nearly parallel or very slightly expanding, in the microspheric form broadening rapidly toward the apertural end, triangular throughout in both, in the microspheric form with the sides deeply concave, in the megalospheric form only slightly so, angles sharply keeled in both forms, initial triserial portion often somewhat distinct from the later uniserial part; chambers distinct, the uniserial chambers in the microspheric form low and broad, in the megalospheric form somewhat higher; sutures distinct, slightly depressed in the uniserial portion; wall finely arenaceous, with much cement, smoothly finished; aperture terminal, with a slight neck and usually three lobes pointing toward the angles of the test. Length up to 2.50 mm., breadth 1.00 mm. or more in the microspheric form.

This species is evidently derived from such forms as *Clavulinoides trilatera* var. *concava* of the Taylor. It is a more extreme form with great differences between the microspheric and megalospheric forms and is marked by very strong development of the keels and a sharp distinction between the triserial and uniserial portions. It is rather widely distributed in beds of upper Navarro age in Texas, Arkansas, Mississippi, and Alabama.

Navarro age.
- Kemp clay. Texas, Navarro County (4); Williamson County (11, 12); Guadalupe County (18, 21).
- Corsicana marl. Texas, Hunt County (24); Navarro County (25–28); Limestone County (29–31); Falls County (32); Travis County (36, 40, 41); Caldwell County (44); Bexar County (46).
- Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84–87). Alabama, Sumter County (101, 102).

Clavulinoides disjuncta (Cushman) Cushman
Plate 10, figures 12–14

Clavulina plummerae Cushman (not Sandidge), Jour. Paleontology, vol. 6, p. 333, pl. 50, figs. 1a, b, 1932.
Clavulina disjuncta Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 22, 1933.
Clavulinoides disjuncta (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 125, pl. 18, figs. 1–3, 1937.

Test with the early portion triserial and trilateral, the sides slightly concave or flat, angles subacute; early chambers of the uniserial portion triangular in section, but the later adult chambers becoming rounded and in side view with a definite tapering form both toward the base and toward the apertural end, the greatest breadth being in the middle zone; sutures distinct, becoming more depressed in the adult chambers; wall arenaceous with a considerable amount of cement, smoothly finished; aperture terminal and rounded in the adult, often with a distinct lip. Length up to 1.50 mm. or more, breadth up to 0.50 mm.

This species is distinguished by the peculiar shape of the last-formed chambers in the uniserial portion. These are distinctly cut under by the basal side down to the suture and develop a very distinct ridge about the chamber itself. It is apparently a good marker for beds of Taylor age, occurring in the lower part of the upper Taylor marl, the Wolfe City sand, and the Annona chalk.

Taylor age.
- Upper part of Taylor marl. Texas, Limestone County (136).
- Wolfe City sand member of Taylor marl. Texas, Navarro County (188).
- Annona chalk. Texas, Red River County (188a, 198).

Genus PSEUDOGAUDRYINELLA Cushman, 1936
Pseudogaudryinella capitosa (Cushman) Cushman
Plate 10, figures 15–19

Gaudryinella capitosa Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 52, pl. 5, figs. 8a–c, 1933.
Pseudogaudryinella capitosa (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 139, pl. 19, fig. 12, 1937.
Cushman and Deaderick, idem, Contr., vol. 19, p. 54, pl. 10, figs. 1–5, 1942.
Cushman, idem, Contr., vol. 20, p. 84, pl. 13, fig. 4, 1944.

Test elongate, the early portion equally triangular in transverse section, earliest stage triserial, later biserial, the two sides showing the alternating chambers broader than the third side, later portion uncoiled, nearly circular in section; chambers in the early portion somewhat indistinct, later distinct and inflated; sutures of the biserial portion fairly distinct, not depressed, later distinct, depressed; wall coarsely arenaceous but smoothly finished; aperture in the adult small, rounded, terminal, without a neck or lip. Length up to 2.25 mm., breadth 0.90 mm., thickness 0.60 mm.

This species is widely distributed in the Selma chalk and also in various parts of the Taylor marl. It may be distinguished from the following variety, which is found in the upper and middle portions of the Austin chalk, by the rather indistinct chambers of the early portion and the rather smooth faces of the triangular portion, the sutures being indistinct and very slightly, if at all, depressed. The varietal form has a distinctly low periphery and distinctly depressed sutures.

Taylor age.
- Upper part of Taylor marl. Texas, Rockwall County (124).
- Ozan formation. Arkansas, Sevier County (253).
- Pecan Gap chalk member of Taylor marl. Texas, Collin County (171); Rockwall County (175).
- Selma chalk (middle part). Mississippi, Lee County (268).
- Wolfe City sand member of Taylor marl. Texas, Hunt County (184, 186); Navarro County (188).
- Annona chalk. Texas, Red River County (194).
- Lower part of Taylor marl. Texas, Collin County (207–209); Dallas County (223–225); McLennan County (243); Williamson County (246); Travis County (247).

Austin age.
- Selma chalk, lower part. Mississippi, Lee County (350).
- Brownstown marl. Arkansas, Sevier County.

Pseudogaudryinella capitosa (Cushman) Cushman var. serrulata (Cushman) Cushman
Plate 10, figures 20–23

Gaudryinella capitosa Cushman var. *serrulata* Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 52, pl. 5, figs. 9a–c, 1933.
Pseudogaudryinella capitosa (Cushman) Cushman var. *serrulata* (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 140, pl. 19, figs. 13–16, 1937.

This variety differs from the typical form, especially in the lobed character of the biserial portion, the sutures also being distinctly depressed and the number of chambers usually smaller in the biserial portion.

The varietal form has the earlier portion much more distinctly triserial and is followed by a sharply angled biserial portion. The final chambers are distinct and somewhat inflated. Its range is rather restricted in the basal Taylor marl and the upper part of the Austin chalk.

Taylor marl, lower part. Texas, Collin County (209, 210); Dallas County (219, 222, 224, 227); Travis County (249).

Austin age.
- Gober tongue of Austin chalk. Texas, Fannin County (275, 277–280); Lamar County (282–284, 287, 288).
- Austin chalk. Texas, Collin County (292, 293, 295); Hill County (312); Bell County (315, 316).
- Brownstown marl. Texas, Red River County (318, 319); Lamar County (320, 321).

Pseudogaudryinella mollis (Cushman) Cushman
Plate 11, figure 1

Gaudryinella mollis Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 53, pl. 6, figs. 6a–c, 1933.
Pseudogaudryinella mollis (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 140, pl. 19, fig. 17, 1937.

Test compressed, tapering, broadest toward the apertural end, earliest chambers triserial, later biserial, and in the adult with the final chamber terminal; chambers fairly distinct, increasing rather rapidly in height as added; sutures distinct, very slightly depressed; wall thin, rather coarsely arenaceous but smoothly finished; aperture terminal, narrowly elliptical. Length 0.40 mm., breadth 0.20 mm., thickness 0.08 mm.

This peculiar species is known only from the type locality. The chambers are thin-walled and tend to collapse. The last-formed chambers, however, tend to become uniserial with a terminal aperture.

Austin chalk. Texas, Dallas County (311).

Pseudogaudryinella colombiana Cushman and Hedberg

Plate 66, figures 3, 4

Pseudogaudryinella colombiana Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 84, pl. 21, figs. 9, 10, 1941.

Test elongate, earliest portion triserial, triangular, with subacute angles, later irregularly biserial, then uniserial in the adult; chambers distinct, later ones strongly inflated, circular in section; sutures of the triserial portion indistinct, later ones distinct and depressed; wall distinctly arenaceous, with much cement, smoothly finished; aperture large, terminal, circular. Length 0.85 to 1.25 mm., diameter of adult portion 0.30 to 0.35 mm.

The types are from the lower zone of the Colon formation, Quebrada Mito Juan, Department of Santander del Norte, Colombia.

This species resembles *P. capitosa* (Cushman) Cushman but differs in the smaller size, more symmetrical triserial portion, and less acute angles. This seems to be a characteristic species of the lower zone of the Colon formation but occurs very sporadically.

Genus HETEROSTOMELLA Reuss, 1865

Heterostomella austinana Cushman

Plate 11, figures 2–7

Heterostomella austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 53, pl. 6, figs. 1–3, 1933; Cushman Lab. Foram. Research Special Pub. 7, p. 141, pl. 19, figs. 18–20, 1937.

Test elongate, slightly tapering, the megalospheric form in front view with the greatest width toward the apertural end, the microspheric form somewhat more fusiform, the greatest width usually attained in about the middle of the test, earliest chambers triserial, later biserial, fairly distinct, the angles of the chambers very thin, usually eroded, leaving large depressions in linear series; sutures rather indistinct; wall finely arenaceous, rather smoothly finished; aperture in the adult terminal, small, rounded, with a distinct neck. Length up to 1.00 mm., breadth 0.30 to 0.40 mm., thickness 0.25 to 0.30 mm.

This is the oldest species of the genus. In some respects it is less specialized than the later ones. The axis of the test is straight, and the sides in the megalospheric form are nearly parallel for most of their length. The microspheric form is more tapering. The species is characterized also by large, linear depressions. It is characteristic of the upper portion of the Austin, but in our collections it occurs in a very few samples assigned to the basal part of the Taylor marl.

Taylor marl, lower part. Texas, Collin County (210); Dallas County (217, 220, 227); McLennan County (238).

Austin age.

Burditt marl (of Adkins). Texas, Bell County (269); Travis County (271).

Gober tongue of Austin chalk. Texas, Fannin County (276–280); Lamar County (287, 288).

Austin chalk. Texas, Grayson County (291); Collin County (292–295); Dallas County (307, 310); Hill County (313); Bell County (315, 316).

Brownstown marl. Texas, Lamar County (320).

Ector tongue of Austin chalk. Texas, Grayson County (332).

Heterostomella boynensis Wickenden

Plate 11, figures 8, 9

Heterostomella boynensis Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 89, pl. 1, figs. 5a, b, 1932.

Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 142, pl. 19, figs. 21, 22, 1937.

Test small, elongate, 2 to 2½ times as long as broad, triangular throughout, the angles truncate but usually not distinctly fistulose, sides flattened or slightly concave; chambers indistinct, not inflated, early chambers triserial, later chambers biserial; sutures mostly indistinct, somewhat deflected backward, and often appearing as lighter lines against the darker background of the main body of the test; wall finely arenaceous, rather smoothly finished; aperture in the adult terminal, rounded, with a short neck. Length 0.45 mm., breadth 0.18 mm.

This is a small species known only from the type locality.

Upper Cretaceous. Boyne beds, 1 mile east of Babcock, Manitoba, Canada.

Heterostomella americana Cushman

Plate 11, figures 10, 12–21

Heterostomella foveolata Cushman (not Marsson), Cushman Lab. Foram. Research Contr., vol. 4, p. 111, pl. 16, figs. 9–12, 1928; Jour. Paleontology, vol. 6, p. 333, 1932.

Heterostomella americana Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 24, pl. 3, fig. 20, 1936; idem, Special Pub. 7, p. 142, pl. 19, figs. 23, 24; pl. 20, figs. 1–3, 1937.

Cole, Florida Geol. Survey Bull. 16, p. 34 (list), pl. 3, figs. 11, 12, 1938.

Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 3, pl. 1, figs. 11, 12, 1944.

Test in the microspheric form fusiform, rounded in transverse section; in the megalospheric form with the greatest breadth toward the apertural end, somewhat compressed; chambers largely obscured by the numerous longitudinal ridges of the surface; wall finely arenaceous but much roughened by the surface ridges; aperture terminal, usually without much development of a neck. Length 0.75 mm., diameter 0.35 mm.

This species was originally figured as *Heterostomella foveolata* Marsson, but, after a study of Marsson's types and a series of European specimens, our American species seems to be very distinct. The megalospheric and microspheric forms show great differences, the former tapering throughout and more compressed, whereas the microspheric form is much larger, stouter, expands much more rapidly, and in some large specimens becomes contracted toward the apertural end and distinctly fusiform. Through the connecting links the two forms have been found to belong to a single species, but the extremes of the microspheric and megalospheric forms are very different. The species, particularly in the microspheric form, develops numerous longitudinal ridges that give it a distinctive appearance from others of the genus. So far as seen, *H. americana* is confined to the Taylor marl and its equivalents of Texas and related areas, with the exception of a few specimens from the Navarro that may not be identical.

Navarro age.

Corsicana marl. Texas, Bexar County (46).

Prairie Bluff chalk. Alabama, Sumter County (101, 102).

Ripley formation. Tennessee, McNairy County (94).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–109); Lamar County (110–112); Collin County (122); Rockwall County (124); Kaufman County (125); Williamson County (140).
Anacacho limestone (upper part). Texas, Bexar County (164).
Ozan formation. Arkansas, Little River County (254).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (169).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181, 183); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (193, 195–198).
Lower part of Taylor marl. Texas, Collin County (209); Kaufman County (228, 229); Ellis County (234); Bell County (245).

Heterostomella foveolata (Marsson) Cushman
Plate 11, figure 11

Tritaxia foveolata Marsson, Naturwiss. Ver. Neu-Vorpommern u. Rügen Mitt., Jahrg. 10, p. 161, pl. 3, figs. 30a–c, 1878.
Franke, Greifswald Univ., Geol.-Palaeont. Inst., Abh., vol. 6, p. 19, pl. 2, fig. 3, 1925.
Heterostomella foveolata Cushman, Jour. Paleontology, vol. 5, p. 301, pl. 34, figs. 8a, b, 1931; Cushman Lab. Foram. Research Special Pub. 7, p. 148, pl. 20, figs. 17, 18, 20–22, 1937.

Test somewhat wedge-shaped, with the greatest breadth toward the apertural end; chambers and sutures usually indistinct, largely obscured by the rough surface and the somewhat fistulose ridges, which follow the angles of the test, with another series on the middle portion of the broadest face of the test; wall finely arenaceous, with much cement, usually roughened slightly by erosion, and the whole surface very irregular, due to the fistulose ridges; aperture terminal, rounded, with a slight neck. Length up to 1.25 mm., diameter 0.50 mm.

The only typical specimens in the American Cretaceous in the large amounts of material examined are from the Saratoga chalk.

Navarro age.
Saratoga chalk. Arkansas, Howard County (79).

Heterostomella cuneata Sandidge
Plate 11, figures 22, 23

Heterostomella cuneata Sandidge, Jour. Paleontology, vol. 6, p. 269, pl. 41, figs. 11, 15, 16, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 7, p. 143, pl. 20, figs. 4, 5, 1937.

Test elongate, tapering, greatest breadth at or near the apertural end, slightly curved, sides somewhat concave or flattened, early portion in a triangular pyramid, later portion irregularly quadrilateral, apertural end somewhat convex, the angles of the chamber each marked by a row of small fistulae; chambers of the early portion more or less indistinct, triserial, later biserial; sutures slightly depressed, mostly indistinct, those of the biserial portion rather strongly sloping toward the base at the sides; wall finely arenaceous, largely calcareous, the surface somewhat irregular; aperture in the adult terminal, in the middle of the apertural face, with a distinct tubular neck. Length up to 0.50 mm., breadth 0.25 mm.

The species seems to be limited to the Saratoga chalk of Arkansas and the Ripley formation and upper part of the Selma chalk of Alabama.

Navarro age.
Saratoga chalk. Arkansas, Hempstead County (80, 81).
Selma chalk (upper part). Alabama, Marengo County (104).

Heterostomella cuneata Sandidge var. curvata Cushman
Plate 11, figure 24

Heterostomella cuneata Sandidge var. *curvata* Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 54, pl. 6, figs. 4a, b, 1933; Cushman Lab. Foram. Research Special Pub. 7, p. 146, pl. 20, fig. 6, 1937.

Variety differing from the typical form in the more curved axis of the test, the sharper angles, and more depressed sides.

This variety may be easily distinguished from the typical form when the two are seen together. The peculiar curved form of the test is characteristic of all the specimens from this particular horizon.

This variety is known only from horizons near the top of the Selma chalk at the type locality and from the Saratoga chalk of Arkansas.

Navarro age.
Saratoga chalk. Arkansas, Hempstead County (81).
Selma chalk (upper part). Mississippi, Union County (92).

Heterostomella mexicana Cushman
Plate 11, figures 25, 26

Heterostomella mexicana Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 24, pl. 3, figs. 23a, b, 1936; idem, Special Pub. 7, p. 146, pl. 20, figs. 7, 8, 1937.

Test elongate, distinctly tapering at the base, later parts very gradually tapering to the greatest breadth near the apertural end, which is somewhat contracted and rounded; triangular in transverse section, the angles usually not eroded; chambers of the early portion triserial, indistinct; later chambers biserial, also in most specimens indistinct, and in some specimens slightly inflated; sutures indistinct throughout; wall rather coarsely arenaceous, smoothly finished; aperture in the adult terminal, rounded, with a short neck. Length 0.80 to 1.05 mm., breadth 0.35 to 0.40 mm.

This species differs from others of the genus by the lack of the fistulose ridges and by the more distinctly triangular test. The biserial final stage and the terminal aperture with a distinct neck are very characteristic of this genus.

Mendez shale. Near Rancho Nuevo, Tamuin River, Mexico.

Family VALVULINIDAE
Genus ARENOBULIMINA Cushman, 1927
Arenobulimina americana Cushman
Plate 12, figure 1

Arenobulimina presli Cushman (not Reuss), Jour. Paleontology, vol. 5, p. 303, pl. 34, figs. 13a, b, 1931; idem, vol. 6, p. 334, 1932.
Arenobulimina americana Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 27, pl. 4, figs. 9a, b, 1936; idem, Special Pub. 8, p. 44, pl. 4, figs. 29, 30, 1937; idem, Contr., vol. 20, p. 4, pl. 1, fig. 13, 1944.

Test small, short, and broad, apertural end truncate and somewhat concave, last-formed whorl making up almost the entire surface of the test; chambers fairly distinct, slightly inflated; usually 4 making up the adult whorl; sutures fairly distinct, very slightly depressed; wall finely arenaceous, rather smoothly finished; aperture a small, loop-shaped opening, at the base of the apertural face. Length up to 0.60 mm., diameter 0.50 mm.

This species is widely distributed in the Cretaceous of the Coastal Plain, ranging from the uppermost Austin chalk to the Saratoga chalk. It also occurs in the Upper Cretaceous of the Tampico Embayment region of Mexico. It is a very broad, short, stout species composed of comparatively few chambers, and it shows comparatively little variation in its long range.

Upper Cretaceous. Velasco and Mendez shales. Vera Cruz, Mexico, well samples from Hacienda el Limon; and south of Velasco, Haciendo el Limon. San Luis Potosi, Mexico, km. 572.45 and 575.19 on San Luis Potosi–Tampico Railroad; Taninul cut, 1 km. south of Taninul; 5, 5.5, and 6.5 kms. southeast of Guerrero; 6 kms. S. 35° W. of Coco.
Navarro age.
Prairie Bluff chalk. Alabama, Sumter County (102).
Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80, 81).
Selma chalk (upper part). Alabama, Marengo County (104).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 107); Kaufman County (130).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (171, 172); McLennan County (177).
Wolfe City sand member of Taylor marl. Texas, Collin County (181, 182); Navarro County (188).
Annona chalk. Texas, Bowie County (190); Red River County (195–197).
Lower part of Taylor marl. Texas, Collin County (208); Dallas County (216, 217, 224, 225, 227); Ellis County (234).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (275); Lamar County (283, 284).
Austin chalk. Texas, Collin County (295); Dallas County (310).
Selma chalk of upper Austin age. Alabama, Pickens County (352).
Brownstown marl. Texas, Lamar County (320).

Genus EGGERELLA Cushman, 1933

Eggerella? trochoides (Reuss) Cushman

Plate 12, figure 2

Globigerina trochoides Reuss, Versteinerungen böhm. Kreideformation, pt. 1, p. 36, pl. 12, fig. 22, 1845; Haidinger's Naturwiss. Abh., vol. 4, pt. 1, p. 37, pl. 3, fig. 5, 1851.
Valvulina trochoides Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 162, pl. 15, figs. 2a–c, 1928.
Bulimina? trochoides Cushman, Tennessee Div. Geology Bull. 41, p. 48, pl. 7, fig. 20, 1931.
Eggerella? trochoides Cushman, Cushman Lab. Foram. Research Special Pub. 8, p. 46, pl. 5, figs. 1, 2, 1937; idem, Contr., vol. 20, p. 4, pl. 1, fig. 14, 1944.

Test triserial, consisting of a conical early portion and an inflated later portion made up of the last 3 chambers in the adult; chambers of the early portion rather indistinct, last 3 greatly inflated and subglobular; sutures of the last portion distinct and depressed, early ones obscure; wall smooth; aperture an elongate slit at the base of the last-formed chamber. Length 0.35 mm., diameter 0.30 to 0.35 mm.

This peculiar small species has a wide distribution in the Upper Cretaceous of Europe and America. It was described by Reuss as *Globigerina* but very evidently does not belong in that genus. It was placed in *Valvulina* by Franke, but the apertural features are not characteristic of that genus. I have previously placed it with a question as *Bulimina*, but again the apertural characters are not typical. It seems to be more like an *Eggerella* than any other genus. The early chambers seem to be more than three in a whorl and the adult seems to be distinctly triserial. The wall has an excess of cement but contains arenaceous fragments. Our American specimens seem to be identical with those of Europe.

The distribution of the species in America seems to be confined to the upper part of the Taylor marl and its equivalents. The few localities placed under the Navarro are mostly open to some question as to their exact age, whether basal part of the Navarro group or upper part of the Taylor marl.

Navarro age.
Saratoga chalk. Arkansas, Hempstead County (80).
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Selma chalk (upper part). Alabama, Marengo County (104).
Taylor age.
Upper part of Taylor marl. Texas, Collin County (121); Hays County (150); Guadalupe County (151); Bexar County (153, 158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (257).
Wolfe City sand member of Taylor marl. Texas, Collin County (183); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (196).
Lower part of Taylor marl. Texas, Delta County (206); Williamson County (246).

Genus MARSSONELLA Cushman, 1933

Marssonella oxycona (Reuss) Cushman

Plate 12, figures 3–5

Gaudryina oxycona Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 229, pl. 12, fig. 3, 1860; idem, vol. 46, pt. 1, 1862, p. 33 (1863).
Karrer, K. k. geol. Reichsanstalt Jahrb., vol. 20, p. 166, 1870.
Marsson, Naturw. Ver. Neu-Vorpommern u. Rügen Mitt., Jahrg. 10, p. 158, 1878.
Schacko, Ver. Freunde Nat. Mecklenburg Archiv, vol. 50, p. 156 (list), 1896.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh. Kl. II, vol. 21, p. 38, pl. 4, figs. 1–3, 1899.
Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 263 (1913); Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 15, pl. 1, figs. 20a, b, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 143, pl. 13, figs. 8a, b, 1928.
Storm, Lotos, vol. 77, p. 55 (list), 1929.
Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 501, pl. 36, figs. 3, 4, 1929.
Cushman, Jour. Paleontology, vol. 5, p. 300, pl. 34, figs. 6a, b, 1931; idem, vol. 6, p. 332, 1932.
Wickenden, idem, vol. 6, p. 205, pl. 29, figs. 3a, b, 1932.
Sandidge, idem, vol. 6, p. 268, pl. 41, figs. 2, 3, 1932.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 18, pl. 5, figs. 1, 2, 1932.
Marssonella oxycona (Reuss) Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 36, pl. 4, figs. 13a, b, 1933; Cushman Lab. Foram. Research Special Pub. 4, pl. 12, fig. 7, 1933; idem, Special Pub. 5, pl. 8, fig. 23, 1933; idem, Special Pub. 8, p. 56, pl. 5, figs. 27–29; pl. 6, figs. 1–17, 1937.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 14, pl. 1, fig. 11, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 59, pl. 10, figs. 7a, b, 1937.
Frizzell, Jour. Paleontology, vol. 17, p. 340, pl. 55, fig. 15, 1943.

Test conical, either gradually tapering or broadly flaring; earliest whorl with 4 or 5 chambers, later reduced to 3, then 2 in a whorl in the adult; rounded in transverse section; chambers distinct but not inflated, simple; sutures distinct, usually flush with the surface; wall coarsely or finely arenaceous, with larger quartz grains at the surface, smoothly finished or slightly roughened; aperture a broad, low opening at the inner margin of the last-formed chamber, often with a valvular, toothlike projection in the middle. Length up to 2.00 mm. or more, diameter 1.50 to 1.80 mm.

This species in its typical form is characteristic of the Upper Cretaceous of Europe and apparently also occurs in the Lower Cretaceous Gault. More than one species may be included in the large series of forms from European localities refered to this name. In the American Cretaceous very similar specimens are present but show some variation in the texture of the wall and in the smoothness of the exterior. Specimens that can be referred to this species range from the Austin chalk to the Saratoga chalk and also occur in the Cretaceous of California. Specimens from Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, may be referred doubtfully to this species.

Mal Paso shale. Northwestern Peru.
Navesink marl. New Jersey.
Mt. Laurel sand. New Jersey.
Navarro age.
Prairie Bluff chalk. Alabama, Sumter County (101, 102).
Saratoga chalk. Arkansas, Hempstead County (81); Howard County (79).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106); Travis County (145); Hays County (150); Guadalupe County (151); Bexar County (159).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Annona chalk. Texas, Bowie County (189); Red River County (196).
Lower part of Taylor marl. Texas, Dallas County (219, 220); McLennan County (238–241); Falls County (244); Bell County (245); Williamson County (246).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (272, 275); Lamar County (285).
Austin chalk. Texas, Grayson County (291); Dallas County 300, 301, 303, 305, 307); Hill County (314); Bell County (315, 316).
Middle part of Austin chalk. Texas, Dallas County (326).
Ector tongue of Austin chalk. Texas, Grayson County (332)

Marssonella indentata (Cushman and Jarvis) Cushman
Plate 12, figures 6, 7

Gaudryina indentata Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 92, pl. 13, fig. 7, 1928.
Verneuilina conica White, Jour. Paleontology, vol. 2, p. 310, pl. 42, fig. 4, 1928.
Marssonella indentata (Cushman and Jarvis) Cushman, Cushman Lab. Foram. Research Special Pub. 8, p. 59, pl. 6, figs 21, 22, 1937.

Test somewhat elongate, conical, tapering from the rather acute initial end, greatest breadth toward the apertural end, or in the adults apertural end somewhat contracted; circular in transverse section; earliest whorl with 4 or 5 chambers, later triserial, adult biserial; chambers numerous, distinct, the middle portion of each chamber indented and the sutures raised in rounded ridges; wall arenaceous but smoothly finished; aperture small, semicircular, at the base of the inner margin of the last-formed chamber. Length up to 1.25 mm., diameter 0.65 to 0.80 mm.

The apertural end is distinctly truncate, with depressed faces, and the general characters of this species place it in the genus *Marssonella*. The younger stages show 4 chambers in a whorl and evidently White's species noted above, which is common in the Velasco shale of Mexico, represents the young of *M. indentata*.

This species was originally described as *Gaudryina*. It is known from the Upper Cretaceous of Lizard Springs, near Guayaguayare, southeastern Trinidad, and there are numerous records for it in the lower part of the Velasco formation and particularly in the upper part of the Mendez shale of the Tampico Embayment region extending southwest beyond Guerrero and north along the San Luis Potosi–Tampico Railroad, Mexico.

Marssonella ellisorae Cushman
Plate 12, figures 8, 9

Marssonella ellisorae Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 44, pl. 4, figs. 11a, b, 1936; idem, Special Pub. 8, p. 60, pl. 6, figs. 19, 20, 1937.

Test elongate, slender, the earliest portion tapering, the later adult portion with the sides nearly parallel, rounded in transverse section, earliest whorls with 4 or 5 chambers, later triserial, and the adult biserial; chambers distinct, very slightly inflated, of rather uniform shape and size in the adult; sutures distinct, slightly depressed; wall arenaceous, smoothly finished; aperture low, in a re-entrant of the inner margin of the last-formed chamber, which is truncate. Length 1.00 mm., diameter 0.35 mm.

This is a rather distinct species that can be easily distinguished from the more broadly flaring *Marssonella oxycona* (Reuss) Cushman. It has been found only in the Pecan Gap chalk.

Taylor marl. Pecan Gap chalk member. Texas, Falls County (179).

Genus DOROTHIA Plummer, 1931

Dorothia concinna (Reuss) Cushman
Plate 12, figures 10, 11

Textularia concinna Reuss, Versteinerungen böhmischen Kreideformation, pt. 2, p. 109, pl. 24, fig. 54, 1846; Akad. Wiss. Wien, Math.-naturwiss. Kl. Denkschr., vol. 7, p. 71, pl. 26, figs. 6a, b, 1854; idem, Sitzungsber., vol. 40, p. 233, pl. 13, figs. 1a, b, 1860.
Egger, Naturwiss. Ver. Regensburg Ber., vol. 12, 1907–9, p. 12, pl. 5, fig. 15 (1910).
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 91, pl. 13, fig. 1, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 15, pl. 4, figs. 1, 2, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 90, 1932.
Dorothia concinna (Reuss) Cushman, Cushman Lab. Foram. Research Special Pub. 8, p. 75, pl. 8, figs. 8–10, 1937.

Test elongate, slightly tapering in the megalospheric form, much more distinctly so in the microspheric, somewhat compressed; chambers distinct, inflated, fairly high for their breadth, increasing gradually in size as added; sutures distinct, depressed, those of the adult nearly horizontal or slightly inclined downward; wall arenaceous, of medium coarseness, the surface somewhat roughened; aperture large, rounded, somewhat contracted at the base. Length up to 1.50 mm., diameter 0.45 to 0.60 mm.

This species is fairly common in the Turonian of central Europe. There is considerable variation in the microspheric and megalospheric forms, as shown by a study of the original specimens named by Reuss. A few specimens in the American Cretaceous may be referred to this species, but they are probably not the same as the European species and the question must rest until material sufficient for full comparison is available.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well, 116 feet, Lizard Springs, Trinidad.
Taylor marl, upper part. Texas, Williamson County (142).

Dorothia conula (Reuss) Cushman
Plate 12, figures 12–14

Textularia conulus Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 38, pl. 8, fig. 59, 1845; pl. 13, fig. 75, 1845; in Geinitz, Grundriss der Verstein., 1845–46, p. 680, pl. 24, fig. 73; Akad. Wiss. Wien, Math.-naturwiss. Kl., Denkschr., vol. 7, p. 72, pl. 26, figs. 7a, b, 1854; idem, Sitzungsber., vol. 40, p. 231, pl. 13, figs. 3a, b, 1860; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 110 (1874).
Perner, K. böhm. Gesell. Wiss. Prag, Sitzungsber, p. 38, 1893.

Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 89, 1932.
Dorothia conula (Reuss) Cushman, Cushman Lab. Foram. Research Special Pub. 8, p. 76, pl. 8, figs. 11–17, 1937.

Test short and stout, tapering, rounded in section or somewhat compressed, earliest whorl with 5 or 6 chambers, later becoming triserial, and in the adult stage biserial; chambers comparatively few in the adult, slightly inflated; sutures fairly distinct in the adult, slightly depressed, horizontal; wall finely arenaceous, smoothly finished; aperture on elongate and a low opening at the inner margin of the last-formed chamber. Length 0.60 to 0.95 mm., diameter 0.50 to 0.60 mm.

In Europe this species is characteristic of the Turonian of the Bohemian and Saxon Basins and occurs also in the lower Senonian. In Texas is occurs in the Annona chalk.

Taylor age. Annona chalk. Texas, Red River County (198).

Dorothia alexanderi Cushman
Plate 12, figure 15

Dorothia alexanderi Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 28, pl. 4, figs. 13a, b, 1936; idem, Special Pub. 8, p. 82, pl. 8, fig. 37, 1937; idem, Contr., vol. 20, p. 85, pl. 13, fig. 5, 1944.

Test elongate, distinctly tapering, somewhat compressed, particularly in the adult, earliest whorl with 4 or 5 chambers, later triserial, and in the adult distinctly biserial with a lobular periphery; chambers of the earlier portion indistinct, later distinct and inflated, compressed in the adult; sutures of the later portion distinct, somewhat depressed, slightly oblique; wall coarsely arenaceous, rather roughly finished; aperture large, rounded. Length up to 1.00 mm., breadth 0.45 to 0.50 mm., thick ness 0.25 to 0.30 mm.

This species shows considerable variation in the shape and size of the later chambers, which in some specimens become very distinctly compressed and expanded, whereas in others they taper more. Large series of specimens seem to show that this is an original characteristic of the specimens and is not due to fossilization. This species occurs commonly in the upper Austin, and there is a single record from the Taylor marl.

Taylor marl, lower part. Texas, Williamson County (246).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (271).
Gober tongue of Austin chalk. Texas, Fannin County (276, 277, 280); Lamar County (283, 284, 288).
Austin chalk. Texas, Collin County (292, 295); Dallas County (301, 302, 306, 311); Hill County (313, 314); Bell County (315, 316).
Brownstown marl. Texas, Red River County (318); Lamar County (320, 321).
Middle Austin chalk. Texas, Collin County (324).
Selma chalk, lower part. Mississippi, Itawamba County (351).

Dorothia stephensoni Cushman
Plate 12, figures 16, 17

Dorothia stephensoni Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 28, pl. 4, fig. 15, 1936; idem, Special Pub. 8, p. 82, pl. 8, figs. 31, 32, 1937; idem, Contr., vol. 20, p. 4, pl. 1, figs. 15, 16, 1944.

Test distinctly tapering, greatest breadth near the apertural end, rounded in transverse section, sides somewhat lobate, earliest whorl with 4 or 5 chambers, later triserial, and the adult biserial; earliest chambers rather indistinct, later chambers becoming slightly inflated toward the apertural end, somewhat overlapping; sutures distinct, particularly in the later portion, slightly depressed, nearly horizontal; wall finely arenaceous, smoothly finished; aperture a low opening at the inner margin of the last-formed chamber, sometimes with a slight lip. Length up to 1.00 mm., diameter 0.45 mm.

This is a common species in the American Upper Cretaceous, particularly in the Taylor marl and upper part of the Austin chalk. It resembles *Dorothia pupa* (Reuss) Cushman but is usually somewhat twisted and continues throughout to have a tapering form. The later chambers become distinct and often inflated. The wall is very finely arenaceous and smoothly finished.

Navarro age.
Saratoga chalk. Arkansas, Howard County (79).
Selma chalk (upper part). Alabama, Marengo County (104).
Taylor age.
Upper part of Taylor marl. Texas, Collin County (121); Rockwall County (123); Navarro County (134); Bexar County (152, 158).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (169); McLennan County (177).
Wolfe City sand member of Taylor marl. Texas, Collin County (180); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (196–198).
Lower part of Taylor marl. Texas, Collin County (208–210); Dallas County (216, 217, 219, 224, 225, 227); Ellis County (234); McLennan County (238, 239); Bell County (245); Williamson County (246).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (277, 279); Lamar County (282–284, 287, 288).
Austin chalk. Texas, Grayson County (290, 291); Collin County (292–294); Dallas County (303, 307–310); Hill County (312, 313); Bell County (315, 316).

Dorothia glabrella Cushman
Plate 12, figures 18, 19

Dorothia glabrella Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 56, pl. 6, figs. 9a–c, 1933; Cushman Lab. Foram. Research Special Pub. 8, p. 83, pl. 9, figs. 1, 2, 1937.
Cushman and Deaderick, idem, Contr., vol. 18, p. 55, pl. 10, fig. 6, 1942.

Test in front view generally triangular, in side view somewhat tapering, with greatest breadth near the apertural end, and in end view roughly quadrangular; earliest portion with 4 or more chambers in a whorl, later triserial, and then regularly biserial; chambers increasing in size as added, later ones slightly inflated; wall finely arenaceous throughout in the early portion, tending to become almost entirely calcareous in the last-formed chambers; aperture an elongate low opening at the base of the inner margin of the last-formed chamber. Length 0.90 to 1.00 mm., breadth 0.70 mm., thickness 0.40 mm.

This species seems to be characteristic of the Taylor marl and its equivalents. The one locality given for beds of Austin age has characteristic Taylor species and may possibly be of Taylor age.

Taylor age.
Upper part of Taylor marl. Texas, Red River County (106, 107); Hays County (150).
Lower part of Taylor marl. Texas, Collin County (209); Ellis County (234); Williamson County (246).
Selma chalk (middle part). Mississippi, Prentiss County (260).
Austin age.
Selma chalk of upper Austin age. Alabama, Warrior River (353).
Brownstown marl. Arkansas, Sevier County.

Dorothia pontoni Cushman
Plate 12, figure 20

Dorothia pontoni Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 55, pl. 6, figs. 8a–c, 1933; Cushman Lab. Foram. Research Special Pub. 8, p. 83, pl. 9, fig. 3, 1937.

Test small, early portion tapering, later broadly flaring, earliest stage with more than three chambers to a whorl, then becoming triserial and later biserial, the triserial portion in a regular conical shape, biserial chambers rapidly enlarging as added; sutures distinct, those of the later portion strongly depressed; wall finely arenaceous, smoothly finished, the later chambers becoming almost entirely calcareous; aperture an arched opening at the base of the inner margin of the last-formed chamber. Length 0.40 mm., breadth 0.30 mm., thickness 0.22 mm.

So far as known, this species seems to be confined to the Selma chalk and the Ripley of Mississippi and Tennessee.

Navarro age. Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94).
Taylor age. Selma chalk (middle part). Mississippi, Lee County (268).

Dorothia bulletta (Carsey) Plummer
Plate 12, figures 21–26

Gaudryina bulletta Carsey, Texas Univ. Bull. 2612, p. 28, pl. 4, fig. 4, 1926.
Dorothia bulletta Plummer, Texas Univ. Bull. 3101, p. 132, pl. 8, figs. 13–17, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 271, pl. 41, figs. 9, 10, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 12, figs. 8a, b, 1933; idem, Special Pub. 5, pl. 8, figs. 10a, b, 1933; Geol. Soc. America Bull., vol. 47, p 416, pl. 11, figs. 2a, b, 1936; Cushman Lab. Foram. Research Special Pub. 8, p. 84, pl. 9, figs. 4–9, 1937.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 14, pl. 1, fig. 12, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p 58, pl. 10, figs. 6a, b, 1937.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 85, pl. 21, fig. 12, 1941.
Cushman and Todd, idem, vol. 19, p. 53, pl. 9, fig. 10, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 330, pl. 50, fig. 22, 1944.

Test generally cylindrical, the base somewhat tapering or rounded, sides nearly parallel for most of their length, transverse section rounded or slightly compressed; earliest whorl with 4 or 5 chambers, later triserial, and in the adult biserial; chambers distinct, very slightly inflated, increasing very little in size as added, somewhat overlapping; sutures distinct, slightly depressed in the adult portion; wall distinctly arenaceous, but with much cement and smoothly finished; aperture a low, broad opening at the inner margin of the last-formed chamber, often with a slight lip. Length up to nearly 1.00 mm., diameter 0.35 mm.

This species seems to be abundant in the Navarro and its equivalents, and specimens from the upper Taylor have been included with it here although it may be possible to separate the two when more is known of their development and distribution. The few records from the Austin chalk are from localities that seem open to question as to their Austin age. The species also occurs in material of Navarro age from the Canyons of Georges Bank, in the Atlantic Ocean.

Upper Cretaceous. Colon formation, Colombia.
Navesink marl. New Jersey.
Mt. Laurel sand. New Jersey.
Navarro age.
Kemp clay. Texas, Navarro County (4); Williamson County (11); Travis County (17); Guadalupe County (18, 20).
Corsicana marl. Texas, Bowie County (23); Hunt County (24); Navarro County (25-28); Limestone County (29–31); Falls County (32); Travis County (34–36, 39–42); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–87). Alabama, Wilcox County (100); Sumter County (101, 103).
Nacatoch sand. Arkansas, White County (76).
Selma chalk (upper part). Alabama, Marengo County (104).
Ripley formation. Mississippi, Pontotoc County (90).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105); Lamar County (110); Delta County (114); Hunt County (115); Collin County (121); Kaufman County (125, 129); Leon County (138); Bexar County (158, 161).
Marlbrook marl. Arkansas, Howard County; Hempstead County.
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Lee County (266).
Lower part of Taylor marl. Texas, Delta County (206); Ellis County (231).
Lower part of Pierre shale. South Dakota and Nebraska.
Austin age.
Austin chalk. Texas, Grayson County (290); Hays County (317).
Selma chalk of upper Austin age. Alabama, Pickens County (352); Warrior River (353).

Dorothia retusa (Cushman) Cushman
Plate 13, figures 1–4

Gaudryina retusa Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 588, pl. 16, figs. 10a, b, 1926.
White, Jour. Paleontology, vol. 2, p. 313, pl. 42, figs. 8, 9, 1928.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 92, pl. 13, figs. 3, 4, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 17, pl. 4, figs. 7–10, 1932.
Verneuilina sp. Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 587, pl. 16, figs. 12a, b, 1926.
Verneuilina rotunda White, Jour. Paleontology, vol. 2, p. 310, pl. 42, figs. 5a, b, 1928.
Gaudryina trochoides White (not Marsson), idem, p. 314, pl. 42, figs. 11a, b, 1928.
Dorothia retusa (Cushman) Cushman, Cushman Lab. Foram. Research Special Pub. 8, p. 85, pl. 8, figs. 33–36, 1937.

Test fairly large, stout, nearly circular in transverse section, earliest whorl with 4 or 5 chambers, later triserial, and in the adult biserial; chambers distinct, somewhat inflated; sutures distinct, in the later portion slightly depressed; wall arenaceous, but smoothly finished; aperture comparatively small, low. Length up to 2.00 mm., diameter 1.25 mm.

There are many records for this species from the Velasco shale and upper part of the Mendez shale of the Tampico Embayment region northward to the region of the San Luis Potosi–Tampico Railroad, in Hacienda el Limon, Vera Cruz, Mexico, southward to the Rio Tamuin, and westward to the region of Guerrero and Rancho Nuevo, San Luis Potosi, Mexico. There are also records for it from the vicinity of Lizard Springs, southeastern Trinidad.

Dorothia glabrata Cushman
Plate 13, figure 5

Dorothia glabrata Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 56, pl. 6, figs. 10a–c, 1933; Cushman Lab. Foram. Research Special Pub. 8, p. 85, pl. 9, fig. 15, 1937.

Test elongate, slightly tapering throughout, greatest width formed by the last 2 chambers, early stages with 4 or more chambers to a whorl, later triserial, and the larger part of the test biserial; chambers of rather uniform shape, increasing in size as added, and the last ones rather rapidly increasing in height; side view with the sides nearly parallel throughout the test, end view broadly elliptical or ovoid; sutures distinct, those of the later portion becoming more depressed; wall finely arenaceous, becoming more and more calcareous toward the apertural end, the last chambers of which may be almost entirely of calcareous cement; aperture a high semicircular opening at the base of the inner margin of the last-formed chamber. Length 0.75 to 0.90 mm., breadth 0.30 to 0.40 mm., thickness 0.20 to 0.25 mm.

The types of this species are from the Navarro group, in which it is abundant. It seems to be characteristic of the Corsicana marl. Somewhat similar specimens occur also in the upper Taylor.

Navarro age.
Corsicana marl. Texas, Travis County (34).
Prairie Bluff chalk. Alabama, Wilcox County (99).
Neylandville marl. Texas, Navarro County (69).
Taylor marl, upper part. Texas, Hunt County (115).

Dorothia cf. D. filiformis (Berthelin)

Dorothia cf. *filiformis* Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 85, pl. 21, fig. 11, 1941.

Some rather poorly preserved specimens that resemble this species are recorded from the lower zone of the Colon formation, Department of Santander del Norte, Colombia. Most of the records for this species are from the Lower Cretaceous.

Genus PLECTINA Marsson, 1878

Plectina watersi Cushman

Plate 13, figures 6–12

Plectina watersi Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 57, pl. 7, figs. 1a–d, 1933; Cushman Lab. Foram Research Special Pub. 8, p. 107, pl. 11, figs. 19–21; pl. 12, figs. 1–4, 1937.
Cushman and Todd, idem, Contr., vol. 19, p. 53, pl. 9, fig. 11, 1943.

Test elongate, in front view slightly tapering, in side view with the early portion broader than the later biserial portion and with the sides nearly parallel, in end view broadly oval; chambers with 4 in the earliest whorl, followed by a fairly long triserial stage, after which the remainder of the test is biserial; chambers fairly distinct, those of the adult biserial portion inflated, and as high as broad; sutures fairly distinct, those of the later portion strongly depressed; wall very finely arenaceous, smoothly finished; aperture of the adult an elongate elliptical opening in the terminal wall. Length 1.00 mm., breadth 0.30 mm., thickness 0.20 mm.

This species is characteristic of the Navarro beds, particularly the upper part above the Nacatoch sand, where it is often extremely abundant.

Navarro age.
Kemp clay. Texas, Williamson County (11); Travis County (13–16); Guadalupe County (18, 20, 21).
Corsicana marl. Texas, Navarro County (26, 27); Travis County (34–36); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70, 72).
Owl Creek formation. Mississippi, Tippah County (83).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (99); Sumter County (103).
Selma chalk (upper part). Mississippi, Prentiss County (91).
Nacatoch sand. Arkansas, White County (76); Lonoke County (77).
Ripley formation. Mississippi, Pontotoc County (90).

Genus GOËSELLA Cushman, 1933

Goësella rugulosa Cushman

Plate 13, figure 13

Goësella rugulosa Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 55, pl. 6, figs. 7a–d, 1933; Cushman Lab. Foram. Research Special Pub. 8, p. 111, pl. 12, fig. 28, 1937.

Test elongate, subcylindrical, early portion rapidly enlarging, later portion nearly cylindrical; chambers in the earliest whorl usually 4, later becoming triserial, in the adult loosely biserial, or in the last-formed chambers nearly uniserial; sutures fairly distinct, slightly depressed; wall arenaceous, the early portion smoothly finished, later uniserial portion somewhat rougher; aperture in the adult terminal, rounded, without a neck, Length 1.40 mm., diameter 0.40 mm.

This species shows the stages from *Eggerella* through *Dorothia* and *Plectina* to the uniserial stage of *Goësella*. These stages in later forms are usually much reduced through acceleration, but in the Cretaceous forms the biserial stage is continued for a considerable period. The specimens from the Saratoga chalk earlier referred to *Gaudryina chapmani* Franke (Cushman, Jour. Paleontology, vol. 5, p. 299, pl. 34, figs. 3a, b, 1931) probably belong here. The type locality for this species was erroneously given, through an error in printing as from the lower Selma chalk ½ mile east of Mooreville, Lee County, Miss. It should have been recorded as from the Arkadelphia marl 7 miles north by west of Hope, Hempstead County, Ark.

Navarro age.
Kemp clay. Texas, Guadalupe County (21).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (87). Alabama, Sumter County (102).
Saratoga chalk. Arkansas, Howard County (79).
Neylandville marl. Texas, Hunt County (55).

Family SILICINIDAE

Genus RZEHAKINA Cushman, 1927

Rzehakina epigona (Rzehak) Cushman var. lata Cushman and Jarvis

Plate 14, figures 1–3

Rzehakina epigona (Rzehak) Cushman var. *lata* Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 93, pl. 13, figs. 11a, b, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 20, pl. 6, figs. 1a, b, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 13, fig. 19, 1933.
Renz, 8th Am. Sci. Congress Proc., pp. 528, 529 (lists), 1942.
Rzehakina epigona (Rzehak) Cushman, Jour. Paleontology, vol. 1, p. 150, pl. 23, fig. 4, 1927.
White, idem, vol. 2, p. 186, pl. 27, fig. 6, 1928.
Jarvis, Inst. Petroleum Technologists Jour., vol. 15, p. 440, 1929.
Macfadyen, *Discovery* Repts., vol. 7, p. 7, text figs. a, b, 1933.

Test differing from the typical form in the broader, nearly circular form and the much more prominent appearance of the last coil, which forms almost a rounded carina about the periphery. The wall is siliceous and entirely unaffected by strong acid.

The variety is common in the Upper Cretaceous at the Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, and at San Fernando, Trinidad. It is less common in the Velasco shale of the Tampico Embayment region of Mexico. A few specimens from the Taylor marl seem to be the same. Macfayden records this variety also in the Cretaceous dredgings from Burdwood Bank, south of the Falkland Islands.

Taylor marl, lower part. Texas, Delta County (206).

Genus **MILIAMMINA** Heron-Allen and Earland, 1930

Miliammina manitobensis Wickenden

Plate 14, figures 4–6

Miliammina manitobensis Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 90, pl. 1, figs. 11a–c, 1932.

Test somewhat elliptical, slightly compressed; chambers distinct, in a quinqueloculine arrangement; sutures fairly distinct, depressed; walls arenaceous, smooth, of fine-grained material with much siliceous cement; aperture a simple opening at the end of a slight neck on the last-formed chamber; colour white.

Length about 0.38 mm., width about 0.22 mm.

This species is known as yet only from the Upper Cretaceous Ashville beds of Manitoba, Canada. Our figured specimens are paratypes received from Doctor Wickenden.

Lower Benton, Ashville beds. Near east end of Thunder Hill; on Roaring River; and on Vermillion River; all three localities in Manitoba, Canada.

Family **MILIOLIDAE**

Genus **QUINQUELOCULINA** D'Orbigny, 1826

Quinqueloculina antiqua Franke var. angusta Franke

Plate 14, figures 8–11

Miliolina (Quinqueloculina) antiqua Franke var. *angusta* Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 127, pl. 11, fig. 25, 1928.

Quinqueloculina antiqua Franke var. *angusta* Cushman, Tennessee Div. Geology Bull. 41, p. 23, pl. 2, fig. 5, 1931.

Cushman and Todd. Cushman Lab. Foram. Research Contr., vol. 19, p. 53, 1943.

Quinqueloculina coonensis W. Berry, in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 17, pl. 2, figs. 8, 9 [by error for 11, 12], 1929.

Test about twice as long as broad; chambers distinct, rounded, the apertural end projecting; sutures distinct, slightly depressed; wall smooth; aperture rounded, terminal. Length 0.40 to 0.60 mm., breadth 0.20 to 0.30 mm., thickness 0.10 mm.

The originals of this variety were described by Franke from the Cretaceous of Germany. Figures (plate 14, figures 8a–c) drawn at Arnstadt from a specimen in the Franke collection are given here for comparison with American specimens. The type of *"Quinqueloculina coonensis* W. Berry" has been redrawn in Washington and is reproduced here. The figures of *"Q. coonensis"* and *"Q. seminulum"* were evidently interchanged on the plate as noted in the reference above.

Specimens that may be referred to this variety occur in the Upper Cretaceous of the Coastal Plain of the United States and Mexico. They are usually not common and seldom well preserved.

Navarro age.
- Corsicana marl. Texas, Travis County (36); Caldwell County (44).
- Prairie Bluff chalk. Alabama, Sumter County (103).
- Ripley formation. Tennessee, McNairy County (94, 97).

Taylor age.
- Upper part of Taylor marl. Texas, Hays County (150).
- Ozan formation. Arkansas, Little River County(254).

Quinqueloculina sp.

Plate 14, figures 12, 13

Quinqueloculina rotunda Carsey (not Roemer), Texas Univ. Bull. 2612, p. 50, pl. 1, figs. 3a, b, 1926.

Plummer, idem, Bull. 3101, p. 112, 1931.

In her work on the "Foraminifera of the Cretaceous of Central Texas" noted above, Mrs. Carsey described a short, broad specimen under the name *Quinqueloculina rotunda*. This name had already been used by Roemer and is, therefore, not available. Her specimen was from the Navarro on Onion Creek, Travis County, Tex. Mrs. Plummer has noted that the type has been lost and that "inquiry has revealed that the specimen figured was a pyrite cast." Mrs. Carsey also states "It is possible that the specimen studied was reworked, the shell was destroyed, and a calcite cast left which gives the clear or hyaline appearance." As the identification of this form is so uncertain and the name preoccupied, it has been thought best not to attempt to give this peculiar Navarro form a distinct name. A short, broad form similar to that figured by Mrs. Carsey occurs in Mexico and also at a few localities in the Coastal Plain, as noted below. The species is usually represented by clear internal casts, such as that noted in Mrs. Carsey's paper, and it is very likely that it is the same as the form that she had. This short, broad, quinqueloculine form may possibly be the quinqueloculine stage of the species later noted as *Triloculina circularis* Bornemann.

Upper Cretaceous. Velasco shale. Shallow well samples, Hacienda el Limon, Vera Cruz, Mexico.

Navarro age.
- Kemp clay. Texas, Travis County (17); Guadalupe County (20).
- Corsicana marl. Texas, Limestone County (29).
- Selma chalk (upper part). Alabama, Marengo County (104).

Quinqueloculina moremani Cushman

Plate 14, figure 7

Quinqueloculina moremani Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 100, pl. 15, fig. 1, 1937.

Quinqueloculina stelligera Moreman (not Schlumberger), Jour. Paleontology, vol. 1, p. 100, pl. 16, figs. 11, 12, 1927.

Test somewhat longer than broad, elongate, oval, with the apertural end distinctly projecting into a rounded tubular neck, angles of the chambers strongly developed, projecting, sides flattened or slightly concave; chambers distinct, quinqueloculine throughout, the last-formed chamber overlapping strongly at the base and very slightly expanded; sutures distinct, very slightly if at all depressed; wall fairly smooth, matte; aperture generally rounded, the inner side somewhat flattened, occasionally with traces of a small tooth. Length 0.50 mm., diameter 0.25 to 0.28 mm.

The types are from the Eagle Ford shale, about 175 feet below the *Metoicoceras whitei* zone, 3 miles west of Midlothian, Ellis County, Tex.

In the reference cited above, Moreman records this species from the Eagle Ford shale 6 miles northwest of Irving at an exposure near the Irving–Coppel road, Texas, representing a zone below the middle of the Eagle Ford, making it range downward to some distance below that of the type locality in the Eagle Ford.

The specimens from the Eagle Ford are much better preserved than those recorded from higher up in the section of the Upper Cretaceous. In some respects, this species resembles the Recent *Q. stelligera* Schlumberger but is never so sharply carinate as that species. As far as seen, it is a very good marker for the Eagle Ford.

Eagle Ford shale. Texas, Dallas County (358, 359); Ellis County (364).

Genus **MASSILINA** Schlumberger, 1893

Massilina texasensis Cushman

Plate 14, figures 14, 15

Massilina texasensis Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 100, pl. 15, figs. 2, 3, 1937.

Cushman and Hedberg, idem, p. 85, pl. 21, fig. 13, 1941.

Test in the adult slightly longer than broad, very much compressed, oval or broadly elliptical, the earliest portion quinqueloculine, periphery squarely truncate; chambers distinct, quadrangular in section, increasing slightly in width as added, the periphery slightly raised, sutures distinct, depressed; wall smooth, matte; aperture terminal, without a distinct neck, rounded, without a distinct tooth. Length 0.40 to 0.50 mm., breadth 0.30 to 0.35 mm., thickness 0.08 mm.

The types are from the Navarro group, Kemp clay, ¾ mile west of old Garfield, Travis County, Tex., in a well at a depth of 65–73 feet.

The species occurs only in the Kemp clay, so far as known. The specimens are usually rather well preserved but rather rare. It differs from *M. ginginensis* Chapman, the only other described Cretaceous species, in the much flatter test, and in having a larger number of narrower chambers.

Upper Cretaceous. Colon formation, upper part. Department of Santander del Norte, Colombia.
Navarro group, Kemp clay. Texas, Travis County (13, 17).

Massilina sp.
Plate 14, figures 16-18

Massilina sp. Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 54, pl. 9, fig. 12, 1943.

In the Navarro clays found in the section of the bluff on Onion Creek 2½ miles west of old Garfield, Travis County, Tex., there are occasional specimens of a *Massilina*. These are mostly represented by pyritized internal casts, but occasionally a portion of the original test is present. These specimens are not well enough preserved to warrant a specific determination. Specimens in our collections, from various parts of this section, show that this species persisted for some time.

It may be that these casts represent the same species as that we have here called *Massilina texasensis*, but none of the specimens show enough of the exterior to permit comparison and apparently are rather definitely rounded in transverse section, whereas *M. texasensis* is decidedly angular.

Another indeterminate form of *Massilina* occurs in the lower part of the Austin chalk and is here figured.

Navarro group, Corsicana marl. Texas, Travis County (35, 36, 38–41).
Austin chalk, basal part. Texas, Dallas County (339).

Genus SPIROLOCULINA D'Orbigny, 1826
Spiroloculina cretacea Reuss
Plate 14, figures 19–23

Spiroloculina cretacea Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Denkschr., vol. 7, pt. 1, p. 72, pl. 26, fig. 9, 1854.
?Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 21, pl. 1, figs. 22–24, 1899; Naturwiss. Ver. Passau Ber., p. 17, pl. 5, fig. 9, 1907.
Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 261 (1913); Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 9, pl. 1, fig. 9, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 127, pl. 11, fig. 27, 1928.
W. Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 16, pl. 2, fig. 6, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 24, 1931.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 55, pl. 10, fig. 7, 1942.
Cushman and Todd, idem, Special Pub. 11, p. 3, pl. 2, figs. 1–4, 1944.
Spiroloculina simplex Albritton and Phleger (not Grzybowski), Jour. Paleontology, vol. 11, p. 350, 1937.

Test broadly elliptical, usually slightly longer than broad, much compressed, the periphery squarely truncate or even slightly concave; chambers distinct, rather uniformly increasing in size as added, the central portion of each distinctly excavated and the peripheral angles slightly keeled; sutures distinct, often appearing slightly limbate; wall smooth, polished; aperture small, rounded, at the end of a projecting neck, without a tooth so far as seen. Length 0.30 to 0.36 mm., diameter 0.12 to 0.22 mm., thickness 0.05 mm.

Reuss described this species from the Cretaceous of central Europe. I have examined specimens in Europe from the Emscher and lower Senonian. The upper Senonian form of Europe, with very high, raised edges, seems to be quite different and is probably represented by the rather poor figures given by Egger in 1899 and noted above with some question. The specimen recorded and figured by Berry and Kelley from the Coon Creek of Tennessee was very poorly drawn, their figure showing but 4 coils where the specimen itself shows 7 very distinctly. The typical specimens that are here figured (figs. 19, 20) occur in the Taylor marl in the clay pit at Palmer, Ellis County, Tex. (231).

Considerable variation is shown, as will be noted in our figures, particularly in the relative length and breadth of the test and the relative breadth of the last-formed chambers. The presence or absence of a keel is also a variable feature, some specimens being decidedly rounded at the periphery whereas others show a distinct but narrow keel.

Taylor marl.
Upper part. Texas, Rockwall County (123); Bexar County (158).
Lower part. Texas, Ellis County (233); Travis County (247).
Austin age. Brownstown marl. Arkansas, Sevier County.

Spiroloculina sp.
Plate 14, figures 24, 25

The peculiar specimens figured are not well preserved but seem to indicate a species different from any of those previously noted. They may even belong to the genus *Massilina*. A record of these is given for future reference.

Taylor marl, upper part. Texas, Bexar County (158).

Genus TRILOCULINA D'Orbigny, 1826
Triloculina circularis Bornemann
Plate 14, figures 26, 27

Triloculina circularis Bornemann, Deutsche geol. Gesell. Zeitschr., vol. 7, p. 349, pl. 19, fig. 4, 1855.
Cushman, Tennessee Div. Geology Bull. 41, p. 23, pl. 2, fig. 5, 1931.
Quinqueloculina wadei W. Berry, in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 17, pl. 2, figs. 3, 4, 1929.

A few specimens from the Ripley formation on Coon Creek, Tenn., seem to be identical with Bornemann's species. This form was named *"Quinqueloculina wadei"* by Berry, but the figures were very inaccurate although the type specimen, which is here refigured, is very well preserved. As usual in this species, the early stages are quinqueloculine.

Navarro age. Ripley formation. Tennessee, McNairy County (97).

Family TROCHAMMINIDAE
Genus TROCHAMMINA Parker and Jones, 1859
Trochammina diagonis (Carsey) Cushman and Waters
Plate 15, figures 1–3

Haplophragmoides diagonis Carsey, Texas Univ. Bull. 2612, p. 22, pl. 3, fig. 1, 1926.

Trochammina diagonis (Carsey) Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 84, pl. 10, figs. 7a, c, 1927.
Cushman, Royal Soc. Canada Trans., 3d ser., vol. 21, sec 4, p. 132, 1927; Cushman Lab. Foram. Research Special Pub. 5, pl. 18, figs. 2a–c, 1933.
Plummer, Texas Univ. Bull. 3101, p. 140, 1931.
Cushman and Deaderick, Cushman Lab. Foram Research Contr., vol. 18, p. 55, pl. 10, figs. 8, 9, 1942; Jour. Paleontology, vol. 18, p. 331, pl. 50, fig. 23, 1944.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 54, pl. 9, fig. 13, 1943.

Test trochoid, somewhat compressed, periphery lobulated; chambers distinct, 6 or 7 in the last-formed coil, increasing rather uniformly in size as added, the general shape being rather constant; sutures distinct, depressed, on the dorsal side slightly curved, on the ventral side nearly radial; wall arenaceous, with much cement; aperture a narrow opening on the ventral side at the inner margin of the last-formed chamber. Diameter 0.65 to 0.80 mm.

This species was originally described from the Upper Cretaceous Navarro group of Texas. It is very common in the Navarro at many localities. A few specimens from the Taylor and Austin have a similar form and are included here. The species, like others of the Upper Cretaceous, is easily distorted in fossilization, and well-preserved specimens are relatively rare. The form referred to this species by Galloway and Morrey (Jour. Paleontology, vol. 5, p. 332, pl. 37, fig. 4, 1931) from Tabasco, Mexico, is probably not the same.

Navarro age.
Kemp clay. Texas, Navarro County (4).
Corsicana marl. Texas, Navarro County (27); Travis County (34).
Owl Creek formation. Mississippi, Tippah County (83).
Saratoga chalk. Arkansas, Clark County (78).
Neylandville marl. Texas, Red River County (50).
Taylor age.
Selma chalk (middle part). Mississippi, Lee County (263).
Marlbrook marl. Arkansas, Howard County.
Austin age. Brownstown marl. Arkansas, Sevier County.

Trochammina texana Cushman and Waters
Plate 15, figures 4, 5

Trochammina texana Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 85, pl. 11, figs. 8a–c, 1927.
Cushman and Todd, idem, vol. 19, p. 54, pl. 9, fig. 14, 1943.

Test trochoid, much compressed, planoconvex, dorsal side flat or even slightly concave; ventral side slightly convex, umbilicate; chambers fairly distinct, 6 in the last-formed coil, the later chambers more distinct, the earlier much less so; the borders of the last chambers raised on the dorsal side, the central portion of each concave, on the ventral side the greatest thickness near the umbilical angle of each chamber; sutures on the dorsal side indistinct except between the last 2 or 3 chambers, on the ventral side distinct and depressed; wall very finely arenaceous, smoothly finished. Diameter 0.55 mm.

The types of this species are from the upper beds of Navarro age, where the species is very common. It has fewer chambers than *Trochammina diagonis* (Carsey) Cushman and Waters, and the periphery is less lobulated. The wall, particularly of the dorsal side, is thin and easily collapsed.

Navarro age.
Kemp clay. Texas, Navarro County (4, 5).
Corsicana marl. Texas, Hunt County (24); Navarro County (27); Travis County (35); Caldwell County (44); Limestone County (30).
Saratoga chalk. Arkansas, Clark County (78).
Neylandville marl. Texas, Red River County (50).

Trochammina gyroides Cushman and Waters
Plate 15, figure 6

Trochammina gyroides Cushman and Waters, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 84, pl. 10, figs. 8a, b, 1927.

Test trochoid, thick, dorsal side flattened, ventral side strongly convex, periphery subacute, chambers distinct, usually 6 in the last-formed coil; sutures less distinct on the dorsal side, where they are very slightly depressed and gently curved, on the ventral side deeply depressed and radial; wall arenaceous, with much cement, smoothly finished; aperture ventral, narrow. Diameter 0.65 mm.

This species is much thicker than either *T. diagonis* (Carsey) Cushman and Waters or *T. texana* Cushman and Waters. It is much less common than either of the others already noted. It is apparently a good marker for the upper beds of Navarro age.

The types are from the Navarro group east of Richland, Navarro County, Tex.

Navarro age.
Corsicana marl. Texas, Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70, 72).

Trochammina albertensis Wickenden
Plate 15, figure 7

Trochammina albertensis Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 90, pl. 1, figs. 9a–c, 1932.

Test free, trochoid, nearly circular in dorsal view, conical in peripheral view; chambers distinct, decidedly flattened, five in the last-formed coil; sutures distinct, not depressed, slightly curved; walls of fine, arenaceous material with much yellowish cement; aperture elongate, ventral; colour white to yellow.

Diameter 0.25 to 0.30 mm., height about 0.13 to 0.20 mm.

The type figures of this species are somewhat obscure. The specimen figured here is a paratype received from Dr. Wickenden and is somewhat higher than the type. The sutures are very distinct.

Bearpaw formation. West bank of Oldman River ½ mile north of main highway running west of Lethbridge; SE¼ sec. 11, T. 9, R. 22 W. of 4th meridian; St. Marys River north of Lundbreck; 6 miles east of Manyberries, Alberta, Canada.

Trochammina ribstonensis Wickenden
Plate 15, figure 9

Trochammina ribstonensis Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 90, pl. 1, figs. 12a–c, 1932.

Test very small, trochoid, umbilical area open, periphery subangular; chambers subglobular, 6 to 9 in the last-formed whorl; sutures slightly curved, both on the dorsal and ventral sides; wall finely arenaceous, rather smoothly finished; aperture a low arch on the inner margin of the ventral side of the last-formed chamber. Diameter 0.20 to 0.275 mm., height 0.05 mm.

This species at present is known only from the Upper Cretaceous of Alberta, Canada. Our figured specimen is a paratype received from Dr. Wickenden and has more chambers in a whorl than shown in his type figure and description.

Upper Cretaceous. Lee Park formation (?). Imperial Ribstone well No. 1, at a depth of 680–720 feet, Alberta, Canada.

Trochammina taylorana Cushman
Plate 15, figure 13
Trochammina taylorana Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 101, pl. 15, fig. 4, 1937.

Test small, compressed, periphery acute, lobulate, the last whorl somewhat open on both dorsal and ventral sides; chambers distinct, slightly inflated, 5 or 6 in the last-formed whorl, increasing rapidly in size as added; sutures distinct, slightly depressed, very slightly curved, nearly radial; wall distinctly arenaceous, of rather uniform sand grains with a few larger ones, firmly cemented; aperture ventral, at the inner margin of the last-formed chamber. Length 0.30 mm., breadth 0.25 mm., thickness 0.075 mm.

The types of this species are from the Taylor marl (lower part) 2.3 miles by road north of Palmer, Ellis County, Tex., (233).

This is a distinct, very compressed, scalelike species that occurs in considerable numbers at this locality but that has not been found as yet elsewhere. This species differs from *T. diagonis* (Carsey) Cushman and Waters in the smaller size, flatter test, and more evolute ventral side.

Trochammina trinitatensis Cushman and Jarvis
Plate 15, figure 12
Trochammina trinitatensis Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 95, pl. 13, figs. 13a–c, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 21, pl. 6, figs. 6a–c, 1932.

Test nearly circular in dorsal view, biconvex in peripheral view, trochoid, somewhat keeled, slightly umbilicate on the ventral side; chambers numerous, 12 or more in the final whorl, not very distinct except for the slight collapse of the wall; central portion of the dorsal side showing the spiral suture slightly depressed; the sutures of the ventral side nearly radial, slightly curved, depressed; wall arenaceous, with numerous angular fragments and much cement; aperture elongate, ventral, at the base of the chamber. Diameter 0.40 mm., thickness 0.20 mm.

This is a peculiar species, appearing at first somewhat like an *Anomalina*, but the test is arenaceous and easily collapsed. Specimens have been found only at the type locality.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Trochammina globigeriniformis (Parker and Jones) Cushman
Plate 15, figures 8, 10, 11
Lituola globigeriniformis Parker and Jones, Philosophical Trans., vol. 155, p. 407, pl. 15, figs. 46, 47; pl. 17, figs. 96–98(?), 1865.
Haplophragmium globigeriniforme Carpenter, The microscope and its revelations, ed. 6, p. 561, text figs. 320a, b, 1881.
Trochammina globigeriniformis Cushman, U. S. Nat. Mus. Bull. 71, pt. 1, p. 124, text figs. 193–195, 1910.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 95, pl. 13, figs. 12a, b, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 21, pl. 6, figs. 2–5, 1932.
Renz, 8th Am. Sci. Congress Proc., pp. 528, 529 (lists), 1942.
Frizzell, Jour. Paleontology, vol. 17, p. 340, pl. 55, fig. 16, 1943.

Numerous specimens in the Upper Cretaceous of Trinidad seem to belong to this species. Most of the specimens are crushed in fossilization, but a few of them retain their original form.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Hobson clay. San Fernando, Trinidad.
Mal Paso shale. Northwestern Peru.

Trochammina sp.
Plate 15, figure 14

The figured specimen represents a very coarse rounded species found only in the material from the Ripley formation, Dave Week's place on Coon Creek, McNairy County, Tenn. (97). It is figured here for future reference.

Family ORBITOLINIDAE
Genus POLYPHRAGMA Reuss, 1871
Polyphragma sp.
Plate 15, figures 15, 16

Occasionally in the Upper Cretaceous of the Gulf Coastal Plain are found elongate cylindrical Foraminifera that are not complete but very strongly suggest the genus *Polyphragma* as described and figured by Reuss. Figures of some of these are given, the best examples coming from the Austin chalk. Somewhat similar specimens are found higher in the section.

Navarro age. Saratoga chalk. Arkansas, Hempstead County (80).
Taylor age.
Upper part of Taylor marl. Texas, Travis County (145).
Ozan formation. Arkansas, Sevier County (253).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Austin chalk. Texas, Dallas County (311).

Family LAGENIDAE
Genus ROBULUS Montfort, 1808

Very abundant specimens throughout the Coastal Plain Cretaceous are to be referred to *Robulus* or to *Lenticulina*. These forms are, however, very difficult to work with, as data to indicate what allowances should be made for variation are lacking. That these forms are very variable is certain, and the microspheric and megalospheric forms show very considerable differences. Some of the more striking species are relatively restricted in their ranges, and it is, therefore, to be suspected that if all the species could be clearly defined after a study of abundant, well-preserved material, they would be useful as index fossils. Very few of the species are noted here, mainly those that have hitherto been recorded, and figures of these are given. The many other forms have been left until further detailed study of the variations may be made by someone who may make comparisons with the many named European species.

Robulus navarroensis (Plummer) Cushman
Plate 16, figures 6–8
Cristellaria navarroensis Plummer, Texas Univ. Bull. 2644, p. 39, figs. 4a, b, (in text), 1927.
Lenticulina navarroensis Plummer, idem, Bull. 3101, p. 141, 1931.
Robulus navarroensis Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 15, pl. 1, figs. 14a, b, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 20, pl. 1, figs. 4a, b, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 55, pl. 15, fig. 1, 1941.
Cushman and Todd, idem, vol. 19, p. 54, pl. 9, fig. 17, 1943.
Cristellaria cultrata Carsey (not Montfort), Texas Univ. Bull. 2612, p. 38, pl. 6, fig. 3, 1926.

Test closely coiled throughout, thickness about one-third the diameter; umbonate, the distinctly limbate sutures fusing with the central boss, often slightly raised; periphery with a broad, thin keel; chambers 10 to 12, very distinct, of uniform shape and very gradually increasing in size; sutures very distinct, limbate, curved; wall smooth, except that the sutures are often slightly raised near the umbo; aperture radial, with a ventral enlarged slit on the apertural face. Diameter 1.00 mm. or more, thickness at umbo about 0.35 mm.

This species is characteristic of the Navarro, especially above the Nacatoch sand, and it is at many places very abundant. It is somewhat variable, as is usual in species of this genus. The young stages are more easily confused with those of other species. It apparently grades into the following variety that occurs with it, particularly in the Corsicana marl.

It has been recorded by Jennings from the Navesink marl and Mt. Laurel sand of New Jersey and by Loetterle from the Niobrara formation in Kansas, Nebraska, and South Dakota.

Navarro age.
- Kemp clay. Texas, Hopkins County (1); Kaufman County (2); Navarro County (4, 6, 7); Williamson County (11, 12); Travis County (13–17); Guadalupe County (18, 21).
- Escondido formation. Texas, Maverick County (22).
- Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (29–31); Falls County (32); Travis County (34–39, 41–43); Caldwell County (44); Bexar County (46).
- Arkadelphia marl. Arkansas, Hempstead County (70–72).
- Owl Creek formation. Mississippi, Tippah County (83).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (99); Sumter County (101).
- Nacatoch sand. Texas, Bowie County (47). Arkansas, White County (76); Lonoke County (77).
- Saratoga chalk. Arkansas, Howard County (79).
- Ripley formation. Mississippi, Pontotoc County (90).
- Selma chalk (upper part). Mississippi, Union County (92).
- Neylandville marl. Texas, Hunt County (54); Rockwall County (57).

Robulus navarroensis (Plummer) Cushman var. extruatus Cushman

Plate 16, figures 9, 10; plate 17, figure 2

Robulus navarroensis (Plummer) Cushman var. *extruatus* Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 31, pl. 5, fig. 1, 1938; idem, vol. 17, p. 56, pl. 15, fig. 2, 1941.

Cushman and Todd, idem, vol. 19, p. 54, pl. 9, fig. 15, 1943.

Variety differing from the typical form in the sutures, which instead of fusing into the smooth umbo are much raised, forming thickened ridges, especially at the inner ends; and in that the whole test tends slightly to uncoil.

The types of the variety are from the Corsicana marl of the Navarro group, Mexia highway at the forks of Wortham road 2.8 miles east-southeast of Cooledge, Limestone County, Tex.

This seems to be a varietal form of *R. navarroensis* and has a distinct keel. It also tends toward *R. spisso-costatus* in its ornamentation and may be a stage between the two. It is best developed in the Corsicana marl.

Navarro age.
- Kemp clay. Texas, Williamson County (11).
- Corsicana marl. Texas, Hunt County (24); Navarro County (26, 27); Limestone County (30); Falls County (32); Bexar County (46).
- Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84–87).

Robulus pondi Cushman

Plate 16, figures 1–5

Robulus pondi Cushman, Tennessee Div. Geology Bull. 41, p. 25, pl. 2, figs. 9a, b, 1931; Cushman Lab. Foram. Research Contr., vol. 17, p. 56, pl. 15, fig. 4, 1941.

Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 331, pl. 50, fig. 24, 1944.

Test of medium size for the genus, flattened at the umbones, closely coiled or occasionally becoming somewhat uncoiled; periphery with knoblike angles, slightly nodose, the interval between slightly concave; chambers numerous, 10 to 12 in the final coil, distinct, of uniform shape and very slightly increasing in size as added; sutures distinct, nearly tangential, slightly curved, not noticeably depressed; wall smooth; aperture radiate with usually a circular opening in addition on the upper end of the ventral face. Diameter up to 1.10 mm.

The types of this species are from the Selma chalk 1½ miles west of Sardis on the Sardis-Henderson road, Henderson County, Tenn. It is most closely related to *Robulus nodosus* (Reuss) Cushman from the Cretaceous of Europe, but the nodes are much less developed and the number of chambers usually greater.

It seems to be a species characteristic of the upper beds of Taylor age and lower beds of Navarro age, represented especially in the Selma chalk of Tennessee. A few specimens apparently very close to this occur in the Prairie Bluff chalk and in the Arkadelphia clay.

Navarro age.
- Corsicana marl. Texas, Falls County (32).
- Prairie Bluff chalk. Mississippi, Chickasaw County (85). Alabama, Sumter County (103).
- Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (95); Henderson County (96).
- Saratoga chalk. Arkansas, Hempstead County (81).
- Selma chalk (upper part). Mississippi, Prentiss County (91).
- Neylandville marl. Texas, Delta County (51, 52); Rockwall County (57); Kaufman County (58, 62); Navarro County (64, 68).

Taylor age.
- Upper part of Taylor marl. Texas, Kaufman County (125, 129); Navarro County (134); Leon County (138); Milam County (139); Williamson County (141, 143, 144); Travis County (145, 149); Guadalupe County (151); Bexar County (158, 159, 161).
- Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
- Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
- Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (259); Prentiss County (261); Lee County (264–267).
- Lower part of Taylor marl. Texas, Dallas County (222).

Robulus spisso-costatus Cushman

Plate 16, figures 11–14; plate 17, figure 1

Robulus spisso-costatus Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 32, pl. 5, fig. 2, 1938; idem, vol. 17, p. 57, pl. 15, fig. 3, 1941.

Cushman and Todd, idem, vol. 19, p. 55, pl. 9, fig. 16, 1943.

Test much compressed, closely coiled except toward the end in the adult, where it may become slightly evolute and expose the inner portion of the preceding coil; periphery subacute or with a slight, rounded keel; chambers numerous, 9 to 12 in the adult, increasing very gradually in size as added, of rather uniform shape throughout; sutures very distinct, curved, more strongly so toward the periphery, limbate, strongly raised, becoming thick and rounded toward the inner end and covering the umbo; wall, except for the raised sutures, smooth; aperture radiate, at the outer angle, with a supplementary slit ventrally. Diameter 1.00 to 1.65 mm., thickness 0.45 to 0.55 mm.

The types of this species are from the Corsicana marl of the Navarro group, Mexia highway at the forks of Wortham road 2.8 miles east-southeast of Cooledge, Limestone County, Tex.

This species is characteristic of the upper part of the Navarro above the Nacatoch sand. It occurs in the

Corsicana marl, Kemp clay, Arkadelphia marl, and also in the Prairie Bluff chalk and Selma chalk. It differs from *R. navarroensis* (Plummer) Cushman in not having a thin, flangelike keel and in the peculiarly raised sutures that become thick and rounded at the inner end.

Navarro age.
Kemp clay. Texas, Navarro County (4, 7); Williamson County (11, 12); Travis County (17); Guadalupe County (20).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (30, 31); Falls County (32); Travis County (34); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (84, 86).
Selma chalk (upper part). Mississippi, Prentiss County (91). Alabama, Marengo County (104).

Robulus taylorensis (Plummer) Cushman
Plate 18, figure 20

Astacolus taylorensis Plummer, Texas Univ. Bull. 3101, p. 143, pl. 11, fig. 16, pl. 15, figs. 8–11, 1931.
Cristellaria gibba Carsey (not D'Orbigny), Texas Univ. Bull. 2612, p. 37, pl. 5, fig. 4, 1926.
Robulus taylorensis Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 57, pl. 15, figs. 5a, b, 1941.
Cushman and Deaderick, idem, vol. 18, p. 56, pl. 10, figs. 14, 15, 1942; Jour. Paleontology, vol. 18, p. 331, pl. 50, fig. 25, 1944.

Test only moderately compressed, periphery subacute but with only a slight keel; slightly evolute, particularly in the megalospheric form, which tends to have 1 or 2 uncoiled chambers in rather rare adult forms; microspheric form more involute; chambers distinct, usually 8 or 9 in the adult whorl in the megalospheric form, 10 in the microspheric, increasing rather regularly in size as added, the last ones in the adult slightly inflated; sutures distinct, tangential, somewhat limbate, depressed only in the last portion, very slightly if at all curved; wall smooth, translucent; aperture at the peripheral angle, radiate. Length 0.50 to 0.75 mm., breadth 0.40 to 0.50 mm., thickness 0.22 to 0.28 mm.

The type of this species is from the upper part of the Taylor marl near Taylor, Tex.

In the present material this species is available from a considerable number of stations, most of them in the lower beds of Taylor age, where, at some localities, it is very abundant. The occurrences in the upper beds of Taylor age and of Austin age are rare. The species is somewhat closely related to *Marginulina stephensoni* Cushman. It is also related to the form described by Reuss as *"Cristellaria lituola"* from the Cretaceous of Bohemia.

Taylor age.
Upper part of Taylor marl. Texas, Fannin County (113); Milam County (139); Williamson County (144).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (170).
Wolfe City sand member of Taylor marl. Texas, Navarro County (187).
Marlbrook marl. Arkansas, Hempstead County.
Annona chalk. Texas, Red River County (193).
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (200, 201); Fannin County (203, 204); Collin County (207, 211–213, 215); Kaufman County (228, 229); Ellis County (232); Navarro County (236); Hill County (237); McLennan County (239, 242); Travis County (248).
Selma chalk (middle part). Mississippi, Lee County (268).
Austin age.
Selma chalk. Alabama, Warrior River (353).
Brownstown marl. Arkansas, Sevier County.

Robulus münsteri (Roemer) Cushman
Plate 17, figures 3–9

Robulina münsteri Roemer, Verstein. norddeutschen Oolithengebirges, Nachtrag., p. 48, pl. 22, fig. 29, 1839; Verstein. norddeutschen Kreidegebirges, p. 98, pl. 15, fig. 30, 1840–41.
Cristellaria münsteri Reuss, Akad. Wiss. Wien, Math-naturwiss. Kl., Sitzungsber., vol. 46, pt. 1, 1862, p. 77, pl. 9, figs. 3, 4 (1863).
Robulus münsteri Cushman, Jour. Paleontology, vol. 6, p. 334, pl. 50, figs. 2a, b, 1932; Cushman Lab. Foram. Research Contr., vol. 17, p. 58, pl. 15, fig. 6, 1941.
Cushman and Hedberg, idem, vol. 17, p. 86, pl. 21, figs. 14a, b, 1941.
Cushman and Deaderick, idem, vol. 18, p. 56, pl. 10, figs. 10–13, 1942; Jour. Paleontology, vol. 18, p. 331, pl. 50, fig. 28, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 85, pl. 13, fig. 7, 1944.

Test involute except for the last portion in the adult, which may tend to become slightly evolute and show the preceding coil, compressed, umbonate, periphery sharply keeled; chambers distinct, of uniform shape and increasing very gradually in size, not inflated, 9 to 12 in the adult coil; sutures distinct, slightly limbate, tangential, slightly curved; wall smooth; aperture radiate, at the outer peripheral angle. Diameter up to 1.50 mm., thickness 0.40 to 0.60 mm.

Specimens referred to this species occur in the Ripley formation, the upper and lower divisions of the Taylor marl, the Annona chalk, the upper portion of the Austin chalk of Texas, and the Selma chalk of Tennessee. Considerable variation is shown in this species, if the specimens included really belong in one species.

Navarro age. Ripley formation. Tennessee, Henderson County (96).
Taylor age.
Upper part of Taylor marl. Texas, Hunt County (117); Kaufman County (130, 131); Limestone County (136); Travis County (149).
Marlbrook marl. Arkansas, Howard County.
Annona chalk. Texas; Red River County.
Lower part of Taylor marl. Texas, Dallas County (219, 222, 223); Kaufman County (228); McLennan County (239).
Austin age.
Burditt marl (of Adkins). Texas, Travis County (270, 271).
Gober tongue of Austin chalk. Texas, Lamar County (288).
Austin chalk. Texas, Grayson County (289, 291); Dallas County (310).
Brownstown marl. Texas, Red River County (319); Arkansas, Sevier County.
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Robulus pseudo-secans Cushman
Plate 17, figures 11–13

Robulus pseudo-secans Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 32, pl. 5, fig. 3, 1938; idem, vol. 17, p. 59, pl. 15, fig. 7, 1941; idem, vol. 20, p. 85, 1944.

Test strongly umbonate, thinning from the umbones to the periphery, which is acute and keeled; chambers distinct, not inflated, 8 or 9 in the adult coil, of uniform shape, increasing gradually in size as added; sutures distinct, strongly limbate and raised, confluent with the highly rounded umbo, inner portion tangential, nearly straight, thence increasingly curved toward the periphery; wall, except for the raised portions, smooth; aperture radiate, at the peripheral angle. Diameter 1.00 to 1.40 mm., thickness 0.65 to 0.80 mm.

The types are from Selma chalk on Jim Wilkin's property, 300 yards north of Union Church, Hardin County, Tenn.

This species somewhat resembles *R. secans* Reuss, from the Gault of Europe, but has fewer chambers and a smaller umbo. It differs from *Lenticulina kansasensis* in the same characters.

Navarro age. Neylandville marl. Texas, Kaufman County (61).
Taylor age. Selma chalk (middle part). Tennessee, Hardin County (255).
Austin age. Selma chalk (lower part). Mississippi, Itawamba County (351).

Robulus isidis (Schwager) Loetterle
Plate 17, figure 10

Robulus isidis (Schwager) Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 21, pl. 1, figs. 5a, b, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 60, pl. 15, figs. 8a, b, 1941.

Specimens from the Niobrara formation of Nebraska are referred to Schwager's species. The original material has not been seen, and a copy of the figure given by Loetterle is illustrated on our plate.

Robulus macrodiscus (Reuss) Cushman and Jarvis
Plate 17, figure 14

Cristellaria macrodisca Reuss, Akad. Wiss. Wien, Math.-naturwiss Kl., Sitzungsber., vol. 46, pt. 1, 1862, p. 78, pl. 9, figs. 5a, b (1863).
Berthelin, Soc. géol. France Mém., 3d ser., vol. 1, no. 5, p. 48, pl. 3(26), figs. 6–11, 1880.
Lenticulina macrodisca White, Jour. Paleontology, vol. 2, p. 198, pl. 28, fig. 7, 1928.
Robulus macrodiscus Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 23, pl. 7, figs. 3a, b, 1932.
Cushman Geol. Soc. America Bull., vol. 47, p. 416, 1936; Cushman Lab. Foram. Research Contr., vol. 17, p. 60, pl. 15, figs. 9a, b, 1941.

Specimens from the Upper Cretaceous of Trinidad and Mexico have been referred with some doubt to Reuss' species. Somewhat similar forms, with large prominent umbo and acute periphery, which is often somewhat keeled, occurred in shales from the canyons of the Georges Bank.

Robulus discrepans (Reuss) Cushman and Jarvis
Plate 17, figure 15

Robulina discrepans Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 46, pt. 1, 1862; p. 78, pl. 9, figs. 7a, b (1863).
Robulus discrepans Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 23, pl. 7, figs. 4a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 60, pl. 15, figs. 10a, b, 1941.

Specimens from the Upper Cretaceous of Trinidad are referred to Reuss' species. The chambers are not inflated but gradually increase in size as added. The periphery is subacute and the apertural face somewhat concave. The sutures are flush with the surface, strongly curved. The aperture has a supplementary slit in the median line of the apertural face.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Robulus oligostegius (Reuss) Cushman and Jarvis
Plate 17, figures 16, 17

Cristellaria oligostegia Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 213, pl. 8, fig. 8, 1860; vol. 46, pt. 1, 1862, p. 93, pl. 13, figs. 2a, b (1863).
Robulus oligostegia Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 22, pl. 6, figs. 8, 9, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 60, pl. 15, fig. 11, 1941.

Figures are given of a peculiar form referred to Reuss' species. It has a few tumid chambers, the later chambers showing a slight tendency to uncoil and the aperture slightly protuberant. It is found in the Upper Cretaceous of Trinidad and in the Velasco shale of Mexico.

Robulus sternalis (Berthelin) Cushman and Jarvis
Plate 18, figure 1

Cristellaria sternalis Berthelin, Soc. géol. France Mém. 3d ser., vol. 1, No. 5, p. 51, pl. 3(26), figs. 2a, b, 1880.
Robulus sternalis Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 22, pl. 6, figs. 11a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 61, pl. 15, figs. 13a, b, 1941.

This species has been recorded from the Upper Cretaceous of Trinidad and similar forms occur in the Velasco shale of Mexico. There are but few chambers and a prominent umbo.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco shale. Hacienda el Limon, Mexico.

Robulus williamsoni (Reuss) Cushman
Plate 18, figures 2, 3

Cristellaria williamsoni Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 44, pt. 6, 1861, p. 327, pl. 6, figs. 4a, b (1862).
Lenticulina williamsoni Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, No. 16, p. 503, pl. 36, figs. 13, 14, 1929.
Robulus williamsoni Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 37, pl. 5, figs. 2a, b, 1931.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 22, pl. 6, figs. 7a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 61, pl. 16, figs. 1, 2, 1941.

Figures are given of two slightly different forms from the Upper Cretaceous of Antigua and Trinidad that have been referred to Reuss' species.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
White chalk. Antigua, British West Indies.

Robulus trinitatensis Cushman and Jarvis
Plate 18, figures 4–6

Robulus trinitatensis Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 22, pl. 6, figs. 10a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 61, pl. 16, figs. 3–5, 1941.

Test closely coiled, compressed, periphery slightly keeled; chambers fairly distinct, 6 to 8 in the adult, not inflated; sutures fairly distinct, strongly curved, continuing into the umbilical region, strongly limbate, but not raised; wall ornamented by a series of obliquely curved costae, toward the periphery gradually becoming nearly parallel to the outer edge of the test, and continuous over the chambers; aperture at the peripheral angle, with a supplementary, elongate opening in the median line of the ventral face. Length 0.50 mm., breadth 0.40 mm., diameter 0.20 mm.

The types are from the Upper Cretaceous of Trinidad.

This is a very interesting and unique species, with its peculiar ornamentation, the heavy costae of the surface forming a continuous spiral independent of the individual chambers.

It is somewhat like *Robulus pseudo-costatus* (Plummer) Cushman from the lower Midway but is less ornate. A species very close to this, and perhaps identical, occurs in the Arkadelphia clay of Texas (73) and is here figured. This may be the ancestral form of the Midway species.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad; Calex C well, 116 feet, at Lizard Springs, Trinidad.

Robulus subalatus (Reuss) Cushman and Jarvis
Plate 18, figures 7, 8

Cristellaria subalata Reuss, Akad. Wiss. Wien, Math.-naturwiss Kl., Denkschr., vol. 7, pt. 1, p. 68, pl. 25, fig. 13, 1854; idem, Sitzungsber., vol. 46, pt. 1, 1862, p. 76, pl. 8, fig. 10; pl. 9, fig. 1 (1863).
Robulus subalatus Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 23, pl. 7, figs. 1, 2, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 62, pl. 15, figs. 14a, b, 1941.

Specimens from the Upper Cretaceous of Trinidad have been referred to this species. Figures show the forms that occur, one with the sutures slightly raised, the other without this character. Both forms have a very thin, broad keel.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Robulus alexanderi Sandidge
Plate 18, figure 9

Robulus alexanderi Sandidge, Am. Midland Naturalist, vol. 13, p. 313, pl. 29, figs. 1, 2, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 62, pl. 15, figs. 14a, b, 1941.

Test close-coiled, strongly convex, peripheral margin subacute; apertural face triangular, slightly impressed; chambers few, 8 in number; sutures indistinct in early stages, very slightly raised between last few chambers, gracefully curving away from aperture, earlier apertures partially visible at periphery; wall smooth; aperture at the peripheral angle, radiate, with lower part extending as a slit into the apertural face. Diameter of holotype 0.70 mm.

The types of this species are from the Ripley formation of Barton's bluff, on the Tombigbee River, Ala. The type figures of this species give few details.

Robulus aldrichi Sandidge
Plate 18, figure 10

Robulus aldrichi Sandidge, Jour. Paleontology, vol. 6, p. 272, pl. 42, figs. 3, 4, 1932.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 15, pl. 1, fig. 13, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 62, pl. 15, figs. 12a, b, 1941.

Test close-coiled, somewhat elongate, moderately compressed, umbonate, peripheral margin distinct, bordered by a narrow rim, chambers gently curving, 8 or 9 in last whorl, sutures limbate in early part of coil, later becoming smooth, curving outward from central boss; wall smooth; apertural face flat, triangular, bordered by a narrow rim; aperture at the apical angle, oval, with a few radial striations around the peripheral edge, lower portion extending into the apertural face. Diameter of holotype, 0.70 mm.
This remarkably characteristic representative of Montfort's early genus is closely related to *Cristellaria degolyeri* Plummer described from the Texas Midway. The rimmed, beadlike periphery, and the very definite variation in the type of the aperture are the chief means of differentiation. This occurrence of the robuline representative in the Ripley leads to speculation regarding the ancestry of the Midway form.

The types of this species are from the Ripley formation, lower part of Red bluff, just north of the boundary between Wilcox and Dallas Counties at the Alabama River, Ala. It has been recorded from the Navesink marl and Mt. Laurel sand of New Jersey.

Robulus stephensoni Cushman
Plate 18, figures 12, 13

Robulus stephensoni Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 90, pl. 16, figs. 2, 3, 1939; idem, vol. 17, p. 63, pl. 16, figs. 6a, b, 1941.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 331, pl. 50, fig. 26, 1944.
Robulus navarroensis Cushman (not Plummer), Tennessee Div. Geology Bull. 41, p. 25, pl. 2, figs. 8a, b, 1931; Jour. Paleontology, vol. 5, p. 303, pl. 34, figs. 14a, b, 1931.

Test closely coiled throughout, somewhat umbonate, thinning from the umbones to the acute periphery, which has a slight narrow keel; chambers distinct, 8 to 10 in the adult coil, of rather uniform size and shape; sutures distinct, strongly limbate, slightly curved, not depressed; wall smooth and unornamented; aperture at the peripheral angle, radiate with a distinct ventral slit. Diameter 2.00 mm. or more, thickness 0.35 to 0.65 mm.
The type is from the Selma chalk 1½ miles west of Sardis on the Sardis-Henderson road, Henderson County, Tenn.
This species does not have as curved sutures or as well developed a keel as *R. navarroensis* (Plummer) Cushman, and it has fewer chambers. It seems to be an ancestral form of *R. navarroensis* and occurs mostly below the Nacatoch sand.

Navarro age.
Nacotoch sand. Texas, Hunt County (49).
Ripley formation. Tennessee, McNairy County (95); Henderson County (96).
Selma chalk (upper part). Tennessee, McNairy County (98).
Neylandville marl. Texas, Delta County (52); Hunt County (53); Rockwall County (57); Kaufman County (59, 60, 62); Navarro County (64).
Saratoga chalk. Arkansas (at type locality).
Taylor age.
Upper Taylor marl. Texas, Hunt County (117); Williamson County (142).
Selma chalk (middle part). Tennessee, Hardin County (255).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.

Robulus sp.
Plate 18, figure 11

The figured specimen is large, has a distinct keel and umbonate center, and is generally evolute. It is from the Ripley formation of Tennessee 1½ miles west of Sardis on the Sardis-Henderson road, Henderson County, Tenn. (96).
This is apparently a distinctive species, but not enough material is available to warrant a description of it.

Genus LENTICULINA Lamarck, 1804

The main distinction between this genus and *Robulus* is in the aperture. This is not always easily determined in poorly preserved fossil material and, therefore, the generic position of many species is difficult to determine. There are so many species already named in the European Cretaceous that a study of these is necessary before applying names to most of our American Cretaceous forms.

Lenticulina jonesi Sandidge
Plate 18, figure 14.

Lenticulina jonesi Sandidge, Jour. Paleontology, vol. 6, p. 273, pl. 42, figs. 1, 2, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 64, pl. 16, figs. 9a, b, 1941.
Cushman and Todd, idem, vol. 19, p. 55, pl. 9, figs. 19, 20, 1943.

Test close-coiled, somewhat longer than broad, periphery acute, sometimes slightly keeled; chambers comparatively few, usually 6 to 8 in the last whorl, slightly curving, somewhat inflated, sutures gently curving lines, sometimes slightly impressed, especially between the last few chambers; wall smooth; apertural face rounded, not sharply truncate, triangular in its general shape; aperture at the peripheral angle, somewhat protruding, radiate. Diameter of holotype, 0.75 mm.
This species has been established to care for the many forms occurring in the Ripley, which resemble in their general appearance *L. gibba* but which cannot be grouped with it because of

their persistently different apertural face. Whereas *L. gibba* has a truncate apertural face with a rimmed margin, that of *L. jonesi* is inflated and rounded. It resembles in some respects Cushman's *L. d'orbignyi* but differs from that form in the shape of the apertural face, in having slightly curving chambers and sutures, and in being smaller. *Robulina subangulata* of Reuss is a closely related species, found in the Cretaceous of Europe, from which the Ripley form is differentiated only by the character of its aperture.

The types of this species are from the Ripley formation, basal beds at Rocky bluff, 1 mile above Prairie bluff on the Alabama River, Ala.

A somewhat similar form occurs in the upper part of the Taylor marl and lower part of the Navarro group of Texas, and although I have not seen the types of this species, the two may be the same.

Lenticulina kansasensis Morrow

Plate 18, figure 15

Lenticulina kansasensis Morrow, Jour. Paleontology, vol. 8, p. 189, pl. 30, figs. 23a, b, 1934.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 22, pl. 1, figs. 6a, b, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 64, pl. 16, figs. 8a, b, 1941.

Test involute, sides strongly convex, thickness almost half the diameter, periphery even, sharp; sutures limbate, curved, meeting the periphery obliquely, elevated into narrow, sharp ridges which die out before reaching the periphery, fusing at the center in a distinct boss; chambers ten to twelve in final whorl; wall smooth except for the raised sutures; apertural face triangular, narrow, joining the preceding whorl in a sharp contact; aperture elliptical, at the apex of the apertural face. Diameter of holotype 0.76 mm.; thickness 0.34 mm.

Lenticulina kansasensis is distinguished from *L. sublaevis* by its stronger and more curved sutures, its slightly more compresed form, and its more elongate apertural face. The surface ornamentation is somewhat like that of *Cristellaria degolyeri* Plummer, a Midway species, but the Kansas species lacks a ragged keel and has several more chambers in the last whorl.

This species is very common in the basal Niobrara and has been found at several localities but apparently does not occur in other members.

Holotype from SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans.

The holotype has been redrawn on our plate. It is a partially eroded specimen and does not show the surface characters well. I have, therefore, hesitated to identify any specimens from the Coastal Plain Cretaceous with it.

Loetterle records the species from the Fort Hays limestone of Kansas, Nebraska, and South Dakota.

Lenticulina navicula (D'Orbigny) Cushman and Jarvis

Plate 18, figure 16

Cristellaria navicula D'Orbigny, Soc. Géol. France Mém., 1st ser. vol. 4, p. 27, pl. 2, figs. 19, 20, 1840.
Reuss, Versteinerungen böhmischen Kreideformation, pt. 1, p. 34, pl. 12, fig. 27, 1845.
Lenticulina navicula Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 24, pl. 7, figs. 5a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 65, pl. 16, figs. 11a, b, 1941.

D'Orbigny described this species from the Cretaceous chalks of the Paris Basin, and Reuss and others have recorded it from the Cretaceous of central Europe. Specimens from Trinidad and Mexico seem to agree very well with those of Europe and may be identified with D'Orbigny's species. The chambers are distinct but not inflated, the periphery subacute, the sutures flush with the surface but strongly curved, and the apertural face convex without any supplementary slit, so that this species may be included in Lamarck's genus. There is a tendency in the later chambers toward uncoiling. The measurements of the figured specimen are as follows: Length 0.90 mm.; breadth 0.55 mm.; thickness 0.40 mm.

Upper Cretaceous: Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco shale: Hacienda el Limon, Mexico.

Lenticulina nuda (Reuss) Cushman and Jarvis

Plate 18, figure 17

Cristellaria nuda Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, 1861; p. 328, pl. 6, figs. 1–3 (1862).
Lenticulina nuda Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 96, pl. 14, fig. 2, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 24, pl. 7, figs. 6a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 66, pl. 16, figs. 12a, b, 1941.

Both in Trinidad and Mexico forms occur in the Upper Cretaceous that are referred to Reuss' species. There is apparently no supplementary aperture, and the form should probably be referred to *Saracenaria.*

Upper Cretaceous: Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco shale: Hacienda el Limon, Mexico.

Lenticulina sublaevis Morrow

Plate 18, figure 18

Lenticulina sublaevis Morrow, Jour. Paleontology, vol. 8, p. 189, pl. 30, figs. 14, 20a, b, 1934.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 22, pl. 1, figs. 7a, b, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 66, pl. 16, figs. 10a, b, 1941.

Test relatively large, involute, sides equally and strongly convex, thickness about one-half the diameter, periphery simple, keeled or very sharply rounded; sutures limbate, gently curved, slightly raised, fusing at the center in a broad smoothly rounded boss; chambers 10 to 12 in final whorl; wall smooth except for the slightly raised sutures; apertural face triangular, convex, fusing into the outer wall of the preceding chamber; aperture circular, at the apex of the apertural face. Diameter of holotype 0.84 mm.; thickness 0.44 mm.

There is some variation in the strength of the sutures, some specimens appearing almost smooth. *Lenticulina sublaevis* lacks the prominent raised sutures shown by *L. kansasensis,* which makes the chambers less distinct and the sides of the test more nearly smooth. The sutures are usually not curved so strongly and meet the periphery at a higher angle than in our other species. *L. sublaevis* lacks the more complicated aperture of *Robulus,* thus making comparisons with species of this otherwise similar genus unnecessary.

This species is also restricted to the basal Niobrara, where it is common at several localities.

Holotype from SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. U. S. National Museum No. 75361.

The holotype has been redrawn on our plate. Numerous specimens in the lower part of the section in the Gulf Coastal Plain may be identical with this species, but they are often not well preserved in the more chalky formations.

Loetterle records the species from the Fort Hays limestone of Kansas, Nebraska, and South Dakota.

Lenticulina rotulata Lamarck

Plate 18, figure 19; plate 19, figures 1–7

Very many forms have been referred to Lamarck's species. From the Coastal Plain material have been referred to this species those forms with a distinct umbo, slightly curved, tangential sutures, and usually a distinct keel. Several figures are given on the plate that are referred here. Such forms are found in the basal beds of Navarro age, throughout the beds of Taylor age, and in the beds of Austin age.

Navarro age. Neylandville marl. Texas, Delta County (51); Navarro County (63).
Taylor age.
Upper part of Taylor marl. Texas, Lamar County (111); Kaufman County (125); Navarro County (134); Limestone County (136); Leon County (138); Milam County (139); Travis County (145); Guadalupe County (151); Bexar County (152, 156, 161–163).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Wolfe City sand member of Taylor marl. Texas, Navarro County (188).
Annona chalk. Texas, Red River County (193).
Selma chalk (middle part). Mississippi, Union County (262).
Lower part of Taylor marl. Texas, Delta County (206); Collin County (208, 214); Dallas County (222); McLennan County (238); Bell County (245).
Austin age.
Gober tongue of Austin chalk. Texas, Lamar County (288).
Austin chalk. Texas, Collin County (292); Dallas County (305, 310).
Bonham marl. Texas, Lamar County (331).

Lenticulina velascoensis White
Plate 19, figure 8

Lenticulina velascoensis White, Jour. Paleontology, vol. 2, p. 199, pl. 28, figs. 8a, b, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 67, pl. 16, figs. 7a, b, 1941.

Test flattened, lenticular, with depressed umbos of clear shell material, through which chambers of the inner whorls may be seen; usually about ten chambers to the last volution; sutures flush, curved; periphery keeled, denticulate due to breaking; aperture oval, obscurely radiate. Diameter of type specimen 0.60 mm.; thickness 0.25 mm.

The types are from the Upper Cretaceous Velasco shale of Mexico.

Genus PLANULARIA Defrance, 1824

Planularia advena Cushman and Jarvis
Plate 19, figures 9, 10

Planularia advena Cushman and Jarvis, U. S. Nat. Mus., Proc., vol. 80, art. 14, p. 24, pl. 8, figs. 1, 2, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 68, pl. 16, figs. 14a, b, 1941.

Test large, much compressed, periphery acute and slightly keeled; chambers distinct, low and broad, uniformly increasing in breadth as added but with the height remaining nearly the same throughout, the later chambers becoming much elongated; sutures limbate, in the early portion raised and somewhat irregularly beaded, later becoming entirely so, and in the last-formed portion even slightly depressed; wall, except for the umbilicus, which is beaded, and the raised sutures, smooth; aperture at the peripheral angle, radiate. Length 5.00 mm.; breadth 3.00 mm.; thickness, in the umbonal region, 0.90 mm.; at the middle of the last-formed chamber, 0.35 mm.

The types are from Upper Cretaceous of Trinidad, where it is rather common.

This is a large and striking species with a distinctive ornamentation. The greatest breadth is formed early in the development of the test in the umbonal region, after which it becomes complanate and much thinner.

Upper Cretaceous: Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Planularia dissona (Plummer) Cushman
Plate 19, figures 11–18

Astacolus dissonus Plummer, Texas Univ. Bull. 3101, p. 145, pl. 11, figs. 17, 18; pl. 15, figs. 2–7, 1931.
Cristellaria reniformis Carsey (not D'Orbigny), Texas Univ. Bull. 2612, p. 37, pl. 3, fig. 2, 1926.
Planularia dissona Cushman, Cushman Lab. Foram. Research Contr., vol. 17, p. 68, pl. 16, figs. 15–19, 1941.
Cushman and Todd, idem, vol. 19, p. 55, pl. 9, figs. 18a, b, 1943.

Test very strongly compressed, thickest in the umbonal region, early portion coiled, later portion in the megalospheric form uncoiling; periphery variable, with a thin keel in the earliest portion, largely disappearing in uncoiled specimens but in coiled ones usually persisting throughout and distinctly flanged; chambers distinct, increasing very rapidly in size, becoming elongate in the adult, slightly inflated in the later portion in uncoiled forms, very variable in number; sutures distinct, slightly limbate, occasionally somewhat raised, slightly depressed in later portion of uncoiled forms, earlier sutures usually more strongly curved than later ones; wall usually smooth but in some specimens with a few weak costae, generally parallel to the periphery; aperture radiate, at the peripheral angle, slightly protruding. Length 0.80 to 1.30 mm., breadth 0.40 to 0.80 mm., thickness 0.20 to 0.30 mm.

This is an exceedingly variable species, as the series of figures on our plate will show. It is an excellent index fossil for the beds of Navarro age above the level of the Nacatoch sand, including the Corsicana marl, Kemp clay, and Arkadelphia marl. It is often very abundant in the Corsicana marl.

Navarro age.
Kemp clay. Texas, Navarro County (4); Williamson County (11, 12); Guadalupe County (18, 21).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (29–31); Falls County (32); Travis County (35, 36); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Nacatoch sand. Texas, Bowie County (47).

Planularia dissona (Plummer) Cushman var. santanderensis Cushman and Hedberg
Plate 66, figures 6–9

Planularia dissona (Plummer) Cushman var. *santanderensis* Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 87, pl. 21, figs. 16–19, 1941.

This variety has a peculiarly ornamented surface with raised sutures and occasional somewhat oblique costae between them, with the whole test much flattened.

The types are from the Mito Juan formation near kilometer post 33 west of Cucuta, Colombia, on the road to Santiago.

Planularia elongata Ehrenberg
Plate 20, figure 1

Planularia elongata Ehrenberg, Mikrogeologie, pl. 32, pt. 2, fig. 10, 1854.
Cushman, Jour. Paleontology, vol. 1, p. 216, pl. 35, fig. 10, 1928; Cushman Lab. Foram. Research Contr., vol. 17, p. 69, pl. 16, fig. 20, 1941.

Under this name Ehrenberg figures an elongate form that evidently belongs in this genus. His material is from the American Cretaceous "Schreib-Kreide des Mississippi-Gebietes." The species resembles *P. dissona* (Plummer), but its identity must remain in doubt.

Planularia tricarinella (Reuss) Cushman
Plate 20, figures 2, 3

Cristellaria tricarinella Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber, vol. 46, pt. 1, 1862, p. 68, pl. 7, figs. 9a, b (1863).
Planularia tricarinella Cushman, Jour. Paleontology, vol. 6, p. 334, pl. 50, figs. 5, 6, 1932; Cushman Lab. Foram. Research Contr., vol. 17, p. 69, pl. 16, figs. 21a, b, 1941; idem, vol. 20, p. 5, pl. 1, fig. 17, 1944.
Cushman and Goudkoff, idem, vol. 20, p. 56, pl. 9, fig. 9, 1944.

Test much compressed, the sides nearly parallel, the outer periphery rounded or somewhat truncate, often with 3 distinct keels, 1 median and 1 at each side; chambers distinct, somewhat uncoiled in the adult, increasing in length as added, height remaining about the same throughout; sutures distinct, raised above the surface, fusing at the periphery into the thickened peripheral margin; wall finely perforate; aperture radiate, at the peripheral angle. Length up to 1.00 mm.; breadth 0.30 to 0.50 mm.; thickness 0.10 to 0.20 mm.

Reuss described this species from the Cretaceous of Europe, and our species is apparently the same. Brady used the name in the *Challenger* report for a Recent species that is not identical, and the name has been used in a similar way by later authors following Brady.

The species, so far as seen, occurs in material from the Pecan Gap chalk and from the Upper Cretaceous of California.

Taylor marl, Pecan Gap chalk member. Texas, Delta County (166, 167).

Planularia sp. A
Plate 20, figure 4

The single specimen figured evidently belongs to *Planularia*. No other specimens could be found in the material available, and it is simply recorded here. It is from the lower part of the Navarro group, base of the Neylandville marl 2.1 miles southeast of Drane, Navarro County, Tex. (63).

Planularia sp. B
Plate 66, figure 5

A single specimen seems distinct from the preceding. It is peculiar in the shape of the last-formed chamber, which has a distinct ventral lobe. It is from the upper zone of the Colon formation, Department of Santander del Norte, Colombia.

Genus SARACENARIA Defrance, 1824

Saracenaria triangularis (D'Orbigny) Cushman and Church
Plate 28, figures 1–3

Cristellaria triangularis D'Orbigny, Soc. géol. France Mém. 1st ser., vol. 4, p. 27, pl. 2, figs. 21, 22, 1840.
Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 34, pl. 8, fig. 48, 1845; (in Geintz), Grundriss der Verstein., p. 663, pl. 24, fig. 29, 1845–46.
D'Orbigny, Prodrome de paléontologie stratigraphique universelle des animaux mollusques et rayonnes, vol. 2, p 281, No. 1375, 1850.
Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Denkschr., vol. 7, p. 68, 1854; Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 46, pt. 1, 1862, pp. 70, 93 (1863).
Berthelin, Soc. géol. France Mém., 3d ser., vol. 1, p. 55, 1880.
Beissel, Preuss. geol. Landesanstalt Abh., new ser. vol. 3, p. 53, pl. 10, figs. 1–9, 1891.
Matouschek, Lotos, vol. 43, p. 146, 1895.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 117, pl. 12, figs. 5, 6, 1899; Naturwiss. Ver. Passau Ber., p. 36, pl. 2, figs. 19–21, 1907.
Heron-Allen and Earland, Royal Micr. Soc. Jour., p. 421, 1910.
Franke, Natur. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 279 (1913).
Chapman, W. Australia Geol. Survey Bull. 72, p. 30, pl. 9, fig. 80, 1917.
Saracenaria triangularis (D'Orbigny) Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 505, pl. 37, figs. 13, 14, 1929.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 88, pl. 21, figs. 35a, b, 1941.
Cushman, idem, vol. 20, p. 8, pl. 2, fig. 5, 1944.

Test fairly large, the early portion completely coiled, later chambers somewhat uncoiled and the test becoming triangular in transverse section; chambers distinct, few in number; sutures distinct but not depressed, curved; wall smooth except for the sides of the apertural face, which are somewhat thickened; aperture at the angle of the upper end, radiate. Length up to 1.30 mm., breadth 0.55 to 0.65 mm.

D'Orbigny described and figured this species from the Upper Cretaceous chalks of the Paris Basin. It has been widely recorded from the Upper Cretaceous. Allowing for some variation, specimens referable to this species occur in the Upper Cretaceous of our Gulf Coastal Plain, particularly in beds of Taylor age and upper part of the Austin chalk. There is a tendency for the periphery and the sides to become somewhat carinate. Elongate uncoiled forms are rare.

Navarro age.
Prairie Bluff chalk. Mississippi, Chickasaw County (87).
Ripley formation. Tennessee, Henderson County (96).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106); Kaufman County (131); Navarro County (132); Limestone County (136); Williamson County (141, 144).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Delta County (165, 166).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 182); Hunt County (186).
Annona chalk. Texas, Red River County (194, 195).
Lower part of Taylor marl. Texas, Fannin County (203); Collin County (208); Dallas County (216, 222, 225); Kaufman County (228, 229); McLennan County (240); Bell County (245).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (280); Lamar County (285).
Austin chalk. Texas, Grayson County (289, 290); Dallas County (310, 311); Bell County (316).
Selma chalk of upper Austin age (?). Alabama, Pickens County (352); Warrior River (353).

Saracenaria saratogana Howe and Wallace
Plate 28, figures 4–6

Saracenaria italica Cushman (not Defrance), Jour. Paleontology, vol. 5, p. 305, pl. 34, figs. 15, 16, 1931; vol. 6, p. 335, 1932.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 58, pl. 10, fig. 17, 1943.
Saracenaria saratogana Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 41, 1932.

In the Saratoga chalk and the upper members of the Navarro are specimens of *Saracenaria* in which the angles are not as sharp as in *S. triangularis* (D'Orbigny) Cushman and Church and there is a greater tendency to uncoiling. These were provisionally referred to *S. italica* Defrance, but the name *S. saratogana* has been proposed for them. Some of the variations in this form are shown on our plate.

There are other forms also that are evidently to be placed in this genus, but material is not in sufficient amount to warrant specific descriptions.

Navarro age.
Kemp clay. Texas, Travis County (17).
Corsicana marl. Texas, Limestone County (30, 31); Falls County (32); Travis County (34); Guadalupe County (45); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (85–87). Alabama, Sumter County (101–103).
Saratoga chalk. Arkansas, Hempstead County (80); Howard County (79).

Genus MARGINULINA D'Orbigny, 1826

Marginulina austinana Cushman

Plate 20, figures 5–10

Marginulina austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 92, pl. 13, figs. 1–4, 1937.

Test elongate, compressed, early portion closely coiled and umbonate, later portion uncoiled, dorsal side gently curved, ventral side slightly lobulate; chambers of the early coiled portion indistinct, later uncoiled chambers more distinct, but not inflated; sutures indistinct except in the later portion, where they are slightly curved, somewhat limbate, with a decided bosslike thickening toward the dorsal side of the middle; wall smooth except for the sutural enlargements; aperture radiate, at outer peripheral angle. Length up to 2.50 mm., breadth 0.70 to 0.80 mm., thickness 0.30 to 0.40 mm.

The types are from the middle part of the Gober tongue of Austin chalk, Randolph road 4 miles north of Leonard, Fannin County, Tex. It occurs in typical form at numerous localities in the upper part of the Austin.

M. austinana differs from *M. modesta* Reuss in the more compressed test, larger number of coiled chambers, and the raised portion of the sutures. It is represented by variations in two directions, one with greater compression and a shorter test, the other with less compression and a more elongate test.

Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (277, 278).
Austin chalk. Texas, Collin County (293, 295); Dallas County (303, 310, 326).
Brownstown marl. Texas, Red River County (318).

Marginulina austinana Cushman var. directa Cushman

Plate 20, figures 11–16

Marginulina austinana Cushman var. *directa* Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 93, pl. 13, figs. 5–8, 1937.

Variety differing from the typical form in the less compressed test, fewer chambers in the coiled portion, dorsal side straight or slightly concave, and the later chambers more inflated.

The types are from about the middle part of the Austin chalk, ditch south of highway leading west from McKinney, 3.1 miles west of McKinney, Collin County, Tex. (324).

This variety occurs in the upper part of the Austin chalk and continues on into the lower and middle parts of the Taylor marl in the Texas region.

Taylor marl.
Wolfe City sand member. Texas, Hunt County (185).
Lower part. Texas, Collin County (210); Dallas County (216); Ellis County (231); Bell County (245); Williamson County (246).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (277).
Austin chalk. Texas, Collin County (292, 293, 324); Dallas County (300–302, 304, 305, 307, 308); Hill County (314); Bell County (315).
Bonham marl. Texas, Lamar County (327).

Marginulina austinana Cushman var. acescens Cushman

Plate 20, figure 17

Marginulina austinana Cushman var. *acescens* Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 93, pl. 13, fig. 9, 1937; idem, vol. 20, p. 85, pl. 13, fig. 9, 1944.

Variety differing from the typical form in the more compressed test, with fewer uncoiled chambers and with the dorsal periphery strongly curved and in many specimens somewhat keeled.

The types are from the lower part of the Gober tongue of the Austin chalk in a cut on the Texas and Pacific Railway 2.2 miles west of High, Lamar County, Tex. (288). It also occurs in the lower part of the Selma chalk of Mississippi (351).

In both this and the preceding variety the thickenings of the sutures are apparent in most specimens, and together with the typical form they form a rather closely related series.

Marginulina inconstantia Cushman

Plate 20, figures 18–23

Marginulina inconstantia Cushman, Cushman Lab. Foram Research Contr., vol. 14, p. 33, pl. 5, figs. 4–9, 1938.

Test compressed, in the microspheric form almost completely coiled, in the megalospheric becoming uncoiled; coiled portion completely involute, periphery angled, often very slightly nodose; sutures rather indistinct, not depressed; wall thick, rather easily eroded; aperture radiate, at the peripheral angle. Length up to 1.40 mm., breadth 0.70 to 1.00 mm.

The types are from the basal part of the Taylor marl just above the Austin contact on the east side of Buckner Boulevard 2 feet below pavement 0.1 mile north of the intersection with U. S. Highway 80 near Buckner Orphans Home, east of Dallas, Dallas County, Tex. (217).

This species differs from *Marginulina austinana* Cushman in the greater range of shape between the microspheric and megalospheric forms, much more curved peripheral line in side view, and larger coiled portion.

This is an extremely variable species, in which the extreme microspheric and megalospheric forms would hardly be placed together were it not for the large series available to show the intermediate stages. The only specimens so far available are from the Taylor marl just above the contact with the Austin, and it may later be found to be a good stratigraphic marker for the basal part of the Taylor marl.

Taylor marl, lower part. Texas, Dallas County (216–218).

Marginulina juncea Cushman

Plate 20, figure 24

Marginulina juncea Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 33, pl. 5, fig. 10, 1938.

Test very elongate, slender, earliest portion coiled, becoming quickly uncoiled and rectilinear, slightly curved; chambers distinct, earliest coiled chambers not inflated, later chambers distinctly inflated, increasing in length and diameter as added; sutures in the later portion becoming increasingly depressed; wall smooth; aperture terminal, radiate. Length up to 1.50 mm., maximum diameter 0.20 mm.

The types are from the Taylor marl in a road ditch on the north-facing slope of Bullhide Creek Valley 5½ miles east by south of Lorena, McLennan County, Tex. (241).

This species differs from *Marginulina texana* Cushman in the slenderer form, more elongate chambers in the adult, and the more definitely coiled early chambers.

The species is very abundant at the type locality but has not been found elsewhere.

Marginulina stephensoni Cushman

Plate 20, figures 25, 26

Marginulina stephensoni Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 93, pl. 13, figs. 10, 11, 1937; idem, vol. 20, p. 5, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 331, pl. 51, figs. 1–3, 1944.

Test of two distinct portions, the earlier portion closely coiled, umbonate, with subacute periphery, later consisting of 2 to 4 chambers uncoiled, inflated, nearly circular in transverse section; chambers distinct, later uncoiled chambers inflated, earlier chambers of uniform shape, increasing very gradually in size as added; sutures distinct, slightly limbate, oblique and nearly straight in the coiled portion, in later portion strongly depressed; wall smooth; aperture radiate, at the outer peripheral angle. Length up to 1.25 mm., breadth of coiled portion 0.45 to 0.50 mm.

The types are from the lower part of the Taylor marl on the Chilton road 10 miles south-southeast of Waco, McLennan County, Tex. (242). It occurs at a number of localities in our material from the lower part of the Taylor marl of Texas.

The species differs from "*Astacolus taylorensis* Plummer," which it resembles in its earlier stages, in the smaller number of chambers in the coil, broader periphery, and more definite and larger uniserial chambers.

Navarro age. Ripley formation. Tennessee, McNairy County (95).
Taylor age.
Upper part of Taylor marl. Texas, Collin County (121); Bexar County (158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Clark County.
Lower part of Taylor marl. Texas, Collin County (207); Ellis County (230, 231); McLennan County (242).
Austin chalk. Texas, Dallas County (305).

Marginulina pseudomarcki Cushman
Plate 20, figures 27, 28
Marginulina pseudomarcki Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 94, pl. 13, figs. 19, 20, 1937.

Test large, compressed, umbonate, closely coiled in the early portion, in the adult becoming uncoiled; periphery entire, not lobulate; chambers distinct, increasing very regularly in size, those of the uncoiled portion somewhat reduced in size; sutures distinct, strongly oblique, only slightly curved, somewhat limbate, very slightly depressed in the adult uncoiled portion; wall smooth throughout; aperture radiate, at the outer, peripheral angle. Length up to 5.00 mm., breadth of coiled portion 2.00 to 2.50 mm.

The types are from the Taylor marl (upper part), from 13½ to 15 feet above water level, left bank of Onion Creek ¾ mile south-southeast of Delvalle, just above road crossing, Travis County, Tex. (149).

This species closely resembles *M. marcki* (Reuss) Cushman from the upper Senonian of Westphalia, Germany. A study of topotype material shows that our species is much larger, less strongly umbonate, and the sutures less curved.

Marginulina dorsata Cushman
Plate 20, figures 29–31
Marginulina dorsata Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 94, pl. 13, figs. 16–18, 1937.

Test elongate, 2½ to 3½ times as long as broad, gradually tapering in the early portion to about the middle, thence with the sides nearly parallel, the earliest chambers in the microspheric form coiled, uncoiled portion making up a very large part of the test; dorsal side in the earlier part pinched in at either side leaving a dorsal ridge that becomes obsolete in the later portion; chambers distinct, comparatively few, earlier chambers increasing rapidly in size as added, becoming distinctly inflated in the adult; sutures of the early portion not depressed, later distinctly depressed; wall smooth; aperture radiate, at the outer peripheral angle. Length 1.00 to 1.60 mm., breadth 0.20 to 0.25 mm.

The types and only other specimens available are from the Annona chalk 4 miles east of Clarksville, Red River County, Tex. (197).

Marginulina armata Reuss
Plate 21, figure 1
Marginulina armata Reuss, Akad Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 209, pl. 7, fig. 7, 1860.

The original figure given by Reuss shows only terminal chambers and the only topotype specimens available show little more. In our collections, however, are complete specimens with a finely spinose surface that may belong to Reuss' species.

Taylor marl, upper part. Texas, Travis County (148).

Marginulina munda Cushman
Plate 21, figures 2, 3
Marginulina munda Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 34, pl. 5, figs. 11, 12, 1938; idem, vol. 20, p. 5, pl. 1, fig. 22, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 331, pl. 51, fig. 4, 1944.

Test elongate, slender, much compressed, periphery subacute; early portion closely coiled, slightly evolute; adult uncoiled, slightly curved; chambers very distinct and sharply outlined, increasing slowly in size, earliest chambers triangular in side view, later chambers oblique; sutures very slightly depressed in the later portion, limbate; wall smooth; aperture radiate, at the dorsal peripheral angle. Length up to 1.00 mm., breadth 0.25 to 0.30 mm.

The types are from the upper Taylor marl 0.3 mile by road southeast of Gastonia, Kaufman County, Tex. (127).

This species differs from *M. plummerae* Cushman in the very sharply cut characters of the chambers and sutures, the greater amount of coiling in the early portion, and lack of ornamentation.

Taylor age.
Upper part of Taylor marl. Texas, Kaufman County (126, 127).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Clark County.

Marginulina cf. M. recta (D'Orbigny) Cushman
Plate 21, figures 4, 5
Cristellaria recta D'Orbigny, Soc. géol. France Mém., 1st ser. vol. 4, p. 28, pl. 2, figs. 23–25, 1840.
Marginulina cf. *M. recta* Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 5, pl. 1, fig. 26, 1944.

The specimens figured have numerous characters similar to D'Orbigny's species, which was described from the Cretaceous White chalk of the Paris Basin. Several chambers reach the proloculum, but they increase rapidly in breadth and the last few chambers fail to reach as far as preceding chambers. The aperture is radiate and forms a rather large protuberance on the peripheral dorsal margin.

A number of specimens were found in the upper part of the Taylor marl in Red River County, Tex. (106), and in the Pecan Gap chalk member, Delta County, Tex. (166).

Marginulina cf. M. elongata D'Orbigny
Plate 21, figures 6–10

The series of figures presented here shows some of the forms that may belong to D'Orbigny's species. The types are from the White chalk of the Paris Basin, and topotypes have been studied. All our figured specimens are from the Annona chalk at a single locality in Red River County, Tex. (197), where the species is common. Specimens are easily broken.

Marginulina taylorana Cushman

Plate 21, figures 11–15

Marginulina taylorana Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 96, pl. 14, fig. 7, 1937.

Test about 3 times as long as broad, early portion closely coiled, later 3 or 4 chambers uncoiling, subcylindrical; chambers distinct, increasing gradually in size as added, later chambers somewhat inflated; sutures distinct, slightly curved, in the later portion slightly depressed; wall smooth, polished; aperture radiate, at the outer peripheral angle. Length 1.00 to 1.25 mm., diameter 0.40 mm.

The types are from the upper part of the Taylor marl, Dallas road 4.3 miles southwest of Greenville, Hunt County, Tex. It occurs in typical form at a number of localities in Texas in the upper part of the Taylor marl.

The species is apparently confined to the upper part of the Taylor marl and the lower part of the Navarro group below the Nacatoch sand.

Navarro age.
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Saratoga chalk. Arkansas, Hempstead County (81).
Neylandville marl. Texas, Delta County (52); Rockwall County (57); Navarro County (66).
Taylor marl, upper part. Texas, Red River County (106, 109); Hunt County (115); Navarro County (134); Williamson County (142); Bexar County (152, 158, 159).

Marginulina cretacea Cushman

Plate 21, figures 16–20, 39

Marginulina cretacea Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 94, pl. 13, figs. 12–15, 1937; idem, vol. 20, p. 5, pl. 1, fig. 18, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 332, pl. 51, fig. 5, 1944.
Marginulina intermedia Cushman (not Philippi), idem, vol. 6, p. 334, pl. 50, figs. 4a, b, 1932.

Test much compressed; early portion coiled, especially in the microspheric form, later portion uncoiled; dorsal periphery strongly convex, not lobulate, ventral periphery concave; dorsal margin acute, ventral margin slightly rounded; chambers distinct, increasing gradually in size and breadth as added, not inflated; sutures distinct, slightly curved, not depressed; wall smooth; aperture radiate at the outer peripheral angle. Length 1.20 to 1.60 mm., breadth 0.50 to 0.80 mm.

The types are from the upper part of the Taylor marl, gully south of the New Braunfels-Clear Springs road, 4 miles southeast of New Braunfels, Guadalupe County, Tex. This species is fairly common at numerous localities in Texas in rocks of Taylor age, including the Pecan Gap chalk member and the Annona chalk, and extending into the Neylandville marl of Navarro age.

Navarro age. Neylandville marl. Texas, Rockwall County (57); Kaufman County (58).
Taylor age.
Upper part of Taylor marl. Texas, Lamar County (110); Collin County (121); Rockwall County (123); Leon County (138); Williamson County (142); Travis County (145); Guadalupe County (151); Bexar County (158).
Marlbrook marl. Arkansas, Clark County; Hempstead County.
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177); Delta County (165, 166).
Annona chalk. Texas, Bowie County (189, 190); Red River County (196).
Lower part of Taylor marl. Texas, Dallas County (222).

Marginulina texasensis Cushman

Plate 21, figures 21–29, 38, 40

Marginulina texasensis Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 95, 1938.
Frizzell, Jour. Paleontology, vol. 17, p. 342, pl. 56, fig. 4, 1943.
Cushman and Deaderick, idem, vol. 18, p. 332, pl. 51, figs. 6, 7, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 86, pl. 13, fig. 8, 1944.
Marginulina texana Cushman, idem, vol. 13, p. 95, pl. 14, figs. 1–4, 1937.
Cushman and Hedberg, idem, vol. 17, p. 88, pl. 21, fig. 21, 1941.
Marginulina elongata Cushman (not D'Orbigny), Jour. Paleontology, vol. 5, p. 304, pl. 35, figs. 6a, b, 1931.
Marginulina modesta Cushman and Jarvis (not Reuss), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 26, pl. 8, figs. 6a, b, 1932.

Test elongate, slender; early portion coiled, rapidly becoming uncoiled, with rather uniform diameter throughout; ventral margin in the adult convex, lobulated, dorsal margin concave; nearly circular in diameter; chambers distinct, strongly inflated in the later portion, increasing gradually in height toward the apertural end; sutures distinct, depressed in the later portion; wall smooth; aperture radiate, protuberant, at the dorsal peripheral angle. Length 1.50 to 2.25 mm., diameter 0.25 mm.

The types are from the Pecan Gap chalk member of the Taylor marl 3.2 miles southwest of Mart, McLennan County, Tex., on secondary road to Otto at crossing of "Big Creek." This species occurs in Texas at numerous localities in the upper part of the Taylor marl, in the Pecan Gap chalk member of the Taylor, in the Annona chalk; and in Arkansas in the Marlbrook marl. It ranges upward into the lower part of the Navarro group and occurs in the Saratoga chalk of Arkansas and in the Selma chalk of Mississippi. It is present in Trinidad, Colombia, and Peru.

The species has been recorded as *"Marginulina elongata* D'Orbigny." It differs from that species in the more tumid and higher chambers, concave dorsal margin, and smaller coiled portion.

Navarro age.
Selma chalk (upper part). Mississippi, Prentiss County (91).
Saratoga chalk. Arkansas, Howard County (79).
Taylor age.
Upper part of Taylor marl. Texas, Limestone County (136); Williamson County (142); Travis County (149); Bexar County (156, 159).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Annona chalk. Texas, Red River County (188a, 198).

Marginulina cf. M. tripleura (Reuss) Cushman

Plate 21, figures 30, 31

Marginulina cf. *M. tripleura* Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 95, pl. 14, figs. 5, 6, 1937; idem, vol. 20, p. 6, pl. 1, fig. 20, 1944.

Reuss described and figured specimens from the Upper Cretaceous of Germany under the name *"Cristellaria tripleura."* Some of the American Cretaceous specimens strongly resemble this form, but though occurring at several localities specimens are never in sufficient number really to show the extent of variation or the characters of the microspheric and megalospheric forms. Our specimens are mostly from the upper part of the Taylor marl and from the Neylandville marl in the lower part of the Navarro group.

Navarro age. Neylandville marl. Texas, Rockwall County (57); Navarro County (66).
Taylor marl.
Upper part. Texas, Lamar County (110); Bexar County (152, 161).
Pecan Gap chalk member. Texas, Delta County (166).
Lower part. Texas, Ellis County (231, 233).

Marginulina bullata Reuss
Plate 21, figures 32–37

Marginulina bullata Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 29, pl. 13, figs. 34–38, 1845.
Cushman, Cushman Lab. Foram Research Contr., vol. 13, p. 96, pl. 14, figs. 9–15, 1937; idem, vol. 20, p. 6, pl. 1, fig. 21, 1944.

The specimens named by Reuss in various collections from the Cretaceous of Bohemia have been examined. The American Cretaceous specimens seem to belong to the same species. It has typically few very strongly inflated chambers that increase in size greatly as added. The surface is smooth, and the aperture has a distinctly proturberant, cylindrical neck.

Specimens occur at numerous localities in the present collections but never in any considerable number. The range includes the beds of Taylor age and extends into the lower beds of Navarro age. It may be easily confused with the somewhat similar species of the beds of upper Navarro age, which has a pointed radiate aperture instead of a cylindrical neck.

There are numerous American records but some, at least, are questionable.

Navarro age. Ripley formation. Tennessee, McNairy County (94).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 106); Hunt County (115); Collin County (121); Rockwall County (124); Kaufman County (126, 129, 131); Leon County (138); Milam County (139).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (169); Delta County (166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Prentiss County (261).
Wolfe City sand member of Taylor marl. Texas, Collin County (180).
Lower part of Taylor marl. Texas, Delta County (206); Collin County (208); Kaufman County (228); Bell County (245).

Marginulina navarroana Cushman
Plate 22, figures 1–5

Marginulina navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 98, pl. 14, figs. 17, 18, 1937.

Test elongate, 4 to 5 times as long as broad, earliest portion coiled, rapidly becoming uncoiled, the last 5 uncoiled chambers in the adult making up almost the entire test, earliest portion slightly compressed, later circular in transverse section, periphery lobulate; chambers distinct, becoming strongly inflated in the adult, increasing gradually in height, but only very slightly in diameter; sutures fairly distinct in the later portion, in which they are somewhat depressed; wall ornamented by longitudinal costae, somewhat variable in coarseness, slightly twisted, especially over the earlier portion, and independent of the sutures; aperture radiate, projecting, at the outer peripheral angle. Length 1.40 to 1.85 mm., breadth 0.35 to 0.40 mm.

The types are from the Prairie Bluff chalk on U. S. Highway 80, 0.35 mile east of the Southern Railway underpass at Livingston, Sumter County, Ala. (102). The species also occurs in the Corsicana marl of Texas.

Navarro age.
Prairie Bluff chalk. Alabama, Sumter County (101, 102).
Corsicana marl. Texas, Bexar County (46).

Marginulina silicula (Plummer) Cushman
Plate 21, figures 42–45

Hemicristellaria silicula Plummer, Texas Univ. Bull. 3101, p. 148, pl. 10, figs. 8, 9, 1931.
Vaginulina ? trilobata Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 30, pl. 4, fig. 11, 1930.
Marginulina silicula Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 97, pl. 14, figs. 19–22, 1937.
Cushman and Hedberg, idem, vol. 17, p. 88, pl. 21, fig. 22, 1941.
Cushman and Todd, idem, vol. 19, p. 55, pl. 10, fig. 4, 1943.

This is a large species characteristic of the Corsicana marl of the Navarro group of Texas. The peculiar spinose early coiled stages and the raised portions in the middle of the sutures are distinctive. Somewhat related forms occurring with these have no early coiled stage and are referred to under *Vaginulina*. The species is an excellent marker for the upper part of the Navarro.

It is interesting to note that similar specimens, apparently identical, are found in the Upper Cretaceous of Bavaria and in the upper part of the Colon formation of the Department of Santander del Norte, Colombia.

Navarro age.
Kemp clay. Texas, Williamson County (11); Guadalupe County (18).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (30, 31); Falls County (32); Travis County (34).
Prairie Bluff chalk. Mississippi, Chickasaw County (85).

Marginulina plummerae Cushman
Plate 22, figures 6–10

Marginulina plummerae Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 97, pl. 13, figs. 21–23, 1937.
Cushman and Todd, idem, vol. 19, p. 56, pl. 10, fig. 2, 1943.
Hemicristellaria ensis Plummer (not Reuss), Texas Univ. Bull. 3101, p. 146, pl. 10, figs. 1–4, 1931.
Cristellaria lineara Carsey (not *C. linearis* D'Orbigny), Texas Univ. Bull. 2612, p. 36, pl. 2, fig. 3, 1926.

Test elongate, 4 to 5 times as long as broad, compressed, especially in the early portion, which is coiled; very early becoming uncoiled and gradually less compressed until in some adult specimens the section becomes nearly circular; ventral side nearly straight, dorsal side slightly convex, in adults becoming straight or even slightly concave; chambers distinct, the few coiled chambers increasing very rapidly in size, later uncoiled chambers increasing very gradually, becoming distinctly inflated; sutures distinct, limbate, slightly raised, especially in the middle portion, where they are somewhat more thickened than at the sides, slightly curved; wall smooth except for the raised sutures; aperture radiate, at the outer peripheral angle. Length 1.00 to 2.00 mm., breadth 0.30 to 0.40 mm.

The types are from the Navarro group, Corsicana marl, in a road ditch on the west-facing slope of Big Creek Valley 3 miles southwest of Stranger and 1.3 miles southeast of Parsons Bridge, Falls County, Tex. (32). It should make an excellent index fossil for the upper part of the Navarro.

This species has been referred to *Marginulina ensis* Reuss, from the Cretaceous of Bohemia. That species, however, is larger, coarser, with much less compression, thicker wall, and different sutures. Its position in the geologic section is much lower than that of *M. plummerae*. It is very questionable if any American forms are identical with Reuss' species.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Travis County (17); Guadalupe County (21).
Corsicana marl. Texas, Navarro County (27); Limestone County (30, 31); Falls County (32); Travis County (40).
Arkadelphia marl. Arkansas, Hempstead County (72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (86).

Marginulina curvatura Cushman
Plate 22, figures 11–14
Marginulina curvatura Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 34, pl. 5, figs. 13, 14, 1938.
Cushman and Todd, idem, vol. 19, p. 56, pl. 10, fig. 3, 1943.

Test elongate, slightly if at all compressed, early portion coiled, later chambers uncoiled in a slightly curved line that gradually becomes straight; chambers distinct, becoming gradually more inflated toward the apertural end, considerably overlapping though less so in the later stages, nearly circular in transverse section; sutures of the early portion hardly if at all depressed, gradually more depressed in later stages; wall smooth; aperture radiate, at the peripheral angle. Length up to 1.00 mm., breadth 0.25 to 0.30 mm.

The types are from the Navarro group, Corsicana marl, 17 feet above the base of bluff on Onion Creek $2\frac{1}{4}$ miles west of old Garfield, Travis County, Tex. (36). It also occurs in the Corsicana marl of other localities and in the Arkadelphia marl of Arkansas.

M. curvatura differs from *M. texasensis* Cushman in the greater proportion of curved early chambers, more curved later portion, and lack of a ridgelike pinching in of the dorsal margin in the early stages.

Navarro age.
Corsicana marl. Texas, Limestone County (30, 31); Falls County (32); Travis County (36); Navarro County (27).
Arkadelphia marl. Arkansas, Hempstead County (73).

Marginulina siliqua Cushman
Plate 22, figures 15, 16
Marginulina siliqua Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 35, pl. 5, figs. 15, 16, 1938.

Test small, strongly compressed, peripheral margin subacute, early portion somewhat coiled, adult portion uncoiled; chambers distinct, not inflated except the latest ones that are very slightly so, increasing rapidly in breadth but only gradually in height, the earliest 4 or 5 reaching back to the proloculum, later ones forming a linear series, but somewhat curved, the inner end narrower; sutures distinct, slightly limbate, not depressed except slightly between the last 2 or 3 chambers, gently curved; wall smooth; aperture radiate, projecting slightly, on the dorsal peripheral margin. Length 0.50 to 0.60 mm., breadth 0.20 mm.

The types are from a horizon near the base of the Kemp clay of the Navarro group, branch of Mustang Creek 1 mile west-southwest of Noack, 900 feet downstream from road, and 0.2 miles southwest of Christ Evangelical Lutheran Church, Williamson County, Tex. (12). It also occurs in the Corsicana marl.

M. siliqua differs from *M. cretacea* Cushman in the fewer and more distinct chambers, in the straight ventral margin, and in a tendency to contract rather than expand toward the apertural end.

Navarro age.
Kemp clay. Texas, Williamson County (12).
Corsicana marl. Texas, Falls County (32).

Marginulina humilis (Reuss) Cushman and Church?
Plate 22, figure 17

Specimens occur in the Upper Cretaceous of Trinidad and in the Velasco shale of Mexico similar to that figured here. The test is nearly cylindrical, and the initial end has a short spine. Some specimens tend to coil, but the generic position is very difficult to determine. It is probably not the same as the species described by Reuss but has already been referred to it (Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 27, pl. 8, fig. 9, 1932). Another form from the Velasco shale has also been referred to this (Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 601, pl. 19, fig. 8, 1926) but should probably be placed under *M. jarvisi*.

Marginulina jarvisi Cushman
Plate 22, figures 18–20
Cristellaria grata Cushman (not Reuss), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 598, pl. 19, figs. 1a, b, 1926.
Lenticulina grata Cushman and Jarvis (not Reuss), Cushman Lab. Foram. Research Contr., vol. 4, p. 96, pl. 14, fig. 3, 1928.
Marginulina grata Cushman and Jarvis (not Reuss), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 25, pl. 7, fig. 7; pl. 8, fig. 3, 1932.
Marginulina schloenbachi Cushman and Jarvis (not Reuss), idem, p. 26, pl. 8, fig. 5, 1932.
Marginulina jarvisi Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 35, pl. 5, figs. 17, 18 1938.

Test compressed, elongate, earliest portion coiled, later uncoiling; periphery rounded, ventral margin slightly concave, dorsal margin convex; chambers distinct, rather few, the earliest 4 to 6 coiled, remainder uncoiled, not inflated; sutures distinct, slightly limbate, not raised, somewhat curved; wall smooth; aperture at the peripheral angle, radiate. Length 1.00 to 1.40 mm., breadth 0.30 to 0.40 mm., thickness 0.20 to 0.25 mm.

The types are from Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, Trinidad, British West Indies.

The forms figured here, all from the same locality, show the very considerable variation in this species. The essential characters are the same, but the form of the test changes greatly. The species differs from "*Cristellaria grata* Reuss" in the much greater proportion of uncoiling, less compressed test, and different angle and curvature of the sutures.

M. jarvisi is also found in the Upper Cretaceous Velasco shale of Mexico, and somewhat similar specimens occur in the upper part of the Navarro of Texas.

Navarro group, Kemp clay. Texas, Williamson County (11).

Marginulina cf. M. decorata (Reuss) Cushman and Jarvis
Plate 21 figure 41
Cristellaria decorata Reuss, Deutsche geol. Gessell. Zeitsch., vol. 7, p. 209, pl. 8, fig. 16; pl. 9, figs. 1, 2, 1855.
Marginulina decorata Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 28, pl. 9, figs. 2a, b, 1932.

Test elongate, compressed, the periphery lobulate; early chambers coiled, later chambers uncoiled and becoming narrower as they are added; sutures distinct, limbate, raised, the earlier sutures broken into a series of beadlike projections, later sutures nearly entire; aperture somewhat produced, at the peripheral angle. Length 1.50 to 1.65 mm., breadth 0.60 to 0.80 mm., thickness 0.50 to 0.60 mm.

The specimens from Trinidad are similar in many of their characters to Reuss' species, but the sutures in the later chambers tend to lose the beaded character although they are still strongly raised.

Upper Cretaceous. Calex C well, 116 feet, near Lizard Springs, Guayaguayare, southeastern Trinidad.

Marginulina trinitatensis Cushman
Plate 22, figure 21

Marginulina trinitatensis Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 99, pl. 14, fig. 16, 1937.
Marginulina jonesi Cushman and Jarvis (not Reuss), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 27, pl. 9, figs. 1a, b, 1932.

Test slightly longer than broad, early portion closely coiled, last portion uncoiled, periphery acute and slightly keeled; chambers fairly distinct, earlier chambers much compressed in the coiled portion, much inflated in the uniserial portion, increasing rapidly in size in the adult; sutures of the early portion indistinct, later distinct and strongly depressed; wall ornamented with numerous acute costae, usually somewhat broken at the sutures, last-formed chamber tending to become smooth; aperture radiate, terminal, with a slight neck. Length 0.90 to 1.00 mm., breadth 0.35 to 0.60 mm., thickness 0.25 to 0.50 mm.

The types are from the Upper Cretaceous of Trinidad.

This species differs from *M. jonesi* Reuss in the compressed and keeled coiled portion, fewer uncoiled and more coiled chambers, and much more distinctly inflated later chambers.

Upper Cretaceous: Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Marginulina? trilobata D'Orbigny
Plate 22, figure 22

Marginulina trilobata D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 16, pl. 1, figs. 16, 17, 1840.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 28, pl. 9, figs. 3, 4, 1932.

Test elongate, the sides nearly parallel, periphery rounded; chambers distinct, rather uniform in size and shape; sutures distinct, limbate; the central portion at each side raised and thickened; wall, except for the sutural projections, smooth; aperture radiate, at the peripheral margin. Length up to 3.50 mm., breadth 0.70 to 0.80 mm., thickness 0.40 to 0.45 mm.

The specimen figured is megalospheric and does not show the early coiled chambers, which are much more apparent in microspheric specimens. The raised sutures are somewhat variable in the degree of thickening, but this character is usually present in considerable degree. The types of this species were described by D'Orbigny from the Cretaceous chalks of the Paris Basin, and it is rather widely distributed in the chalky phase of the Upper Cretaceous of Europe and America. Similar specimens occur in Trinidad and in the Velasco shale of Mexico. There is a question whether the species should be placed under *Marginulina* or *Vaginulina*.

Marginulina sp. A
Plate 22, figure 23

The single specimen figured here is peculiar in its coiled early portion with raised sutures and later portion with depressed sutures and elongate, inflated chambers. In its early stages is resembles *M. plummerae* Cushman, but the later chambers are much more elongate. The specimen is from the Navarro group, Corsicana marl, 13 feet above the base of bluff on Onion Creek ¼ mile below Bastrop road crossing and 2½ miles west of old Garfield, Travis County, Tex. (41).

Marginulina sp. B
Plate 22, figure 24

The accompanying figure shows a very peculiar specimen, evidently belonging to this genus. It may be a somewhat abnormal form but is here recorded for future reference. It is from the lower part of the upper Taylor marl, branch of Kickapoo Creek 1,200 feet south of public road and 1.8 miles northwest of Annona, Red River County, Tex. (106).

Marginulina sp. C
Plate 22, figures 25–27

The three figured specimens are probably young stages referable to *Marginulina* and are figured for the record. They the from marl probably of upper Taylor age, 5 or 6 feet below the base of the *Exogyra-Gryphaea* zone, east bank of Medio Creek 0.85 mile below crossing of Castroville road, Bexar County, Tex. (160).

Genus DENTALINA D'Orbigny, 1826

Dentalina involvens Cushman
Plate 22, figure 28

Dentalina involvens Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 37, pl. 6, fig. 3, 1938; idem, vol. 16, p. 75, pl. 13, fig. 1, 1940.

Test small, elongate, slender, of nearly uniform diameter throughout, slightly curved, initial end with a distinct spine; chambers few, distinct, except the earliest; later chambers slightly inflated, somewhat overlapping; early sutures indistinct, later sutures slightly depressed; wall ornamented by longitudinal costae, those of the early portion coarse and strongly twisted, later costae more numerous, finer, and less oblique, independent of the sutures; aperture radiate, terminal, slightly excentric. Length up to 1.00 mm., diameter 0.15 mm.

The types are from the Austin chalk on the road at the north edge of Whitewright, north-facing slope of branch valley, Grayson County, Tex. (290).

This is a peculiarly ornamented species and holds its characters very closely. It differs from *D. alternata* (Jones) Plummer in the smaller, more slender test, fewer costae, and the peculiarly twisted character of the ornamentation.

Dentalina alternata (Jones) Plummer
Plate 22, figures 29–33

Nodosaria zippei Reuss var. *alternata* Jones, in Wright, Belfast Nat. Field Club Proc., 1884–85, appendix 9, p. 330, pl. 27, fig. 10, 1886.
Dentalina alternata Plummer, Texas Univ. Bull. 3101, p. 153, pl. 11, fig. 7, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 274, pl. 42, fig. 6, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 76, pl. 13, figs. 2–6, 1940; idem, vol. 20, p. 6, pl. 1, fig. 31, 1944; idem, vol. 20, p. 86, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 332, pl. 51, fig. 11, 1944.
Nodosaria alternata Carsey (as new sp.), Texas Univ. Bull. 2612, p. 35, pl. 4, fig. 7, 1926 (1927).
Nodosaria intercostata Cushman (not Reuss), Tennessee Div. Geology Bull. 41, p. 31, pl. 4, figs. 1, 2, 1931.
Nodosaria affinis Cushman (part) (not Reuss), Jour. Paleontology, vol. 5, p. 305, pl. 35, fig. 2 (not 3–5), 1931.
Dentalina pinnigera Sandidge, Jour. Paleontology, vol. 6, p. 274, pl. 42, figs. 11, 12, 1932.

Test elongate, very slightly tapering, initial end with a single, stout spine; chambers of fairly uniform size, increasing slightly in length and diameter as added; sutures distinct, slightly depressed; wall ornamented by a few distinct, longitudinal, platelike costae continuous over adjacent chambers, and between these, secondary costae, usually broken at the sutures; aperture radiate, terminal. Length up to 1.50 mm., diameter 0.25 mm.

This is a rather distinctive species with its peculiar arrangement of the costae. The last formed chambers may become globular and somewhat set off from each other by much-contracted necks. As specimens are easily broken, these final chambers are usually missing. The species ranges from the upper beds of Austin age through those of Taylor age into the lower beds of Navarro age.

Examination of topotype material of both *N. intercostata* Reuss and *N. alternata* Jones shows that the American material is identical with that of Jones from the chalk of Ireland. There is some question whether this species should be placed under *Dentalina* or *Nodosaria*.

Navarro age.
- Saratoga chalk. Arkansas, Hempstead County (80, 81); Howard County (79).
- Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
- Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92).
- Neylandville marl. Texas, Red River County (50); Delta County (52); Rockwall County (57); Kaufman County (58, 60, 62); Navarro County (63, 66, 68, 69).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (106); Lamar County (110); Hunt County (115); Collin County (121); Rockwall County (124); Kaufman County (125, 127–129, 131); Navarro County (134); Milam County (139); Williamson County (140, 142, 144); Travis County (145, 149); Hays County (150); Bexar County (152, 158, 159, 161, 162).
- Anacacho limestone (upper part). Texas, Bexar County (164).
- Ozan formation. Arkansas, Little River County (254).
- Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
- Pecan Gap chalk member of Taylor marl. Texas, Rockwall County (175); Delta County (165, 166).
- Annona chalk. Texas, Bowie County (189); Red River County (192, 193, 198).
- Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Prentiss County (261); Lee County (267).
- Lower part of Taylor marl. Texas, Lamar County (200); Collin County (209, 210); Dallas County (219, 222, 224, 225, 227); Kaufman County (228); McLennan County (241); Bell County (245).

Austin age.
- Gober tongue of Austin chalk. Texas, Lamar County (282–284, 287, 288).
- Austin chalk. Texas, Dallas County (310).
- Brownstown marl. Texas, Red River County (319).
- Selma chalk (lower part). Mississippi, Itawamba County (351).

Dentalina legumen Reuss

Plate 23, figures 1, 2

Dentalina legumen Reuss, Haidinger's Naturwiss. Abh., vol. 4, p. 10, pl. 1, fig. 14, 1851; Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 187, pl. 3, fig. 5, 1860.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 27, pl. 2, fig. 23, 1928.
Cushman, Tennessee Div. Geology Bull. 41, p. 27, pl. 3, fig. 1, 1931.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 30, pl. 9, fig. 9, 1932.
Brotzen, Sveriges geol. undersökning, ser. C. No. 396, p. 75, pl. 5, fig. 9, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 77, pl. 13, figs. 7, 8, 1940.
Cushman and Todd, idem, vol. 19, p. 57, pl. 10, fig. 5, 1943.
Cushman, idem, vol. 20, p. 86, pl. 13, fig. 14, 1944.
Dentalina nana Cushman (not Reuss), Tennessee Div. Geology Bull. 41, p. 29, pl. 3, fig. 21, 1931.

This is a very variable species, originally described by Reuss from the Cretaceous of Lemberg. An examination of material from Lemberg shows that it is variable in the obliquity of the sutures and in the amount of inflation of the chambers. The type figures of *D. legumen* Reuss and *D. nana* Reuss appear quite different, but, when larger series of specimens are studied, the American specimens at least seem to be variable enough to include both forms in one series. Figures of several specimens are given to show this variation.

Forms included under this name have a wide range in the American Cretaceous.

Navarro age.
- Corsicana marl. Texas, Navarro County (26, 27); Limestone County (29, 30); Travis County (34, 36, 38); Bexar County (46).
- Arkadelphia marl. Arkansas, Hempstead County (70).
- Prairie Bluff chalk. Alabama, Wilcox County (99); Sumter County (101).
- Selma chalk (upper part). Mississippi, Prentiss County (91). Alabama, Marengo County (104).
- Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94); Henderson County (96).
- Saratoga chalk. Arkansas, Hempstead County (81).
- Neylandville marl. Texas, Hunt County (53); Kaufman County (62).

Taylor age.
- Upper part of Taylor marl. Texas, Delta County (114); Collin County (122); Rockwall County (124); Kaufman County (128, 129); Navarro County (132); Travis County (145); Hays County (150); Bexar County (159, 163).
- Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
- Annona chalk. Texas, Bowie County (190).
- Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (257–259); Prentiss County (260, 261); Lee County (264, 268).
- Lower part of Taylor marl. Texas, Red River County (199); Lamar County (201); Fannin County (203); Delta County (206); Collin County (210, 212); Dallas County (219, 220, 222, 225); Kaufman County (228); Ellis County (232, 235); Hill County (237); McLennan County (238); Travis County (249).

Austin age.
- Gober tongue of Austin chalk. Texas, Lamar County (283–285).
- Austin chalk. Texas, Grayson County (290); Dallas County (310, 311); Bell County (316).
- Brownstown marl. Texas, Lamar County (320); Arkansas, Sevier County (347).
- Selma chalk (lower part). Mississippi, Itawamba County (351); Lee County (350).

Dentalina gracilis D'Orbigny

Plate 23, figures 3–6

Dentalina gracilis D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 14, pl. 1, fig. 5, 1840.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 29, pl. 2, fig. 22, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 77, pl. 13, figs. 9–11, 1940.
Cushman and Deaderick, idem, vol. 18, p. 57, pl. 11, fig. 4, 1942.
Cushman and Todd, idem, vol. 19, p. 57, pl. 10, fig. 6, 1943.
Cushman, idem, vol. 20, p. 6, pl. 1, fig. 28, 1944; idem, vol. 20, p. 86, pl. 13, fig. 12, 1944.

Under this name D'Orbigny figures a slender, somewhat curved species that corresponds well with some of our American forms. From a study of American material the species is very variable, and some of the variations are to be found on our plate. The range of such forms is wide, and later studies may show that they include more than one species.

Navarro age.
- Kemp clay. Texas, Navarro County (3); Williamson County (12).
- Corsicana marl. Texas, Limestone County (29, 30).
- Arkadelphia marl. Arkansas, Hempstead County (71).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84, 85). Alabama, Wilcox County (99); Sumter County (101–103).

Taylor age.
Upper part of Taylor marl. Texas, Hunt County (116); Collin County (119); Rockwall County (124); Leon County (138); Travis County (149); Bexar County (158, 160).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Annona chalk. Texas, Red River County (193, 198).
Lower part of Taylor marl. Texas, Red River County (199); Collin County (209–211); Dallas County (220, 224, 227); McLennan County (239, 240, 242).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (274, 278, 281); Lamar County (286).
Austin chalk. Texas, Grayson County (289, 291); Dallas County (310).
Brownstown marl. Texas, Red River County (319); Arkansas, Sevier County.
Bonham marl. Texas, Grayson County (328).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Dentalina lorneiana D'Orbigny
Plate 23, figures 7–11

Dentalina lorneiana D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 14, pl. 1, figs. 8, 9, 1840.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 28, pl. 2, fig. 29, 1928.
Cushman, Tennessee Div. Geology Bull. 41, p. 28, pl. 3, figs. 4–7, 1931.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 25, pl. 2, fig. 5, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 77, pl. 13, figs. 12–14, 1940.
Cushman and Hedberg, idem, vol. 17, p. 89, pl. 21, figs. 27, 28, 1941.
Cushman, idem, vol. 20, p. 6, pl. 1, fig. 24, 1944; idem, vol. 20, p. 86, pl. 13, fig. 11, 1944.
Nodosaria lorneiana Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 27, pl. 8, fig. 5, 1845.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 34, pl. 3, fig. 12, 1925.

Test elongate, slender, slightly curved, initial end usually broadly rounded; chambers increasing rapidly in length as added, diameter increasing very slowly, slightly inflated; sutures distinct, slightly depressed; wall smooth; aperture terminal, radiate. Length up to 2.00 mm., diameter 0.15 to 0.18 mm.

The types of this species are from the Upper Cretaceous of the Paris Basin. It is widely distributed in Europe and America. It has been recorded from America also as *D. legumen* Reuss but is not that species. The range is evidently wide, as specimens referable to it occur in the Brownstown marl and Gober tongue of the Austin chalk, in both upper and lower parts of the Taylor, and in the lower part of the Navarro group.

Navarro age.
Nacatoch sand. Texas, Bowie County (47).
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Neylandville marl. Texas, Hunt County (53); Navarro County (68).
Taylor age.
Upper part of Taylor marl. Texas, Kaufman County (129); Navarro County (134); Milam County (139).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Annona chalk. Texas, Red River County (192).
Selma chalk (middle part). Tennessee, Hardin County (255).
Lower part of Taylor marl. Texas, Collin County (208, 213); Dallas County (225, 227); Travis County (247).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (280); Lamar County (283).
Austin chalk. Texas, Grayson County (290).
Brownstown marl. Texas, Red River County (318).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).
Niobrara chalk. Nebraska.

Dentalina lorneiana D'Orbigny var. spirans Cushman
Plate 23, figure 12

Dentalina legumen Reuss var. *spirans* Cushman, Tennessee Div. Geology Bull. 41, p. 28, pl. 3, fig. 2, 1931.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 18, pl. 2, fig. 7, 1936.
Dentalina lorneiana D'Orbigny, var. *spirans* Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 78, pl. 13, fig. 15, 1940.

Variety differing from the typical form in the ornamentation of the surface, which consists of elongate spiral costae, generally continuous over the adjacent chambers.

The types of the variety are from the Ripley formation, New Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. (94).

Dentalina reflexa Morrow
Plate 23, figures 13, 14

Dentalina reflexa Morrow, Jour. Paleontology, vol. 8, p. 189, pl. 29, figs. 5, 20, 1934.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 24, pl. 2, fig. 4, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 79, pl. 13, figs. 16, 17, 1940.

Test elongate, slightly arcuate; successive chambers not increasing appreciably in length and but very little in diameter; initial end pointed, curving slightly reverse to the main curvature of the test; chambers few, distinct, depressed, oblique, especially in early chambers; wall smooth. Length of holotype, 0.9 mm.; thickness 0.16 mm.

The types are from the base of the Niobrara formation, sec. 32, T. 11 S., R. 16 W., Ellis County, Kans. Loetterle records it from the Niobrara formation of Nebraska.

The types are redrawn on our plate but are not very well preserved as to details, and the species must be left until more material is available.

Dentalina fallax Franke
Plate 23, figures 15–17

Dentalina fallax Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 27, pl. 2, fig. 18, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 79, pl. 13, figs. 18–20, 1940.

Test elongate, very slightly tapering, initial end with a distinct spine; chambers distinct, proloculum usually larger than the next succeeding chambers, which are not inflated but are followed by chambers that are more inflated toward the apertural end, strongly overlapping; sutures distinct, earlier sutures not depressed but later sutures progressively more so; wall smooth; aperture terminal, radiate, with a slender neck. Length 0.70 to 0.85 mm., diameter 0.18 to 0.20 mm.

The types are from the Upper Cretaceous of Germany. At a single locality in the upper part of the Taylor marl this species is fairly common but was not seen elsewhere. The horizon of the European specimens is close to that of the American specimens, and the species is to be looked for at other American localities in the upper part of the Taylor marl.

Taylor marl, upper part. Texas, Willamson County (142).

Dentalina basitorta Cushman
Plate 23, figures 18–20

Dentalina basitorta Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 37, pl. 6, figs. 4, 5, 1938; idem, vol. 16, p. 80, pl. 13, figs. 21, 22, 1940.
Cushman and Hedberg, idem, vol. 17, p. 88, pl. 21, fig. 24, 1941.
Cushman, idem, vol. 20, p. 6, pl. 1, fig. 25, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 332, pl. 51, figs. 9, 10, 1944.

Test elongate, slender, somewhat curved, initial end with a basal spine; early portion with the chambers somewhat twisted, later uniserial; chambers distinct, the earliest chambers elongate, twisted about the elongate axis or even appearing somewhat irregularly biserial, not inflated; later chambers strongly inflated, less overlapping; sutures distinct, earlier sutures very strongly oblique, not depressed, later sutures gradually less oblique and progressively more depressed; wall smooth; aperture terminal, radiate. Length up to 1.00 mm., diameter 0.18 mm.

The types are from a horizon near the top of the Selma chalk, Alpina road 2 miles south of Graham, Union County, Miss. (92). It also occurs at several localities in beds of Taylor age. It is possible that the type locality is really of Taylor age. It also occurs in the Cretaceous of Colombia.

Dentalina basitorta differs from *D. legumen* Reuss in the early stages, which in *D. basitorta* are very peculiarly twisted and have the sutures very oblique. These peculiar features are held in all the specimens to a greater or lesser degree and should make this species easily recognizable and perhaps a good index fossil for the Taylor marl.

Navarro age. Selma chalk (upper part). Mississippi, Union County (92).
Taylor age.
Upper part of Taylor marl. Texas, Lamar County (110); Bexar County (158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Howard County; Hempstead County.
Selma chalk (middle part). Mississippi, Union County (262).
Lower part of Taylor marl. Texas, Delta County (206).

Dentalina aculeata D'Orbigny
Plate 26, figures 17, 18

Dentalina aculeata D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 13, pl. 1, figs. 2, 3, 1840.
Reuss, in Geinitz, Grundriss der Verstein., p. 654, pl. 24, fig. 10, 1845–46.
D'Orbigny, Prodrome de paléontologie stratigraphique universelle des animaux mollusques et rayonnés, vol. 2, p. 280, No. 1353, 1850.
Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 189, 1860; idem, vol. 46, pt. 1, 1862, p. 44 (1863).
Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg. vol. 59, 1912, p. 268 (1913).
Cushman, Jour. Paleontology, vol. 6, p. 335, pl. 50, fig. 7, 1932; Cushman Lab. Foram. Research Contr., vol. 20, p. 6, pl. 2, fig. 11, 1944.

A few incomplete American specimens may be referred to the species described by D'Orbigny from the Senonian of the Paris Basin and later recorded several times from the Upper Cretaceous of Europe. The chambers are more pyriform than in *Nodosaria aspera* Reuss. D'Orbigny's species may possibly represent the free end chambers of a *Ramulina*. No complete specimens have as yet been obtained.

This species, with distribution of the specimens, is again referred to under *Ramulina* (p. 100).

Taylor age.
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
Annona chalk. Texas, Red River County (188a).

Dentalina multicostata D'Orbigny
Plate 23, figures 21–23

Dentalina multicostata D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 15, pl. 1, figs. 14, 15, 1840.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 80, pl. 13, figs. 23–25, 1940.

Specimens from the upper part of the Taylor marl of Texas seem to be identical with this species, described by D'Orbigny from the Upper Cretaceous chalk of the Paris Basin. The stratigraphic position in the two areas is consistent.

Although none of our specimens is complete, enough is present to show that the species is gently tapering, with globular chambers rather closely set, and the wall ornamented by numerous distinct longitudinal costae, which may be somewhat oblique. From what is known of its occurrence, this species should be a good index fossil for beds of Taylor age.

Taylor marl.
Upper part. Texas, Red River County (106); Lamar County (110); Navarro County (132); Bexar County (152).
Lower part. Texas, Delta County (206).

Dentalina megalopolitana Reuss
Plate 23, figures 24–26

Dentalina megalopolitana Reuss, Deutsche geol. Gesell. Zeitschr., vol. 7, p. 267, pl. 8, fig. 10, 1855.
Cushman, Jour. Paleontology, vol. 5, p. 304, pl. 34, fig. 17, 1931; Tennessee Div. Geology Bull. 41, p. 29, pl. 3, fig. 8, 1931; Jour. Paleontology, vol. 6, p. 335, 1932.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 29, pl. 9, fig. 5, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 80, pl. 13, figs. 26–28, 1940; idem, vol. 20, p. 7, pl. 1, fig. 27, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 332, pl. 51, fig. 8, 1944.
Cushman and Goudkoff, Cushman Lab. Foram. Research Contr., vol. 20, p. 56, pl. 9, fig. 11, 1944.

Test large, fairly stout, tapering, slightly fusiform, greatest breadth developed before the last-formed chamber in the adult; chambers numerous, not inflated, distinct, of uniform shape, gradually increasing in size as added, the later chambers in many specimens slightly decreasing; sutures distinct, not depressed, slightly oblique; wall smooth; aperture radiate, slightly protuberant at the inner angle of the terminal face of the last-formed chamber. Length up to 2.00 mm., breadth up to 0.30 mm.

The American specimens agree with those of the European Cretaceous. Most of the American records are from the upper beds of Taylor age. Specimens referred to the species from the Cretaceous of Trinidad are not so typical as those from the Taylor.

Upper Cretaceous. ? Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco shale. ?Hacienda el Limon, Mexico.
Upper Cretaceous. California.
Navarro age.
Saratoga chalk. Arkansas, Howard County (79); Hempstead County (81).
Neylandville marl. Texas, Rockwall County (57).
Taylor age.
Upper part of Taylor marl. Texas, Rockwall County (124); Limestone County (136); Williamson County (142).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Annona chalk. Texas, Red River County (196, 197).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (259).

Dentalina catenula Reuss
Plate 23, figures 27–32

Dentalina catenula Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 185, pl. 3, fig. 6, 1860.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 81, pl. 13, figs. 29–34, 1940; idem, vol. 20, p. 7, pl. 1, fig. 30, 1944.

Test elongate, tapering, slightly curved, initial end usually with a distinct spine; chambers pyriform, somewhat overlapping, increasing rather uniformly in size as added, of uniform shape, greatest diameter below the middle, more tapering toward the apertural end; sutures distinct, strongly depressed; wall smooth; aperture terminal, radiate. Length up to 2.00 mm., diameter 0.35 to 0.45 mm.

The types of this species are from the Upper Cretaceous of Westphalia, Germany. The American material has been compared with topotype material and seems identical. In the Gulf Coastal Plain the species is widely distributed and is confined to the middle and upper beds of Taylor age, with occasional specimens in the Neylandville marl of the lower part of the Navarro group.

The species varies in the amount of overlapping of the chambers and in the early portion in the microspheric and megalospheric forms as will be seen by the figures on our plate.

From a study of topotype material it seems that the species described by Reuss in 1845 as *Nodosaria oligostegia* from the Cretaceous of Bohemia differs from this but that the material he referred to *D. oligostegia* in 1851 from the Cretaceous of Lemberg is the same as *D. catenula.*

Navarro age. Neylandville marl. Texas, Navarro County (63).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106, 107); Lamar County (110); Hunt County (115); Collin County (121); Rockwall County (123, 124); Kaufman County (129, 131); Navarro County (132); Bexar County (152, 158, 159, 161).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Kaufman County (173); McLennan County (177); Falls County (178); Delta County (166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Wolfe City sand member of Taylor marl. Texas, Collin County (181).
Annona chalk. Texas, Bowie County (189, 190); Red River County (195, 198).
Lower part of Taylor marl. Texas, Ellis County (234); McLennan County (238); Bell County (245).

Dentalina basiplanata Cushman

Plate 24, figures 1–6

Dentalina annulata Cushman (not Reuss), Tennessee Div. Geology Bull. 41, p. 28, pl. 3, fig. 3, 1931.
Dentalina reussi Plummer (not Neugeboren), Texas Univ. Bull. 3101, p. 151, pl. 11, fig. 5, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 274, pl. 42, fig. 10, 1932.
Dentalina basiplanata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 38, pl. 6, figs. 6–8, 1938; idem, vol. 16, p. 82, pl. 14, figs. 1–6, 1940.
Cushman and Hedberg, idem, vol. 17, p. 88, pl. 21, fig. 23, 1941.
Cushman and Todd, idem, vol. 19, p. 56, pl. 10, fig. 7, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 333, pl. 51, figs. 17, 18, 1944.

Test very elongate, slightly tapering, usually slightly curved; early portion showing oblique costae that indicate coiling, especially in the microspheric form, often slightly compressed; chambers distinct, earlier chambers not inflated, later chambers become increasingly inflated as added; earlier chambers much more strongly overlapping; sutures distinct, somewhat limbate, earlier sutures flush with the surface, oblique, later sutures progressively more depressed and more nearly at right angles to the elongate axis; wall smooth, or the earliest portion sometimes slightly roughened; aperture terminal, radiate. Length up to 2.50 mm., diameter 0.20 to 0.25 mm.

The types are from the Corsicana marl in a clay pit 2 miles south of Corsicana Courthouse, Navarro County, Tex.

This species is often very abundant in the Corsicana marl, Kemp clay, and Arkadelphia marl. Specimens occur less commonly in the lower beds of Navarro age, and there are rare specimens from beds of Taylor age. Specimens in the Upper Cretaceous of Mexico may be referred here also.

D. basiplanata differs from *D. annulata* Reuss in the less tapering test, more limbate sutures, and the peculiarly compressed chambers of the early stages.

Some of the specimens from the Selma chalk that have been referred to *D. megalopolitana* Reuss also belong here, as well as those from the Saratoga chalk referred to under the same name (Cushman, Jour. Paleontology, vol. 5, p. 304, pl. 34, fig. 17, 1931).

Navarro age.
Kemp clay. Texas, Navarro County (3, 4); Williamson County (11); Travis County (13, 14, 17); Guadalupe County (21).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (29–31); Falls County (32); Travis County (34–37, 39, 40); Caldwell County (44); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (86). Alabama, Wilcox County (100).
Nacatoch sand. Arkansas, White County (76).
Saratoga chalk. Arkansas, Clark County (78); Hempstead County (80).
Ripley formation. Tennessee, McNairy County (95); Henderson County (96).
Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Tennessee, McNairy County (98).
Neylandville marl. Texas, Red River County (50); Hunt County (53); Rockwall County (57); Kaufman County (61); Navarro County (63, 69).
Taylor age.
Upper part of Taylor marl. Texas, Delta County (114); Collin County (121); Kaufman County (125, 128); Navarro County (134); Milam County (139); Bexar County (162).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Wolfe City sand member of Taylor marl. Texas, Collin County (181).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Annona chalk. Texas, Bowie County (189).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (258); Prentiss County (261); Union County (262); Lee County (264, 267, 268).
Lower part of Taylor marl. Texas, Delta County (206).

Dentalina confluens Reuss

Plate 24, figures 9–12

Dentalina confluens Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, 1861, p. 335, pl. 7, fig. 5 (1862).
Franke, Preuss. geol. Landesanstalt Abh., new ser. vol. 111, p. 36, pl. 3, fig. 14, 1928.
Cushman, Jour. Paleontology, vol. 5, p. 304, pl. 35, fig. 1, 1931.
Sandidge, idem, vol. 6, p. 273, pl. 42, fig. 9, 1932.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 30, pl. 9, figs. 10–12, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 82, pl. 14, figs. 9–12, 1940.

The above-mentioned references give the records for this species, originally described from Cretaceous greensands of New Jersey. As the types are not available, various forms have been placed under the name. Most of these are slightly tapering, with longitudinal costae somewhat twisted and unbroken at the sutures. The series of specimens assigned to the species in the present material are mostly from beds of Navarro age, and from the upper beds of Taylor age, but they may well represent more than one species. Similar specimens occur in the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. Larger series of specimens are necessary to give the full details of variation.

Navarro age.
Corsicana marl. Texas, Travis County (34).
Prairie Bluff chalk. Mississippi, Chickasaw County (85).
Saratoga chalk. Arkansas, Howard County (79); Hempstead County (81).
Selma chalk (upper part). Alabama, Marengo County (104).
Neylandville marl. Texas, Kaufman County (63).
Taylor marl.
Upper part. Texas, Kaufman County (128).
Lower part. Texas, Delta County (206).

Dentalina solvata Cushman
Plate 24, figures 13–17, 22

Dentalina solvata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 39, pl. 6, figs. 9–14, 1938; idem, vol. 16, p. 83, pl. 14, figs. 13–17, 1940; idem, vol. 20, p. 7, pl. 1, fig. 29, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 333, pl. 51, figs. 12, 13, 1944.

Test elongate, slender, slightly curved, initial end with a short spine; chambers distinct, early chambers slightly overlapping, gradually increasing in size as added and becoming less overlapping until in the adult they are in a loose series, somewhat longer than broad, connected by narrow, stolonlike portions; sutures distinct, strongly limbate, more and more depressed as growth proceeds; wall in the early portion with 8 to 10 longitudinal costae, in the later chambers the main surface smooth, but the costae persisting over the sutures; aperture terminal, radiate. Length up to 3.00 mm., diameter 0.20 to 0.22 mm.

The types are from the Selma chalk in a gully near a public road 3½ miles northwest of Booneville, Miss.

The species occurs at a number of localities in the upper beds of Taylor age and in the lower beds of Navarro age, as well as at scattered localities elsewhere.

The later chambers become much separated from each other, and the connecting stolons are easily broken so that perfect specimens are very rare.

Navarro age. Selma chalk (upper part). Mississippi, Prentiss County (91).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106, 107); Kaufman County (128); Navarro County (134); Leon County (138); Milam County (139); Bexar County (152, 158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Hempstead County.
Annona chalk. Texas, Bowie County (189).
Austin age.
Gober tongue of Austin chalk. Texas, Lamar County (284).

Dentalina crinita Plummer
Plate 24, figures 29, 30

Dentalina crinita Plummer, Texas, Univ. Bull. 3101, p. 154, pl. 11, figs. 12, 13, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 274, pl. 42, fig. 5, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 83, pl. 14, figs. 28, 29, 1940.
Cushman and Todd, idem, vol. 19, p. 57, pl. 10, fig. 8, 1943.

Test very elongate, slender, of nearly uniform diameter throughout; chambers distinct, earliest chambers not inflated, much overlapping, later chambers gradually more inflated and less overlapping, one side in many specimens flattened and the other convex; sutures distinct, slightly limbate, slightly if at all oblique, later sutures depressed; wall in the earliest portion smooth, later with a fine ornamentation consisting mostly of irregular spinose projections arranged more or less in longitudinal lines; aperture terminal. Length up to 3.00 mm., diameter 0.18 to 0.22 mm.

The types are from the Corsicana marl in a pit of the Corsicana Brick Co. about 2 miles south of Corsicana, Navarro County, Tex.

The species evidently has a rather long range for one so highly ornamented. Specimens that have been placed under this specific name were obtained from various units of Navarro age, Arkadelphia marl, Kemp clay, Corsicana marl, Nacatoch sand, Saratoga chalk, and Neylandville marl, and from a number of localities in beds of Taylor age.

The very elongate test is distinctive, but the ornamentation is subject to considerable variation, from nearly smooth to a highly ornamented test.

Navarro age.
Kemp clay. Texas, Navarro County (3, 4); Williamson County (11); Guadalupe County (18).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (30, 31); Travis County (35, 36, 39, 41).
Arkadelphia marl. Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (87).
Nacatoch sand. Arkansas, White County (76).
Saratoga chalk. Arkansas, Hempstead County (81).
Ripley formation. Tennessee, Henderson County (96).
Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92).
Neylandville marl. Texas, Red River County (50); Delta County (51, 52); Hunt County (53, 55); Rockwall County (57); Kaufman County (58, 62?); Navarro County (68?).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105); Lamar County (110); Hunt County (115); Rockwall County (124); Kaufman County (125?); Navarro County (134); Leon County (138); Williamson County (142); Travis County (145); Bexar County (152, 158, 159, 162).
Anacacho limestone (upper part). Texas, Bexar County (164).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (259); Prentiss County (260, 261); Union County (262); Lee County (265).
Annona chalk. Texas, Bowie County (190); Red River County (196, 198).
Lower part of Taylor marl. Texas, Delta County (206); Bell County (245).

Dentalina cf. D. consobrina D'Orbigny
Plate 24, figures 23–27

To this species are referred specimens, most of which are incomplete, showing the earliest chamber with usually a basal spine and succeeding chambers rapidly increasing in length as the test develops. The apertural end is not well preserved in any of our specimens. In some respects they resemble *D. lorneiana* D'Orbigny, but the chambers become much more elongate. Specimens from Tennessee have already been referred to this species (Cushman, Tennessee Div. Geology Bull. 41, p. 30, pl. 3, figs. 13–15, 1931), from Trinidad (Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 29, pl. 9, figs. 6, 7, 1932), from Colombia (Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 89, pl. 21, figs. 30, 31, 1941), from the Corsicana marl (Cushman and Todd, idem, vol. 19, p. 57, 1943), and from Peru (Frizzell, Jour. Paleontology, vol. 17, p. 344, pl. 56, fig. 5, 1943).

Specimens occur in the upper beds of Taylor age and Selma chalk with a few specimens from beds of Navarro age, in the Corsicana marl and Kemp clay. Besides Trinidad it occurs in the Velasco shale of Mexico.

Navarro age.
Kemp clay. Texas, Guadalupe County (18).
Corsicana marl. Texas, Travis County (42).
Ripley formation. Tennessee, McNairy County (94).
Taylor age.
Upper part of Taylor marl. Red River County (106); Milam County (139); Bexar County (160).
Selma chalk (middle part). Tennessee, Hardin County (255).

Dentalina pertinens Cushman
Plate 24, figures 18–21

Dentalina pertinens Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 40, pl. 6, figs. 15–18, 1938; idem, vol. 16, p. 84, pl. 14, figs. 18–21, 1940.

Test rather short, tapering, especially in the microspheric form, which is pointed and very narrow in the early portion; greatest breadth toward the apertural end; chambers of the early portion indistinct and not inflated, later inflated and less overlapping; sutures distinct except in the early portion, slightly limbate, progressively more depressed toward the apertural end; wall ornamented by very fine, numerous longitudinal costae, twisted, particularly so in the earlier portion, running from the initial end to the aperture independent of the sutures; aperture terminal, radiate, excentric, slightly projecting. Length up to 1.00 mm., diameter 0.30 mm.

The types are from the upper part of the Taylor marl on the road to Corsicana 2.6 miles east of Barry, Navarro County, Tex. (132).

This species differs from *D. multicostata* D'Orbigny in the much smaller size, finer costae, and very decided twist to the ornamentation, especially in the early portion. Besides the upper part of the Taylor, it occurs in the Selma chalk of Mississippi in material of early Navarro age.

Navarro age. Selma chalk (upper part). Mississippi, Prentiss County (91).
Taylor marl, upper part. Texas, Navarro County (132).

Dentalina delicatula Cushman
Plate 25, figures 1–6

Dentalina delicatula Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 40, pl. 6, figs. 19, 20, 1938; idem, vol. 16, p. 85, pl. 15, figs. 1–6, 1940.
Cushman and Todd, idem, vol. 19, p. 57, pl. 10, fig. 9, 1943.

Test elongate, slender, gently curved, initial end with a distinct spine, very slightly tapering; chambers distinct, earlier chambers not inflated, somewhat overlapping, increasing very slightly in height as added until, in the adult, becoming more remote and strongly inflated, somewhat pyriform; sutures distinct, limbate, later sutures somewhat depressed; wall ornamented with numerous (15 to 20) rather high, platelike, longitudinal costae, somewhat less raised and more delicate on the final chambers, independent of the sutures; aperture terminal, radiate, with a tapering neck. Length up to 1.60 mm., diameter 0.20 mm.

The types are from the Corsicana marl 35 feet above the base of a bluff on Onion Creek 2½ miles west of old Garfield, Travis County, Tex.

In some respects this species resembles *D. alternata* (Jones) Plummer, but it is a more delicate, thinner-walled form, with a larger number of costae. It seems to be characteristic of the Corsicana marl.

Navarro age.
Kemp clay. Texas, Williamson County (11).
Corsicana marl. Texas, Navarro County (26, 27); Limestone County (30, 31); Travis County (35, 36, 40); Caldwell County (44).

Dentalina angusticostata Cushman
Plate 24, figures 7, 8

Dentalina angusticostata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 41, pl. 6, figs. 21, 22, 1938; idem, vol. 16, p. 85, pl. 14, figs. 7, 8, 1940.
Cushman and Todd, idem, vol. 19, p. 57, pl. 10, fig. 10, 1943.

Test elongate, slender, slightly curved, very gradually tapering; chambers distinct, somewhat inflated, somewhat fusiform, longer than broad, only slightly overlapping, increasing very gradually in size as added; sutures distinct, depressed, somewhat limbate; wall ornamented with very numerous longitudinal costae that continue across the sutures to the apertural end; aperture radiate, the apertural chamberlet somewhat projecting. Length up to 3.00 mm. or more, diameter up to 0.30 mm.

The types are from Corsicana marl of the Navarro group, Mexia highway at the forks of Wortham road 2.8 miles east-southeast of Cooledge, Limestone County, Tex.

This species differs from *D. multicostata* D'Orbigny in the more slender test, more fusiform chambers, and very abundant and narrow costae.

Navarro age. Corsicana marl. Texas, Limestone County (29, 30); Travis County (36).

Dentalina sp.
Plate 25, figure 7

Dentalina catenula Cushman and Jarvis (not Reuss), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 29, pl. 9, figs. 8a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 86, pl. 15, fig. 7, 1940.

A figure is given of a peculiar dentaline form with a narrow elongate aperture at one side of the final chamber and the base with a distinct spine.

It is from the Upper Cretaceous of Trinidad. A somewhat similar form occurs in the Velasco shale of Mexico.

Genus NODOSARIA Lamarck, 1812
Nodosaria affinis Reuss
Plate 25, figures 8–23

Nodosaria affinis Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 26, pl. XIII, fig. 16, 1845; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 83, pl. II (20), fig. 12 (1874).
Perner, Foram. Ceskeho Cenomanu, p. 57, pl. 6, figs. 10, 14a, b, 1892.
Franke, Greifswald Univ., Geol.-palaeont. 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. 86, pl. 15, figs. 8–23, 1940.
Cushman and Todd, idem, vol. 19, p. 57, pl. 10, fig. 11, 1943.
Cushman, idem, vol. 20, p. 7, pl. 2, fig. 1, 1944; idem, vol. 20, p. 87, pl. 13, fig. 18, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 333, pl. 51, figs. 19–21, 1944.
Nodosaria proxima W. Berry and Kelley (not Silvestri), U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 7, pl. 1, fig. 13, 1929.

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 platelike; 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 was described from the Cretaceous of Bohemia. An examination of specimens named by Reuss in the collection at Dresden shows that the American material is to be included in his species. Specimens show great variation, from microspheric specimens with very slender early stages increasing gradually to the largest chamber at the apertural end, to megalospheric forms with very large proloculum and only 2 or 3 succeeding chambers that become rapidly much smaller. The microspheric form is often somewhat curved. The species apparently ranges throughout the Upper Cretaceous above the Eagle Ford shale.

Navarro age.
- Kemp Clay. Texas, Navarro County (3); Williamson County (11); Travis County (13); Guadalupe County (18, 21).
- Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (29–31); Travis County (34–36, 39–41); Caldwell County (44); Bexar County (46).
- Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
- Prairie Bluff chalk. Mississippi, Chickasaw County (85–87). Alabama, Wilcox County (99); Sumter County (102).
- Saratoga chalk. Arkansas, Clark County (78); Howard County (79); Hempstead County (80–82).
- Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
- Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Tennessee, McNairy County (98).
- Neylandville marl. Texas, Delta County (51, 52); Hunt County (54); Rockwall County (57); Kaufman County (58, 60–62); Navarro County (63, 64, 67, 68).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (107, 109); Lamar County (110); Hunt County (115); Collin County (121, 122); Rockwall County (124); Kaufman County (125, 127–129, 131); Navarro County (134); Limestone County (136); Leon County (138); Milam County (139); Williamson County (142); Travis County (145); Guadalupe County (151); Bexar County (152, 155, 158).
- Anacacho limestone (upper part). Texas, Bexar County (164).
- Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
- Ozan formation. Arkansas, Sevier County (253); Little River County (254).
- Pecan Gap chalk member of Taylor marl. Texas, Rockwall County (175); McLennan County (177); Delta County (165, 166).
- Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
- Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (257–259); Prentiss County (260, 261); Union County (262); Lee County (264–268).
- Wolfe City sand member of Taylor marl. Texas, Collin County (180–182); Hunt County (186); Navarro County (188).
- Annona chalk. Texas, Bowie County (189, 190); Red River County (192, 193, 196, 198).
- Lower part of Taylor marl. Texas, Delta County (206); Collin County (207, 209); Dallas County (223); Ellis County (234); McLennan County (239, 243); Bell County (245); Travis County (247, 249).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269).
- Gober tongue of Austin chalk. Texas, Fannin County (275, 277, 278, 280); Lamar County (288).
- Austin chalk. Texas, Grayson County (290, 291); Collin County (292, 293, 295, 324); Dallas County (296, 300–303, 305–308, 311, 326); Hill County (313, 314); Bell County (316).
- Brownstown marl. Texas, Lamar County (320). Arkansas, Sevier County (347).
- Selma chalk (lower part). Mississippi, Lee County (350).
- Lower part of Austin chalk. Texas, Collin County (337); Dallas County (339).

Nodosaria distans Reuss
Plate 26, figures 1, 2

Nodosaria distans Reuss, Deutsche geol. Gessell, Zeitschr., vol. 7, p. 264, pl. 8, fig. 5, 1855.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 87, pl. 15, figs. 24, 25, 1940.
Frizzell, Jour. Paleontology, vol. 17, p. 345, pl. 56, fig. 14, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 87, pl. 13, figs. 19–21, 1944.

A fragmentary specimen from the Cretaceous of Germany is figured by Reuss under this name. It represents the adult portion, with chambers somewhat separated by stolonlike connections. The surface is ornamented by longitudinal costae, not interrupted at the sutures, and the chambers are polygonal in transverse section.

Similar specimens are present in American material, particularly that from the upper portion of the Austin chalk and the lower part of the Taylor marl; and are recorded from the Cretaceous of Peru.

Taylor marl, lower part. Texas, McLennan County (241); Falls County (244).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270).
- Gober tongue of Austin chalk. Texas, Fannin County (277, 280).
- Austin chalk. Texas, Dallas County (297, 342).
- Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Nodosaria alternistriata Morrow
Plate 26, figures 3, 4

Nodosaria alternistriata Morrow, Jour. Paleontology, vol. 8, p. 190, pl. 29, figs. 1a, b, 1934.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 88, pl. 15, figs. 26, 27, 1940; idem, vol. 20, p. 87, 1944.

Test elongate, tapering, initial end bluntly pointed; chambers few, slightly inflated, rather irregular in size; sutures slightly depressed, tending to be obscured by the surface ornamentation; wall ornamented by numerous weak, parallel, longitudinal costae which extend the full length of the test or are broken partially at the sutures; costae alternate stronger and weaker; aperture radiate, terminal. Length of holotype 0.75 mm.; diameter 0.15 mm.

The type is from the Upper Cretaceous, basal Niobrara, SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. It has been redrawn in our plate.

In some respects this species closely resembles *N. fusula* Reuss and may possibly be identical.

Austin age?
- Selma chalk (lower part). Mississippi, Lee County (350).

Nodosaria fusula Reuss
Plate 26, figure 5

Nodosaria fusula Reuss, Palaeontographica, vol. 20, pt. 2, 1872–75, p. 82, pl. II(20), fig. 9 (1874).
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 49, pl. 4, fig. 3, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 88, pl. 16, fig. 1, 1940; idem, vol. 20, p. 87, pl. 13, fig. 15, 1944.

The figures of this species show a form somewhat similar to *N. amphioxys* Reuss but with a larger number of costae and the chambers slightly more cylindical. Specimens referable to this species occur rarely at a number of localities in the lower beds of Taylor age and in beds of Austin age. *N. fusula* and *N. amphioxys* were found together in Reuss's material, but the two forms as distinguished here seem to have distinct ranges.

Taylor age.
Ozan formation. Arkansas, Little River County (254).
Selma chalk (middle part). Mississippi, Lee County (268).
Annona chalk. Texas, Red River County (192).
Lower part of Taylor marl. Texas, Collin County (211); Dallas County (222); McLennan County (238).
Austin age.
Austin chalk. Texas, Grayson County (289); Collin County (294); Dallas County (310); Hill County (312, 313).
Brownstown marl. Texas, Lamar County (321). Arkansas, Sevier County (347).
Lower part of Austin chalk. Texas, Grayson County (335).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Nodosaria aspera Reuss
Plate 26, figure 6

Nodosaria aspera Reuss, Verstein. böhm, Kreideformation, pt. 1, p. 26, pl. 13, figs. 14, 15, 1845; (in Geinitz), Grundriss der Verstein., p. 653, pl. 24, fig. 4, 1845–46.
Egger, K. bayer. Akad. Wiss., Math. naturh. Abt., Abh., Kl. 2, vol. 21, p. 80, pl. 8, fig. 15, 1899.
Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 267 (1913); Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 50, pl. 4, fig. 14, 1928.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol., 80, art. 14, p. 35, pl. 11, fig. 5, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 88, pl. 16, fig. 2, 1940; idem, vol. 20, p. 7, pl. 1, fig. 19, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 333, pl. 51, fig. 16, 1944.

Test elongate, somewhat tapering, with the greatest breadth near apertural end; chambers fairly distinct, subglobular, increasing rather uniformly in size as added, somewhat overlapping; sutures distinct, but only slightly depressed; wall ornamented with small, closely set spines covering the entire surface; aperture with a slender, elongate, cylindrical neck projecting well beyond the outline of the final chamber. Length up to 1.60 mm., diameter 0.50 to 0.55 mm.

The types of this species are from the Cretaceous of Bohemia, and it has been recorded several times from central Europe. In the present material, except for the record from Trinidad, it has occurred rarely at localities in beds of Taylor age, a range in general accord with that in the European Cretaceous.

Upper Cretaceous. Boulders in conglomerate on "Bon Accord" estate, ¼ mile from Pointe-à-Pierre Railroad Station, San Fernando, Trinidad.
Taylor age.
Upper part of Taylor marl. Texas, Hunt County (116).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (169); Delta County (166).
Wolfe City sand member of Taylor marl. Texas, Collin County (181).
Marlbrook marl. Arkansas, Clark County.
Annona chalk. Texas, Red River County (192, 198).
Lower part of Taylor marl. Texas, Dallas County (224); Bell County (245).

Nodosaria naumanni Reuss
Plate 26, figure 11

Nodosaria naumanni Reuss, Palaeontographica, vol. 20, pt. 2, 1872–75, p. 82, pl. II(20), fig. 11 (1874).
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 40, pl. 3, fig. 31, 1925; Preuss. geol. Landesanstalt Abh., n. ser., vol. 111, p. 42, pl. 3, fig. 29, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 89, pl. 16, fig. 7, 1940.

A very few specimens from the Taylor marl are assigned to this species. They are straight, tapering, composed of few chambers, which are slightly inflated, somewhat overlapping and increase in length as added. Our figured specimen closely resembles the figures given of European specimens of this species.

Taylor marl.
Upper part. Texas, Bexar County (152).
Lower part. Texas, Collin County (208); Ellis County (234).

Nodosaria gracilitatis Cushman
Plate 26, figures 7–10

Nodosaria gracilitatis Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 41, pl. 6, figs. 23–26, 1938; idem, vol. 16, p. 89, pl. 16, figs. 3–6, 1940.

Test very elongate, slender, of nearly equal diameter throughout; initial end with a short spine into which the basal costae fuse; chambers distinct, elongate, cylindrical or slightly fusiform, not inflated; sutures limbate, not depressed; wall translucent, ornamented with 6 to 12 longitudinal costae, slightly raised, thin, highest at the base of the proloculum, where they fuse into the initial spine; aperture radiate, at the end of a conical projection of the last-formed chamber. Length up to 4.00 mm. or more, diameter 0.20 mm.

The types are from the lower part of the Taylor marl on the east bank of a road cut, near the crest of a hill 14.4 miles south of Paris and 0.9 mile north of Lake City, Delta County, Tex. (206).

This is a peculiar species, rather common at this locality, but as specimens are very slender, they are easily broken. It differs from *N. filiformis* Reuss in the much more elongate chambers, nondepressed sutures, the ornamentation covering the entire test, and the very elongate proloculum.

Nodosaria proboscidea Reuss
Plate 26, figures 12, 13

Nodosaria proboscidea Reuss, Haidinger's Naturwiss. Abh., vol. 4, pt. 1, p. 7, pl. 1, fig. 6, 1851.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 89, pl. 16, figs. 8, 9, 1940; idem, vol. 20, p. 8, pl. 2, fig. 3, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 334, pl. 51, fig. 25, 1944.

Reuss gave this name to a form found in the Cretaceous of Lemberg. It is a short form, with a few strongly overlapping chambers, the apertural end drawn out into a long slender neck, and the surface ornamented by longitudinal costae running the length of the test, uninterrupted at the sutures.

Such forms occur in the present material from the upper part of the Taylor marl but are rare. The stratigraphic position in both regions is very similar.

Taylor age.
Upper part of Taylor marl. Texas, Bexar County (161).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Clark County.
Selma chalk (middle part). Mississippi, Prentiss County (260).

Nodosaria amphioxys Reuss
Plate 26, figure 14

Nodosaria amphioxys Reuss, Palaeontographica, vol. 20, pt. 2, 1872–75, p. 82, pl. II(20), fig. 8 (1874).
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 76, pl. 8, fig. 9, 1899.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 42, pl. 3, fig. 39, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 48, pl. 4, fig. 2, 1928.
Storm, Lotos, vol. 77, p. 46, pl., fig. 6, 1929.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 90, pl. 16, fig. 10, 1940.

Reuss and subsequent authors have figured under this name a slender species with acute or spinose initial end, regularly tapering, with the greatest breadth at the last-formed chamber, increasing regularly but rather rapidly in size as chambers are added; sutures only slightly depressed; wall ornamented by a few longitudinal costae running across the sutures. Our specimens are all rather small and thin walled. They occur rarely in the upper beds of Taylor age and in beds of Navarro age. This species may be somewhat difficult to distinguish from *N. obscura* Reuss.

Navarro age.
Kemp clay. Texas, Navarro County (3).
Neylandville marl. Texas, Navarro County (66).
Taylor age.
Upper part of Taylor marl. Texas, Rockwall County (124); Travis County (149); Bexar County (159).
Selma chalk (middle part). Mississippi, Prentiss County (261).

Nodosaria obscura Reuss
Plate 26, figures 15, 16

Nodosaria obscura Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 26, pl. 13, figs. 7–9, 1845; (in Geinitz), Grundriss der Verstein., p. 653, pl. 24, fig. 3, 1845–46; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 81, pl. 2(20), figs. 1–4 (1874).
Heron-Allen and Earland, Royal Micr. Soc. Jour., p. 418, pl. 7, fig. 7, 1910.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 43, pl. 3, fig. 40, 1925.
Storm, Lotos, vol. 77, p. 47, pl., figs. 1–5, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 32, pl. 4, figs. 3, 4, 1931.
Brotzen, Sveriges geol. undersökning, ser. C, No. 396, p. 84, pl. 5, figs. 24, 25, text figs. 26, 27, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 90, pl. 16, figs. 11, 12, 1940; idem, vol. 20, p. 7, pl. 2, fig. 2, 1944; idem, vol. 20, p. 87, pl. 13, figs. 16, 17, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 334, pl. 51, figs. 22–24, 1944.

Test somewhat fusiform, of variable length, broadest toward the apertural end, the initial end usually pointed, sometimes with a definite spine; chambers often obscured by the ornamentation of the test, not inflated; sutures often indistinct, not depressed; wall ornamented by 10 to 15 distinct longitudinal costae continuous over the whole test, coalescing at the apertural end, which in many specimens has a distinct, collarlike thickening about the aperture; aperture terminal and obscurely radiate. Length up to 1.00 mm., diameter 0.25 to 0.30 mm.

This species was originally described from the Cretaceous of Bohemia, and specimens selected by Reuss have been studied. The species occurs in America in the Upper Cretaceous, particularly in the upper beds of Taylor age as well as in the lower beds of Navarro age.

Navarro age.
?Arkadelphia marl. Arkansas, Hempstead County (73).
Ripley formation. Tennessee, Henderson County (96).
Selma chalk (upper part). Alabama, Marengo County (104).
Taylor age.
Upper part of Taylor marl. Texas, Travis County (145).
Anacacho limestone (upper part). Texas, Bexar County (164).
Annona chalk. Texas, Red River County (198).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Austin age. Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Nodosaria navarroana Cushman
Plate 26, figures 23, 24

Nodosaria navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 103, pl. 15, fig. 11, 1937; idem, vol. 16, p. 91, pl. 16, figs. 16, 17, 1940.
Cushman and Todd, idem, vol. 19, p. 57, pl. 10, figs. 12a, b, 1943.

Test small, elongate, of about equal diameter throughout except at the rapidly tapering initial end; chambers distinct, rapidly increasing in size and height in the early stages, especially in the microspheric form; very slightly inflated in the adult, not inflated in the earlier stages; sutures distinct, slightly limbate; wall ornamented by 4 longitudinal costae running uninterruptedly from the initial end to the aperture, which is terminal and radiate. Length 0.50 to 0.60 mm., diameter 0.08 to 0.10 mm.

The types are from the Navarro group, Corsicana marl, pit of Corsicana Brick Co., 2 miles south of the courthouse at Corsicana, Tex.

This species differs from *Nodosaria affinis* Reuss in the very much smaller size and the number of costae, typically 4 instead of many. The species seems to be characteristic of this horizon.

Navarro age.
Corsicana marl. Texas, Navarro County (25–27); Limestone County (30); Falls County (32); Travis County (36).
Prairie Bluff chalk. Mississippi, Chickasaw County (85).

Nodosaria corsicanana Cushman
Plate 26, figures 19–22

Nodosaria corsicanana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 42, pl. 7, figs. 1–4, 1938; idem, vol. 16, p. 91, pl. 16, figs. 13–15, 1940.
Cushman and Todd, idem, vol. 19, p. 58, pl. 10, fig. 13, 1943.

Test elongate, tapering slightly, if at all, initial end pointed with a distinct spine; chambers few, usually 2 to 5, slightly inflated, increasing but little in length or size as added, fusiform, only slightly overlapping; sutures distinct, slightly depressed, limbate; wall ornamented by a few (10 to 14) longitudinal costae, only slightly raised and narrow, slightly twisted, not interrupted at the sutures; aperture radiate, terminal. Length up to 3.00 mm., diameter 0.25 to 0.35 mm.

The types are from the Corsicana marl in a road ditch 3.5 miles northwest of Union Seminary School and 4.3 miles south-southeast of Corbet, Navarro County, Tex.

This is a characteristic species of the Corsicana marl. It somewhat resembles *N. sceptriformis* Olszewski, but the chambers are more elongate, and the costae more delicate and are twisted.

Navarro group, Corsicana marl. Texas, Navarro County (25, 27); Limestone County (30); Guadalupe County (45).

Nodosaria velascoensis Cushman
Plate 26, figures 27–30

Nodosaria fontannesi Berthelin, var. *velascoensis* Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 504, pl. 18, fig. 12, 1926.
Nodosaria velascoensis Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 97, pl. 13, figs. 15, 16, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 35, pl. 11, figs. 1–4, 1932.
Cushman and Campbell, Cushman Lab. Foram. Research Contr., vol. 11, p. 72, pl. 11, fig. 3, 1935.
Cushman, idem, vol. 16, p. 92, pl. 16, figs. 20–22, 1940.

Test elongate, subcylindrical, very slightly tapering, greatest width developed by the last-formed chamber; consisting of numerous chambers increasing in height as added, the last chambers somewhat longer than broad, circular in transverse section; sutures only slightly depressed, ornamentation consisting of very fine longitudinal costae that in the early portion may be continuous but, over most of the test, are restricted to the areas over the sutures. Length up to 2.50 mm., breadth 0.30 to 0.40 mm.

This form was originally described from the Velasco shale of Mexico, where it is fairly common. It is also common in the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, and shows a considerable degree of variation, especially in the ornamentation of the test. The costae are usually somewhat spirally arranged, especially in the early portion, and in later chambers are often restricted to the area immedately adjoining the sutures.

Nodosaria limonensis Cushman

Plate 26, figures 25, 26

Nodosaria limonensis Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 1, p. 21, pl. 3, figs. 4a, b, 1925; Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 596, pl. 18, figs. 7 (?), 13, 1926; Cushman Lab. Foram. Research Contr., vol. 16, p. 92, pl. 16, figs. 18, 19, 1940.

Test elongate, subconical, widest near the base, circular in transverse section; chambers indistinct on the surface; sutures indistinct; wall ornamented by a series of 8 broad, prominent, longitudinal costae, which toward the base bifurcate; between these, above the early portion, are very thin, delicate, longitudinal costae alternating with the thick costae; aperture somewhat projecting, radiate. Length of the evidently incomplete type specimen 0.85 mm., breadth at base 0.25 mm.

The types are from the Velasco shale in Tamalte Arroyo, Hacienda el Limon, State of San Luis Potosi, Mexico.

No complete specimens have been found, but fragmentary specimens occur at various localities in the Velasco shale of Mexico. Two specimens from the Pecan Gap chalk member of the Taylor marl 3.2 miles southwest of Mart, McLennan County, Tex. (177), seem identical.

Nodosaria limbata D'Orbigny

Plate 27, figures 1, 2

Nodosaria limbata D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 12, pl. 1, fig. 1, 1840.

Brown, Annals and Mag. Nat. History, 2d. ser., vol. 12, p. 240, pl. 9, fig. 1, 1853.

Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 595, pl. 18, fig. 14, 1926.

Franke, Preuss, geol. Landesanstalt Abh., new ser., vol. 111, p. 42, pl. 3, figs. 27, 28, 1928.

Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 32, pl. 10, fig. 5, 1932.

Macfadyen, *Discovery* Repts., vol. 7, p. 7, text fig. E, 1933.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 93, pl. 16, figs. 23, 24, 1940.

Nodosaria concinna Cushman and Jarvis (not Reuss), Cushman Lab. Foram. Research Contr., vol. 4, p. 97, pl. 14, figs. 5, 11, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 31, pl. 10, fig. 4, 1932.

Test cylindrical or very slightly tapering, initial end with or without a spine; chambers distinct, few, inflated, only slightly overlapping, somewhat pyriform, the apertural end drawn out to a point; sutures distinctly limbate, depressed; wall smooth; aperture radiate, terminal. Length 1.00 mm. or more, diameter 0.35 to 0.45 mm.

This species was described by D'Orbigny from the Upper Cretaceous White chalk of the Paris Basin at Meudon. The writer collected at Meudon but failed to find the species, which D'Orbigny records as very rare. Material from the Upper Cretaceous of Trinidad and Mexico contains specimens that seem to belong to D'Orbigny's species. They show some variation as to size but in other respects are fairly constant in their characters. It was not found in the Texas region.

The forms referred to *N. concinna* Reuss, after a study of European material, seem best placed in *N. limbata*.

Nodosaria limbata D'Orbigny var. basiornata Cushman and Jarvis

Plate 27, figures 3, 4

Nodosaria limbata D'Orbigny var. *basiornata* Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 32, pl. 10, figs. 7, 8, 1932.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 93, pl. 16, figs. 25, 26, 1940.

Variety differing from the typical form in the ornamentation of the surface, which consists of numerous subnodose projections on the smaller part of each chamber.

The only records for this ornate variety are from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Nodosaria limbata D'Orbigny var. tumidata Cushman and Jarvis

Plate 27, figure 5

Nodosaria limbata D'Orbigny var. *tumidata* Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 32, pl. 10, figs. 6a, b, 1932.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 94, pl. 16, fig. 27, 1940.

Variety differing from the typical form in the shape of the chambers, which are somewhat conical, the greatest breadth being nearly at the base of the basal portion, which is very strongly truncated.

The types are from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. Similar forms occur also in the Velasco shale of Mexico.

Nodosaria brevitesta Franke

Plate 27, figure 6

Nodosaria brevitesta Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 42, pl. 3, fig. 37, 1925.

Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 97, pl. 13, fig. 10, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 35, pl. 10, fig. 11, 1932.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 94, pl. 16, fig. 28, 1940.

Specimens from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, have been referred to this species. They also somewhat resemble *N. clausa* Marsson. Specimens are rare, and the specimen figured is probably not an adult.

Nodosaria cf. N. marcki Reuss

Plate 27, figure 7

Nodosaria cf. *N. marcki* Reuss, Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 97, pl. 14, fig. 4, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 34, pl. 10, fig. 12, 1932.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 94, pl. 16, fig. 29, 1940.

In the above references material from the Upper Cretaceous pit at Lizard Springs, southeastern Trinidad, has been referred to Reuss' species. It is very similar to material so identified and figured by Franke (Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, pl. 3, figs. 22a, b, 1925). Similar specimens occur in the Velasco shale of Mexico.

Nodosaria orthopleura Reuss

Plate 27, figure 8

Nodosaria orthopleura Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 46, pt. 1, 1862, p. 89, pl. 12, figs. 5a, b (1863).

Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 33, pl. 10, fig. 10, 1932.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 95, pl. 16, fig. 30, 1940.

Test very elongate, slightly tapering at each end, for most of its length with the sides parallel or nearly so; chambers numerous, not inflated; sutures fairly distinct, slightly limbate; wall ornamented by a few distinct elevated costae running from the base to the apertural end; aperture terminal, radiate.

The figured specimen is from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. This is a fragmentary specimen, but when entire it probably measured 8 to 10 millimeters in length. Somewhat similar specimens, more definitely quadrangular in section than those from Trinidad, occur in the Velasco shale of Mexico.

Nodosaria monile Hagenow
Plate 27, figure 9

Nodosaria monile Hagenow, Neues Jahrb., 1842, p. 568.
Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 27, pl. 8, fig. 7, 1845.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 31, pl. 2, figs. 27a, b, 1928.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 33, pl. 10, fig. 9, 1932.
Cushman and Campbell, Cushman Lab. Foram. Research Contr., vol. 11, p. 71, pl. 10, fig. 5, 1935.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 96, pl. 16, fig. 31, 1940.

Test elongate, very slightly tapering; chambers very distinct, inflated, subglobular throughout; sutures distinct, depressed especially toward the later-formed portion; wall smooth; aperture terminal, radiate, not projecting. Length 1.50 mm., diameter 0.25 mm.

This species is very close to that recorded as *Nodosaria nuda* (Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 510, pl. 39, figs. 4–6, 1929). In that species, however, the chambers become elongate in the adult whereas in *N. monile* the chambers are subglobular throughout and show little tendency to lengthen. Specimens from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, are very close indeed to those figured by Franke from Germany. Specimens identical with these occur in the Velasco shale of Mexico.

Nodosaria paupercula Reuss
Plate 27, figures 10–12

Nodosaria paupercula Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 26, pl. 12, fig. 12, 1845.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 33, pl. 10, figs. 14, 15, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 96, pl. 16, figs. 32–34, 1940.
Cushman and Hedberg, idem, vol. 17, p. 89, pl. 21, figs. 32, 33, 1941.

The specimens figured are from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. They rather closely resemble the figures given by Reuss but may not be identical. Not enough material is available to give the full characters of the species. Fragmentary specimens have also been recorded from Colombia.

Genus CHRYSALOGONIUM Schubert, 1907

Chrysalogonium texanum Cushman
Plate 27, figures 14, 15

Chrysalogonium texanum Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 55, pl. 9, figs. 24, 25, 1936.

Test very elongate, slender, very slightly tapering, slightly arcuate, initial end with a distinct spine; chambers distinct, somewhat inflated, increasing in length as added, in the adult at least 3 times as long as broad; sutures distinct, slightly limbate, slightly depressed; wall smooth; aperture in the adult a sieve plate, slightly raised into a small terminal projection. Length 2.00 mm.; diameter 0.15 mm.

The types are from the lower part of the Taylor marl on Cooper road 6 miles south of Paris, Tex.

The species occurs most commonly in the lower beds of Taylor age and in the upper beds of Austin age.

Taylor age.
Upper part of Taylor marl. Texas, Navarro County (132); Williamson County (142).
Annona chalk. Texas, Red River County (198).
Lower part of Taylor marl. Texas, Lamar County (200); Collin County (209, 210); Dallas County (219, 224); McLennan County (239).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (280); Lamar County (285).
Austin chalk. Texas, Dallas County (310).

Chrysalogonium eximium Cushman
Plate 27, figures 16–19

Chrysalogonium eximium Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 42, pl. 7, figs. 5–8, 1938.

Test elongate, slender, slightly curved, initial end with a spine, very slightly tapering; chambers very slightly inflated in the adult portion, slightly fusiform, very slightly overlapping, increasing greatly in length in the adult but little in diameter; sutures slightly depressed, limbate; wall ornamented by 18 to 24 fine longitudinal costae, in some adults stronger over the sutures; aperture terminal, consisting of a sieve plate with numerous small openings. Length up to 4.00 mm., diameter 0.20 mm.

The types are from Pecan Gap chalk member of the Taylor marl on a secondary road to Otto at a crossing of "Big Creek" 3.2 miles southwest of Mart, McLennan County, Tex. (177).

This species differs from *C. texanum* Cushman particularly in the ornamentation of the wall and the somewhat more slender and slightly less inflated chambers.

Navarro age. Selma chalk (upper part). Mississippi, Union County (92).
Taylor marl. Pecan Gap chalk member. Texas, McLennan County (177).

Chrysalogonium cretaceum Cushman and Church
Plate 27, figure 13

Chrysalogonium cretaceum Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 513, pl. 39, figs. 23, 24, 1929.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 21, figs. 15a, b, 1933.
Dentalina lorneiana Cushman and Jarvis (not D'Orbigny), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 31, pl. 10, fig. 2, 1932.

Test elongate, slender, very slightly and evenly tapering, with the greatest width at the last-formed chamber, initial end rounded; chambers distinct, slightly overlapping, increasing rather regularly in length as added, very slightly inflated; sutures distinct, slightly depressed; wall smooth, matte; aperture consisting of numerous fine pores in a cone-shaped form, terminal. Length up to 1.60 mm., diameter 0.20 mm.

The holotype is from the Upper Cretaceous of California. The species also occurs in the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

From the known occurrence of the species in these two regions, it should also be looked for in the Upper Cretaceous of the Tampico region of Mexico in the Velasco shale.

Genus PSEUDOGLANDULINA Cushman, 1929

Pseudoglandulina manifesta (Reuss) Cushman

Plate 27, figures 20–26

Glandulina manifesta Reuss, Haidinger's naturwiss. Abh., vol. 4, pt. 1, p. 22, pl. 1, fig. 4, 1851.
Franke, Preuss. geol. Landesanstalt Abh., new 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.
Sandidge, Jour. Paleontology, vol. 6, p. 278, pl. 42, fig. 8, 1932.
Nodosaria larva Carsey, Texas Univ. Bull. 2612, p. 31, pl. 2, fig. 2, 1926.
Nodosaria humilis Cushman (not Roemer), Tennessee Div. Geology Bull. 41, p. 32, pl. 4, fig. 5, 1931.
Pseudoglandulina manifesta Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 58, pl. 10, fig. 15, 1943.

The types of this species are from the Upper Cretaceous of Lemberg. The type figure evidently represents the microspheric form of the species, which has a pointed initial end, often with a small spine, and the whole test rapidly tapering. Such forms are comparatively rare, but with them is usually the megalospheric form, which has a large proloculum with a rounded base and the test much more nearly cylindrical. In the early stages the chambers are much overlapping and there is little or no inflation of the chambers, but in the adult they are much inflated, with deeper sutures. The wall is smooth and polished and the aperture terminal and radiate.

Such forms are widely distributed in the American Cretaceous, particularly in beds of Navarro and Taylor ages and are much less common in the upper beds of Austin age. It is probable that the forms assigned by Reuss to *Glandulina elongata* and *G. mutabilis* are with *G. manifesta* all one series. Some of the variations are shown in the illustrations.

Navarro age.
Kemp clay. Texas, Navarro County (3); Williamson County (11, 12); Travis County (17); Guadalupe County (20).
Corsicana marl. Texas, Hunt County (24); Navarro County (27); Limestone County (29, 30); Falls County (32); Travis County (35–38, 41, 43); Caldwell County (44); Guadalupe County (45).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (87). Alabama, Wilcox County (99); Sumter County (102).
Saratoga chalk. Arkansas, Hempstead County (81).
Ripley formation. Tennessee, Henderson County (96).
Neylandville marl. Texas, Red River County (50); Navarro County (66–68).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 107); Lamar County (110, 112); Delta County (114); Hunt County (115); Collin County (121, 122); Kaufman County (129, 130); Navarro County (134); Leon County (138); Travis County (149); Bexar County (152, 154, 161).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168).
Annona chalk. Texas, Red River County (196).
Lower part of Taylor marl. Texas, Delta County (206).
Austin age.
Gober tongue of Austin. Texas, Lamar County (284).
Austin chalk. Texas, Hays County (317).
?Selma chalk of upper Austin age. Alabama, Warrior River (353).

Pseudoglandulina pygmaea (Reuss) Cushman

Plate 27, figures 27, 28

Glandulina pygmaea Reuss, Haidinger's Naturwiss. Abh., vol. 4, pt. 1, p. 6, pl. 1, fig. 3, 1851.

Reuss described and figured a fusiform species from the Cretaceous of Lemberg in which the chambers overlap so greatly that the last-formed chamber makes up almost the entire surface of the test.

Such forms in the American material occur at scattered stations in beds of Navarro and Taylor ages.

Navarro age.
Owl Creek formation. Mississippi, Tippah County (83).
Arkadelphia marl. Arkansas, Hempstead County (73).
Selma chalk (upper part). Alabama, Marengo County (104).
Neylandville marl. Texas, Kaufman County (61).
Taylor age.
Upper part of Taylor marl. Texas, Hays County (150); Bexar County (159).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Annona chalk. Texas, Bowie County (189).
Lower part of Taylor marl. Texas, Bell County (245).

Pseudoglandulina lagenoides (Olszewski) Cushman and Hedberg

Plate 27, figure 29

Glandulina lagenoides Olszewski, Sprawozd. Kom. Fizyj. Akad. Umiej., Krakowie, vol. 9, p. 107, pl. 1, fig. 6, 1875.
Pseudoglandulina sp. Plummer, Texas Univ. Bull. 3101, p. 158, pl. 10, figs. 16. 17, 1931.
Pseudoglandulina lagenoides Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 89, pl. 21, fig. 34, 1941.
Cushman and Todd, idem, vol. 19, p. 58, pl. 10, fig. 14, 1943.
Cushman, idem, vol. 20, p. 8, pl. 2, fig. 4, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 334, pl. 51, figs. 14, 15, 1944.

In this species the chambers are not inflated and the periphery is entire. The whole test is very small and in many specimens has a spine at the base. It tapers rapidly from the middle toward the initial end and toward the apertural end, giving a fusiform shape to the whole test.

Specimens seem to be confined to beds of Navarro age and the upper beds of Taylor age.

Navarro age.
Corsicana marl. Texas, Limestone County (30); Travis County (34, 40).
Selma chalk (upper part). Mississippi, Union County (92).
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (107); Travis County (145, 149).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Howard County.
Selma chalk (middle part). Mississippi, Alcorn County (259); Lee County (264, 266).

Pseudoglandulina bistegia (Olszewski) Cushman and Jarvis

Plate 27, figures 30–32

Cristellaria bistegia Olszewski, Sprawozd. Kom. Fizyj. Akad. Umiej., Krakowie, vol. 9, p. 115, pl. 1, fig. g(error for 9), 1875.
Pseudoglandulina bistegia Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 37, pl. 11, figs. 10–12, 1932.

The specimens figured are from the Upper Cretaceous of Trinidad. They resemble the type figure, but the apertural characters are not well preserved in any of them. In some specimens the proloculum is much roughened and the second chamber smooth.

From 720 feet in well at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Pseudoglandulina cylindracea (Reuss) Cushman and Jarvis

Plate 27, figures 33, 34

Nodosaria cylindracea Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 25, pl. 13, figs. 1, 2, 1845.

Glandulina cylindracea Reuss, Haidinger's Naturwiss. Abh., vol. 4, pt. 1, p. 23, pl. 1, fig. 5, 1851; Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 190, pl. 4, fig. 1, 1860; idem, vol. 44, pt. 1, 1861, p. 307 (1862); Palaeontographica, vol. 20, pt. 2, 1872–75, p. 89 (1874).
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 84, pl. 5, figs. 19, 20, 1899.
Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 511, pl. 39, figs. 8, 9, 1929.
Nodosaria (Glandulina) cylindracea Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 594, pl. 18, fig. 1, 1926.
Pseudoglandulina cylindracea Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 36, pl. 11, figs. 7, 8, 1932.

Test composed of a few subcylindrical chambers that are distinctly involute, the final chamber often being nearly twice as long as broad; sutures distinct, very slightly depressed, slightly oblique; wall smooth, aperture terminal, radiate, slightly projecting. Length up to 3.00 mm., breadth 0.60 mm.

Specimens occur rather commonly in the Upper Cretaceous of Trinidad and in the Velasco shale of Mexico. Similar forms occur in the Cretaceous of California, but the species seems to be rare or wanting in the Gulf Coastal Plain area.

Pseudoglandulina parallela (Marsson) Cushman and Jarvis
Plate 27, figure 35

Glandulina parallela Marsson, Naturw. Ver. Neu-Vorpommern u. Rügen Mitt., Jahrg. 10, vol. 10, p. 124, pl. 1, figs. 4a, b, 1878.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 51, pl. 4, fig. 16 (17–19 ?), 1928.
Pseudoglandulina parallela Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 36, pl. 11, fig. 9, 1932.

The types of this species are from the Upper Cretaceous chalks of the Island of Rügen, Germany. In the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, very similar specimens appear, and they occur also in the Velasco shale of Mexico.

Pseudoglandulina sp.
Plate 27, figure 36

Pseudoglandulina sp. Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 37, pl. 11, fig. 13, 1932.

A specimen from the Upper Cretaceous is figured. It is a very broad form with longitudinal costae somewhat interrupted. There are too few specimens to make a specific determination possible.

Upper Cretaceous. Boulder in conglomerate on "Bon Accord" estate, ¼ mile from Pointe-à-Pierre Railroad Station, San Fernando, Trinidad.

Genus LINGULINA D'Orbigny, 1826

Lingulina taylorana Cushman
Plate 27, figure 37

Lingulina taylorana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 43, pl. 7, fig. 9, 1938.

Test minute, compressed, tapering, peripheral margins of each chamber keeled near the base, 2 to 3 times as long as broad; chambers distinct, proloculum spherical, following chambers compressed, slightly overlapping, increasing gradually in height as added; sutures distinct, very slightly depressed; wall smooth; aperture terminal. Length 0.20 to 0.30 mm., breadth 0.12 to 0.14 mm.

The types are from the lower part of the Taylor marl in a ditch east of the Commerce-Paris highway 8.4 miles south of Paris, Lamar County, Tex. (202).

A number of specimens from this locality show very constant characters. The species is minute and may be easily overlooked. It differs from *L. pygmaea* Reuss in the fewer chambers, strongly tapering test, and in the thin flanges at the basal angles of the chambers.

Lingulina pygmaea Reuss
Plate 27, figure 38

Lingulina pygmaea Reuss, Palaeontographica, vol. 20, pt. 2, 1872–75, p. 90, pl. 2(20), fig. 23 (1874).

Test much compressed, early portion subacute, sides for most of the test nearly parallel, entire or slightly indented, apertural end broadly rounded; chambers distinct, broader than high, increasing very slightly in size and height as added; sutures slightly depressed, becoming more strongly curved in the adult; wall smooth; aperture terminal. Length 0.85 mm., breadth 0.20 mm.

Reuss described and figured this species from the Upper Cretaceous of Saxony. The specimen figured here is very close to this and apparently is to be included under this species. It is from the Wolfe City sand member of the Taylor marl 3 miles west of Barry, Navarro County, Tex. (188).

Genus VAGINULINA D'Orbigny, 1826

Vaginulina texana Cushman
Plate 28, figures 7–22

Vaginulina texana Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 30, pl. 4, figs. 2, 3, 1930.
Morrow, Jour. Paleontology, vol. 8, p. 192, pl. 29, fig. 10, 1934.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 59, pl. 12, figs. 1–6, 1942.
Cushman, idem, vol. 20, p. 88, 1944.
Vaginulina sp. Cushman, idem, vol. 6, p. 30, pl. 4, figs. 12, 13, 1930.
Vaginulina regina Plummer, Texas Univ. Bull. 3101, p. 162, pl. 10, fig. 22, 1931.

Test very variable in size and shape, distinctly compressed, the sides nearly parallel or tapering, with the ventral side becoming somewhat convex toward the apertural end; periphery rounded, initial end with a slight spine; chambers few to numerous, enlarging in size as added, the height about equal at the opposite ends, the upper and lower sides nearly parallel, usually not inflated, and usually obscured by the ornamentation; sutures oblique, straight or very slightly curved, usually not depressed, obscured by the surface ornamentation; wall longitudinally costate, the smaller specimens with but 5 or 6 costae on each side, increasing gradually to many in the larger specimens, the costae bifurcating to fill the area as the test broadens; aperture radiate, somewhat produced, at the dorsal margin. Length of holotype 1.30 mm., breadth 0.25 mm., maximum length 5.00 mm. or more.

The holotype represents the smaller, narrower form of the species, but figures show the intermediate forms grading to the larger, broader forms later named *Vaginulina regina* Plummer. The gradation between these extremes is complete in our series, and these usually occur in a single sample where the species is at all common. The species in our material is particularly characteristic of the upper beds of Austin age, particularly of the Gober tongue. Morrow figures a specimen from the Upper Cretaceous of Kansas. A somewhat similar form is recorded by Moreman from the Eagle Ford shale (Jour. Paleontology, vol. 1, p. 98, pl. 16, fig. 1, 1927) as "*V. simondsi* Carsey."

The type locality for *Vaginulina regina* is the "top of Austin chalk close to bridge over Little Walnut Creek on Austin-Manor highway 3.9 miles by road from the corner of East Avenue and Twenty-second Street, Austin," Tex.

The species occurs in the present collections from beds of Austin age only and should make an excellent index fossil for this part of the Cretaceous.

Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270).
Gober tongue of Austin chalk. Texas, Fannin County (276, 277, 279); Lamar County (282, 283, 287, 288).
Austin chalk. Texas, Collin County (295); Dallas County (301–304, 306, 307, 311, 326); Hill County (313, 314).
Brownstown marl. Texas, Red River County (319). Arkansas, Sevier County (347, 348).
Bonham clay. Texas, Lamar County (327).
Selma chalk (lower part). Mississippi, Itawamba County (351).

Vaginulina recta Reuss
Plate 28, figure 23

Vaginulina recta Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 46, pt. 1, 1862, p. 48, pl. 3, figs. 14, 15 (1863).
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 27, pl. 4, fig. 5, 1930.
Cushman and Alexander, idem, vol. 6, p. 4, pl. 1, figs. 17–22, 1930.
Tappan, Jour. Paleontology, vol. 14, p. 110, pl. 17, figs. 7, 8, 1940; idem, vol. 17, p. 501, pl. 80, figs. 22a, b, 1943.

The figured specimen in its general appearance closely resembles the species described by Reuss from the Cretaceous of Europe. A study of the early stages of our specimen seems to show that it is frondicularian at the base, and it may therefore be an abnormal specimen.

The species is also recorded from the Lower Cretaceous of Texas and Oklahoma.

Austin chalk.
Gober tongue. Texas, Lamar County (282).
Lower part. Texas, Dallas County (342).
Eagle Ford shale. Texas, Dallas County (356).

Vaginulina subcomarginata Morrow
Plate 28, figure 24

Vaginulina subcomarginata Morrow, Jour. Paleontology, vol. 8, p. 192, pl. 29, fig. 21, 1934.

Test small, broad, flattened, broadest at about the middle, periphery bicarinate, dorsal edge straight, ventral edge sigmoid in side view, concave near the posterior end, becoming strongly convex above, apertural end broad; sutures flush with surface, very oblique, nearly straight; chambers not inflated, almost obscured by the ornamentation near the initial end; surface ornamented near the dorsal periphery on either side by a strong, straight costa, which curves slightly inward near the aperture, and in addition by several strong costae, which radiate from the initial end for a short distance. Length of holotype about 1 mm., breadth as reconstructed 0.4 mm., thickness 0.14 mm.

A single specimen in the collection represents this species, but it differs so strikingly from anything described that no hesitation is felt in giving it a name, despite the meager material. Species of *Vaginulina* commonly bear the radiate aperture at the end of a necklike projection. The aperture opens into a bulbous cavity in this projection, which in turn is connected with the chamber by a short constricted opening. The specimen shows at the apertural end a small round opening indicating that the true aperture is broken away leaving the constricted opening below it visible. A small part of the initial tip and ventral edge is also wanting. This species is unique in having a straight dorsal margin and greatest breadth near or below the middle. The majority of species possessing the former are broadest near the apertural end, and those showing the latter usually have a marked curvature to the dorsal margin.

Basal Niobrara. Exceedingly rare.

Holotype from sec. 32, T. 11 S., R. 16 W., Ellis County, Kans. U. S. National Museum, No. 75367.

The above description and notes are copied from the original, and the type has been redrawn.

Vaginulina knighti Morrow
Plate 28, figure 25

Vaginulina knighti Morrow, Jour. Paleontology, vol. 8, p. 191, pl. 29, fig. 23, 1934.

Test small elongate, moderately flattened, broadest near apertural end, edges nearly straight, very gently tapering, carinate, apertural end slightly produced; sutures feebly depressed, very oblique, slightly curved; chambers few, early ones tending to be obscured by the surface ornamentation, proloculum bulbous, bluntly pointed; surface bearing a few long, widely spaced irregular costae, some of which continue onto the proloculum; aperture slightly produced, radiate. Length of holotype 1 mm., breadth 0.22 mm., thickness 0.14 mm.

Vaginulina knighti is distinguished from *V. rectilateralis* by being more elongate and not so flattened, by having slightly curved and more oblique sutures and coarser longitudinal costae, and in lacking the sets of fine parallel costae on the later chambers. These characters likewise distinguish the species from any other known to the writer. It differs from *V. simondsi* Carsey [Texas Univ. Bull. 2612, p. 40, pl. 2, fig. 4, 1926] in having much shorter, less oblique chambers and lacks the regular fine ornamentation which covers the surface of the Texas species.

Very rare in the basal Niobrara, at the locality given below.

Holotype from SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. U. S. National Museum, No. 75366.

The above description and notes are copied from the original, and the type has been redrawn.

Vaginulina rectilateralis Morrow
Plate 28, figure 26

Vaginulina rectilateralis Morrow, Jour. Paleontology, vol. 8, p. 191, pl. 29, fig. 29, 1934.

Test small, elongate, flattened, broadest at the apertural end, edges nearly straight, gently tapering, tricarinate, apertural end slightly produced; sutures flush with surface, only moderately oblique, straight, parallel, chambers indistinct, obscured by surface ornamentation, not inflated, rather few, proloculum prominent, bulbous, pointed; surface bears in addition to the peripheral carinae about three long longitudinal costae on each side which pass onto the proloculum and another group of faint, longitudinal, short, parallel costae which are arranged in sets on the surfaces of the later chambers; aperture slightly produced, radiate. Length of holotype 1 mm., breadth 0.28 mm., thickness 0.1 mm.

This species, which is believed to be undescribed, cannot be confused with the other species of *Vaginulina* described here because of its distinctive surface ornamentation and outline. It resembles slightly a form figured by Cushman as *V.* cf. *simondsi* Carsey [Carsey, Texas Univ. Bull 2612, p. 40, pl. 2, fig. 4, 1926] from a much higher horizon in Tennessee but in specific details they are quite different.

Basal Niobrara. Very rare and found only at the locality given below.

Holotype from SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. U. S. National Museum, No. 75365.

The above description and notes are copied from the original, and the type has been redrawn.

Vaginulina niobrarensis Morrow
Plate 28, figure 27

Vaginulina niobrarensis Morrow, Jour. Paleontology, vol. 8, p. 191, pl. 29, figs. 8a–c, 1934.

Test very large, flattened, broadest at the apertural end, dorsal edge straight, carinate, the carinae rising in pairs from the center of the dorsal side, passing downward and diverging slightly so as to terminate near the dorsal margin on opposite sides of the test; ventral edge rounded, slightly convex, distinctly lobed; chambers numerous, evenly spaced, nearly at right angles to the dorsal edge, curving slightly downward toward the ventral edge; sutures distinct, flat in young stages but becoming depressed toward the apertural end; wall smooth, initial end pointed; aperture slightly produced at the dorsal border, radiate. Length of holotype 6 mm., breadth 1.5 mm., thickness 0.45 mm.

Another smaller individual shows a slight curvature to the dorsal edge. *V. niobrarensis* resembles most closely *V. webbervillensis* Carsey [Texas Univ. Bull. 2612, p. 39, pl. 2, fig. 7, 1926] a species from the Navarro formation of Texas, but is distinct from it and other species in outline, in the slight obliquity of the chambers and in the character of the dorsal edge.

Basal Niobrara. Only two specimens have been found.

Holotype from SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. U. S. National Museum, No. 75364.

The above description and notes are from Morrow. His type specimen has been redrawn.

Vaginulina wadei Kelley

Plate 29, figures 1–6

Vaginulina wadei Kelley, in W. Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 8, pl. 1, fig. 7, 1929.
Cushman, Geol. Soc. America Bull., vol. 47, p. 417, pl. 1, fig. 4, 1936.
Todd, Am. Jour. Sci., vol. 242, p. 331, pl. 1, figs. 1–8, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 334, pl. 52, figs. 1, 2, 1944.
Vaginulina cf. *V. simondsi* Cushman, Tennessee Div. Geology Bull. 41, p. 34, pl. 4, figs. 8a, b, 1931.
Vaginulina webbervillensis Cushman (not Carsey), idem, p. 33, pl. 4, fig. 6, 1931.

Test elongate, somewhat compressed, periphery rounded on the dorsal edge, channelled on the ventral edge, gently tapering from the rounded initial end; chambers distinct, inflated slightly if at all, 2 or 3 times as long as broad in the early stages, much broader in the adult, of nearly uniform height throughout, increasing gradually in breadth as added; sutures strongly limbate, depressed little if at all, straight or very slightly curved or slightly sigmoid, strongly oblique; wall ornamented with a few longitudinal, or very slightly oblique, costae, largely independent of the chambers and sutures, strongest over the proloculum and early chambers, varying considerably in any large series of specimens; aperture slightly projecting, radiate, on the dorsal margin. Length of holotype 1.20 mm., breadth 0.30 mm., thickness 0.15 mm. Maximum measurements: length 3.80 mm., breadth 0.90 mm., thickness 0.20 mm.

The type of this species is from the Coon Creek tongue of the Ripley formation, from Dave Week's place on Coon Creek, 3½ miles south of Enville, 7½ miles north of Adamsville, and ⅛ mile east of the main Henderson-Adamsville road in the northeastern part of McNairy County, Tenn. (97). It occurs there in some numbers but, compared with other species, is rare.

The species is variable in the character of the surface ornamentation, which in some specimens is weak and mostly confined to the base, but in others, as shown in our figures, displays considerable development over the later chambers as well. These variations occur in the series of specimens from a single sample. The broader forms also occur with those that are much less rapidly tapering. All agree, however, in the form of the initial portion, which is rounded and without any sign of a spine at the base.

Besides the type locality, the species occurs in our material from the following localities:

Navarro age.
Selma chalk (upper part). Tennessee, McNairy County (98).
Ripley formation. Tennessee, Henderson County (96); McNairy County (95, 97).
Nacatoch sand. Texas, Bowie County (47); Hunt County (49).
Saratoga formation. Arkansas, Clark County.
Neylandville marl. Texas, Hunt County (53); Kaufman County (60).
Taylor age.
Pecan Gap chalk member of Taylor marl. Texas, Rockwall County (175).
Wolfe City sand member of Taylor marl. Texas, Hunt County (186).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Lee County (268).
Marlbrook marl. Arkansas, Clark County; Hempstead County.
Lower part of Taylor marl. Texas, Collin County (207); Bell County (245).
Austin age.
Brownstown marl. Arkansas, Sevier County (347).
Selma chalk (lower part). Mississippi, Itawamba County (351).

Vaginulina selmaensis Cushman

Plate 29, figures 7, 8

Vaginulina selmaensis Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 101, pl. 15, figs. 8, 9, 1937.
Vaginulina? sp. Cushman, Tennessee Div. Geology Bull. 41, p. 34, pl. 4, figs. 9, 10, 1931.

Test elongate, only slightly compressed, sides nearly parallel, dorsal side straight, ventral side slightly convex, periphery rounded, initial end with a weak spine; chambers distinct, slightly inflated, slightly higher than broad in the adult; sutures distinct, slightly depressed, somewhat oblique; wall ornamented with longitudinal costae (8 to 10) visible on each side, in many specimens slightly oblique and independent of the chambers; aperture large, slightly protuberant, radiate at the dorsal angle. Length nearly 1.00 mm., breadth 0.18 to 0.20 mm., thickness 0.15 to 0.18 mm.

The types of the species are from the Ripley formation on the new Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. (94).

All the available specimens of this species are megalospheric but hold the characters very closely. It seems to belong to *Vaginulina*, as there is a tendency toward a compressed test, with oblique sutures, and the aperture is at the dorsal angle. It is known only from the type locality. The species differs from *Vaginulina texana* Cushman in the less compressed test with more numerous and slightly oblique costae.

Vaginulina multicostata Cushman

Plate 29, figures 9–16

Vaginulina multicostata Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 28, pl. 4, fig. 4, 1930.
Cushman and Todd, idem, vol. 19, p. 58, pl. 10, fig. 19, 1943.
Cushman, idem, vol. 20, p. 88, pl. 13, fig. 13, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 334, pl. 52, fig. 3, 1944.
Vaginulina simondsi Cushman (part) (not Carsey), Tennessee Div. Geology Bull. 41, pl. 4, figs. 7a, b, 1931; Jour. Paleontology, vol. 5, p. 306, pl. 35, fig. 7, 1931.

Test elongate, much compressed throughout, dorsal edge straight or even slightly concave, ventral edge strongly convex, pointed at both ends; chambers few, elongate, curved, low and broad, the last-formed one reaching back halfway to the base along the ventral margin; sutures distinct, usually not depressed, somewhat limbate, very oblique, curved; wall ornamented with numerous fine costae, in general parallel to the straight dorsal edge of the test, and generally independent of the individual chambers; aperture at the dorsal angle, extended into a point, radiate. Length up to 1.70 mm., breadth 0.30 mm., thickness 0.12 to 0.15 mm.

The holotype of this species is from the Prairie Bluff chalk at old Canton Landing, Alabama River, Ala. It is widely distributed in beds of Navarro age in Texas, Arkansas, Mississippi, Alabama, and Tennessee. The specimen figured from the Saratoga chalk is not quite typical but is placed here. Scattered records from horizons below the Navarro are given here though the specimens are not always typical and are comparatively rare.

There is considerable variation, as in other members of the genus, but on the whole the shape and ornamentation are rather constant. It is typically a species of the Navarro group and its equivalents.

Navarro age.
Kemp clay. Texas, Navarro County (4); Williamson County (12).

Corsicana marl. Texas, Navarro County (25–27); Limestone County (29–31); Milam County (33); Travis County (34, 35, 41); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (84). Alabama, Wilcox County (100).
Saratoga chalk. Arkansas, Howard County (79).
Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Tennessee, McNairy County (98). Alabama, Marengo County (104).
Ripley formation. Tennessee, Henderson County (96).
Neylandville marl. Texas, Red River County (50); Delta County (52); Rockwall County (57); Kaufman County (58, 62); Navarro County (66, 69).

Taylor age.
Upper part of Taylor marl. Texas, Hunt County (115); Kaufman County (129); Navarro County (134); Milam County (139).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (169); Falls County (178).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Marlbrook marl. Arkansas, Howard County; Hempstead County.
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Prentiss County (261); Union County (262); Lee County (265, 268).
Annona chalk. Texas, Red River County (192).
Lower part of Taylor marl. Texas, Lamar County (202); Delta County (206).

Austin age. Selma chalk (lower part). Mississippi, Itawamba County (351).

Vaginulina simondsi Carsey
Plate 29, figures 23–25

Vaginulina simondsi Carsey, Texas Univ. Bull. 2612, p. 40, pl. 2, fig. 4, 1926.
Plummer, Texas Univ. Bull. 3101, p. 161, pl. 10, figs. 13–15, 1931.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 58, pl. 10, fig. 18, 1943.

Test of medium size for the genus, much compressed, broadest toward the apertural end; periphery strongly carinate throughout, both dorsal and ventral sides nearly straight, thickened; initial end typically with a distinct spine; chambers fairly numerous, distinct, low and broad, increasing rather uniformly in width as added, not distinctly curved; sutures distinct, somewhat limbate especially on the dorsal side, flush with the surface, straight; wall usually ornamented with longitudinal costae, in general parallel to the dorsal border, often stronger in the early stages; aperture somewhat protruding, at the dorsal angle, radiate. Average length about 2 mm.

This is a much less common species than *Vaginulina webbervillensis*, which is a much larger, smoother form, with a tendency to become rapidly broader toward the apertural end, resulting in a convex ventral border and strongly curved sutures. The two occur together and may possibly be only varieties of a single species. In a previous work the writer has misidentified this species, as will be seen by a reference to the synonymy under other species. Others have done likewise, and it now seems that the specific name should be limited to the species from beds of upper Navarro age defined by Mrs. Plummer, who has chosen a new type specimen, the holotype having been lost.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Williamson County (11); Travis County (13).
Corsicana marl. Texas, Navarro County (25, 27, 28); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (71, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (86, 87). Alabama, Wilcox County (100); Sumter County (102).
Ripley formation. Mississippi, Pontotoc County (90).
Neylandville marl. Texas, Delta County (51).

Vaginulina cretacea Plummer
Plate 30, figures 11–14

Vaginulina gracilis Plummer var. *cretacea* Plummer, Texas Univ. Bull. 2644, p. 172, pl. 2, fig. 8, 1927.
Vaginulina cretacea Cushman, Geol. Soc. America Bull., vol. 47, p. 417, pl. 1, fig. 5, 1936.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 59, pl. 10, fig. 20, 1943.

Test very elongate, somewhat compressed, slender, slightly tapering, usually slightly arcuate; dorsal side concave, ventral side convex, periphery rounded; chambers numerous, very distinct, inflated slightly if at all, increasing gradually in height from the earlier chambers, which are much lower than broad, to the adult, in which they are often as high as broad; earlier chambers with very slight traces of coiling; sutures very distinct, slightly oblique in the early stages, nearly at right angles to the periphery in the adult, somewhat limbate, the central portion on each side raised and appearing as an elongate beadlike protuberance; wall smooth except for the raised sutures; aperture radiate, slightly produced, at the dorsal angle. Length up to nearly 5 mm., breadth 0.40 to 0.50 mm., thickness 0.20 to 0.25 mm.

The type of this species is from clays in the upper part of the Navarro group about 5 feet below the Midway greensand, bank of Walker Creek 6 miles N., 15° E. of Cameron, Milam County, Tex.

The species is somewhat similar to *Vaginulina silicula* (Plummer) Cushman but is narrower, without the initial spine, with less of a tendency to coil at the base, and with the raised beads of the sutures more elongate and less rounded. The vertical range of this species is much greater than that of *V. silicula*, and it is much more common, but it is distinctive of beds of Navarro age. It occurs in material dredged from the canyons of Georges Bank.

Navarro age.
Kemp clay. Texas, Navarro County (4); Williamson County (11, 12); Travis County (16, 17); Guadalupe County (18, 20, 21).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (30, 31); Falls County (32); Travis County (34, 36, 41); Caldwell County (44); Guadalupe County (45); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70–72).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–87). Alabama, Wilcox County (99, 100).
Saratoga chalk. Arkansas, Hempstead County (80).
Ripley formation. Mississippi, Pontotoc County (90).

Vaginulina navarroana Cushman
Plate 29, figures 17–22

Vaginulina navarroana Cushman, Geol. Soc. America Bull., vol. 47, p. 416, pl. 1, fig. 3, 1936.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 90, pl. 22, fig. 1, 1941.
Cushman and Todd, idem, vol. 19, p. 59, pl. 10, fig. 16, 1943.

Test typically 2 to 3 times as long as broad, strongly compressed, somewhat fusiform in front view, periphery rounded; chambers few, fairly distinct, elongate, highest at the dorsal margin, very slightly inflated; sutures strongly curved, especially at the dorsal end, often tending to become slightly sigmoid, somewhat depressed; wall ornamented by distinct, raised costae, somewhat oblique and usually independent of the individual chambers; aperture radiate, somewhat projecting, at the dorsal border. Length up to 1.10 mm., breadth 0.25 to 0.30 mm., thickness 0.07 to 0.10 mm.

The type is from Cretaceous greensand of Navarro age, Canyon II, Tow 6, Georges Bank. This species is characteristic of the Corsicana marl and occurs as far down as the Nacatoch sand. It is somewhat variable in its ornamentation and in the relative breadth of the test, but the general characters are rather definitely held. Typical specimens occur in the Mito Juan formation and the upper part of the Colon formation in Colombia.

Navarro age.
- Kemp clay. Texas, Navarro County (3, 4).
- Corsicana marl. Texas, Navarro County (27); Limestone County (29–31); Travis County (36, 39, 42, 43); Bexar County (46).
- Prairie Bluff chalk. Mississippi, Chickasaw County (85). Alabama, Sumter County (101, 102).
- Nacatoch sand. Arkansas, White County (76).

Vaginulina suturalis Cushman
Plate 30, figures 1–3

Vaginulina suturalis Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 102, pl. 15, figs. 5–7, 1937.
Vaginulina strigillata Cushman (not Reuss), Cushman Lab. Foram. Research Contr., vol. 6, p. 26, pl. 4, figs. 1, 9, 10, 1930.

Test slender, elongate, tapering, much compressed, greatest breadth made by the last-formed chamber, periphery rounded or slightly truncate, initial end acute; chambers distinct, very slightly if at all inflated, increasing very gradually but regularly in breadth and height; sutures distinct, straight or slightly curved, very strongly oblique, slightly raised, broken by numerous short costae parallel to the straight edge of the test; wall smooth except for the raised and costate sutures; aperture radiate, slightly produced, at the dorsal angle. Length up to 3.00 mm., breadth 0.35 to 0.40 mm., thickness 0.10 to 0.15 mm.

The types are from what is probably the Nacatoch sand, Arkadelphia, Clark County, Ark.

This species was originally identified as *V. strigillata* Reuss, but specimens from his type locality at Luschitz, Bohemia, show the two to be distinct. The species is characterized by the lack of costae on the chambers themselves, but they are developed on the sutures. Typical specimens are very long and slender. The species seems to be most characteristic of the upper beds of Taylor age but extends higher in the section.

Navarro age.
- Kemp clay. Texas, Williamson County (11).
- Neylandville marl. Texas, Navarro County (68).
- Nacatoch sand. Arkansas, Clark County (74).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (105); Hunt County (116); Collin County (118, 120); Limestone County (137); Leon County (138); Williamson County (144); Bexar County (159).
- Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177); Falls County (178).
- Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
- Wolfe City sand member of Taylor marl. Texas, Collin County (183).
- Lower part of Taylor marl. Texas, Ellis County (234).

Vaginulina webbervillensis Carsey
Plate 30, figures 5–10

Vaginulina webbervillensis Carsey, Texas Univ. Bull. 2612, p. 39, pl. 2, fig. 7, 1926.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 27, pl. 4, fig. 14, 1930.
Plummer, Texas Univ. Bull. 3101, p. 160, 1931.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 59, pl. 10, figs. 21a, b, 1943.
Todd, Am. Jour. Sci., vol. 242, p. 334, pl. 1, figs. 9–18, 1944.

Test very large, much compressed, broadest toward the apertural end, periphery usually bicarinate or tricarinate in the young, usually rounded and smooth in the adult; dorsal edge nearly straight, thickened; ventral edge much convex; initial end typically with a distinct spine; chambers numerous, distinct, low and broad, curved, increasing rapidly in width as added; sutures distinct, somewhat limbate, especially on the dorsal side, usually flush with the surface, strongly curved backward toward the initial end, which develops a few costae; aperture somewhat protruding, at the dorsal angle, radiate. Length up to 6.00 or 7.00 mm., breadth very variable.

This is a very large and well-marked species, most characteristic of the Corsicana marl and other beds younger than the Nacatoch sand. It is the largest of our Cretaceous species and is often very abundant.

It has been confused with the somewhat similar species that occur in the Taylor marl and the Eagle Ford shale. The Taylor species usually has both margins costate, and it lacks the initial spine.

Our specimens show the following distribution:

Navarro age.
- Kemp clay. Texas, Navarro County (7); Limestone County (8); Williamson County (11); Guadalupe County (18).
- Corsicana marl. Texas, Hunt County (24); Navarro County (25–28); Limestone County (30, 31); Falls County (32); Travis County (34–41); Caldwell County (44); Bexar County (46).
- Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (100); Sumter County (103).

Vaginulina subgracilis Cushman
Plate 30, figure 4

Vaginulina subgracilis Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 103, pl. 15, fig. 13, 1937.
Cushman and Todd, idem, vol. 19, p. 59, pl. 10, fig. 22, 1943.
Vaginulina gracilis Cushman (not Plummer), Tennessee Div. Geology Bull. 41, p. 34, pl. 4, fig. 11, 1931.

Test elongate, very slightly compressed; the earliest portion partially coiled, especially in the microspheric form; remainder of test uniserial, with the greatest breadth attained before the test is half completed, and containing the same breadth thereafter; periphery rounded; chambers distinct, little inflated except at the apertural end, increasing gradually in height as added, earliest chambers about 3 times as broad as high, in the adult slightly higher than broad; sutures limbate, those of the earliest portion somewhat raised and strongly thickened in the middle, in the last-formed portion becoming somewhat depressed; wall smooth, except for the raised sutures, finely perforate; aperture terminal, radiate. Length up to 1.60 mm., breadth 0.18 mm.

The types are from the Corsicana marl, pit of Corsicana Brick Co., 2 miles south of courthouse at Corsicana, Navarro County, Tex. (26).

This species differs from *V. gracilis* Plummer in the somewhat smaller size and the more cylindrical, less tapering, and less compressed test.

Navarro age.
- Corsicana marl. Texas, Navarro County (26, 27).
- Ripley formation. Tennessee, Henderson County (96).

Vaginulina taylorana Cushman
Plate 28, figures 28, 29

Vaginulina taylorana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 36, pl. 5, fig. 19, 1938.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 334, pl. 52, fig. 4, 1944.

Test elongate, somewhat compressed, periphery subacute, dorsal side straight or somewhat concave, initial end rounded, without a spine; chambers numerous, distinct, much broader than high, increasing very gradually in size as added, the early chambers showing a slight tendency toward coiling; sutures distinct, limbate, the median portion of each thickened, forming an elongate, elliptical, beadlike process; wall smooth except for the thickened sutures; aperture radiate, at the dorsal angle, only slightly projecting. Length up to 3.00 mm., breadth 0.70 mm., thickness 0.50 mm.

The types are from the upper part of the Taylor marl 5 miles southeast of Taylor, Williamson County, Tex.

This species seems to be confined to the Taylor marl, where it is more common in the upper portion. In some respects is resembles some of the species described by D'Orbigny from the Craie blanche of the Paris Basin. It is not identical, however, as a comparison with his species has shown. The species also resembles *Vaginulina silicula* Plummer in the swollen central areas above the sutures, but is very different in its other characters.

Taylor age.
Upper part of Taylor marl. Texas, Williamson County (142); Bexar County (156, 160).
Marlbrook marl. Arkansas, Clark County; Hempstead County.
Lower part of Taylor marl. Texas, Ellis County (234).

Vaginulina barcoensis Cushman and Hedberg
Plate 66, figure 10

Vaginulina barcoensis Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 90, pl. 22, fig. 2, 1941.

Test strongly compressed, initial end acute, with a blunt spine, dorsal margin with a distinct keel, ventral margin truncate, greatest breadth near the base; chambers distinct, not inflated, increasing gradually in size as added, each reaching back to the basal line; sutures distinct, curved, slightly limbate; wall ornamented with numerous, very fine, longitudinal costae, nearly parallel to the dorsal margin; aperture terminal, radiate. Length 0.70 to 0.75 mm., breadth 0.25 mm., thickness 0.03 mm.

The types are from the lower zone of the Colon formation, Quebrada Mito Juan, Department of Santander del Norte, Colombia.

This species differs from *V. navarroana* Cushman in the extension of all the chambers to the basal margin, more compressed test, and the numerous, very fine, longitudinal costae.

Genus PALMULA Lea, 1833

Palmula cushmani (Morrow) Cushman
Plate 32, figures 15, 16

Flabellina cushmani Morrow, Jour. Paleontology, vol. 8, p. 194, pl. 29, fig. 25, 1934.

Test large, broad, much compressed, greatest breadth near the base, sides strongly convex in outline, rounded in edge view; chambers distinct, numerous, quite uniform in shape, the very early ones showing distinct coiling; sutures distinct, very slightly depressed, bearing at their apex a low, rounded elevation; wall smooth except for the depressed sutures and low elevations at the apex. Length about 2.15 mm., breadth about 2 mm.

The holotype of this species is from the basal part of the Niobrara formation, sec. 32, T. 11 S., R. 16 W., Ellis County, Kans.

A study of the holotype of this species, which is here refigured, shows that the species occurs in typical form in the lower part of the Austin chalk of Texas. It may be distinguished from *P. suturalis* (Cushman) Cushman, of which it may be the ancestral form, by the sutures of the early portion which are not raised and platelike as in that species.

Austin chalk. Texas, Dallas County (297, 298, 342, 343, 345); Collin County (337).

Palmula suturalis (Cushman) Loetterle
Plate 32, figures 3–14

Flabellina rugosa Heron-Allen and Earland (not D'Orbigny), Royal Micr. Soc. Jour., p. 422, pl. 8, fig. 7, 1910.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 64, pl. 5, fig. 12, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 92, pl. 8, figs. 18a, b, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 32, pl. 4, fig. 15, 1930; Jour. Paleontology, vol. 5, p. 307, pl. 35, fig. 10, 1931.
Plummer, Texas Univ. Bull. 3101, p. 166, pl. 12, fig. 4, 1931.
Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 38, pl. 5, fig. 3, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 279, pl. 42, fig. 22, 1932.
Flabellina suturalis Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 86, pl. 13, figs. 9–18, 1935.
Palmula suturalis Loetterle, Nebraska Geol. Survey Bull., ser. 2, bull. 12, p. 28, pl. 3, fig. 5, 1937.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 60, pl. 13, fig. 1, 1942; Jour. Paleontology, vol. 18, p. 334, pl. 52, fig. 5, 1944.

Test rhomboid or somewhat cordate at the base, much compressed, periphery truncate; chambers of the early portion coiled, usually forming a single coil or less before the chevron-shaped chambers are developed, width of the chambers increasing gradually as the test develops; sutures very distinct, very high and platelike in the earliest portion, thence less high as development progresses, outer apical portion somewhat convex but not ending in a separate loop; wall smooth, polished; aperture radiate, terminal, often with a slight neck. Length 2.00 mm., breadth 1.50 mm.

The holotype is from the Taylor marl 20 feet above top of Marlin chalk, Waco road 1 mile west-southwest of Prairie Hill, Limestone County, Tex.

This species, which has been confused with *Palmula rugosa* (D'Orbigny) Cushman, is rather widely distributed in the American Upper Cretaceous, ranging through beds of Austin age upward into the lower and middle beds of Taylor age. It is apparently present also in Europe, where it has also been confused with *P. rugosa*. It occurs in the Cretaceous of the West Indies and at Quebrada Honda, Venezuela. In some respects *P. suturalis* resembles *P. rugosa*, but the sutures are usually higher, the intermediate surface smooth, and loops are not typically developed at the apical end of the chambers. The two species occur together at only a few of the more than 60 stations from which material of the two species is available.

Navarro age.
Saratoga chalk. Arkansas, Howard County (79).
Selma chalk (upper part). Mississippi, Prentiss County (91).
Neylandville marl. Texas, Delta County (51); Kaufman County (58, 62).

Taylor age.
Upper part of Taylor marl. Texas, Collin County (121); Limestone County (135, 136).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (172); Falls County (178).
Selma chalk (middle part). Mississippi, Prentiss County (260).
Annona chalk. Texas, Red River County (195, 198).
Lower part of Taylor marl. Texas, Collin County (211, 212); McLennan County (238); Bell County (245).

Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (273); Lamar County (288).
Austin chalk. Texas, Dallas County (296, 297, 299, 300, 302, 304, 305, 307–311, 326, 339, 344); Hill County (313, 314, 346).
Bonham clay. Texas, Lamar County (327).
Brownstown marl. Arkansas, Sevier County.

Palmula rugosa (D'Orbigny) Cushman
Plate 31, figures 9–17

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, Prodrome 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.
Palmula rugosa Cushman, Foraminifera, Ed. 3, Key, pl. 20, fig. 8, 1940; Cushman Lab. Foram. Research Contr., vol. 20. p. 8, pl. 2, fig. 6, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 335, pl. 52, fig. 7, 1944.
Flabellina interpunctata Von de 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.

This species was originally described by D'Orbigny from the Upper Cretaceous Craie blanche of the Paris Basin. The type figures do not show any of the surface ornamentation except the sutures. However, D'Orbigny's original description includes the following, "couvert partout de granulations inégales." Figures 13 and 14 represent specimens from the White Chalk of the Paris Basin, and show the typical ornamented surface. Another of the characters that is not shown in the type figures, but that is distinct in most specimens, is the peculiar semicircular structure at the upper angle of each chamber at the median line of the test. This is noted in D'Orbigny's description as follows, "toutes marquées sur leurs sutures d'une crête saillante venant former un demi-cercle en avant du sommet de chaque loge."

These two sets of characteristics are very well marked in the type specimens and also in the American specimens, although our figured specimens, most of which are not completely mature, do not show the semicircular markings as clearly as in some others. It has been interesting to see in European collections that this species was correctly named by Karrer in his Austrian material and also by Franke. From a study of topotype material representing the localities cited in papers noted in the references, *Flabellina interpunctata* Von der Marck is a definite synonym of D'Orbignys' *F. rugosa*, and the two have the same general vertical range in Europe, in general the equivalent of the Taylor marl of America. In the American Cretaceous *P. rugosa* is a characteristic species of the beds of Taylor age and its equivalents, the Pecan Gap chalk, Wolfe City sand, Annona chalk, and the middle part of the Selma chalk. Available material shows that the species is somewhat variable but that the essential characters are firmly held.

Somewhat similarly marked species are found higher in the series in the Upper Cretaceous of Trinidad and in the Arkadelphia marl and the Paleocene Midway group of Texas and Arkansas.

Navarro age.
Corsicana marl. Texas, Falls County.
Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Alabama, Marengo County (104).
Nacatoch sand. Arkansas, Clark County (74).
Saratoga chalk. Arkansas, Howard County (79); Hempstead County (81).
Neylandville marl. Texas, Red River County (50); Rockwall County (57); Kaufman County (58, 60, 61); Navarro County (63, 66, 68, 69).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–107); Lamar County (110); Hunt County (115, 116); Collin County (118, 120–122); Rockwall County (123, 124); Kaufman County (125, 128–131); Navarro County (134); Limestone County (135–137); Leon County (138); Williamson County (140); Bexar County (152, 158).
Marlbrook marl. Arkansas, Howard County; Hempstead County.
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (169, 171); Rockwall County (175); Falls County (178); Delta County (165, 166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (259); Prentiss County (261); Lee County (266).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (196, 198).

Lower part of Taylor marl. Texas, Delta County (206); Collin County (209); Kaufman County (229); Ellis County (234); Travis County (250).
Austin age. Gober tongue of Austin chalk. Texas, Lamar County (288).

Palmula reticulata (Reuss) Cushman
Plate 31, figures 1–6

Flabellina reticulata Reuss, Haidinger's Naturwiss. Abh., vol. 4, pt. 1, p. 30, pl. 1, fig. 22, 1851; Akad. Wiss. Wien, Math.—naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, 1861, p. 326 (1862).
Olszewski, Sprawozd. Kom. Fizyj. Akad. Umiej., Krakowie, vol. 9, p. 110, 1875.
Marsson, Naturw. Ver. Neu-Vorpommern u. Rügen Mitt. Jahrg. 10, p. 139, 1878.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Cl. 2, vol. 21, p. 107, pl. 13, figs. 5–7, 1899.
Franke, Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 64, pl. 5, fig. 14, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 93, pl. 8, fig. 19, 1928.
White, Jour. Paleontology, vol. 2, p. 204, pl. 28, fig. 15, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 32, pl. 4, figs. 18, 19, 1930.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 37, pl. 11, fig. 15, 1932.
Brotzen, Deutschen Palästina-Vereins Zeitschr., Jahrg., 1934, p. 46, 1934.
Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 87, pl. 13, fig. 19, 1935.
Frondicularia reticulata Bagg, U. S. Geol. Survey Bull. 88, p. 50, pl. 3, fig. 6, 1898.
Weller, New Jersey Geol. Survey, Paleontology, vol. 4, p. 230, pl. 2, fig. 30, 1907.
Plummer, Texas Univ. Bull. 2644, pp. 39, 172, pl. 2, fig. 5, 1927.
Palmula reticulata Cushman, Foraminifera, Ed. 3, Key, pl. 20, fig. 9, 1940.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 60, pl. 10, fig. 23, 1943.
Flabellina favosa Beissel, Preuss. geol. Landesanstalt Abh., new ser., vol. 3, p. 49, pl. 19, figs. 25–28; pl. 26, fig. 28, 1891.
Frondicularia cf. *F. interpunctata* Cushman (not Von der Marck), Am. Assoc. Petroleum Geologists Bull., vol. 10, No. 6, p. 598, pl. 20, fig. 6, 1926.

Test much compressed, sides nearly or quite flat, outline of test variable, rhomboid or the base rounded, even lobed, periphery truncate, early portion coiled, later chambers extending back on both sides; chambers distinct, chevron-shaped, narrow; sutures distinct, raised somewhat, the surface of the test between covered by a raised network of octagonal meshes, with the long axis at right angles to the sutures; aperture slightly produced, radiate. Length up to 2.00 mm., breadth 1.50 to 2.00 mm.

The species was originally described from the Upper Cretaceous of Europe and occurs there rather widely distributed in the uppermost Cretaceous. Topotype material of Reuss' species from Lemberg has been studied and also topotype material of Beissel's species *Flabellina favosa* from the Upper Cretaceous of Friedrichsberg near Aachen. The two are evidently synonyms. Most of the European material I have seen is rather rhomboid in outline, whereas most of the American specimens are cordate. There are however many specimens which seem to bridge over these differences in shape. The range both in Europe and America is very similar, limited to the uppermost Cretaceous.

In the American Cretaceous material the species is limited to beds of Navarro age, with one exception. That is material designated as from the upper part of the Taylor marl from the Marquez salt dome, Leon County, Tex. The species is particularly abundant in the Corsicana marl.

Navarro age.
Kemp clay. Texas, Navarro County (5, 7); Williamson County (11, 12); Travis County (17); Guadalupe County (18, 21).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (30, 31); Falls County (32); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (84, 86, 87).
Nacatoch sand. Texas, Bowie County (47).
Taylor marl, upper part. Texas, Leon County (138).

Palmula primitiva Cushman
Plate 32, figures 1, 2

Palmula simplex Cushman (not Reuss), Cushman Lab. Foram. Research Contr., vol. 14, p. 36, pl. 6, fig. 1, 1938.
Palmula primitiva Cushman, idem, vol. 15, p. 91, pl. 16, figs. 4, 5, 1939.
Cushman and Hedberg, idem, vol. 17, p. 90, pl. 21, figs. 36, 37, 1941.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 335, pl. 52, fig. 6, 1944.

Test elongate, much compressed, greatest thickness at the umbo, formed by the proloculum, thinning thence toward the periphery; the later portion greatly compressed, rounded at the base, sides in the adult nearly parallel; periphery acute, at the base slightly carinate; early portion closely coiled, later uncoiling, and in the adult with a few chambers chevron-shaped; chambers distinct, not inflated; sutures distinct, slightly limbate, not depressed; wall with very delicate, longitudinal striae; aperture terminal, elongate, with a slender neck. Length up to 1.60 mm., breadth 0.30 to 0.35 mm.

The types are from Pecan Gap chalk member of the Taylor marl, on secondary road to Otto at crossing of "Big Creek," 3.2 miles southwest of Mart, McLennan County, Tex. The species occurs at several localities in the upper part of the Taylor marl and should make a good index fossil for this part of the section. It also occurs in the upper zone of the Colon formation of Colombia.

P. primitiva differs from *P. rugosa* in the nearly parallel sides and very smooth surface ornamented with very numerous, very fine, longitudinal striae.

Taylor age.
Upper part of Taylor marl. Texas, Hunt County (116); Kaufman County (131); Bexar County (158, 161).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (169); McLennan County (177).
Marlbrook marl. Arkansas, Howard County.

Palmula pilulata Cushman
Plate 32, figures 18–21

Palmula pilulata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 37, pl. 6, fig. 2, 1938.

Test much compressed; periphery truncate except about the initial portion which is carinate, with a thin transparent flange; early portion coiled; chambers distinct, comparatively few, early coiled chambers of rather uniform shape, increasing very gradually in size; adult chambers chevron-shaped, extending backward at the sides but not including much of the early coiled chambers; sutures limbate, very slightly raised, each of the earlier sutures ending at the inner end in a raised bead, slightly elongate; wall smooth except for the raised sutures; aperture in the adult terminal, radiate, very slightly projecting. Length up to 3.00 mm., breadth 2.00 mm.

The types are from the Bonham marl on U. S. Highway 271, 4.5 miles north of Paris and 0.7 mile south of Hinckley, Lamar County, Tex. (327).

The species is well developed at this locality and has been found in the Bonham marl in well samples. It should make an excellent marker for this formation. *P. pilulata* differs from *P. elliptica* (Nilsson) Cushman in the much greater coiled stage, the somewhat raised sutures, and beaded ornamentation.

Palmula semireticulata (Cushman and Jarvis) Cushman
Plate 31, figures 7, 8

Flabellina semireticulata Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 98, pl. 13, fig. 14, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 38, pl. 11, fig. 14, 1932.
Flabellina reticulata Cushman and Jarvis (not Reuss), idem, p. 37, pl. 11, fig. 15, 1932.
Frondicularia cf. *F. interpunctata* Cushman (not Von der Marck), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 598, pl. 20, fig. 3, 1926.

Test rhomboid in front view, much compressed, apertural end extended; chambers and sutures obscured by the surface ornamentation, which consists of a more or less irregular reticulation, the sides of the polygonal areas raised, thin, and platelike. Length 0.60 mm., breadth 0.35 mm., thickness 0.08 mm.

The types of this species are from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. It also occurs in the Velasco shale, Hacienda el Limon, Mexico.

The reticulations, instead of being very elongate and regular as in *F. reticulata,* are much smaller and much more irregular in both size and shape.

Palmula jarvisi (Cushman) Cushman
Plate 31, figures 18–20

Flabellina interpunctata Cushman and Jarvis (not Von der Marck), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 38, pl. 12, fig. 1, 1931.
Flabellina jarvisi Cushman, Cushman Lab. Foram. Research Contr., vol. 11, p. 85, pl. 13, figs. 7, 8, 1935.

Test elongate, rhomboid or semielliptical, much compressed, sides flattened, periphery truncate; earliest chambers coiled but very quickly followed by typical chevron-shaped chambers, each newly added chamber failing to extend over the preceding one on the periphery, narrow, of uniform width; sutures very high and platelike at the apical end of each chamber and ending in one or several semicircular loops; surface between the sutures strongly papillate; aperture radiate, somewhat projecting. Length 1.50 mm., breadth 0.80 mm.

The types are from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. The species also occurs in Trinidad in Cretaceous boulders in conglomerate on "Bon Accord" estate, 1.4 miles from Pointe-à-Pierre Railroad Station, San Fernando, Trinidad.

This species is more accelerated than *P. rugosa* (D'Orbigny) Cushman, with a much narrower test, fewer coiled chambers, the sutures very high and platelike with numerous semicircular or irregularly-shaped loops. Somewhat similar specimens occur in the uppermost Cretaceous Velasco shale, near Velasco station, Hacienda el Limon, Mexico.

Palmula elliptica? (Nilsson) Brotzen
Plate 32, figure 17

The large form figured here is from the Upper Cretaceous of Trinidad (Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 39, pl. 12, fig. 2, 1932). It is very questionably referred to Nilsson's species as that is typically much narrower and more elongate.

Genus FRONDICULARIA Defrance, 1826

Frondicularia lanceola Reuss
Plate 33, figures 1–4

Frondicularia lanceola Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 198, pl. 5, figs. 1a, b, 1860.
Perner, Ceská Akad. Cisare Frantiska Josefa, Trida 2, p. 38, pl. 3, fig. 2, 1897.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 87, pl. 15, figs. 9, 10, 1899.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 38, pl. 5, figs. 18, 19, 1930.
Sandidge, Am. Midland Naturalist, vol. 13, p. 357, pl. 32, fig. 7, 1932.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 23, pl. 2, fig. 20, 1936.

Test very elongate, slender, much compressed, tapering from the proloculum to the greatest width toward the apertural end; periphery usually rounded or subacute; chambers distinct, increasing gradually in size as added, very slightly inflated, proloculum elongate, in many specimens with a short spine; sutures distinct, slightly depressed; wall smooth, sometimes showing faint traces of longitudinal costae; aperture terminal, radiate, usually with a somewhat extended neck. Length up to 6.00 mm., breadth 0.50 to 0.60 mm.

This species was originally described from the Upper Cretaceous of Westphalia, Germany. In the present material it seems to be most characteristic of the Taylor marl. It also occurs in the Navesink marl and Mt. Laurel sand of New Jersey.

Navarro age.
Corsicana marl. Texas, Bowie County (23).
Prairie Bluff chalk. Mississippi, Chickasaw County (86). Alabama, Wilcox County (100); Sumter County (103).
Taylor age.
Upper part of Taylor marl. Texas, Collin County (118, 121); Rockwall County (124); Navarro County (132); Limestone County (136); Williamson County (140).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177); Falls County (178).
Annona chalk. Texas, Bowie County (189); Red River County (193, 194, 198).
Lower part of Taylor marl. Texas, Collin County (209); Dallas County (222, 224, 225); Kaufman County (228, 229); Ellis County (234); McLennan County (239, 242); Travis County (250).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (281); Lamar County (287, 288).
Austin chalk. Texas, Grayson County (289, 290); Dallas County (304, 306).
?Selma chalk of upper Austin age. Alabama, Pickens County (352).
Brownstown marl. Texas, Lamar County (321).
Bonham marl. Texas, Lamar County (327, 331).

Frondicularia lanceola Reuss var. bidentata Cushman
Plate 33, figures 5–8

Frondicularia verneuiliana D'Orbigny var. *bidentata* Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 37, pl. 5, figs. 13–15, 1930.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 28, pl. 3, figs. 6, 7, 1937.

Variety differing from the typical form in having the upper ends of the sutures thickened and projecting above the surface in a series of paired, short ribs.

This form seems to be most common in beds of Austin age but apparently has a wide range.

Navarro age. Prairie Bluff chalk. Alabama, Wilcox County (99).
Taylor age.
Upper part of Taylor marl. Texas, Limestone County (135).
Lower part of Taylor marl. Texas, Dallas County (217, 223); Travis County (250).

Austin age.
Burditt marl (of Adkins). Texas, Travis County (270).
Gober tongue of Austin chalk. Texas, Fannin County (276–278, 280, 281); Lamar County (282, 288).
Austin chalk. Texas, Collin County (295); Dallas County (296, 300, 305–307, 310, 311); Bell County (315, 316).
Brownstown marl. Texas, Lamar County (320).

Frondicularia austinana Cushman
Plate 33, figures 9, 10

Frondicularia austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 13, pl. 3, figs. 12, 13, 1936.

Test much compressed, broad faces flattened; outline nearly elliptical, somewhat more pointed at the apertural end, initial end with a short spine; periphery entire, slightly truncate; chambers narrow, elongate, increasing rather regularly in size as added, earliest chambers in microspheric form tending to be flabelline, proloculum elongate, narrow; sutures distinct, flush with the surface, gently but rather evenly convex toward the outside; wall with short, nearly vertical costae, several on each chamber, and not crossing the sutures; aperture small, at the end of a very slight neck. Length about 2.00 mm., breadth 0.50 to 0.70 mm., thickness 0.10 to 0.12 mm.

This species is characteristic of the Austin chalk but occurs sparingly in the lower beds of Taylor age. The early chambers in what seem to be microspheric specimens have a flabelline arrangement, but in those with a much larger proloculum the chambers are often frondicularian throughout.

It is probable that the specimen figured as *Frondicularia cordai* from the Austin chalk (Cushman Lab. Foram. Research Contr., vol. 6, p. 34, pl. 5, fig. 17, 1930) belongs here.

Taylor marl, lower part. Texas, Collin County (210); Dallas County (216, 217); Williamson County (246).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (271).
Gober tongue of Austin chalk. Texas, Fannin County (277, 280); Lamar County (282).
Austin chalk. Texas, Grayson County (289); Collin County (295); Dallas County (309, 310); Bell County (316).
Eagle Ford shale. Texas, Dallas County (359).

Frondicularia inversa Reuss
Plate 33, figures 11–18

Frondicularia inversa Reuss, Geognostische Skizzen Böhmen, vol. 2, pt. 1, p. 211, 1844; Verstein böhm. Kreideformation, pt. 1, p. 31, pl. 8, figs. 15–19; pl. 13, fig. 42, 1845; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 94, pl. 2 (21), figs. 5–7, 11 (1874).
Perner, Foram. Ceského Cenomanu (Resumé), p. 59, pl. 7, fig. 9, 1892.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 48, pl. 4, fig. 1, 1925.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 16, pl. 3, figs. 23, 24, 1936.

Test elongate, elliptical, very strongly compressed, periphery rounded, base with a short, stout spine; chambers distinct, the proloculum narrow, elongate, later chambers gradually failing to reach the base, giving a narrow tapering shape to that part of the test; sutures distinct, flush with the surface, gently curved, usually crossed by fine vertical costae, especially near the apertural end of each; wall smooth or occasionally with a few, short, vertical costae; aperture terminal, radiate. Length 3.00 mm. or more, breadth 1.25 to 1.50 mm.

This species has been recorded by various authors whose combined records give a range from the Lower Cretaceous Gault to the top of the Upper Cretaceous. A glance at the figures given will show how dissimilar the various forms grouped under this name are. Fortunately the Cambridge (Massachusetts) set of Reuss' specimens has a fine suite named by him. In our American material the species is characteristic of beds of Austin age but apparently ranges somewhat higher. Material recorded under this name from the Taylor marl is not characteristic and is referred elsewhere.

Navarro[1] age.
Arkadelphia marl. Arkansas, Clark County (74).
Ripley formation. Tennessee, Henderson County (96).
Taylor marl, upper part. Texas, Bexar County (158).
Austin age.
Gober tongue of Austin chalk. Texas, Lamar County (288).
Austin chalk. Texas, Bell County (315, 316).
Brownstown marl. Texas, Lamar County (321).

Frondicularia dunbari Morrow
Plate 34, figures 1, 2

Frondicularia dunbari Morrow, Jour. Paleontology, vol. 8, p. 192, pl. 29, figs. 7a, b, 22, 1934.

Test elongate, tapering evenly with greatest width near the base of the last chamber, much compressed, faces nearly parallel; due to the curvature of the outer margin of the chambers the periphery is slightly scalloped. Periphery truncate, sometimes becoming rounded in the last chambers; initial end small, bluntly pointed; chambers distinct, of uniform shape, evenly spaced, apertural end extended; sutures distinct, usually slightly depressed, nearly straight; wall smooth except for the slight depression of the sutures; aperture radiate, at the end of a slight protuberance. Length 1.15 mm., breadth 0.36 mm., thickness 0.14 mm.

In outline this species shows a striking resemblance to *F. archiaciana* D'Orbigny [Soc. géol. France Mém., ser. 1, vol. 4, p. 20, pl. 1, figs. 34–36, 1840] but they may be distinguished by the raised and sigmoidally curved sutures of the latter. The evenly tapered and scalloped sides and the slightly depressed sutures are believed to distinguish *F. dunbari* from other described species. The several specimens in the collection show this species to be quite constant in its characters.

Fairly common at several localities but restricted to the basal Niobrara.

Holotype from SE.¼, sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. U. S. National Museum, No. 75368.

The above description and notes are from the original. The type specimen is redrawn.

It occurs in the Austin chalk of Texas at numerous localities.

Austin age.
Burditt marl (of Adkins). Texas, Travis County (271).
Gober tongue of Austin chalk. Texas, Fannin County (279, 280); Lamar County (283, 288).
Austin chalk. Texas, Grayson County (289); Dallas County (299, 344); Bell County (316).

Frondicularia extensa Morrow
Plate 34, figures 3, 4

Frondicularia extensa Morrow, Jour. Paleontology, vol. 8, p. 193, pl. 29, fig. 31, 1934.

Test broadly elongate, greatest breadth above but near the middle, strongly compressed, faces nearly parallel, periphery broadly rounded in edge view, slightly scalloped in outline, initial end bluntly pointed; chambers distinct, rather few in number, of uniform shape and spacing, apertural end extended; sutures distinct, slightly depressed, nearly straight; wall smooth except for the slight depression of the sutures; aperture radiate, at the end of a slender protuberance; proloculum slightly inflated. Length 1.1 mm., breadth 0.5 mm.

This species is readily distinguished from *F. dunbari* by its much greater breadth compared to the length, fewer chambers, and general outline. No other described species has been encountered which resembles it closely.

From the basal Niobrara. Found only at the locality given below.

Holotype from sec. 32, T. 11 S., R. 16 W., Ellis County, Kans. U. S. National Museum, No. 75369.

The above description and notes are from the original. The type specimen is redrawn.

Frondicularia aclis Morrow
Plate 34, figures 5–8

Frondicularia aclis Morrow, Jour. Paleontology, vol. 8, p. 193, pl. 29, fig. 30, 1934.
Brotzen, Sveriges geol. undersökning, ser. C, No. 396, p. 103, pl. 6, fig. 4, 1936.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 60, pl. 13, fig. 4, 1942.

Test elongate, tapering, greatest breadth toward the apertural end, much compressed, faces nearly parallel, periphery truncate, initial end bluntly pointed; chambers rather indistinct, of nearly uniform shape, apertural end bluntly pointed; sutures distinct, slightly depressed, nearly straight, the depression of the sutures at the apex extended so as to give the appearance of a faint longitudinal furrow; wall covered with obscure longitudinal lirae; proloculum bulbous, smooth or ornamented by one or more of the lirae which may continue onto it. Length about 1.2 mm., breadth 0.35 mm.

The figured specimen, which has the apertural end broken, and another somewhat larger individual showing the aperture but lacking the initial end, are the only specimens of this type in the collection. The liration alone is sufficient to make this species easily distinguished from the other species of *Frondicularia* given in this paper. It differs from *F. gracilis* Franke [Abhandl. Geol. Pal. Instit. Univ. Greifswald, vol. 6, p. 50, pl. 4, fig. 9, 1925] and *F. angusta* Nilsson [Petrif. Suec., p. 11, pl. 9, figs. 22a, A, 1827] in its much more subdued longitudinal ornamentation and more angular outline.

Basal Niobrara. Very rare.
Holotype from SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. U. S. National Museum, No. 75370.

The foregoing description and notes are from the original. The type specimen is redrawn.

This species is very close to *F. striatula* Reuss.

Specimens referable to this species occur rarely in our material from beds of Austin age and the lower beds of Taylor age. A typical specimen is figured by Brotzen from the Upper Cretaceous of Sweden.

Taylor marl, lower part. Texas, Dallas County (216, 217, 219).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (278).
Austin chalk. Texas, Dallas County (303, 310).
Brownstown marl. Arkansas, Sevier County (347, 348).

Frondicularia undulosa Cushman
Plate 34, figures 9–13

Frondicularia undulosa Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 13, pl. 3, figs. 7–11, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull 12, p. 29, pl. 3, figs. 8, 9, 1937.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 60, pl. 13, figs. 2, 3, 1942.
Cushman, idem, vol. 20, p. 89, 1944.

Test typically elongate, with the sides nearly parallel or gently tapering, but in some specimens somewhat broader and flaring; periphery truncately rounded, undulate; broader sides flattened; whole test thin; chambers distinct, increasing gradually in size as added, the basal portion rounded to form the lobular periphery; apertural end narrow, extended; sutures distinct, strongly oblique, nearly straight or slightly concave toward the outer side; wall smooth except for the proloculum in the megalospheric form, which has a single, raised, longitudinal costa, the base with a short, stout spine; aperture small, at the end of a somewhat slender neck. Length up to 2.50 mm., breadth 0.50 to 0.75 mm., thickness 0.15 mm.

This species, with its undulate periphery and usually narrow test, seems to be characteristic of the Gober chalk member of the Austin, although a somewhat broader form, otherwise similar, occurs rarely at a few localities in the Taylor marl.

There is but a single raised costa on the proloculum, both in the more slender and in the broader forms. As in many of the species of this genus, the form is variable. In the Taylor specimens, which may be found to be distinct, the test is usually more flaring, but there seems to be a close relationship between the two forms.

Taylor marl.
Upper part. Texas, Limestone County (135).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168).
Lower part. Texas, Collin County (210); Dallas County (225); McLennan County (239); Falls County (244); Williamson County (246).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (277); Lamar County (288).
Austin chalk. Texas, Dallas County (311, 342); Grayson County (326, 336); 6.5 miles east by north of Allen, Collin County.
Brownstown marl. Texas, Red River County (319). Arkansas, Sevier County.
Selma chalk (lower part). Mississippi, Itawamba County (351).

Frondicularia mucronata Reuss
Plate 34, figures 14–17

Frondicularia mucronata Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 31, pl. 13, figs. 43, 44, 1845; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 96, pl. 2, figs. 14–16 (1874).
Perner, Ceská Akad. Císare Frantiska Josefa, Trida 2, vol. 3, p. 41, pl. 4, fig. 4, 1897.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 48, pl. 4, fig. 3, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 61, pl. 5, fig. 5, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 15, pl. 3, figs. 16, 17, 1936.

The figured specimens shows the typical form of this species, with basal spine, very elongate proloculum with a raised central ridge and nearly embracing chambers of rather uniform size extended at the apertural end into a definite neck, the sides flattened, periphery truncate, and sutures distinct but not depressed.

Reuss' types were from the Cretaceous of Bohemia. Typical material was seen in the collections of Reuss now in Dresden and Vienna. Some of the European material referred to this species is not correctly identified, particularly that of Karrer, which was also examined. The above references are to the forms that seem to belong here.

In the American Cretaceous the species occurs in typical form in the Gober tongue of the Austin chalk and is found also in the Taylor marl of Texas.

Taylor marl.
Upper part. Texas, Hunt County (116); Limestone County (135, 136).
Lower part. Texas, Dallas County (222).
Austin chalk. Gober tongue. Texas, Fannin County (275); Lamar County (282, 285).

Frondicularia goldfussi Reuss
Plate 34, figures 18–20; plate 35, figures 1, 2

Frondicularia goldfussi Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber, vol. 40, p. 192, pl. 4, fig. 7, 1860.
Egger, K. bayer. Akad. Wiss., Math.-naturh., Abt., Abh., Kl. 2, vol. 21, p. 89, pl. 13, figs. 12, 13, 16, 17, 1899.
Cushman, Cushman Lab. Foram Research Contr., vol. 6, p. 33, pl. 5, fig. 3, 1930; idem, vol. 12, p. 15, pl. 3, figs. 21, 22, 1936.
Cushman and Hedberg, idem, vol. 17, p. 91, pl. 22, figs. 7–10, 1941.
Cushman, idem, vol. 20, p. 8, 1944; Am. Jour. Sci., vol. 242, p. 611, pl. 1, figs. 12–14; pl. 2, figs. 1, 2, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 335, pl. 52, figs. 11, 12, 1944.

The species has a basal spine and a rounded or slightly elongate proloculum, the following chambers increasing very slightly in width as added, the sutures becoming progressively more curved, slightly limbate, but not rising above the generally smooth, flattened, broad face of the test. The periphery is distinctly truncate, even slightly concave. The apertural end usually projects slightly into a very short, apertural neck. At the base, the chambers reach well back, and form a broadly wedge-shaped base with the central portion projecting.

Reuss' species, described from the Upper Cretaceous of Westphalia, Germany, occurs in rather typical form in the American material. It seems to be most characteristic of the Taylor marl, but there are a few specimens from the upper Austin that closely resemble these. It also occurs in the upper zone of the Colon shale in Colombia. The specimens figured under this name from the Annona chalk (Cushman, Jour. Paleontology, vol. 6, p. 336, pl. 50, figs. 8, 9, 1932) should be referred to *Frondicularia cordata* Roemer.

Taylor age.
- Upper part of Taylor marl. Texas, Limestone County (135); Bexar County (158).
- Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177); Falls County (178); Delta County (166).
- Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
- Marlbrook marl. Arkansas, Howard County; Hempstead County.
- Annona chalk. Texas, Red River County (188a, 194).
- Lower part of Taylor marl. Texas, Dallas County (216, 219); Kaufman County (228).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270).
- Gober tongue of Austin chalk. Texas, Fannin County (278); Lamar County (282).
- Austin chalk. Texas, Dallas County (310); Bell County (315, 316).

Frondicularia cordata Roemer

Plate 35, figures 3–7

Frondicularia cordata Roemer, Verstein. norddeutschen Kreidegebirges, 1840–41, p. 96, pl. 15, fig. 8 (1841).
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 16, pl. 4, figs. 1–3, 1936.
Cushman and Deaderick, idem, vol. 18, p. 61, pl. 13, figs. 7, 8, 1942.
Frondicularia goldfussi Cushman (not Reuss), Jour. Paleontology, vol. 6, p. 336, pl. 50, figs. 8, 9, 1932.

Test much compressed, flattened, periphery truncate, in the young rhomboid, later heart-shaped; microspheric form with a distinct, projecting, angular portion at the base; chambers distinct in the adult, of rather uniform shape, increasing very gradually in size as added, proloculum in the megalospheric form with one or more longitudinal costae; sutures distinctly limbate, depressed little if at all, in the young fairly straight, becoming more curved in the adult; wall smooth; aperture terminal, radiate, slightly projecting. Length up to 3.00 mm., breadth up to 2.50 mm., thickness 0.15 mm.

Some of the specimens referred to *F. cordai* Reuss in the literature may belong here. The typical form is most common in the Taylor marl, but a few very similar specimens appear in the upper part of the Austin chalk.

Taylor age.
- Upper part of Taylor marl. Texas, Limestone County (135, 136).
- Pecan Gap chalk member of Taylor marl. Texas, Falls County (178, 179).
- Annona chalk. Texas, Red River County (192–194, 198).
- Selma chalk (middle part). Mississippi, Prentiss County (261).
- Lower part of Taylor marl. Texas, Dallas County (222, 223); Ellis County (234).

Austin age.
- Gober tongue of Austin chalk. Texas, Lamar County (288).
- Austin chalk. Texas, Hill County (312); Bell County (316).
- Brownstown marl. Arkansas, Sevier County.

Frondicularia linearis Franke

Plate 35, figures 8–10

Frondicularia linearis Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 72, pl. 6, figs. 17, 18, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 21, pl. 4, figs. 19, 20, 1936; idem, vol. 20, p. 8, pl. 2, fig. 7, 1944; idem, vol. 20, p. 88, pl. 13, fig. 22, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 335, pl. 52, figs. 8, 9, 1944.

Test small, slender, with the sides nearly parallel or slightly tapering, compressed, the broad faces flat or slightly concave, periphery truncate, base with a stout, acicular spine; chambers few, rather uniform in shape, increasing gradually in size as added, not inflated, proloculum globular; sutures distinct, slightly limbate, slightly depressed; wall smooth except for the proloculum, which has a few longitudinal costae; aperture terminal, radiate. Length 1.00 to 1.50 mm., breadth 0.20 to 0.25 mm.

It is possible that some of the specimens grouped under this name may be very narrow young specimens of other species. The species was originally described from the Cretaceous of northern Germany. From the record given here the species seems to range from the upper beds of Austin age through most of the beds of Taylor age.

Taylor age.
- Upper part of Taylor marl. Texas, Collin County (122); Kaufman County (129).
- Pecan Gap chalk member of Taylor marl. Texas, Collin County (172); Kaufman County (173); Delta County (166).
- Marlbrook marl. Arkansas, Howard County; Hempstead County.
- Annona chalk. Texas, Red River County (193).
- Lower part of Taylor marl. Texas, Delta County (206); Collin County (209, 210, 212); McLennan County (241).

Austin age.
- Gober tongue of Austin chalk. Texas, Lamar County (288).
- Austin chalk. Texas, Collin County (294, 324).
- Bonham marl. Texas, Grayson County (328).
- Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Frondicularia intermittens Reuss

Plate 35, figures 11–13

Frondicularia intermittens Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 52, Abt. 1, p. 460, figs. 11a, b, 1865.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 21, pl. 4, figs. 16–18, 1936.
Cushman and Deaderick, idem, vol. 18, p. 61, pl. 13, figs. 5, 6, 1942.
Cushman, idem, vol. 20, p. 9, pl. 2, fig. 10, 1944.
Frondicularia inversa Cushman (not Reuss), Tennessee Div. Geology Bull. 41, p. 35, pl. 5, figs. 1, 2, 1931.
Frondicularia verneuiliana Cushman (not D'Orbigny), Cushman Lab. Foram. Research Contr., vol. 6, p. 36, pl. 5, figs. 5, 6, 1930.

Test elongate, tapering; early chambers enlarging but slightly, after which the diameter increases more rapidly; much compressed, broad sides flattened, periphery rounded, base with a short, stout spine; chambers increasing in length but of about equal height throughout, proloculum globular; sutures distinct, nearly straight or very slightly curved, depressed very slightly if at all, occasionally crossed by fine longitudinal costae, especially toward the apertural end of the sutures; wall generally smooth, except for the sutures and the proloculum, which has a few, longitudinal costae; aperture terminal, radiate, somewhat projecting. Length up to 4.00 mm., breadth up to 0.80 mm.

This species is characteristic of the beds of Taylor age. It resembles *F. clarki,* of Navarro age, but that species has more curved sutures and a somewhat different shape.

Taylor age.
Upper part of Taylor marl. Texas, Delta County (114); Hunt County (115); Collin County (121); Navarro County (132); Limestone County (135, 136); Travis County (149); Bexar County (153, 158, 162).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Rockwall County (175); Falls County (178, 179); Delta County (166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (259); Lee County (267).
Annona chalk. Texas, Red River County (192).
Lower part of Taylor marl. Texas, Collin County (207, 209); Dallas County (219, 224); Bell County (245); Travis County (249).
Austin age. Brownstown marl. Arkansas, Sevier County.

Frondicularia frankei Cushman
Plate 35, figures 14–16; plate 36, figure 1

Frondicularia angusta Reuss (not Nilsson), Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 196, pl. 4, fig. 5, 1860.
Frondicularia archiaciana D'Orbigny var *strigillata* Bagg (not *F. strigillata* Reuss), U. S. Geol. Survey Bull. 88, p. 47, pl. 3, fig. 5, 1898.
Frondicularia gracilis Franke (not Perner), Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 50, pl. 4, fig. 9, 1925.
Cushman, Cushman Lab. Foram Research Contr., vol. 6, p. 37, pl. 5, fig. 16, 1930.
Frondicularia frankei Cushman, idem, vol. 12, p. 18, pl. 4, figs. 6, 7, 1936; idem, vol. 20, p. 9, pl. 2, fig. 9, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 335, pl. 52, fig. 10, 1944.

Test elongate, tapering gradually from the subacute initial end to the greatest width near the apertural end, periphery truncate, central part of the test somewhat thickened; chambers numerous, gradually and regularly increasing in size; sutures slightly depressed in the later portion, in the earliest portion often slightly raised, strongly oblique; wall of the individual chambers ornamented with strongly raised, short, stout, vertical costae, usually discontinuous over the sutures; aperture small, at the end of a short, projecting neck. Length up to 5.00 mm., breadth 1.00 mm.

The species is characteristic of the upper and middle beds of Taylor age. There are similar specimens in the lower part of the Navarro. Its vertical range in Europe is very similar.

Navarro age.
Selma chalk (upper part). Mississippi, Prentiss County (91).
Ripley formation. Tennessee, McNairy County (95).
Neylandville marl. Texas, Rockwall County (57); Kaufman County (60).
Taylor age.
Upper part of Taylor marl. Texas, Lamar County (110); Limestone County (135, 136); Travis County (149); Bexar County (152).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177); Falls County (178); Delta County (166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Prentiss County (261); Lee County (266).
Wolfe City sand member of Taylor marl. Texas, Collin County (181).
Marlbrook marl. Arkansas, Howard County.
Lower part of Taylor marl. Texas, Dallas County (216); Bell County (245).

Frondicularia cuspidata Cushman
Plate 36, figures 3–7

Frondicularia cuspidata Cushman, Tennessee Div. Geology Bull. 41, p. 36, pl. 5, figs. 4, 5, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 278, pl. 42, figs. 16, 17, 1932.
Brotzen, Sveriges geol. undersökning, ser. C, No. 396, p. 97, pl. 6, fig. 2, 1936.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 23, pl. 2, fig. 19, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 19, pl. 4, figs. 12–14, 1936.
Frondicularia lanceola Cushman (not Reuss), idem, vol. 6, p. 38, pl. 5, figs. 18, 19, 1930.

Test elongate, consisting of an elongate, tapering proloculum with a long tapering spine at the initial end, nearly circular in transverse section, the later chamber or chambers much compressed, the periphery channelled; proloculum with several (5 or 6) longitudinal costae, later chambers smooth; sutures distinct, depressed; wall of later chambers smooth; aperture terminal, radiate. Length up to nearly 4.00 mm., breadth 0.40 mm.

This species was originally described from the Selma chalk of Tennessee, and later recorded by Sandidge from the Ripley formation of Alabama. Further study has shown that the species is common in the middle and upper parts of the Taylor marl of Texas and its equivalents, and in the Ripley formation of Tennessee. It is also recorded from the Upper Cretaceous of New Jersey and Sweden.

In the original type material two-chambered specimens were the most common, but later material has shown the adult to have several more chambers and to reach a length of nearly 4.00 mm.

The proloculum is very elongate, with a fairly long basal spine and several longitudinal costae. In the adult the periphery is often somewhat undulate, and the apertural end drawn out into a distinct elongate neck. The surface, except that of the proloculum, is unornamented.

Navarro age. Ripley formation. Tennessee, McNairy County (94, 95).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106); Lamar County (110).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Lower part of Taylor marl. Texas, Collin County (212).

Frondicularia cuspidata Cushman var. costifera Cushman
Plate 36, figure 8

Frondicularia cuspidata Cushman var. *costifera* Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 21, pl. 4, fig. 15, 1936.

Variety differing from the typical form in the surface, which has the sutures of the adult distinctly depressed and the wall of the chambers with distinct short costae.

Navarro age. Selma chalk (upper part). Mississippi, Union County (92). Alabama, Marengo County (104).
Taylor marl, upper part. Texas, Lamar County (110).

Frondicularia linguiformis Marsson
Plate 36, figures 9–11

Frondicularia linguiformis Marsson, Naturw. Ver. Neu-Vorpommern u. Rügen, Mitt., Jahrg. 10, p. 135, pl. 2, figs. 14a–c, 1878.
Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 273 (1913); Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 50, pl. 4, fig. 14, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 65, pl. 5, figs. 17a, b, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 17, pl. 3, figs. 18–20, 1936.

Our figured specimens although young or fragmentary seem to belong to Marsson's species.

The vertical costae between the sutures are very fine and numerous, and the whole test may reach a length of 5 mm. The test is narrow and gradually tapering, and the proloculum is rounded, with about 3 distinct longitudinal costae, and is thicker than the remainder of the test. The specimen figured from the Cretaceous of Trinidad as "*Frondicularia gracilis* Franke(?)" (Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 40, pl. 12, fig. 5, 1932) should be referred to Marsson's species.

This species was originally described by Marsson from the Upper Cretaceous chalk of the Island of Rügen and was recorded by Franke from chalks of similar age in northern Germany. Our figured specimens are from the Annona chalk at two localities east of Clarksville, Red River County, Tex. There are other specimens from the Taylor marl of similar age. These have been compared with type and topotype material, and our American specimens seem identical with the European specimens. The vertical range both in Europe and America is short and very similar, so that this should make an excellent species for correlation purposes.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Taylor age.
Upper part of Taylor marl. Texas, Guadalupe County (151).
Annona chalk. Texas, Red River County (195–197).

Frondicularia microdisca Reuss
Plate 36, figure 2

Frondicularia microdisca Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 195, pl. 5, fig. 4, 1860.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 33, pl. 5, fig. 4, 1930.

Test as broad as or broader than long, much compressed, basal margin forming a broad angle, periphery rounded; chambers numerous, very low and broad, increasing gradually in size as added, height increasing very slightly if at all; sutures distinct, gently convex, nearly flush with the surface; wall smooth; aperture terminal, radiate, little if any extended beyond the general outline of the test. Length 2.50 to 3.00 mm., breadth 2.50 to 3.25 mm.

The types of this species are from the Upper Cretaceous of Westphalia, Germany. In America specimens occur in the Taylor marl.

Taylor marl. Pecan Gap chalk member. Texas, Falls County (178).

Frondicularia verneuiliana D'Orbigny
Plate 36, figures 12–15

Frondicularia verneuiliana D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 20, pl. 1, figs. 32, 33, 1840.
Brown, Annals and Mag. Nat. History, 2d ser., vol. 12, p. 241, pl. 9, fig. 5, 1853.
Egger, Naturw. Ver. Passau, Ber., p. 29, pl. 1, figs. 6, 15, 16, 1907.
Heron-Allen and Earland, Royal Micr. Soc. Jour., p. 419, pl. 7, fig. 15, 1910.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 36, pl. 5, figs. 5, 6, 1930; idem, vol. 12, p. 19, pl. 4, fig. 11, 1936.
Cushman and Deaderick, idem, vol. 18, p. 61, pl. 13, fig. 9, 1942.
Cushman and Todd, idem, vol. 19, p. 60, pl. 10, fig. 24, 1943.

Test elongate, evenly tapering, compressed, the sides somewhat convex in the middle; edges very straight, slightly keeled, truncate; chambers distinct, very slightly if at all inflated, very gradually increasing in breadth but of almost uniform height throughout; sutures distinct, limbate, raised, slightly sigmoid, the upper ends distinctly swollen; wall smooth except for the proloculum, which has a very few longitudinal raised costae; aperture terminal, radiate. Length up to 3.50 mm. or more, breadth 0.60 to 0.70 mm.

The American material seems identical with this species, known from the general Senonian of Europe. It occurs mostly in the beds of Taylor age of the Coastal Plain.

Navarro age.
Corsicana marl. Texas, Limestone County (30).
Selma chalk (upper part). Mississippi, Prentiss County (91).
Taylor age.
Upper part of Taylor marl. Texas, Navarro County (134); Limestone County (136).
Ozan formation. Arkansas, Sevier County (253); Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Falls County (178).
Annona chalk. Texas, Red River County (193).
Lower part of Taylor marl. Texas, Delta County (206); Bell County (245).
Austin age.
Burditt marl (of Adkins). Texas, Travis County (271).
Austin chalk. Texas, Dallas County (297); Grayson County (334).
Brownstown marl. Arkansas, Sevier County.

Frondicularia verneuiliana D'Orbigny var. fossata Cushman
Plate 36, figures 16–19

Frondicularia verneuiliana D'Orbigny var. *fossata* Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 36, pl. 5, figs. 7, 8, 1930.

Variety differing from the typical form in having a channel along the middle of each broad face with a costa at each side.

This variety, which may be distinct from *F. verneuiliana*, is apparently confined to beds of Taylor age.

Taylor age.
Upper part of Taylor marl. Limestone County (135, 136).
Pecan Gap chalk member of Taylor marl. Texas, Falls County (178).
Selma chalk (middle part). Mississippi, Alcorn County (258).
Austin age.
Austin chalk. Texas, Dallas County (311).
Gober tongue of Austin chalk. Texas, Lamar County (288).

Frondicularia striatula Reuss
Plate 37, figures 1–4

Frondicularia striatula Reuss, Geognostische Skizzen Böhmen, vol. 2, p. 212, 1844; Verstein. böhm. Kreideformation, pt. 1, p. 30, pl. 8, fig. 23, 1845; Palaeontographica, vol. 20, pt. 2, 1872–75, p. 94, pl. 2 (21), figs. 2a–c (1874).
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 51, pl. 4, fig. 15, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 67, pl. 6, figs. 1a, b, 2, 1928.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 18, pl. 4, figs. 4, 5, 1936.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 336, pl. 52, fig. 14, 1944.
Frondicularia gracilis Perner, Foram. Ceského Cenomanu (résumé), p. 60, pl. 8, fig. 9, 1892.

Test elongate, compressed, the sides flattened, gently tapering, with the greatest width made by the last-formed chamber, basal end with or without a short spine, periphery truncate; chambers distinct, not inflated, increasing very gradually in size as added; sutures distinct, limbate, raised, slightly sigmoid, often slightly thickened at the upper end; wall ornamented with a few, short, distinctly raised, vertical costae; aperture terminal, radiate. Length up to 4.00 mm., breadth 0.75 mm.

Reuss described this species from the Upper Cretaceous of Bohemia and later recorded it from the Saxon Basin.

Material from both these localities has been studied. The present figured specimens are from the Taylor marl.

Taylor marl.
  Upper part. Texas, Red River County (108); Lamar County (110); Collin County (121).
  Pecan Gap chalk member. Texas, McLennan County (177).
  Marlbrook marl. Arkansas, Hempstead County.
Austin chalk, Gober tongue. Texas, Lamar County (282).

Frondicularia glabrans Cushman
Plate 37, figure 5

Frondicularia glabrans Cushman, Tennessee Div. Geology Bull. 41, p. 34, pl. 4, figs. 12a, b, 1931; Cushman Lab. Foram. Research Contr., vol. 12, p. 16, 1936.

Test large, broad, flattened, greatest breadth near the base, sides strongly convex in outline, channeled in side view; chambers comparatively few, of nearly uniform shape; sutures distinct, not depressed; wall smooth; aperture terminal, radiate, slightly protuberant. Length 2.00 mm. or more, breadth 1.50 mm., thickness 0.15 to 0.20 mm.

The only locality for this species is the following:

Navarro age. Ripley formation. 1½ miles west of Sardis on the Sardis-Henderson road, Henderson County, Tenn. (96).

Frondicularia watersi Cushman
Plate 37, figures 6, 7

Frondicularia watersi Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 14, pl. 3, figs. 14, 15, 1936.
  Cushman and Hedberg, idem, vol. 17, p. 91, pl. 22, fig. 6, 1941.
Frondicularia cordai Cushman (not Reuss), Jour. Paleontology, vol. 5, p. 307, pl. 35, fig. 8, 1931.

Test strongly compressed, broad faces flattened; outline generally elliptical, the apertural end somewhat extended and the initial end tending to be truncated, with a stout basal spine; periphery entire, slightly truncate; chambers narrow, elongate, increasing rather regularly in size as added; earliest chambers in the microspheric form tending to be flabelline; proloculum elongate, narrow, in the microspheric form shorter and with several fine, longitudinal costae; sutures distinct, flush with the surface, toward the apertural end in many specimens with fine vertical lines, rather evenly curved toward the periphery; wall smooth throughout except over the microspheric proloculum and the outer ends of the sutures; aperture small, at the end of a very slight neck. Length up to 2.25 mm., breadth up to 0.85 mm., thickness 0.10 to 0.15 mm.

This species differs from *F. austinana* Cushman mainly in the lack of the surface ornamentation. The base is usually somewhat more truncate, and the chambers tend to be narrower and more numerous.

F. watersi is characteristic of the beds of Taylor age, with a few occurrences in the lower part of the Navarro.

Navarro age.
  Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80, 81).
  Selma chalk (upper part). Alabama, Marengo County (104).
Taylor age.
  Upper part of Taylor marl. Texas, Kaufman County (130); Bexar County (152).
  Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
  Selma chalk (middle part). Mississippi, Alcorn County (258).
  Lower part of Taylor marl. Texas, Collin County (209); Dallas County (225, 227); Travis County (250).

Frondicularia archiaciana D'Orbigny
Plate 37, figures 8–20

Frondicularia archiaciana D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 20, pl. 1, figs. 34–36, 1840.
  Eley, Geology in the garden, p. 197, pl. 4, fig. 19, 1859.
  Heron-Allen and Earland, Royal Micr. Soc. Jour., p. 419, pl. 7, figs. 11, 12, 1910.
  Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 52, pl. 4, fig. 18, 1925; Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 71, pl. 6, figs. 14, 15, 1928.
  Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 37, pl. 5, figs. 9–12, 1930; Tennessee Div. Geology Bull. 41, p. 35, pl. 4, figs. 13a, b, 1931.
  Sandidge, Jour. Paleontology, vol. 6, p. 278, pl. 42, figs. 15, 26, 1932.
  Cushman, idem, p. 335; Cushman Lab. Foram. Research Contr., vol. 12, p. 19, pl. 4, figs. 8–10, 1936.
  Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 22, pl. 2, fig. 18, 1936.
  Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 60, pl. 10, fig. 26, 1943.
  Cushman, idem, vol. 20, p. 9, pl. 2, fig. 8, 1944.

Test elongate, gently tapering, greatest breadth toward the apertural end, compressed, sides flattened, periphery truncate; chambers distinct, not inflated, gradually increasing in size as added, proloculum rounded; sutures distinct, raised, limbate, slightly sigmoid; wall smooth, except for the raised sutures and the proloculum, which has several longitudinal costae; aperture terminal, radiate. Length up to 2.50 mm., breadth 0.50 to 0.65 mm.

The American material seems to be identical with that of Europe, as a study of topotype material has shown. The species is common in beds of Taylor age, with a few localities in the lower beds of Navarro age. It is recorded from the Navesink marl of New Jersey.

Navarro age.
  Corsicana marl. Texas, Limestone County (30).
  Ripley formation. Tennessee, McNairy County (94, 95).
Taylor age.
  Upper part of Taylor marl. Texas, Red River County (106); Lamar County (110, 111); Hunt County (115); Collin County (118); Kaufman County (130); Limestone County (135, 136); Williamson County (140); Guadalupe County (151); Bexar County (157, 158).
  Ozan formation. Arkansas, Sevier County (253); Little River County (254).
  Selma chalk (middle part). Mississippi, Prentiss County (261).
  Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (169); McLennan County (177); Falls County (178); Delta County (165, 166).
  Wolfe City sand member of Taylor marl. Texas, Collin County (180).
  Annona chalk. Texas, Bowie County (190); Red River County (197, 198).
  Lower part of Taylor marl. Texas, Ellis County (234); Travis County (250).

Frondicularia arkadelphiana Cushman
Plate 37, figures 21, 22

Frondicularia arkadelphiana Cushman, Cushman Lab. Foram Research Contr., vol. 12, p. 12, pl. 3, figs. 2, 3, 1936.

Test elongate, narrow, slightly tapering, periphery truncate, slightly concave, broader surfaces nearly flat, proloculum spherical, somewhat thicker than the remainder of the test in the megalospheric form; chambers distinct, increasing gradually and regularly in size as added, not inflated; sutures distinct, strongly oblique, slightly curved, somewhat raised; wall ornamented with fine longitudinal, raised costae, becoming somewhat finer and more numerous on the later chambers, the costae at the base of each chamber fusing into the raised sutural ridge; aperture small, terminal, with a slight neck, radiately toothed. Length 2.00 mm. or more, breadth 0.65 to 0.70 mm., thickness 0.25 mm.

As far as seen, it is confined to the upper beds of Navarro age.

It also occurs at a locality assigned to the Arkadelphia marl 5½ miles northeast of Hope, Hempstead County, Ark., but this may be in the lower part of the Midway (Paleocene).

Navarro age.
Arkadelphia marl. Arkansas, Hempstead County (73).
Prairie Bluff chalk. Alabama, Sumter County (101, 102).

Frondicularia clarki Bagg
Plate 38, figures 1–5

Frondicularia clarki Bagg, U. S. Geol. Survey Bull. 88, p. 48, pl. 3, fig. 4, 1898.
Weller, New Jersey Geol. Survey, Paleontology, vol. 4, p. 227, pl. 2, fig. 23, 1907.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 34, pl. 5, figs. 1, 2, 1930.
Plummer (part), Texas Univ. Bull. 3101, p. 171, pl. 9, fig. 17 (not fig. 16), 1931.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 12, pl. 3, figs. 4–6, 1936.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 22, pl. 2, fig. 21, 1936.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 34 (list), pl. 2, fig. 11, 1938.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 61, pl. 10, fig. 25, 1943.

The test in the microspheric form has a shape near the base somewhat different from that of the megalospheric form. The surface is smooth, but the sutures are usually distinct and peculiarly curved, giving an almost elliptical shape to the test, especially in the adult megalospheric form. The whole test is very flat and thin. The initial end usually has a short spine, and the megalospheric proloculum may have a few longitudinal costae. Bagg described this species from the Upper Cretaceous of Atlantic Highlands, N. J.

It has been recorded by Jennings from the Navesink marl of New Jersey and by Cole from Selma chalk of Florida wells.

In the Texas Cretaceous material, it has been found to be common and characteristic of the upper beds of Navarro age, particularly the Corsicana marl.

Navarro age.
Corsicana marl. Texas, Navarro County (25–27); Limestone County (30, 31); Falls County (32); Travis County (41).
Prairie Bluff chalk. Mississippi, Chickasaw County (84). Alabama, Sumter County (101).
Saratoga chalk. Arkansas, Hempstead County (81).

Frondicularia dimidia Bagg
Plate 38, figure 6

Frondicularia angusta (Nilsson) Reuss var. *dimidia* Bagg, U. S. Geol. Survey Bull. 88, p. 47, pl. 3, figs. 7a, b, 1898.
Weller, New Jersey Geol. Survey Paleontology, vol. 4, p. 225, pl. 2, figs. 20, 21, 1907.
Frondicularia dimidia Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 11, pl. 3, fig. 1, 1936.

This species was originally described from deposits near Vincentown, N. J., was then assigned to the Cretaceous, but is now placed in the Eocene. It is characterized by an elongate, narrow, tapering test, thickest along the median line, thence decreasing in thickness to the periphery. The sutures are strongly oblique and depressed. The main body of each chamber is somewhat raised and ornamented by strongly raised sutures; longitudinal costae are usually wanting over the sutures. As Nilsson's species is very poorly described and figured, it cannot be determined satisfactorily, and Bagg's variety is here given specific rank.

Frondicularia dimidia Bagg occurs in the present Cretaceous material from the lower part of the Navarro group in the Neylandville marl, southeast edge of Greenville, 0.3 mile south of fair grounds, Hunt County, Tex. (55).

Frondicularia jarvisi Cushman
Plate 38, figure 7

Frondicularia jarvisi Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 91, pl. 16, fig. 6, 1939.
Frondicularia archiaciana Cushman (not D'Orbigny), idem, vol. 2, pt. 1, p. 21, pl. 3, fig. 4, 1926.
Frondicularia sp. Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 598, pl. 20, fig. 2, 1926.
Frondicularia elongata Cushman and Jarvis (not Olszewski), Cushman Lab. Foram. Research Contr., vol. 4, p. 98, pl. 14, fig. 1, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 39, pl. 12, fig. 3, 1932.

Test narrow, elongate, initial end with a short, stout spine, sides for the most part nearly parallel; chambers and sutures largely hidden by the ornamentation, which consists of high, longitudinal costae running from base to apex, those of the proloculum swinging toward the middle of the test with new costae coming in from the sides in the adult; aperture terminal, radiate. Length up to 1.20 mm., breadth 0.25 mm.

The type locality is in the Upper Cretaceous beds at the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

This species differs from *F. striatula* Reuss in the character of the surface, which consists of high, platelike costae, not broken at the sutures, and sides nearly parallel instead of tapering. *F. jarvisi* also occurs in the Velasco shale of Mexico.

A somewhat similar form was figured by White (Jour. Paleontology, vol. 2, p. 205, pl. 29, fig. 3, 1928) as *F. elongata*. This is from the Mendez shale and seems to be *F. striatula* Reuss. Olszewski already had given the name *elongata* to a European species in 1875.

Frondicularia sp.
Plate 38, figure 8

Frondicularia gracilis? Cushman and Jarvis (not Franke), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 40, pl. 12, fig. 5, 1932.

This beautifully ornamented species is represented by a fragment only but seems to be distinct from any of the others recorded from the American Cretaceous. It is from the Upper Cretaceous of Trinidad.

Genus KYPHOPYXA Cushman, 1929

Kyphopyxa christneri (Carsey) Cushman
Plate 38, figures 12–17; plate 39, figures 1–12

Frondicularia christneri Carsey, Texas Univ. Bull. 2612, p. 41, pl. 6, fig. 7, 1926.
Kyphopyxa christneri Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 1, pl. 1, figs. 1–7, 1929.
Church, Jour. Paleontology, vol. 3, p. 411, 1929.
Cushman, Cushman Lab. Foram. Research Contr., vol. 6, p. 33, pl. 4, fig. 20, 1930; p. 85, pl. 12, fig. 2, 1930.
Cushman and Hedberg, idem, p. 65, pl. 9, fig. 5, 1930.
Vanderpool, Jour. Paleontology, vol. 4, pp. 254, 255, (lists), 1930.
Cushman, Cushman Lab. Foram. Research Special Pub. 2, pl. 3, fig. 2, 1930.
Plummer, Texas Univ. Bull. 3101, p. 168, pl. 12, figs. 9–19, 1931.
Cushman, Jour. Paleontology, vol. 6, p. 336, pl. 50, figs. 11, 12, 1932; Cushman Lab. Foram. Research Special Pub. 5, pl. 21, figs. 1, 2, 1933.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 29, pl. 4, fig. 1, 1937.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 62, pl. 14, figs. 1–7, 1942.
Cushman, idem, vol. 20, p. 89, pl. 13, figs. 23, 24, 1944.

Test much compressed, heart-shaped or variously shaped in front view, apertural end usually narrowed to a point at the aperture; periphery truncate, early portion usually thicker than the later, adult portion; chambers distinct, consisting of a globular proloculum followed by usually 2 or 3 chambers that make the beginning of a planispiral coil, as in *Palmula,* then followed by several chambers alternating, each as added extending farther and farther back, in some specimens overlapping below the proloculum to form a broadly curved base, in others reaching back only to the level of the proloculum to form a straight base, or falling short of the early portion to leave a somewhat angular base, adult chambers chevron-shaped, more compressed than the earlier chambers, in many specimens entirely enveloping the borders of the previous ones, sutures distinct, limbate, those of the early stages strongly raised, often platelike, standing high above the general level, in the adult greatly reduced and even in some specimens slightly incised; wall smooth, except for the raised sutures; aperture terminal, radiate. Length up to 3.00 mm., breadth 2.00 mm.

But a single species of the genus *Kyphopyxa* appears to be present. It ranges from the Austin chalk, where it is abundant at many localities, up to the higher portions of the Taylor marl. Two other species have been named, and the figures and descriptions are reproduced below so that they may be readily available, but both seem to come within the range of variation of *K. christneri.*

The figures given on our plate show the different shapes that may be assumed by this species, especially when the specimens represent different stages in development. The genus seems to have arisen in the Austin of Texas and not to have extended beyond the American area, though it is found in the Upper Cretaceous of California and Venezuela.

Taylor age.
- Upper part of Taylor marl. Texas, Limestone County (136); Bexar County (163).
- Anacacho limestone (upper part). Texas, Bexar County (164).
- Ozan formation. Arkansas, Sevier County (253); Little River County (254).
- Pecan Gap chalk member of Taylor marl. Texas, Falls County (178).
- Selma chalk (middle part). Mississippi, Lee County (268).
- Wolfe City sand member of Taylor marl. Texas, Hunt County 186).
- Annona chalk. Texas, Red River County (188a, 194, 195, 198).
- Lower part of Taylor marl. Texas, Red River County (199); Lamar County (202); Collin County (207–209, 211); Dallas County (219, 221, 223, 225); Kaufman County (228, 229); Ellis County (232; Navarro County (236); McLennan County (241–243); Falls County (244); Bell County (245); Williamson County (246); Travis County (247, 249, 250).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270, 271).
- Gober tongue of Austin chalk. Texas, Fannin County (276–280); Lamar County (282–285, 288).
- Austin chalk. Texas, Grayson County (289, 290, 333, 335); Collin County (292, 295, 295a, 324); Dallas County (300–303, 305–309, 326); Hill County (312, 313); Bell County (315, 316).
- Brownstown marl. Texas, Red River County (319). Arkansas, Sevier County (347, 348).
- Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Kyphopyxa undulata Loetterle
Plate 38, figures 10, 11

Kyphopyxa undulata Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 30, pl. 4, figs. 2, 3, 1937.

Test triangular in outline, widest at or slightly above the middle, compressed, periphery undulate below the middle; chambers of the early portion flabelline, later biserial, in the adult stage uniserial and saggitate, long and narrow in the biserial and uniserial portions of the test; sutures flush or faintly incised at the base of the chambers, elevated into sharp ridges across the apices, in some specimens tending to form small apical loops, straight in the uniserial portion; aperture terminal, faintly radiate, protruding. Length of holotype, 1.18 mm.; greatest breadth, 0.63 mm.; thickness, 0.27 mm.

So far as the writer is aware, this is the second species of *Kyphopyxa* to be described. It differs from *K. christneri* (Cushman) [(Carsey)] in the shape of the test, being widest near or above the middle. Each chamber is shorter at the base than the one preceding, giving rise to a strongly tapering lobulate periphery below the middle. Thus, there is no tendency for later chambers to curve toward and around the proloculum as in *K. christneri.* Plummer's figure 13 approaches *K. undulata* but has its greatest width near the base. (Texas Univ. Bull. 3101, pl. 12, fig. 13, 1931.)

A few specimens were obtained from the Fort Hays limestone north of Ransom, Kans., and the section of the same member northeast of St. James, Nebr., yielded several beautifully preserved tests. The species was not observed elsewhere, however. Holotype from northeast of St. James, Nebr., in the SE¼ sec. 15, T. 32 N., R. 3 E., 25 feet above the base of the Fort Hays.

Wherever *K. christneri* (Carsey) Cushman is common some of the specimens, especially the immature ones, assume the shape described for *K. undulata* Loetterle.

Kyphopyxa cushmani Albritton and Phleger
Plate 38, figure 9

Kyphopyxa cushmani Albritton and Phleger, Jour. Paleontology, vol. 11, p. 354, text fig. 1, 1937.

Test free, large, subquadrate or ovate in outline, thickest in central area, periphery truncate to slightly rounded; first few chambers planispirally coiled, succeeding 5 to 7 chambers biserial and embracing, last few chambers frondicularian and curved downward around early portion of test; sutures of coiled and biserial portions marked by thin, continuous, platelike elevations which are highest in the central area and but weakly developed in the frondicularian stage; walls smooth, thin, calcareous, finely perforate; aperture terminal, projecting, radiate.

Kyphopyxa cushmani is a comparatively rare form at Ferris, where it is associated with the common Taylor and Austin species, *K. christneri* (Carsey). *K. christneri* may be distinguished from the present species by the sharp convergence of its sides toward the aperture.

The types of this species are from clays of upper Taylor age at Ferris, Ellis County, Tex. (230).

It is probable that this is but a local form of *K. christneri,* but more material is necessary to determine this.

Genus LAGENA Walker and Jacob, 1798

Owing to the rather poor preservation of many of the Cretaceous forms belonging to this genus and to the genus *Entosolenia,* and also owing to the considerable variation found in the group, it has seemed best to include the specimens available under few specific names. Figures illustrating the species recognized are of Cretaceous specimens, usually representing specimens derived from clay samples, from which the forms may be washed without loss of the details of their structure.

Lagena hispida Reuss
Plate 39, figure 13

Under this name are included a wide range of forms with somewhat differing shapes, but all with a finely spinose surface and usually with a rather elongate, slender neck. A number of names have been given to Cretaceous spinose forms, some of which are evidently the detached final chambers of such species as *Nodosaria aculeata* and *N. aspera.*

Navarro age.
Kemp clay. Texas, Williamson County (12).
Corsicana marl. Texas, Falls County (32); Caldwell County (44); Guadalupe County (45); Travis County (40).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Sumter County (103).
Saratoga chalk. Arkansas, Hempstead County (81).
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Selma chalk (upper part). Tennessee, McNairy County (98).
Neylandville marl. Texas, Delta County (51); Kaufman County (58); Navarro County (63, 67).
Taylor age.
Upper part of Taylor marl. Texas, Delta County (114); Rockwall County (124); Kaufman County (125, 128); Williamson County (142); Travis County (149); Guadalupe County (151); Bexar County (154, 159).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (258); Prentiss County (261); Lee County (268).
Wolfe City sand member of Taylor marl. Texas, Collin County (180).
Marlbrook marl. Arkansas, Howard County.
Annona chalk. Texas, Red River County (192, 194, 195, 197, 198).
Lower part of Taylor marl. Texas, Lamar County (201, 202); Delta County (206); Dallas County (217, 220, 225); Kaufman County (229); McLennan County (238, 240); Falls County (244); Williamson County (246); Travis County (249).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Gober tongue of Austin chalk. Texas, Fannin County (278, 279); Lamar County (284, 285, 287).
Austin chalk. Texas, Grayson County (289, 290); Dallas County (301, 303, 307, 309, 310).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).
Brownstown marl. Texas, Red River County (319); Lamar County (320). Arkansas, Sevier County (347).
Ector tongue of Austin chalk. Texas, Grayson County (332).

Lagena acuticosta Reuss
Plate 39, figures 14, 15

Specimens referred to this species have a wide distribution, as noted below. I have included here those specimens that have rather few, high, platelike costae, the test broadest toward the base and somewhat broadly pyriform. Figures have been given in previous papers of forms from the Saratoga and Annona chalks, and these are repeated here. The variation in these forms is considerable.

Navarro age.
Corsicana marl. Texas, Travis County (41).
Prairie Bluff chalk. Alabama, Sumter County (101, 103).
Saratoga chalk. Arkansas, Clark County (78); Howard County (79).
Ripley formation. Tennessee, McNairy County (94, 95).
Selma chalk (upper part). Alabama, Marengo County (104).
Neylandville marl. Texas, Kaufman County (62); Navarro County (66, 69).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 107); Lamar County (110); Hunt County (115); Collin County (119, 122); Navarro County (132); Travis County (145); Bexar County (158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165); Hunt County (168); Collin County (169, 170).
Selma chalk (middle part). Mississippi, Alcorn County (257, 259); Lee County (264, 265).
Wolfe City sand member of Taylor marl. Texas, Collin County (183); Navarro County (188).
Annona chalk. Texas, Red River County (188a, 195).
Lower part of Taylor marl. Texas, Lamar County (202); Delta County (206); Dallas County (216); Hill County (237); McLennan County (241); Williamson County (246); Travis County (249).
Austin age.
Burditt marl (of Adkins). Texas, Travis County (271).
Gober tongue of Austin chalk. Texas, Fannin County (274).
Brownstown marl. Texas, Red River County (319).
Selma chalk (lower part). Mississippi, Itawamba County.

Lagena amphora Reuss var. paucicosta Franke
Plate 40, figures 4, 5

Lagena amphora Reuss var. *paucicosta* Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 87, pl. 7, fig. 38, 1928.

Franke figures an elongate pyriform specimen under this name, with a very few longitudinal costae. Rarely specimens having this general character occur at a number of American localities and probably should be included under the name. Franke's types were from the Upper Cretaceous of Germany.

Navarro age. Ripley formation. Tennessee, McNairy County (95); Henderson County (96).
Taylor marl.
Upper part. Texas, Rockwall County (124); Williamson County (140).
Pecan Gap chalk member. Texas, Collin County (169).
Lower part. Texas, Lamar County (201, 202); Delta County (206).
Austin chalk. Texas, Grayson County (289).

Lagena apiculata Reuss
Plate 39, figure 23

Under this name are included a few specimens, generally rounded and smooth, except for a distinct basal spine. The specimens are mostly somewhat pyriform. It is possible that in a few instances they may represent the megalospheric proloculum of some such forms as *Dentalina catenula* Reuss.

Navarro age. Neylandville marl. Texas, Kaufman County (62).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (107); Hunt County (115); Bexar County (152).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Selma chalk (middle part). Mississippi, Lee County (265).

Lagena sulcata (Walker and Jacob) Parker and Jones var. semiinterrupta W. Berry
Plate 39, figures 18–21

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.

It is possible that more than one form has been placed under this name. The types are from Coon Creek, Tenn., and the holotype is refigured. The costae form a ring at the base and are frequently divided on the middle portion of the test. The neck is slender. The original description mentions the costae as arranged in "loops," but the structure is that common in costate forms when the costae divide at the base, and in this way multiply to cover the expanding surface.

Navesink marl. New Jersey.
Mt. Laurel sand. New Jersey.
Navarro age.
Ripley formation. Tennessee, McNairy County (94, 95, 97); Henderson County (96).
Selma chalk (upper part). Tennessee, McNairy County (98).

Lagena hexagona (Williamson) Siddall
Plate 39, figure 16

The only specimens referred to this species are from the Selma chalk and the Ripley formation. The surface network is shown in the illustration and consists of hexagonal depressed areas with raised borders.

Navarro age.
Ripley formation. Tennessee, McNairy County (95).
Selma chalk (upper part). Alabama, Marengo County (104).

Lagena lineata (Williamson) Reuss
Plate 39, figure 24

The only specimens referred to this species are from the Ripley formation of Tennessee. Specimens are somewhat longer than broad, the apertural end is blunt, and the surface is ornamented with longitudinal costae somewhat variable in height.

Navarro age. Ripley formation. Tennessee, McNairy County (94, 95).

Lagena plumigera H. B. Brady
Plate 39, figure 17

A few very finely preserved specimens close to this species, as figured by Brady, occur in the Selma chalk. They have high, thin, platelike costae with obliquely radiating tubular portions in them. These high costae are often interspersed with lower, more simple ones. The neck is slender and tapering.

Navarro age. Selma chalk (upper part). Tennessee, McNairy County (98).

Lagena substriata Williamson
Plate 39, figure 22

Specimens referred to this species are from beds of Navarro and Taylor age. The costae are fine and numerous, raised only slightly above the general surface. The body of the test is elongate, elliptical, or oval in side view, and the neck is slender.

Navarro age.
Kemp clay. Texas, Navarro County (3).
Ripley formation. Tennessee, McNairy County (94).
Taylor age.
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Howard County.

Lagena laevigata Reuss
Plate 40, figure 1

Occasional specimens from the Taylor marl especially may be referred to Reuss' species. They are smooth, somewhat compressed forms, pyriform in front view, and without a definite neck. There is considerable variation in the outline and the amount of compression of the test.

Navarro age.
Ripley formation. Tennessee, McNairy County (94).
Selma chalk (upper part). Tennessee, McNairy County (98).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105); Williamson County (142).
Selma chalk (middle part). Mississippi, Alcorn County (258).
Pecan Gap chalk member of Taylor marl. Texas, Lamar County (165).
Lower part of Taylor marl. Texas, Delta County (206).

Lagena cf. L. globosa Montagu
Plate 39, figure 26

Rounded specimens, generally globular in form, without a basal spine, occur at a number of localities. It is possible that these are the prolocula of *Nodosaria* or of other genera of the Lagenidae.

Velasco shale. Hacienda el Limon, Mexico.
Navarro age.
Corsicana marl. Texas, Travis County (34, 42).
Prairie Bluff chalk. Alabama, Sumter County (101).
Ripley formation. Tennessee, McNairy County (95).
Selma chalk (upper part). Tennessee, McNairy County (98).
Taylor age.
Upper part of Taylor marl. Texas, Navarro County (134).
Annona chalk. Texas, Red River County (191, 197).
Lower part of Taylor marl. Texas, Collin County (209); Williamson County (246).
Austin age.
Brownstown marl. Arkansas, Sevier County (347).

Lagena alveolata H. B. Brady
Plate 40, figure 2

Specimens referable to this species are very rare in the American Cretaceous material. The keel is very strongly developed on the basal portion of the test and is there split, leaving an elongate depression in the median line between the two platelike portions of the keel.

Navarro age.
Ripley formation. Tennessee, McNairy County (94).
Selma chalk (upper part). Tennessee, McNairy County (98).

Lagena vulgaris Williamson
Plate 40, figure 3

Small specimens from the Saratoga chalk have already been referred to this species. Other specimens are from beds of Austin age. They may be the same as some of those referred to *L.* cf. *L. globosa*. The surface is smooth, the test nearly spherical, with a short, slender apertural neck.

Navarro age. Saratoga chalk. Arkansas, Howard County (79).
Austin age. Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Lagena semilineata J. Wright
Plate 39, figure 25

The figured specimen seems very close indeed to this species with the basal spine and the lower half or more of the test with distinct longitudinal costae while the upper part is smooth.

Taylor marl, upper part. Texas, Red River County (105).

Family POLYMORPHINIDAE
Genus GUTTULINA D'Orbigny, 1839
Guttulina trigonula (Reuss) Cushman and Ozawa
Plate 40, figures 6, 7

Polymorphina trigonula Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 40, pl. 13, fig. 84, 1845.
H. B. Brady, Parker and Jones, Linnean Soc. Trans., vol. 27, p. 232, pl. 40, figs. 16a, b, 1870.
Guttulina trigonula Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 28, pl. 4, figs. 2a–c, 1930.
Cushman, Tennessee Div. Geology Bull. 41, p. 39, pl. 6, figs. 3, 4, 1931; Geol. Soc. America Bull., vol. 7, p. 418, 1936.
Brotzen, Sveriges geol. undersökning, ser. C, No. 396, p. 113, pl. 7, figs. 13a–d, 1936.

Test spheroidal, truncate at the base, obtuse at the apertural end; chambers rounded, inflated, arranged in a clockwise, quinqueloculine series, each succeeding chamber extending back to the base, but not covering the earlier chambers at the base; sutures depressed, distinct; wall smooth, the apertural end in many specimens covered with fistulose tubes; aperture produced, radiate. Length 0.35 to 0.70 mm., breadth 0.35 to 0.65 mm., thickness 0.25 to 0.50 mm.

Specimens referred to this species are from the upper beds of Taylor age, with occasional specimens from the Ripley formation of Tennessee. Specimens both with and without fistulose outgrowths occur.

Velasco shale. Hacienda el Limon, Mexico.
Navarro age. Ripley formation. Tennessee, McNairy County (94).
Taylor age. Ozan formation. Arkansas, Little River County (254).

Guttulina adhaerens (Olszewski) Cushman and Ozawa
Plate 40, figures 8–10

Polymorphina adhaerens Olszewski, Sprawozd. Kom. Fizyj. Akad. Umiej., Krakowie, vol. 9, p. 119, pl. 1, fig. 11, 1875.
Guttulina adhaerens Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 36, pl. 1, figs. 9a–c; pl. 6, figs. 7a, b, 1930.
Cushman, Tennessee Div. Geology Bull. 41, p. 39, pl. 6, figs. 5, 6, 1931.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 40, pl. 12, figs. 8a, b, 1932.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 61, pl. 11, fig. 1, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 336, pl. 52, fig. 18, 1944.
Guttulina problema Plummer (not D'Orbigny(?)), Texas Univ. Bull. 3101, p. 173, pl. 13, fig. 1, 1931.
Sandidge, Am. Midland Naturalist, vol. 13, p. 358, pl. 31, figs. 23, 24, 1932.

Test ovate, broadest below the middle, rounded at the base, acute toward the apertural end; chambers clavate, arranged in an almost quinqueloculine series, each succeeding chamber slightly removed from the base; sutures but little depressed, distinct; wall smooth; aperture radiate. Length 0.50 to 1.10 mm., breadth 0.35 to 0.80 mm., thickness 0.22 to 0.50 mm.

This species occurs in the present material in the upper beds of Navarro age and in the Marlbrook marl. The specimens recorded from the Navarro of Texas as *G. problema* D'Orbigny by Mrs. Plummer and from the Ripley of Alabama by Sandidge probably belong here.

Upper Cretaceous. Hobson clay. San Fernando, Trinidad.
Navarro age.
Corsicana marl. Texas, Navarro County (27); Limestone County (29, 30); Caldwell County (44); Travis County (37).
Arkadelphia marl. Arkansas, Hempstead County (72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (87). Alabama, Wilcox County (99).
Ripley formation. Tennessee, McNairy County (94).
Taylor age. Marlbrook marl. Arkansas, Clark County; Hempstead County.

Genus **GLOBULINA** D'Orbigny, 1839

Globulina lacrima Reuss
Plate 40, figures 11, 12

Polymorphina (Globulina) lacrima Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 40, pl. 12, fig. 6; pl. 13, fig. 83, 1845.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, pt. 1, p. 125, pl. 17, figs. 39, 40, 1899.
Globulina lacrima Reuss, Haidinger's Naturwiss. Abh., vol. 4, p. 27, pl. 4, fig. 9, 1851.
Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 77, pl. 19, figs. 1, 2, 1930.
Cushman, Tennessee Div. Geology Bull. 41, p. 40, pl. 6, figs. 9a–c, 1931; Jour. Paleontology, vol. 6, p. 337, pl. 51, fig. 2, 1932; Geol. Soc. America Bull., vol. 47, p. 418, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 31, pl. 4, figs. 4a, b, 1937.
Frizzell, Jour. Paleontology, vol. 17, p. 348, pl. 56, fig. 27, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 61, pl. 11, fig. 3, 1943.
Cushman, idem, vol. 20, p. 9, pl. 2, fig. 15, 1944; idem, vol. 20, p. 89, pl. 13, fig. 28, 1944; Am. Jour. Sci., vol. 242, p. 612, pl. 2, fig. 10, 1944.
Polymorphina gibba Cushman (not D'Orbigny), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 604, pl. 20, figs. 8, 15, 1926.

Test subglobular, the base broadly rounded, apertural end produced, regularly acuminate, the sides straight, not concave, typically rounded in end view; chambers few, extending back almost to the base; sutures not depresssed; wall smooth; aperture radiate, slightly produced. Length 0.55 to 0.75 mm., breadth 0.40 to 0.55 mm., thickness 0.40 to 0.55 mm.

The apertural end of this species is definitely produced, and the sides are usually straight and not concave. It is widely distributed in the Cretaceous of Europe and America. Most of the American Cretaceous records are of Navarro and Taylor ages.

Navarro age.
Corsicana marl. Texas, Navarro County (27); Limestone County (29, 30); Falls County (32); Travis County (38).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (99); Sumter County (102).
Saratoga chalk. Arkansas, Clark County (78).
Ripley formation. Tennessee, McNairy County (95); Henderson County (96).
Selma chalk (upper part). Mississippi, Union County (92). Alabama, Marengo County (104).
Nacatoch sand. Arkansas, Hempstead County (75); Lonoke County (77).
Taylor age.
Upper part of Taylor marl. Texas, Rockwall County (124).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165).
Ozan formation. Arkansas, Little River County (254).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (259); Prentiss County (261).
Annona chalk. Texas, Red River County (188a, 195, 198).
Lower part of Taylor marl. Texas, Delta County (206).
Austin age.
Austin chalk. Texas, Collin County (292); Dallas County (302).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Globulina lacrima Reuss var. subsphaerica (Berthelin) Cushman and Ozawa
Plate 40, figure 13

Polymorphina subsphaerica Berthelin, Soc. géol. France Mém., ser. 3, vol. 1, p. 58, pl. 4, figs. 18a, b, 1880.
Globulina lacrima Reuss var. *subsphaerica* (Berthelin) Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 78, pl. 19, figs. 5–7, 1930.
Cushman, Tennessee Div. Geology Bull. 41, p. 41, pl. 6, figs. 10a–c, 1931.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 25, pl. 3, figs. 6a, b, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 31, pl. 4, figs. 5a, b, 1937.
Tappan, Jour. Paleontology, vol. 14, p. 113, pl. 17, fig. 24, 1940.
Cushman and Goudkoff, Cushman Lab. Foram. Research Contr., vol. 20, p. 57, pl. 9, fig. 14, 1944.

Variety differing from the typical form in the slightly compressed test, which is more rounded at the base than at the apertural end. Length 0.33 to 0.45 mm., breadth 0.30 to 0.40 mm., thickness 0.20 to 0.30 mm.

This more compressed variety of *Globulina lacrima* is very widely distributed in the Cretaceous of Europe and is already recorded from the Upper Cretaceous of Mexico, Mississippi, Texas, Nebraska, California, and New Jersey.

The form referred by Sandidge to *G. inaequalis* (Am. Midland Naturalist, vol. 13, p. 359, pl. 31, figs. 25, 26, 1932) from the Ripley formation of Alabama may belong here.

Navarro age.
Corsicana marl. Texas, Bowie County (23).
Arkadelphia marl. Arkansas, Hempstead County (72).
Owl Creek formation. Mississippi, Tippah County (83).
Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94, 95).
Selma chalk (upper part). Mississippi, Union County (92).
Taylor age.
Upper part of Taylor marl. Texas, Bexar County (159).
Selma chalk (middle part). Mississippi, Alcorn County (257); Prentiss County (261).

Globulina lacrima Reuss var. horrida Reuss
Plate 40, figure 14

Globulina horrida Reuss, Verstein. böhm. Kreideformation, pt. 2, p. 110, pl. 43, fig. 14, 1846.
Globulina lacrima Reuss var. *horrida* Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 79, pl. 19, fig. 3, 1930.
Cushman, Jour. Paleontology, vol. 6, p. 337, pl. 51, fig. 3, 1932; Cushman Lab. Foram. Research Contr., vol. 20, p. 89, pl. 13, figs. 29, 30, 1944.

Variety differing from the typical in having the surface finely spinose and usually the apertural end fistulose.

The few American records are from the upper beds of Taylor age and the beds of Navarro age. Specimens are usually rare.

Navarro age.
Corsicana marl. Texas, Falls County (32); Travis County (35); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70).
Prairie Bluff chalk. Mississippi, Chickasaw County (84).
Selma chalk (upper part). Mississippi, Union County (92).
Taylor age.
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Ozan formation. Arkansas, Little River County (254).
Annona chalk. Texas, Collin County (188a).
Austin age.
Austin chalk. Texas, Dallas County (306).
Selma chalk (lower part). Mississippi, Itawamba County (351).

Globulina prisca Reuss
Plate 40, figures 15–17

Globulina prisca Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber, vol. 46, pt. 1, 1862, p. 79, pl. 9, fig. 8 (1862).
Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 76, pl. 12, figs. 6a–c, 1930.
Cushman, Jour. Paleontology, vol. 6, p. 337, pl. 51, fig. 1, 1932.
Brotzen, Sveriges geol. undersökning, ser. C, no. 396, p. 114, pl. 7, fig. 11, 1936.

Test elongate, fusiform, more or less compressed, acuminate toward both ends; chambers elongate, tapering to the base, arranged in an almost triserial series; sutures but little depressed; wall smooth; aperture radiate. Length 0.50 to 0.80 mm., breadth 0.25 to 0.35 mm., thickness 0.18 to 0.27 mm.

Specimens of the general form described and figured by Reuss occur very rarely in the present material. Occasional fistulose forms, such as that figured, appear in the Annona chalk and Pecan Gap chalk of Taylor age and in the Prairie Bluff chalk of Navarro age. It is possible that these forms should be included under *Pyrulina cylindroides* (Roemer) Cushman and Ozawa.

Navarro age.
Prairie Bluff chalk. Alabama, Sumter County (101).
Selma chalk (upper part). Mississippi, Union County (92).
Taylor age. Annona chalk. Texas, Collin County (188a).

Genus PYRULINA D'Orbigny, 1839
Pyrulina cylindroides (Roemer) Cushman and Ozawa
Plate 40, figures 18, 19

Polymorphina cylindroides Roemer, Neuss Jahrb., 1838, p. 385, pl. 3, fig. 26.
H. B. Brady, Parker and Jones, Linnean Soc. Trans., vol. 27, p. 221, pl. 39, figs. 6a–c, 1870.
Pyrulina cylindroides Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 56, pl. 14, figs. 1–5, 1930.
Cushman, Tennessee Div. Geology Bull. 41, p. 40, pl. 6, figs. 7, 8, 1931.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 22, fig. 14, 1933.
Tappan, Jour. Paleontology, vol. 14, p. 114, pl. 18, figs. 1a–c, 1940.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 62, pl. 11, fig. 2, 1943.
Cushman, idem, vol. 20, p. 9, pl. 2, fig. 16, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 336, pl. 52, fig. 17, 1944.
Polymorphina fusiformis Cushman (not Roemer), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 604, pl. 20, fig. 14, 1926.
Polymorphina gutta W. Berry (not D'Orbigny), in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 10, pl. 1, fig. 11, 1929.

Test elongate, fusiform to cylindrical, acuminate toward both extremities, almost circular in cross section; chambers elongate, not much embracing, arranged in a nearly triserial series, tending to become biserial, each succeeding chamber farther removed from the base; sutures but little depressed; wall smooth; aperture radiate. Length 0.50 to 1.10 mm., breadth 0.18 to 0.32 mm., thickness 0.15 to 0.30 mm.

Elongate, fusiform specimens occur at numerous localities. There is considerable variation in these, and they seldom occur in any great numbers.

Navarro age.
Kemp clay. Texas, Travis County (17).
Corsicana marl. Texas, Hunt County (24); Navarro County (27); Travis County (34); Limestone County (30).
Arkadelphia marl. Arkansas, Hempstead County (72).
Prairie Bluff chalk. Alabama, Wilcox County (100).
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Selma chalk (upper part). Mississippi, Union County (92). Tennessee, McNairy County (98). Alabama, Marengo County (104).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106); Collin County (120, 121); Kaufman County (129); Navarro County (134).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Hempstead County.
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Lee County (264).

Pyrulina velascoensis (Cushman) Cushman and Ozawa
Plate 40, figure 20

Polymorphina velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 604, pl. 20, figs. 16a, b, 1926.
Pyrulina velascoensis Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 59, pl. 29, figs. 1a–c, 1930.

Test elongate, fusiform in front view, in side view with the sides unequal, one side convex, the other concave, the concave side in front view with a central depression; chambers not elongate, rather compressed, arranged in a biserial series; sutures not at all depressed, very indistinct; wall smooth; aperture radiate. Length 0.70 mm., breadth 0.25 mm., thickness 0.18 mm.

This is a very peculiarly curved species with a longitudinal central depression.

This species is well developed in the Velasco shale of the Tampico Embayment region of Mexico.

Genus PSEUDOPOLYMORPHINA Cushman and Ozawa, 1928
Pseudopolymorphina incerta (Egger) Cushman and Ozawa
Plate 41, figure 1

Polymorphina incerta Egger, Neues Jahrb., 1857, p. 286, pl. 13, figs. 19–21.
Pseudopolymorphina incerta Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 110, pl. 9, figs. 3–5, 1930.
Cushman, Tennessee Div. Geology Bull. 41, p. 41, pl. 6, figs. 11a–c, 1931.

Test almost equally compressed on both sides, oval, margin rounded; chambers not numerous, usually 5 or 6, compressed, usually almost as broad as long, arranged in a nearly biserial series; sutures not depressed; wall smooth; aperture radiate. Length 0.55 to 0.75 mm., breadth 0.45 to 0.60 mm., thickness 0.18 to 0.25 mm.

The figures will give the general characters of this species, which is much more characteristic of the Tertiary than the Cretaceous. It is somewhat variable in form, but the general characters are fairly constant. The species has been recorded under many names, a list of which may be found in the paper by Cushman and Ozawa noted above.

Navarro age. Ripley formation. Tennessee, McNairy County (94).
Taylor marl, upper part. Texas, Red River County (107).

Pseudopolymorphina digitata (D'Orbigny) Cushman and Ozawa
Plate 40, figure 21

Polymorphina digitata D'Orbigny, Guerin-Menevilles Cuvier, Iconographie, Mollusques, p. 9, pl. 3, fig. 3, 1829–43.
Polymorphina nodosaria Franke, Danmarks geol. Undersogelse, 2d Raekke, No. 46, p. 35, pl. 3, fig. 18, 1927.
Pseudopolymorphina digitata (D'Orbigny) Cushman and Ozawa, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 108, pl. 28, figs. 3a, b, 1930.
Cushman, Geol. Soc. America Bull., vol. 47, p. 418, 1936.

Test elongate, cylindrical, rounded at both ends; chambers short, nearly as long as broad, slightly embracing, arranged in an entirely biserial series; sutures but little depressed, distinct; wall smooth; aperture radiate. Length 1.95 mm., breadth 0.55 mm., thickness 0.50 mm.

A specimen from the Cretaceous greensand of Georges Bank in the western Atlantic Ocean, is referred to this elongate species. It should be looked for in the Navarro group or upper part of the Taylor marl.

Pseudopolymorphina cuyleri Plummer
Plate 41, figures 2–10

Pseudopolymorphina cuyleri Plummer, Texas Univ. Bull. 3101, p. 173, pl. 9, figs. 18–21, 1931.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 62, pl. 11, figs. 6a, b, 1943.
Pseudopolymorphina mendezensis Cushman and Ozawa (part), U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 109, pl. 28, figs. 7–9, 1930.

Test large, much compressed, gradually tapering from the rounded initial end to the greatest width at the base of the last pair of chambers, periphery rounded, apical end somewhat pointed; chambers distinct, earliest chambers somewhat spiral, later biserial, increasing gradually in breadth as added but height rather uniform throughout; sutures distinct, somewhat limbate, in some specimens slightly depressed toward the periphery in the adult; wall smooth, thick, in some specimens with added thickening over the central portion at either side of the median elongate axis; aperture radiate, terminal. Length up to 3.00 mm., breadth 1.40 to 1.65 mm.

This is an excellent index fossil for the upper portion of the Navarro group, particularly well developed and often abundant in the Corsicana marl and its equivalent in the upper Selma chalk of Mississippi. Very typical specimens also occur ni the Arkadelphia clay of Arkansas.

Navarro age.
Corsicana marl. Texas, Hunt County (24); Navarro County (25, 27); Limestone County (30, 31); Travis County (34).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (86, 87). Alabama, Wilcox County (99).

Pseudopolymorphina ozawana Cushman and Jarvis
Plate 41, figure 11

Pseudopolymorphina ozawana Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 41, pl. 12, figs. 9a, b, 1932.

Test elongate, very much compressed; early chambers somewhat thicker than the later chambers, which are definitely biserial; sutures raised and subnodose; wall between the sutures smooth; aperture terminal, radiate. Length 2.50 mm., breadth 1.00 mm., thickness 0.50 mm.

The types are from the Upper Cretaceous in a pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, British West Indies.

This is a peculiar highly ornamented species of the genus and very distinct from any other known Cretaceous form, and, so far as known, has not been found elsewhere, though it is to be looked for in the Velasco shale of Mexico.

Pseudopolymorphina mendezensis (White) Cushman and Ozawa
Plate 41, figure 12

Polymorphina mendezensis White, Jour. Paleontology, vol. 2, p. 213, pl. 29, fig. 14, 1928.
Pseudopolymorphina mendezensis (White) Cushman and Ozawa (part), U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 109, 1930.
Brotzen, Sveriges geol. undersökning, ser. C, No. 396, p. 115, pl. 7, figs. 10a–c, 1936.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 63, pl. 11, fig. 5, 1943.

Test broadly oval in outline, much compressed, composed of four or more chambers of clear hyaline material; aperture radiate, not fistulose. Length of type specimen, 0.7 mm.; greatest width, 0.4 mm.; thickness, 0.13 mm.

The types are from the Mendez shale of Mexico.

Navarro group, Corsicana marl. Texas, Navarro County (27, 28); Limestone County (30).

Genus SIGMOMORPHINA Cushman and Ozawa, 1928

Sigmomorphina semitecta (Reuss) Cushman and Ozawa var. terquemiana (Fornasini) Cushman and Ozawa
Plate 41, figure 13

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.

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 0.33 mm., breadth 0.20 mm., thickness 0.10 mm.

Specimens from the Ripley formation and Selma chalk are placed here. They are common at the Tennessee locality but rare elsewhere.

Navarro age. Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94).
Taylor age. Selma chalk (middle part). Mississippi, Lee County (268).

Genus BULLOPORA Quenstedt, 1856

Bullopora laevis (Sollas) Wickenden
Plate 42, figures 1–4

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.
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.
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.
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.

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 stolonlike connections, or branching into two or more series; wall smooth.

Such smooth attached forms occur in beds of upper Austin age, of Taylor age, and, occasionally, of Navarro age. Some of our specimens show well the development from an attached *Globulina*-like young stage.

Alberta shale. Border Oils Co., sec. 6, T. 1, R. 14 west 4th meridian, southern Alberta.
Navarro age. Corsicana marl. Texas, Limestone County (30); Caldwell County (44); Travis County (38).
Taylor marl.
Upper part. Texas, Lamar County (110); Limestone County (135, 136); Leon County (138); Bexar County (158, 161).
Pecan Gap chalk member. Texas, McLennan County (177); Delta County (166).
Lower part. Texas, Ellis County (234).
Austin age.
Gober tongue of Austin chalk. Texas, Lamar County (283, 284).
Brownstown marl. Texas, Lamar County (321).
Bonham marl. Texas, Lamar County (331).

Bullopora tuberculata (Sollas) Cushman
Plate 42, figures 5–7

Webbina tuberculata Sollas, Geol. Mag., dec. 2, vol. 4, p. 104, pl. 6, figs. 4–7, 9, 1877.
Vitrewebbina tuberculata Chapman, Annals and Mag. Nat. History, ser. 6, vol. 18, p. 332, text fig. 4, 1896; Royal Micr. Soc. Jour., pp. 586, 587, pl. 13, fig. 3, 1896; Annals and Mag. Nat. History, ser. 7, vol. 3, p. 315, text fig. 3, 1899.
Franke, Greifswald Univ., Geol.-palaeont. Inst. Abh., vol. 6, p. 81, pl. 7, fig. 3, 1925; Preuss, geol. Landesanstalt Abh., new ser., vol. 111, p. 125, pl. 11, fig. 22, 1928.

Test attached, consisting of a *Globulina*-like stage, followed by a series of chambers loosely arranged, joined by stolonlike connections, increasing in size, irregular in shape; wall hispid or finely tuberculate.

Specimens are not as common as is the smooth species *B. laevis*. All the localities are in the upper part of the Taylor marl.

Taylor marl, upper part. Texas, Kaufman County (129, 131); Navarro County (132); Travis County (147); Bexar County (159, 162).

Genus RAMULINA Rupert Jones, 1875

Numerous species, or at least forms, in the American Upper Cretaceous evidently belong to this genus. It is very difficult to find anything that gives a clue to the early stages of these peculiar forms. However, the peculiar fistulose growths from various species of the Polymorphinidae seem to be links that bring *Ramulina* into this family. They may be outgrowths from *Bullopora*. Whatever their source, the various fragmentary specimens have characters that are rather constant, and in some species a very definite vertical range is indicated. On these grounds they have been divided into several species that may be found of use in stratigraphic work.

It is quite possible that some of the specimens referred to *Nodosaria aculeata* D'Orbigny may belong in this group, and they have been so placed by some authors. Some specimens, such as that referred to *R. globulifera* H. B. Brady by Plummer (Texas Univ. Bull. 3101, p. 174, pl. 11, figs. 15a (not b), 1931), are probably end chambers of *Nodosaria aspera* Reuss.

Ramulina navarroana Cushman
Plate 43, figures 1, 2

Ramulina navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 43, pl. 7, figs. 10, 11, 1938.
Cushman and Todd, idem, vol. 19, p. 63, pl. 11, fig. 7, 1943.

Test consisting of a central, more or less globular body from which radiate comparatively large, stout tubular projections that are little if at all tapering; wall of the central portion smooth, the arms sometimes hispid or finely spinose.

The types are from Corsicana marl, Mexia road 2.75 miles east of Cooledge on east-facing slope of Elm Creek Valley, Limestone County, Tex.

This species differs from *R. laevis* Rupert Jones in the more globular central body and the more definite radiating projections with finely spinose or hispid surface.

The distribution seems to be confined to the Corsicana marl of the Navarro group.

Navarro group, Corsicana marl. Texas, Limestone County (30, 31); Falls County (32); Travis County (36).

Ramulina arkadelphiana Cushman
Plate 43, figures 3–8

Ramulina arkadelphiana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 43, pl. 7, figs. 12–14, 1938.

Test with irregularly elongate or fusiform portions from which somewhat tapering tubular projections extend in various directions, tapering toward the ends, which have rounded openings; wall thin, finely hispid.

The types are from Arkadelphia marl, near base, 7 miles north by west of Hope, Hempstead County, Ark.

This species differs from *R. laevis* Rupert Jones in the more irregular form and the finely hispid surface. It occurs often very abundantly in the Arkadelphia marl, in the Prairie Bluff chalk, and in the Kemp clay.

Navarro age.
Kemp clay. Texas, Guadalupe County (18).
Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (99, 100).

Ramulina ornata Cushman
Plate 43, figure 9

Ramulina sp. Cushman and Jarvis (part), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 41, pl. 12, fig. 11 (not fig. 10), 1932.
Ramulina ornata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 44, pl. 7, fig. 15, 1938.

Test consisting of a globular chamber with numerous, radiating, tubular processes slightly if at all tapering, the surface of the rounded portion closely set with short, somewhat rounded, spinose projections.

The type is from Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. Very similar specimens also occur in the Velasco shale of the Tampico Embayment region, Mexico.

This species differs from *R. laevis* Rupert Jones in the more globular central mass and the peculiar ornamentation of the surface with its short, rounded spines.

Ramulina globo-tubulosa Cushman
Plate 43, figure 10

Ramulina sp. Cushman, Tennessee Div. Geology Bull. 41, p. 42, pl. 7, fig. 1, 1931.
Ramulina globo-turbulosa Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 44, pl. 7, fig. 16, 1938.

In the upper part of the Taylor marl, in the Pecan Gap chalk member, and in the Ripley formation and Annona chalk are globular specimens with very fine tubular projections radiating from the surface, which is finely hispid. For convenience, these may be grouped under the above name.

The type is from the Ripley formation 1½ miles west of Sardis, on Sardis-Henderson road, Henderson County, Tenn. (96).

This species differs from *R. laevis* Rupert Jones, in the more globular central chamber, finer tubular projections, and hispid surface.

Navarro age. Ripley formation. Tennessee, Henderson County (96).
Taylor age.
Pecan Gap chalk member of Taylor marl. Texas, Collin County (171).
Annona chalk. Texas, Red River County (192).
Austin chalk. Texas, Collin County (295).

Ramulina aculeata (D'Orbigny) Wright
Plate 43, figures 11–16

For synonymy see *Dentalina aculeata* D'Orbigny.

Numerous irregular specimens with rather definite sharp spines evidently do not belong to any of the species noted above. They occur mainly in beds of Austin Age and the lower beds of Taylor age.

Mendez shale. Hacienda el Limon, Mexico.
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, McLennan County (177).
Annona chalk. Texas, Bowie County (190).
Lower part of Taylor marl. Texas, Collin County (209); Dallas County (224).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (275, 279, 280); Lamar County (282).
Austin chalk. Texas, Bell County (316).
Selma chalk (lower part). Mississippi, Lee County (350).

Family NONIONIDAE
Genus NONION Montfort, 1808
Nonion jarvisi Thalmann
Plate 43, figure 17

Nonion cretaceum Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 41, pl. 12, figs. 12a, b, 1932.
Nonion jarvisi Thalmann, Eclogae geol. Helvetiae, vol. 25, No. 2, p. 313, 1932.
Cushman, U. S. Geol. Survey Prof. Paper 191, p. 3, pl. 1, fig. 5, 1939.

Test closely coiled, compressed, very slightly umbilicate, periphery subacute; chambers distinct, 8 making up the adult coil, of uniform shape increasing very slightly in size as added; sutures distinct, limbate, very slightly curved; wall smooth, the central umbilical region covered with a layer of clear shell material, in which are tubular spaces connecting with the umbilici, represented by lighter spaces in the clear material; aperture narrow, at the base of the last-formed chamber. Diameter 0.65 mm., thickness 0.25 mm.

This is a very peculiar species of the genus and unlike any other described form. It has very limbate sutures and a peculiar arrangement of the umbilical region, with its thickening of clear shell material pierced by irregularly curved tubular openings.

The only material of this species is from the Upper Cretaceous in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Genus NONIONELLA Cushman, 1926
Nonionella austinana Cushman
Plate 43, figures 18–20

Nonionella austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 57, pl. 7, figs. 2a–c, 1933; U. S. Geol. Survey Prof. Paper 191, p. 27, pl. 7, figs. 1, 2, 1939.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 336, pl. 52, fig. 19, 1944.

Test small, nearly as broad as long, dorsal side flattened or slightly concave in the center, ventral side convex, periphery broadly rounded; chambers distinct, few, 6 in the last-formed whorl, increasing regularly in size as added; sutures distinct, slightly curved, very slightly depressed; wall smooth, finely perforate; aperture a low elongate slit, at the base of the inner margin of the last-formed chamber on the ventral side. Length 0.25 mm., breadth 0.18 mm., thickness 0.12 mm.

This is a small but distinctive species, distinguished from *Nonionella cretacea* Cushman by the much more rounded form, very highly rounded periphery, and the fewer chambers (6 per whorl in *N. austinana* and as many as 10 in *N. cretacea*). From *Nonionella robusta* Plummer, characteristic of the Navarro formation, it is distinguished by the more broadly rounded periphery and the fewer chambers in a whorl, *N. robusta* having typically about 8 chambers and *N. austinana* only 6.

While this species is most abundant in beds of Austin age it occurs in beds of Taylor age and at one locality in the Eagle Ford shale just below the contact with the Austin chalk.

Taylor marl.
Upper part. Texas, Collin County (122); Travis County (145); Bexar County (154, 159).
Pecan Gap chalk member. Texas, Kaufman County (173).
Marlbrook marl. Arkansas, Clark County; Howard County.
Lower part. Texas, Fannin County (205); McLennan County (239, 240); Travis County (249).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Gober tongue of Austin chalk. Texas, Fannin County (278); Lamar County (284, 287).
Austin chalk. Texas, Grayson County (289, 291, 335); Collin County (292, 295, 324); Dallas County (297, 298, 300–307, 311, 326); Hill County (314).
Brownstown marl. Texas, Red River County (318); Lamar County (320, 321). Arkansas, Sevier County (347).
Eagle Ford shale. Texas, Dallas County (362).

Nonionella robusta Plummer
Plate 43, figures 21–23

Nonionella robusta Plummer, Texas Univ. Bull. 3101, p. 175, pl. 14, fig. 12, 1931.
Cushman, U. S. Geol. Survey Prof. Paper 191, p. 27, pl. 7, figs. 3a–c, 1939.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 63, pl. 11, fig. 9, 1943.
Nonionina scapha Carsey (not Fichtel and Moll), Texas Univ. Bull. 2612, p. 49, pl. 1, fig. 2, 1926.

Test very small, moderately compressed, about equally biconvex but unsymmetrically developed; periphery narrowly rounded and bluntly angular in maturity, only slightly lobate in later portion of some tests but an even curve on most tests; chambers about 8 in the final convolution, rapidly lengthening, gently inflated on most specimens, distinctly but not coarsely punctate; sutures slightly depressed or flush with the contour of the test, somewhat curved; umbilicus on dorsal side small, narrow, depressed, shallow, showing minute chambers of inner whorl; on ventral side umbilical depression filled with the successive short extensions of the chambers filling the depression irregularly; aperture a low slit on the periphery at base of final chamber.

Length 0.20 to 0.35 mm., breadth 0.12 to 0.25 mm., thickness 0.10 to 0.16 mm.

This seems to be an excellent index fossil for the Navarro group. Some of the specimens of *Nonionella cretacea* from the Taylor resemble this in some respects, but the number of chambers in *N. robusta* is smaller, and in peripheral view the test is much broader in *N. robusta* than in *N. cretacea*. The whole test is also shorter and thicker.

Navarro age.
Kemp clay. Texas, Navarro County (7); Falls County (9); Travis County (13, 15, 17).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–27); Limestone County (29, 30); Falls County (32); Travis County (34, 37–40, 42, 43); Caldwell County (44).
Prairie Bluff chalk. Mississippi, Chickasaw County (85). Alabama, Sumter County (101).
Neylandville marl. Texas, Hunt County (54); Navarro County (66).

Nonionella cretacea Cushman
Plate 43, figure 24

Nonionella cretacea Cushman, Tennessee Div. Geology Bull. 41, p. 42, pl. 7, figs. 2a–c, 1931; Geol. Soc. America Bull., vol. 47, p. 418, 1936.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 25, pl. 3, figs. 3a, b, 1936.
Cushman, U. S. Geol. Survey Prof. Paper 191, p. 28, pl. 7, figs. 5a–c, 1939.

Test much compressed, periphery rounded, dorsal side showing the earliest coils, ventral side involute; chambers numerous, about 10 in the adult whorl, rather rapidly increasing in length in the adult; sutures distinct, slightly depressed, very slightly curved; wall smooth; aperture at the periphery and extending over onto the ventral side, at the base of the final chamber. Length 0.25 mm., breadth 0.18 mm.

This is a small species rather widely distributed in beds of Taylor age in northern Mexico and the Gulf Coastal Plain of the United States. It occurs higher in the section in the Velasco shale of Mexico and material of Navarro age from the Georges Bank Canyons.

Upper Cretaceous. Velasco shale, Hacienda el Limon, Vera Cruz, Mexico.
Navarro age.
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Selma chalk (upper part). Tennessee, McNairy County (98).
Taylor age.
Upper part of Taylor marl. Texas, Navarro County (134); Travis County (149); Bexar County (156, 158).
Annona chalk. Texas, Red River County (198).
Lower part of Taylor marl. Texas, McLennan County (238, 241).

Nonionella ansata Cushman
Plate 44, figure 1

Nonionella ansata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 44, pl. 7, fig. 17, 1938.

Test nearly as broad as long in the adult, narrower in the earlier stages, much compressed throughout, periphery rounded, broad faces nearly flat; chambers distinct, about 10 in the adult whorl, increasing rapidly in length as added, but very gradually in height, much extended in the adult on the ventral side with ear-like projections over the earliest whorl; sutures fairly distinct, depressed little if at all, strongly curved; wall smooth, finely perforate; aperture a low, elongate slit, at the base of the inner margin of the last-formed chamber on the ventral side. Length 0.35 mm., breadth of adult 0.30 mm.

The types are from the Prairie Bluff chalk on U. S. Highway 80, 2.4 miles east-southeast of the Southern Railway underpass at Livingston, Sumter County, Ala.

This species differs from *N. austinana* Cushman in the larger number of chambers, greater curvature of the sutures and much greater extension of the later chambers on the ventral side. It is a somewhat larger, much broader form than *N. cretacea* Cushman, from which it was probably derived. It is common at the type locality.

Navarro age. Prairie Bluff chalk. Alabama, Wilcox County (99); Sumter County (101, 102).

Family CAMERINIDAE
Genus OPERCULINA D'Orbigny, 1826
Operculina catenula Cushman and Jarvis
Plate 44, figure 2

Operculina catenula Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 42, pl. 12, figs. 13a, b, 1932.

Test broadly complanate, periphery rounded, greatest thickness in the umbonal region; chambers distinct, about 15 in the last-formed coil, of rather uniform shape and increasing somewhat in length as added; sutures distinct, limbate, raised, ornamented by numerous bead-like protuberances, which are slightly elongate in the line of the suture, sutures ending in the umbonal region in a distinct boss that itself is somewhat beaded; wall between the sutures smooth. Diameter 2.25 mm., thickness 0.60 mm.

This is one of the few species of this genus known from the Upper Cretaceous and has been seen only in the Upper Cretaceous of the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. Some of the specimens show a much stronger ornamentation than that shown in the type figure and the bosses of the central portion become large and strongly raised.

Family HETEROHELICIDAE
Subfamily HETEROHELICINAE
Genus HETEROHELIX Ehrenberg, 1843
Heterohelix americana (Ehrenberg) Cushman
Plate 44, figure 3

Spiroplecta americana Ehrenberg, Mikrogeologie, pl. 32, pt. 2, fig. 35, 1854.
Heterohelix americana (Ehrenberg) Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 190, 1927; Jour Paleontology, vol. 1, p. 214, pl. 36, fig. 25, 1927; Cushman Lab. Foram. Research Special Pub. 4, pl. 21, figs. 1a, b, 1933; idem, Special Pub. 5, pl. 26, fig. 1, 1933.

Ehrenberg in his work on the American Cretaceous figures this species from the chalk of the Mississippi region without giving any definite locality for it. The test has the early stages planispiral and forming a considerable portion of the test, with only a few adult chambers in the biserial stage. Such forms are apparently rare. The figure given here is copied from Ehrenberg's original in the Mikrogeologie.

Genus BOLIVINOPSIS Yakovlev, 1891
Bolivinopsis rosula (Ehrenberg) Macfadyen
Plate 44, figures 4–8

Spiroplecta rosula Ehrenberg, Mikrogeologie, pl. 32, pt. 2, fig. 26, 1854.

Spiroplectoides rosula (Ehrenberg) Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 62, pl. 13, figs. 9a, b; p. 114, pl. 23, figs. 6, 7, 1927; Tennessee Div. Geology Bull. 41, p. 44, pl. 7, fig. 9, 1931; Cushman Lab. Foram. Research Special Pub. 4, pl. 21, figs. 12a, b, 1933; idem, Special Pub. 5, pl. 26, fig. 4, 1933; Cushman Lab. Foram. Research Contr., vol. 10, p. 38, pl. 6, figs. 10–13, 1934.

Bolivinopsis rosula Macfadyen, Royal Micr. Soc. Jour., vol. 53, p. 141, 1933.

Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 26, 1936.

Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 64, pl. 11, fig. 10, 1943.

Cushman, idem, vol. 20, p. 10, pl. 2, fig. 17, 1944; idem, vol. 20, p. 90, 1944.

Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 336, pl. 53, fig. 1, 1944.

Test very elongate, slender, compressed, the early portion closely coiled, planispiral, with a single coil, later chambers biserial, of uniform size and shape, the sides of the test parallel; chambers numerous in the adult, often higher than broad; sutures distinct, extending obliquely backward; wall smooth and polished, calcareous, finely perforate. Length up to 1.00 mm., breadth 0.10 to 0.15 mm.

The types of this species were from the American Cretaceous, but the exact locality is not known.

With the Bailey collection in the Boston Society of Natural History is a series of letters received by Bailey from various correspondents. Among them are letters showing that Bailey had an extensive correspondence with Ehrenberg. In a letter from Ehrenberg dated Berlin, August 29, 1843, and received by Bailey March 16, 1844, Ehrenberg thanks him for the samples of Cretaceous from Missouri and Mississippi, very definitely settling the source of those samples figured in the Mikrogeologie. Unfortunately the letters of Bailey to Ehrenberg are not available. In another letter of Ehrenberg dated August 10, 1844, he speaks of the fact that he has figured various species sent him by Bailey from various localities. Among these he mentions *Spiroplecta rosula* from three localities—the first, "Cretaceous of Claiborne Bluff"; the second, "Cretaceous, Selma, Ala."; and the third, "Upper Mississippi." Which of these three localities forms the actual type locality for the species cannot be determined, but it does give a hint to the localities from which Ehrenberg had material of this species at the time he prepared his figures for the Mikrogeologie. In Berlin some years ago I saw the original drawings of Ehrenberg, prepared for various works but do not at this time recall whether or not the exact localities are given on the sheets of drawings. If so, the type locality might be even more definitely determined.

As *Bolivinopsis rosula* (Ehrenberg) Macfadyen occurs in the Selma chalk of various localities in Alabama, Tennessee, and Mississippi, and as it is sure that Ehrenberg had specimens from the Selma chalk of Alabama, specimens from this general region may be taken as typical. A figure is given of a fairly complete specimen from the Selma chalk of Mississippi and others from the Cretaceous of Texas.

Bolivinopsis rosula is a rather common species in the Cretaceous of the Gulf Coastal Plain of the United States, although it is small and delicate, being easily broken in the preparation of material. The early coiled stages are frequently broken away. The chambers are often much higher than broad in the adult, making it distinct from any other American species. No specimens have been found at the many localities represented in our collections which have developed any sign of a siliceous test.

Navarro age.
- Corsicana marl. Texas, Navarro County (25, 27); Limestone County (29, 30); Falls County (32); Travis County (36).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84-86). Alabama, Wilcox County (99); Sumter County (101, 102).
- Selma chalk (upper part). Tennessee, McNairy County (98). Mississippi, Prentiss County (91); Union County (92). Alabama, Marengo County (104).
- Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
- Neylandville marl. Texas, Red River County (50).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (108); Delta County (114); Collin County (122); Rockwall County (124); Kaufman County (129); Navarro County (132, 134); Leon County (138); Williamson County (140, 141, 144); Travis County (145, 149); Bexar County (154, 158, 159).
- Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Kaufman County (173); Rockwall County (175, 176); McLennan County (177).
- Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
- Selma chalk (middle part). Mississippi, Alcorn County (257–259); Prentiss County (260, 261); Union County (262); Lee County (264, 265, 267).
- Wolfe City sand member of Taylor marl. Texas, Collin County (180, 183); Hunt County (185).
- Marlbrook marl. Arkansas, Howard County; Hempstead County.
- Annona chalk. Texas, Red River County (192, 198).
- Lower part of Taylor marl. Texas, Red River County (199); Lamar County (202); Fannin County (203, 205); Delta County (206); Collin County (211); Dallas County (216, 219, 222); Kaufman County (228, 229); Ellis County (234); McLennan County (238, 239, 241); Bell County (245); Williamson County (246); Travis County (249).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270, 271).
- Gober tongue of Austin chalk. Texas, Fannin County (275, 278, 281); Lamar County (283–285, 287),
- Austin chalk. Texas, Grayson County (290); Collin County 294, 295); Dallas County (310); Hill County (313).
- Brownstown marl. Texas, Red River County (318, 319); Lamar County (320, 321).
- Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Bolivinopsis papillata (Cushman) Cushman

Plate 44, figure 9

Spiroplectoides papillata Cushman, Tennessee Div. Geology Bull. 41, p. 44, pl. 7, figs. 10a, b, 1931; Cushman Lab. Foram. Research Special Pub. 5, pl. 26, fig. 5, 1933; Cushman Lab. Foram. Research Contr., vol. 10, p. 41, pl. 6, figs. 24a, b, 1934.

Bolivinopsis papillata Cushman, Foraminifera, Ed. 3, Key, pl. 26, fig. 5, 1940.

Test elongate, compressed, early chambers planispirally coiled, later chambers regularly biserial, low and broad; sutures distinct, slightly depressed, directed obliquely backward; wall ornamented by small, slightly raised papillae arranged more or less in lines parallel to the sutures; aperture at the base of the inner margin of the chamber. Length of holotype 0.35 mm., breadth 0.12 mm.

The type of this species is from the Upper Cretaceous Ripley formation, New Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. (94).

The species is very small but seems to be characteristically ornamented and has much broader chambers than the other distinctive American species, *B. rosula* (Ehrenberg) Macfadyen, the chambers being at least twice as broad as high.

Navarro age.
- Ripley formation. Tennessee, McNairy County (94, 95).

Taylor marl.
- Upper part. Texas, Red River County (109).
- Lower part. Texas, Lamar County (201).

Bolivinopsis? clotho (Grzybowski) Cushman
Plate 44, figures 10–13

Spiroplecta clotho Grzybowski, Akad. Umiej. Wydz. mat.-przyr. rozpr., vol. 41, p. 283, pl. 7, fig. 18, 1901.
Spiroplectoides clotho (Grzybowski) Cushman, Jour. Paleontology, vol. 1, p. 159, pl. 28, fig. 6, 1927.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 101, pl. 14, figs. 13, 14, 1928.
White, Jour. Paleontology, vol. 3, p. 32, pl. 4, fig. 5, 1929.
Jarvis, Inst. Petroleum Technologists Jour., vol. 15, p. 441, 1929.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 43, pl. 13, figs. 5, 6, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 26, figs. 2, 3, 1933; Cushman Lab. Foram. Research Contr., vol. 10, p. 42, pl. 6, figs. 19–23, 1934.
Bolivinopsis clotho (Grzybowski) Cushman, Foraminifera, Ed. 3, Key, pl. 26, figs. 2, 3, 1940.
Spiroplecta annectens Cushman (not Parker and Jones), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 584, pl. 15, figs. 4a, b, 1926.

Test elongate, somewhat compressed, thickest along the median line, megalospheric form broadest at the base, with the sides either parallel or decreasing in breadth toward the apertural end, microspheric form with the early coiled portion the narrowest, thence increasing rapidly in breadth toward the apertural end, which again becomes reduced to a blunt point; chambers distinct, earliest chambers planispiral, forming about a single coil, later biserial, low and broad, often several times as broad as high; sutures distinct, slightly depressed, often distinctly limbate, forming an angle with the horizontal which in the earlier stages may be as low as 15° but in the final stages may increase to as much as 50°; wall apparently siliceous, surface smooth. Length up to 1.25 mm., breadth up to 0.35 mm.

This species was originally described by Grzybowski from the Upper Cretaceous of Poland. The species occurs abundantly in the Upper Cretaceous of Trinidad, and also in the Velasco shale of Mexico. I have tested numerous specimens from both areas with acid, and they seem to be entirely siliceous. There is no indication of an arenaceous test having been altered to a siliceous one, and the source of these siliceous forms becomes a perplexing problem. A copy of the original figure given by Grzybowski is given here. This shows a test of very similar form but with the chambers even lower and broader than in most of the American specimens. This character is, however, subject to some variation in the considerable number of specimens available.

Recently Frizzell has proposed the name *Spiroplectammina grzybowskii* n. sp. for this species (Jour. Paleontology, vol. 17, p. 339, pl. 55, figs. 12, 13, 1943) and it probably should be placed in the Textulariidae.

Genus GUMBELITRIA Cushman, 1933

Gümbelitria cretacea Cushman
Plate 44, figure 14

Gümbelitria cretacea Cushman, Cushman, Lab. Foram. Research Contr., vol. 9, p. 37, pl. 4, figs. 12a, b, 1933; Cushman Lab. Foram. Research Special Pub. 4, pl. 21, figs. 3a, b, 1933; idem, Special Pub. 5, pl. 26, figs. 9a, b, 1933; Geol. Soc. America Bull., vol. 47, p. 418, pl. 1, figs. 12a, b, 1936.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 28, pl. 3, fig. 12, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 19, pl. 3, figs. 14a, b, 1938.
Cushman and Hedberg, idem, vol. 17, p. 91, pl. 22, fig. 17, 1941.
Cushman and Todd, idem, vol. 19, p. 65, pl. 11, fig. 16, 1943.

Test small, triserial; chambers globular, nearly spherical; sutures much depressed; wall smooth, finely perforate; aperture large, semicircular or semielliptical at the inner margin of the last-formed chamber. Length of holotype 0.20 mm., breadth 0.17 mm.

This triserial form occurs in the upper part of the Navarro group of Texas and in the upper part of the Selma chalk, as well as in the Ripley formation. The specimens from the Ripley formation are somewhat more coarsely perforate than those from the upper portion of the section and may be found to be distinct when more material is available. It occurs in the Georges Bank canyons in material of Navarro age and in the Upper Cretaceous of Colombia and New Jersey.

Navarro age.
Kemp clay. Texas, Kaufman County (2); Navarro County (7); Williamson County (12); Travis County (15); Guadalupe County (18).
Corsicana marl. Texas, Limestone County (29, 30); Falls County (32); Travis County (36, 37, 39, 40, 42); Caldwell County (44).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (99).
Ripley formation. Mississippi, Pontotoc County (90).
Selma chalk (upper part). Mississippi, Union County (92).

Genus GUMBELINA Egger, 1899

The early stages are planispiral in the microspheric form, linking this genus to *Heterohelix* Ehrenberg. Young specimens of the other genera derived from *Gümbelina,* especially of the microspheric form, may not go beyond the biserial stage, and are very easily confused with *Gümbelina*. As will be noted, some of the species are rather difficult to place generically unless large series of both microspheric and megalospheric forms are present.

Gümbelina moremani Cushman
Plate 44, figures 15–17

Gümbelina moremani Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 10, pl. 2, figs. 1–3, 1938; idem, vol. 20, p. 90, pl. 14, fig. 1, 1944.
Gümbelina globulosa Moreman (not Ehrenberg), Jour. Paleontology, vol. 1, No. 1, p. 99, pl. 16, fig. 10, 1927.
Gümbelina globifera Carman (not Reuss), idem, vol. 3, p. 311, pl. 34, fig. 3, 1929.
Morrow, idem, vol. 8, p. 194, pl. 29, figs. 15, 17, 1934.

Test elongate, 2½ to 3 times as long as broad, gradually tapering throughout, only slightly enlarging in the later portion, periphery distinctly indented throughout; chambers globular, often slightly irregular and occasionally with one developed at the side in the adult; sutures distinct and depressed throughout; wall smooth, finely perforate; aperture, a high, arched opening at the inner margin of the last-formed chamber, with a slight lip which may reach forward at the sides onto the previously formed chamber. Length 0.35 to 0.45 mm., breadth 0.15 to 0.18 mm., thickness 0.10 mm.

The types are from the Cretaceous, lower part of Eagle Ford shale, south bank of small stream 100 yards east of highway 2.1 miles north of Itasca, Hill County, Tex.

This species differs from *G. globulosa* (Ehrenberg) Egger in the larger number of chambers and more slender and less tapering test. It occurs in the Eagle Ford and equivalent formations in considerable numbers, and occasionally shows a tendency toward *Ventilabrella*.

Austin age.
Austin chalk, lower part. Texas, Dallas County (340).
Selma chalk (lower part). Mississippi, Lee County (350).
Eagle Ford shale. Texas, Grayson County (354); Dallas County (355–360, 362, 363); Hill County (365–369); Ellis County (370).

Gümbelina reussi Cushman

Plate 44, figures 18, 19

Gümbelina reussi Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 11, pl. 2, figs. 6–9, 1938

Cushman and Deaderick, idem, vol. 18, p. 63, pl. 15, figs. 5–7, 1942.

Cushman, idem, vol. 20, p. 90, pl. 14, fig. 2, 1944.

Textularia globulosa Reuss (not Ehrenberg), Verstein. böhm. Kreideformation, pt. 1, p. 39, pl. 12, fig. 23(?), 1845.

Test about 1½ times as long as broad, rapidly tapering, greatest breadth formed by the last pair of chambers, periphery of early part usually entire, later distinctly indented; chambers globular, and in the later portion distinctly set apart, with a triangular, depresssed area between; sutures distinctly depressed throughout; wall smooth, finely perforate, the earliest portion sometimes showing longitudinal rows of perforations; aperture high, semicircular, at the inner border of the chamber. Length 0.40 to 0.50 mm., breadth 0.28 to 0.30 mm., thickness 0.22 to 0.25 mm.

The types are from the lower part of the Austin chalk, ditch on west side of Sherman-Dennison highway 3 miles north of Sherman, Tex.

This species differs from *G. globulosa* (Ehrenberg) Egger in the tendency for the early portion to have an entire periphery, and in the less overlapping chambers, clearly set off from one another and with a triangular indented area between. This species ranges mainly from the lower beds of Austin age into the lower beds of Taylor age.

Taylor age.
- Ozan formation. Arkansas, Little River County (254).
- Selma chalk (middle part). Mississippi, Lee County (268).
- Annona chalk. Texas, Bowie County (189); Red River County (191–193, 196–198).
- Lower part of Taylor marl. Texas, Red River County (199); Lamar County (200); Fannin County (203, 205); Collin County (208–215); Dallas County (216, 217, 219–222, 224, 225, 227); Ellis County (232, 235); Navarro County (236); McLennan County (238–240, 242); Falls County (244); Travis County (247).

Austin age.
- Gober tongue of Austin chalk. Texas, Fannin County (272–281); Lamar County (282–288).
- Austin chalk. Texas, Grayson County (289–291, 333–335); Collin County (292–295, 324, 337); Dallas County (296–309, 311, 325, 326, 338 339, 341–345); Hill County (312–314, 346); Bell County (315, 316).
- Brownstown marl. Texas, Lamar County (320). Arkansas, Sevier County.
- Bonham marl. Texas, Lamar County (327, 330, 331); Grayson County (328).
- Ector tongue of Austin chalk. Texas, Grayson County (332).
- Selma chalk (lower part). Mississippi, Itawamba County (351).

Gümbelina plummerae Loetterle

Plate 45, figures 1–3

Gümbelina plummerae Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 33, pl. 5, figs. 1, 2, 1937.

Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 15, pl. 3, figs. 3–5, 1938.

Cole, Florida Dept. Cons. Geol. Bull. 16, p. 34 (list), pl. 3, fig. 9, 1938.

Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 62, pl. 15, figs. 2–4, 1942.

Cushman, idem, vol. 20, p. 10, pl. 2, fig. 18, 1944; idem, vol. 20, p. 90, pl. 14, fig. 3, 1944.

Textularia globulosa Carsey (not Ehrenberg), Texas Univ. Bull. 2612, p. 25, pl. 5, fig. 2, 1926.

Test comparatively large, stout, rapidly tapering in the early portion, in the adult much more gradually tapering or even contracted, thickness often greater than the breadth, periphery of the early portion slightly keeled, later deeply indented; chambers of the later portion strongly inflated, occasionally with one or more irregularly placed chambers at the upper end, tending toward *Ventilabrella;* sutures depressed, somewhat curved in the later portion; wall of the early portion distinctly costate, becoming less markedly so in the later chambers; aperture a low, broad arch with a slight lip. Length 0.50 to 0.65 mm., breadth 0.30 to 0.40 mm., thickness 0.40 to 0.45 mm.

From the original description of this species, it seems that it is widely distributed not only in Nebraska and Kansas, but in the Gulf Coastal Plain as well. It is present at many localities ranging in horizon from beds of Austin age upward through those of Taylor age into the Neylandville marl. In the upper beds of Navarro age it is replaced by *Ventilabrella carseyae* Plummer, which is evidently derived from it. It is recorded from the Selma chalk of Florida well samples.

Navarro age.
- Corsicana marl. Texas, Travis County (43)(?)
- Selma chalk (upper part). Alabama, Marengo County (104).
- Neylandville marl. Texas, Red River County (50); Hunt County (55); Rockwall County (57); Navarro County (63).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (105–109); Delta County (114); Hunt County (116); Collin County (121); Rockwall County (123, 124); Kaufman County (125, 128, 129); Navarro County (132); Leon County (138); Milam County (139); Williamson County (140, 142–144); Travis County (145, 149); Bexar County (155, 156, 158, 159, 161, 162).
- Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (169, 170); Kaufman County (173); McLennan County (177); Delta County (165, 166).
- Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
- Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181); Hunt County (184); Navarro County (188).
- Annona chalk. Texas, Bowie County (189); Red River County (194, 196, 198).
- Lower part of Taylor marl. Texas, Delta County (206); Ellis County (234); McLennan County (239, 241–243); Falls County (244); Bell County (245); Travis County (249).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269).
- Austin chalk. Texas, Grayson County (336).
- Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).
- Selma chalk of late Austin age? Alabama, Warrior River (353).
- Brownstown marl. Arkansas, Sevier County.

Gümbelina striata (Ehrenberg) Egger

Plate 45, figures 4, 5

Textilaria striata Ehrenberg, K. preuss. Akad. Wiss. Berlin, Abh., p. 135, pl. 4, figs. 1α, 2α, 3α, 1838; Mikrogeologie, pl. 27, fig. 3; pl. 28, fig. 6; pl. 31, fig. 9; pl. 32i, fig. 4b; pl. 32ii, figs. 11, 14, 1854.

Cushman, Jour. Paleontology, vol. 1, pp. 215, 216, pl. 34, fig. 4b; pl. 35, figs. 11, 14, 1928.

Gümbelina striata Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 33, pl. 14, figs. 37–39 (not 5–7, 10, 11), 1899.

Voorwijk, Royal Acad. Amsterdam Proc., vol. 40, p. 7, pl. 1, figs. 9, 10, 1937.

Cushman, Cushman Lab. Foram Research Contr., vol. 14, p. 8, pl. 1, figs. 34–40, 1938.

Cushman and Deaderick, idem, vol. 18, p. 63, pl. 15, figs. 8–10, 1942.

Cushman and Todd, idem, vol. 19, p. 64, pl. 11, fig. 11, 1943.

Cushman, idem, vol. 20, p. 10, pl. 2, fig. 19, 1944; idem, vol. 20, p. 91, pl. 14, fig. 4, 1944.

Test in the adult about twice as long as broad, tapering; the greatest breadth toward the apertural end, where in the adult the increase in diameter becomes very gradual; periphery distinctly indented throughout; chambers inflated throughout, nearly spherical; sutures distinct, depressed throughout; wall in the earliest portion distinctly and finely longitudinally costate, in the later chambers becoming less clearly costate and ornamented by fine pits in longitudinal lines, and in the final chambers in the adult usually smooth; aperture a rather large opening at the inner margin at the base of the apertural face. Length 0.45 to 0.60 mm., breadth 0.25 to 0.35 mm., thickness 0.18 to 0.22 mm.

The surface ornamentation decreases in strength as growth progresses, from a finely costate early stage to smooth final chambers in the adult. Ehrenberg in 1854 records the species from various American and other localities, but all figures are from specimens in balsam and give little indication of the surface characters other than rather conventional fine longitudinal lines. In actual specimens in side view, these lines follow the general curved surface, and the present figures attempt to show the changes that appear.

In America this species has been confused with *G. costulata* Cushman, which is very distinct. *G. striata* may be distinguished from *G. globulosa* (Ehrenberg) Egger by its surface characters, somewhat greater relative length, and lesser tendency to flare in the adult.

In Europe it occurs in the upper part of the Cretaceous, and in America it ranges from beds of Austin age up through those of Taylor age into the Neylandville but is rarely found typically in the upper beds of Navarro age.

Navarro age.
- Corsicana marl. Texas, Limestone County (29, 30); Navarro County (27).
- Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94, 95).
- Neylandville marl. Texas, Kaufman County (60, 61); Navarro County (68).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (107, 109); Milam County (139); Guadalupe County (151); Bexar County (159).
- Pecan Gap chalk member of Taylor marl. Texas, Delta County (166); Collin County (172); Rockwall County (175).
- Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
- Lower part of Taylor marl. Texas, Collin County (207); Dallas County (220, 221); Kaufman County (228); McLennan County (238, 241); Travis County (248).

Austin age.
- Austin chalk. Texas, Collin County (292); Dallas County (310).
- Brownstown marl. Texas, Red River County (318, 319); Lamar County (321). Arkansas, Sevier County.
- Ector tongue of Austin chalk. Texas, Grayson County (332).
- Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).
- Selma chalk of upper Austin age. Alabama, Pickens County (352).

Gümbelina planata Cushman

Plate 45, figures 6, 7

Gümbelina planata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 12, pl. 2, figs. 13, 14, 1938; idem, vol. 20, p. 10, pl. 2, fig. 20, 1944.

Test compressed, about $1\frac{1}{2}$ times as long as broad, rapidly tapering with the greatest breadth formed by the last pair of chambers, periphery slightly keeled in the early portion, in the remainder deeply indentate; chambers broader than high throughout, somewhat compressed, in the adult portion separated by depressed triangular areas; sutures distinctly depressed, somewhat curved; wall smooth, finely perforate, the perforations tending to be in longitudinal lines; aperture high, arched, with distinct, lateral flanges running out onto the preceding chamber. Length 0.35 to 0.45 mm., breadth 0.25 to 0.30 mm., thickness 0.12 to 0.14 mm.

The types are from the Taylor marl on the Paris highway 1.8 miles east of Deport on west-facing slope of Mustang Creek Valley, Red River County, Tex.

This species differs from *G. striata* (Ehrenberg) Egger in the broader, more compressed chambers, slight keel in the early portion, and the smoother surface.

So far, the species has been found only in the Taylor marl.

Taylor marl.
- Upper part. Texas, Red River County (108); Leon County (138).
- Pecan Gap chalk member. Texas, Delta County (166).

Gümbelina carinata Cushman

Plate 45, figure 8

Gümbelina carinata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 18, pl. 3, fig. 10, 1938; idem, vol. 20, p. 92, pl. 14, fig. 6, 1944.

Test only slightly longer than broad, much compressed, early portion rapidly tapering, later with the sides nearly parallel, all but the latest chambers keeled; chambers broader than high, increasing somewhat in relative height in the last chambers, only slightly inflated; sutures of the early portion slightly limbate, later sutures slightly depressed; wall in the early portion slightly costate, later smooth, finely perforate; aperture low, arched. Length 0.20 to 0.22 mm., breadth 0.15 to 0.18 mm., thickness 0.06 to 0.08 mm.

The types are from the lower part of the Taylor marl in a ditch southeast of the Commerce-Paris highway 6 miles south of the Texas & Pacific Railway Station in Paris, Lamar County, Tex.

This species differs from *G. striata* (Ehrenberg) Egger in the smaller, much compressed test, which is strongly carinate. It occurs mostly in the lower part of the Taylor marl, but specimens also occur rarely in the Annona chalk and Wolfe City sand member of the Taylor marl. It is evidently the ancestral form of some of the later species with compressed and carinate early stages. It was at first thought to be possibly the young form of some of the other species, but it seems to be distinct.

Taylor age.
- Wolfe City sand member of Taylor marl. Texas, Navarro County (187).
- Annona chalk. Texas, Red River County (192).
- Lower part of Taylor marl. Texas, Lamar County (201, 202); Collin County (211, 214); Dallas County (221); Navarro County (236); Hill County (237).

Austin age. Selma chalk (lower part). Mississippi, Itawamba County (351).

Gümbelina globulosa (Ehrenberg) Egger

Plate 45, figures 9–15

Textilaria globulosa Ehrenberg, K. preuss. Akad. Wiss. Berlin, Abh., p. 135, pl. 4, fig. 4β, 1834; Mikrogeologie, pl. 21, fig. 87, etc., 1854.
- Eley, Geology in the garden, pp. 194, 202, pl. 2, fig. 9; pl. 9, fig. 9, 1859.
- Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 134, pl. 12, fig. 11, 1928.
- Cushman, Jour. Paleontology, vol. 1, p. 215, pl. 34, fig. 8, 1928.

Gümbelina globulosa Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, pt. 1, p. 32, pl. 14, fig. 43, 1899.
- Chapman, Western Australia Geol. Survey Bull. 72, p. 14, pl. 2, fig. 17, 1917; New Zealand Geol. Survey Paleontology Bull. 11, p. 33, pl. 8, fig. 5, 1926.
- Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 190, 1927.
- Carman, Jour. Paleontology, vol. 3, p. 312, pl. 34, figs. 10–20(?), 1929.
- White, idem, p. 36, pl. 4, figs. 10a, b, 1929.

Cushman, Tennessee Div. Geology Bull. 41, p. 43, pl. 7, figs. 3–5, 1931; Cushman Lab. Foram. Research Contr., vol. 7, p. 39, pl. 5, figs. 7a, b, 1931; Jour. Paleontology, vol. 6, p. 338, 1932; Geol. Soc. America Bull., vol. 47, p. 418, pl. 1, figs. 8a, b, 1936.
Morrow, Jour. Paleontology, vol. 8, p. 194, pl 29, figs. 18a, b(?), 1934.
Glaessner, Problems of paleontology, vol. 1, p. 108, pl. 2, fig. 2, 1936.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 27, pl. 3, fig. 9, 1936.
Voorwijk, Royal Acad. Amsterdam Proc., vol. 40, p. 5, 1937.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 34, pl. 5, fig. 3(?), 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 6, pl. 1, figs. 28–33, 1938.
Cole, Florida Geol. Survey Bull. 16, p. 34, pl. 3, fig. 10, 1938.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 92, pl. 22, figs. 15a, b, 1941.
Macfadyen, Geol. Mag., vol. 79, p. 139 (list), 1942.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 64, pl. 11, fig. 12, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 336, pl. 53, figs. 2, 3, 1944.
Textilaria globifera Reuss, Akad. Wiss. Wien, Math.-naturwiss. Sitzungsber., vol. 40, p. 232, pl. 13, figs. 7, 8, 1860.
Egger, Naturw. Ver. Passau Ber., p. 18, pl. 5, fig. 4, 1907; K. bayer. Akad. Wiss., Math.-phys. Kl., Jahrg. 11, Abh., Sitzungsber, p. 22, pl. 2, fig. 16, 1909; Naturw. Ver. Regensburg Ber., p. 12, pl. 5, fig. 11, 1910.
Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 11, pl. 1, fig. 13, 1925.
Gümbelina globifera Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 2, vol. 21, pt. 1, p. 33, pl. 14, figs. 35, 36, 53–55, 1899.
Chapman, Western Australia Geol. Survey Bull. 72, p. 14, pl. 2, fig. 18, 1917; New Zealand Geol. Survey Paleontology Bull. 11, p. 33, pl. 8, fig. 4, 1926.
White, Jour. Paleontology, vol. 3, p. 35, pl. 4, fig. 9, 1929.
Gümbelina pupa White (not Reuss), Jour. Paleontology, vol. 3, p. 38, pl. 4, fig. 11, 1929.

Test rapidly tapering, greatest breadth toward the apertural end, initial end subacute, 1½ to 2 times as long as broad, in side view with the chambers regularly enlarging to the greatest width at the last-formed chamber, periphery distinctly indented throughout; chambers inflated throughout, increasing in size rather more rapidly toward the apertural end, nearly spherical; sutures distinct, depressed throughout; wall smooth, finely perforate; aperture broad, low, with a slightly thickened rim above. Length 0.30 to 0.50 mm., breadth 0.20 to 0.25 mm., thickness 0.18 to 0.25 mm.

The wall is smooth throughout, and the fine perforations show little or no tendency to form elongate lines. The periphery is lobulate throughout, usually even in the earliest portion.

Numerous other references to this species cannot be verified from original material. Reuss' *Textilaria globifera* seems to be a synonym of Ehrenberg's species, although Reuss' *T. globulosa* from Bohemia seems to be different from Ehrenberg's and may be the same as *Gümbelina reussi* Cushman.

The species in Europe seems to occur mainly in the Senonian and Maestrichtian and in America apparently ranges downward from horizons as high as the Kemp clay at the top of the Navarro group to horizons as low as at least the middle part of the Taylor marl, with rare occurrences below. It apparently developed from *G. reussi*, which occurs in the lower part of the section and does not have the earlier chambers so globose. The records from the Niobrara and other chalks of the Kansas-Nebraska region are given here with some question. An examination of the original material may show them to be *G. reussi.*

The species occurs in the Selma chalk of wells in Florida and in both the upper and the lower zones of the Colon formation in Colombia, and is recorded from the Upper Cretaceous of Cuba.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Kaufman County (2); Navarro County (7); Falls County (9); Williamson County (11); Travis County (13, 15, 17).
Corsicana marl. Texas, Navarro County (27, 28); Limestone County (29, 30); Travis County (34, 41, 42); Caldwell County (44); Guadalupe County (45); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70).
Owl Creek formation. Mississippi, Tippah County (83).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–87). Alabama, Sumter County (101, 102).
Nacatoch sand. Texas, Bowie County (47, 48).
Saratoga chalk. Arkansas, Hempstead County (81).
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Selma chalk (upper part). Mississippi, Union County (92). Tennessee, McNairy County (98).
Neylandville marl. Texas, Red River County (50); Delta County (51, 52); Hunt County (54); Kaufman County (60, 62); Navarro County (64, 68).
Taylor age.
Upper part of Taylor marl. Texas, Lamar County (110–112); Hunt County (117); Collin County (121, 122); Kaufman County (129); Milam County (139); Travis County (145, 149); Bexar County (154, 156, 158).
Selma chalk (middle part). Mississippi, Alcorn County (257–259); Prentiss County (261); Union County (262); Lee County (265–267).
Wolfe City sand member of Taylor marl. Texas, Hunt County (186); Navarro County (187).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Lower part of Taylor marl. Texas, Kaufman County (228, 229).

Gümbelina pseudotessera Cushman
Plate 45, figures 16–20

Gümbelina tessera Cushman (not *G. tessera* Cushman, 1936, nor *Grammostomum tessera* Ehrenberg), Jour. Paleontology, vol. 6, p. 338, pl. 51, figs. 4, 5, 1932.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 34, pl. 5, fig. 4, 1937.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 27, pl. 3, figs. 10a, b, 1936.
Voorwijk, Royal Acad. Amsterdam Proc., vol. 40, No. 2, p. 7, pl. 1, figs. 3, 4, 1937.
Gümbelina pseudotessera Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 14, pl. 2, figs. 19–21, 1938; idem, vol. 20, p. 10, 1944; idem, vol. 20, p. 91, pl. 14, fig. 5, 1944.

Test compressed, 1½ to 2 times as long as broad, rapidly tapering with greatest breadth at the last pair of chambers, periphery indented throughout; chambers somewhat inflated, broader than high throughout, in the adult somewhat curved and broader; sutures depressed, somewhat curved in the last portion; wall smooth and polished, very finely perforate; aperture a very high, arched opening with a slight lip and distinct flanges, but not extending far onto the preceding chamber. Length 0.25 to 0.50 mm., breadth 0.20 to 0.30 mm., thickness 0.08 to 0.12 mm.

The types are from the upper part of the Taylor marl 4.9 miles east of Forney, on the Forney-Terrell highway, Kaufman County, Tex.

This species differs from *G. globulosa* in the compressed test, broader chambers, particularly in the last portion, and the somewhat curved sutures. The microspheric form is much broader than the megalospheric, and occasional specimens of the megalospheric form are very narrow.

G. pseudotessera according to present records apparently ranges through most of the beds of Austin age and of Taylor age. It is recorded also from the Cretaceous of Cuba.

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 106); Lamar County (110, 112); Hunt County (116, 117); Collin County (119, 122); Kaufman County (125, 129); Navarro County (132).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165).
Selma chalk (middle part). Mississippi, Union County (262).
Annona chalk. Texas, Collin County (188a).
Lower part of Taylor marl. Texas, Lamar County (201); Delta County (206); Collin County (211, 212); Dallas County (217, 219, 220–222, 227); Kaufman County (228); Navarro County (236); Hill County (237); McLennan County (238).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Gober tongue of Austin chalk. Texas, Fannin County (278); Lamar County (284).
Austin chalk. Texas, Grayson County (289, 291, 333, 335); Collin County (295); Dallas County (301, 302, 304, 305, 307, 308, 311, 326); Hill County (314).
Brownstown marl. Texas, Lamar County (320).
Bonham marl. Texas, Lamar County (327, 331); Grayson County (328).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Gümbelina semicostata Cushman
Plate 46, figures 1–5
Gümbelina semicostata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 16, pl. 3, fig. 6, 1938.

Test about 1½ times as long as broad, compressed, gradually tapering, less rapidly in the later portion, early portion slightly keeled, later portion with the periphery slightly indentate, initial end acute; chambers with the faces flattened but broadly rounded at the periphery, broader than high throughout; sutures broadly limbate, slightly if at all depressed, curved; wall in the middle and inner portions smooth, toward the periphery with several strongly curved costae; aperture a rounded, arched opening with a thickened, rounded lip. Length 0.35 mm., breadth 0.20 mm., thickness 0.10 mm.

The types are from the lower beds of the upper part of the Taylor marl in the east bank of a road cut near the crest of a hill 14.4 miles south of Paris and 0.9 mile north of Lake City, Delta County, Tex.

This species differs from *G. striata* (Ehrenberg) Egger in the strongly limbate, well-developed, curved costae at the outer side of the chambers, and compressed test. It is one of the most striking species of the genus, and its range seems to be mostly confined to the upper part of the Taylor marl. It should be an excellent index fossil for this part of the section.

Navarro group. Neylandville marl. Texas, Navarro County (66).
Taylor marl.
Upper part. Texas, Lamar County (110).
Lower part. Texas, Delta County (206).

Gümbelina ultimatumida White
Plate 46, figures 6, 7
Gümbelina ultimatumida White, Jour. Paleontology, vol. 3, p. 39, pl. 4, fig. 13, 1929.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 27, pl. 3, fig. 11, 1936.
Voorwijk, Royal Acad. Amsterdam Proc., vol. 40, No. 2, p. 7, pl. 1, figs. 5, 6, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 13, pl. 2, figs. 17, 18, 1938.
Textularia pupa Cushman (not Reuss), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 584, pl. 15, figs. 5, 6, 1926.
Gümbelina pupa Cushman (not Reuss), Jour. Paleontology, vol. 1, p. 157, pl. 27, figs. 6a, b, 1927.

Test about 1½ times as long as broad, early portion rapidly tapering, later portion with little increase in width, periphery slightly indented; chambers inflated throughout, strongly so in the adult; sutures depressed; wall in the early portion faintly striate, later with the perforations in lines, and smooth in the adult; aperture a high arch with a slightly thickened border. Length 0.40 to 0.60 mm., breadth 0.25 to 0.35 mm., thickness 0.20 to 0.25 mm.

The types are from the Cretaceous Mendez shale in an arroyo in Chapacao, 5.5 kms. north of Chijol Station, Mexico. The figured specimens are from the Velasco shale of Mexico. From the series available, the type specimen is probably immature, and both young and adult forms are given on our plate.

Besides occurring in Mexico and Cuba, the species occurs in the Upper Cretaceous of Trinidad and has been recorded from Texas, but the records are not accompanied by figures. It has also been recorded from New Jersey, but the figure given is not typical.

Gümbelina globocarinata Cushman
Plate 46, figures 8, 9
Gümbelina globocarinata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 10, pl. 2, figs. 4, 5, 1938.
Cushman and Deaderick, idem, vol. 18, p. 63, 1942.
Cushman, idem, vol. 20, p. 10, pl. 2, fig. 21, 1944.

Test rapidly tapering from the subacute initial end to the greatest breadth formed by the last 2 chambers, early portion compressed and slightly carinate, periphery in the early portion entire, later distinctly indented; chambers of the early portion compressed, much broader than high, thence increasing gradually in relative height, last-formed pair much enlarged and inflated; sutures distinct, early sutures slightly limbate, depressed strongly in the later portion; wall of the early portion finely costate longitudinally, later with longitudinal rows of fine pits; aperture a large, arched opening at the inner margin of the chamber. Length 0.40 to 0.50 mm., breadth 0.28 to 0.30 mm., thickness 0.20 mm.

The types are from the upper part of the Taylor marl, Milton road, west-facing slope of a branch valley 1 mile west of Deport, Lamar County, Tex.

This species differs from *G. striata* (Ehrenberg) Egger in the carinate and compressed early portion, and the very rapidly expanding last chambers.

The range of the species seems to be from beds of Austin age throughout the beds of Taylor age and into horizons equivalent to the Neylandville marl, but not above.

Navarro age.
Selma chalk (upper part). Alabama, Marengo County (104).
Neylandville marl. Texas, Hunt County (53, 55); Rockwall County (57); Kaufman County (58, 62); Navarro County (63, 64, 66, 67, 69).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 106, 108); Lamar County (110, 112); Fannin County (113); Delta County (114); Hunt County (115, 116); Collin County (119–122); Kaufman County (128–131); Navarro County (132, 134); Limestone County (136); Leon County (138); Milam County (139); Williamson County (141, 143, 144); Hays County (150); Guadalupe County (151); Bexar County (152, 153, 155, 156, 158–60, 162, 163).
Anacacho limestone (upper part). Texas, Bexar County (164).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (169–172); Kaufman County (173); Rockwall County (175); McLennan County (177).

Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (258); Prentiss County (260); Lee County (263).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181, 183); Navarro County (187, 188).
Lower part of Taylor marl. Texas, Lamar County (201); Delta County (206); Dallas County (223); Kaufman County (228); Ellis County (234); Hill County (237); Williamson County (246); Travis County (249); Comal County (251).

Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270, 271).
Austin chalk. Texas, Grayson County (290).
Brownstown marl. Arkansas, Sevier County.

Gümbelina costulata Cushman
Plate 46, figures 10–12

Gümbelina costulata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 16, pl. 3, figs. 7–9, 1938.
Cushman and Todd, idem, vol. 19, p. 64, pl. 11, fig. 13, 1943.

Test 1½ to 2 times as long as broad, rather rapidly tapering, initial end often acute with a slight point, somewhat compressed; earlier portion with the periphery slightly keeled, later portion slightly indented; chambers slightly inflated, mostly broader than high, last chambers with the inner portion reduced in height; sutures in the early portion slightly limbate and little if at all depressed, later depressed and slightly curved; wall ornamented throughout with fine longitudinal costae, becoming somewhat curved and nearly parallel to the periphery in the later part; aperture semicircular, with a slightly thickened lip. Length 0.25 to 0.30 mm., breadth 0.15 to 0.20 mm., thickness 0.10 mm.

The types are from the lower beds of the upper part of the Taylor marl in a gully north of a road west of an iron bridge over a branch of Kickapoo Creek 1.9 miles northwest of Annona, Red River County, Tex.

This species differs from *G. striata* (Ehrenberg) Egger in the smaller size, compressed test, lower and broader chambers, and distinctly costate surface throughout. It occurs in greatest numbers in the middle and upper portions of the Taylor marl and its equivalents, but it also continues on through beds of the Navarro group, where it evidently gives rise to the somewhat larger and more coarsely ornamented *G. excolata* Cushman.

Navarro age.
Kemp clay. Texas, Navarro County (7); Falls County (9); Travis County (15); Guadalupe County (18).
Corsicana marl. Texas, Navarro County (25, 27); Falls County (32); Travis County (34, 37, 38, 40, 42, 43); Caldwell County (44); Limestone County (30).
Prairie Bluff chalk. Mississippi, Chickasaw County (85, 86). Alabama, Sumter County (101, 102).
Nacatoch sand. Texas, Bowie County (48).
Ripley formation. Tennessee, McNairy County (94).
Neylandville marl. Texas, Hunt County (54); Kaufman County (58, 60–62); Navarro County (66).

Taylor marl.
Upper part. Texas, Red River County (105–107, 109); Lamar County (110, 112); Collin County (119, 121, 122); Kaufman County (125, 129–131); Navarro County (132, 134); Leon County (138); Milam County (139); Williamson County (141, 144); Travis County (145, 149); Bexar County (156, 158, 159).
Pecan Gap chalk member. Texas, Delta County (166); McLennan County (177).
Wolfe City sand member. Texas, Collin County (183).
Lower part. Texas, Delta County (206); Collin County (212); Kaufman County (228, 229).

Gümbelina punctulata Cushman
Plate 46, figures 13, 14

Gümbelina punctulata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 13, pl. 2, figs. 15, 16, 1938.

Test broad and rounded, about 1½ times as long as broad, initial portion rapidly tapering, later portion of nearly uniform width, periphery of early portion keeled, later indented; chambers of the early portion somewhat compressed, keeled, much broader than high, rapidly inflated in the adult, in which they are globular; sutures in the early portion slightly depressed and limbate, later strongly depressed; wall in the early portion slightly costate or with the fine perforations in vertical lines, in the adult thicker-walled with the surface rather coarsely punctate; aperture, a low, broad arch with a slight lip, the sides continuing in a flange onto the preceding chamber. Length 0.45 to 0.55 mm., breadth 0.32 to 0.35 mm., thickness 0.22 to 0.25 mm.

The types are from the Taylor marl, Paris highway 1.8 miles east of Deport, west-facing slope of Mustang Creek Valley, Red River County, Tex.

This species differs from *G. striata* (Ehrenberg) Egger in the compressed and keeled early portion, very rapid expansion of the later chambers, rather uniform width in the adult, and the coarsely punctate surface in the adult. The range seems to be mostly through the upper beds of Taylor age, including the Wolfe City sand member, the Annona chalk, and also the Neylandville marl.

Navarro age. Neylandville marl. Texas, Rockwall County (57).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 106, 108, 109); Lamar County (110); Leon County (138); Milam County (139).
Wolfe City sand member of Taylor marl. Texas, Navarro County (188).
Annona chalk. Texas, Red River County (194, 195).
Lower part of Taylor marl. Texas, Delta County (206).

Gümbelina spinifera Cushman
Plate 46, figure 15

Gümbelina spinifera Cushman, Tennessee Div. Geology Bull. 41, p. 43, pl. 7, figs. 8a, b, 1931; Cushman Lab. Foram. Research Special Pub. 5, pl. 26, fig. 7, 1933; Cushman Lab. Foram. Research Contr., vol. 14, p. 11, pl. 2, fig. 10, 1938.

Test slightly longer than broad, rapidly tapering, periphery indented throughout; chambers inflated, globular in the adult, in the early portion broader than high; sutures distinctly depressed; wall ornamented by short spines scattered over the whole surface; aperture small, semicircular, with a slight lip. Length 0.20 to 0.25 mm., breadth 0.15 mm., thickness 0.10 mm.

The types of this species are from the Ripley formation of Tennessee, and it has not been noted elsewhere in our material.

Navarro age. Ripley formation. Tennessee, McNairy County (94).

Gümbelina excolata Cushman
Plate 46, figure 16

Gümbelina excolata Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 20, pl. 2, fig. 9, 1926; Jour. Paleontology, vol. 1, p. 157, pl. 28, fig. 13, 1927.
White, idem, vol. 3, p. 34, pl. 4, fig. 7, 1929.
Plummer, Texas Univ. Bull. 3101, p. 176, pl. 8, fig. 10, 1931.
Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 17, pl. 3, fig. 11, 1938.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 34, pl. 3, fig. 4, 1938.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 92, pl. 22, fig. 14, 1941.
Cushman and Todd, idem, vol. 19, p. 64, pl. 11, fig. 15, 1943.
Textularia costata Carsey, Texas Univ. Bull. 2612, p. 26, pl. 1, fig. 4, 1926.

Test about $1\frac{1}{2}$ times as long as broad, tapering, in the later portion increasing only slightly in breadth, somewhat compressed, becoming more so in the last chambers, early portion with the periphery entire, later indented; chambers broader than high in the early portion, becoming somewhat higher in the later portion, the apertural end reduced in height; sutures of the early portion slightly limbate, later slightly depressed; wall ornamented with very coarse costae nearly parallel to the periphery; aperture semicircular, with a slight lip. Length 0.40 to 0.50 mm., breadth 0.25 to 0.30 mm., thickness 0.15 to 0.18 mm.

The types of this species are from the Cretaceous shales, east bank of Tamuin River 5 kilometers southeast of Guerrero, San Luis Potosi, Mexico. It is common in the Papagallos formation and particularly in the Mendez shale of Mexico. It is recorded from the Colon formation of Santander del Norte, Colombia, as well as from the Selma chalk of wells in Florida. In the Gulf Coastal Plain it occurs in the Corsicana, Kemp, and Arkadelphia formations of Navarro age. It is a larger and much more coarsely ornamented species than *G. costulata* and was probably developed from that species.

Navarro age.
Kemp clay. Texas, Williamson County (12); Travis County (17).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–28); Limestone County (30, 31); Travis County (36, 39, 40); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (71).
Taylor marl, upper part. Texas, Red River County (107).

Gümbelina glabrans Cushman
Plate 46, figures 17, 18

Gümbelina tessera Cushman (not *G. tessera* Cushman, 1932, nor *Grammostomum tessera* Ehrenberg), Geol. Soc. America Bull., vol. 47, p. 418, pl. 1, figs. 9a, b, 1936.
Gümbelina glabrans Cushman, Cushman Lab. Foram Research Contr., vol. 14, p. 15, pl. 3, figs. 1, 2, 1938.
Cushman and Hedberg, idem, vol. 17, p. 92, pl. 22, fig. 16, 1941.
Cushman and Todd, idem, vol. 19, p. 64, pl. 11, fig. 14, 1943.

Test nearly twice as long as broad, tapering throughout, much compressed, early portion with the periphery entire and slightly keeled, later moderately indented; chambers in the microspheric form mostly slightly broader than high, in the megalospheric form the later chambers with the height as great as or greater than the breadth, later chambers more inflated but somewhat compressed throughout; sutures in the early portion slightly limbate, in the adult depressed; wall in the early portion coarsely punctulate, somewhat roughened, in the adult smooth and polished; aperture higher than broad, arched, with a slight lip and flanges at the sides extending onto the preceding chamber. Length 0.40 mm., breadth 0.20 to 0.25 mm., thickness 0.10 mm.

The types are from the Cretaceous Navarro group, base of Kemp clay, branch of Mustang Creek 1 mile west-southwest of Noack, 900 feet downstream from road, and 0.2 mile southwest of Christ Evangelical Lutheran Church, Williamson County, Tex.

This species differs from *G. globulosa* (Ehrenberg) Egger in the much compressed test, the keeled and roughened early portion, and the smooth and polished later portion. It seems to be confined to rocks of Navarro age, occurring in the Corsicana marl, Kemp clay, and Prairie Bluff chalk. The specimens from the Georges Bank Canyons noted in the reference above also belong here. It occurs also in the upper zone of the Colon formation of Colombia.

Navarro age.
Kemp clay. Texas, Williamson County (12).
Corsicana marl. Texas, Hunt County (24); Navarro County (26, 27); Travis County (35, 36, 38); Limestone County (30).
Prairie Bluff chalk. Alabama, Wilcox County (99).
Selma chalk (upper part). Tennessee, McNairy County (98).

Genus RECTOGUMBELINA Cushman, 1932

This genus is derived directly from *Gümbelina* by the addition of the uniserial stage. From the material at hand, it is evident that there are other species than those described here, but more specimens are needed for full details of these species. The species are evidently specialized and short lived, and should make good index fossils.

Rectogümbelina texana Cushman
Plate 46, figures 19–21

Rectogümbelina texana Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 6, pl. 1, figs. 8–10, 1932; idem, Special Pub. 5, pl. 26, fig. 10, 1933; idem, Contr., vol. 14, p. 20, pl. 3, figs. 17–19, 1938.

Test very elongate, slightly tapering, first 3 to 4 chambers biserial, similar to *Gümbelina*, later and larger portion uniserial, rectilinear; chambers globular, latest chambers somewhat pyriform, slightly overlapping; sutures distinct, depressed; wall thin, finely perforate, surface roughened, slightly spinose; aperture rounded, at the end of tubular neck. Length 0.25 to 0.30 mm., diameter 0.06 to 0.07 mm.

This species is rather rare but occurs from the upper part of the Eagle Ford shale to the middle part of the Austin chalk. The biserial portion is very restricted, especially when compared with the following species.

Austin chalk (middle part). Texas, Grayson County (323).
Eagle Ford shale. Texas, Hill County (369).

Rectogümbelina hispidula Cushman
Plate 46, figures 22–24

Rectogümbelina hispidula Cushman, Cushman Lab Foram. Research Contr., vol. 14, p. 21, pl. 3, figs. 20–22, 1938.

Test elongate, slightly tapering, biserial for most of the length, latest portion uniserial; chambers inflated, earliest chambers biserial, gradually becoming more loosely so, and last-formed chambers rectilinear and nearly globular or slightly pyriform; sutures depressed; wall finely hispid throughout; aperture rounded, at the end of a short neck that is usually excentrically placed. Length 0.25 to 0.30 mm., diameter 0.08 to 0.10 mm.

The types are from the middle part of the Austin chalk in a road cut on the north side of the West Dallas pike 5.3 miles northeast of the Austin-Eagle Ford contact at Chalk Hill, Tex.

This species differs from *R. texana* in the much longer biserial stage and loosely biserial arrangement in the adult. It occurs at several stations in the lower and middle parts of the Austin chalk. In the loosely biserial character it resembles the figures given of *Tubitextularia* from the Cretaceous of Bohemia.

Austin chalk. Texas, Grayson County (334); Dallas County (325, 326, 339, 345).

Rectogümbelina minuta Cushman
Plate 47, figure 1

Rectogümbelina minuta Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 45, pl. 7, fig. 18, 1938.

Test minute, elongate, 2 to $2\frac{1}{2}$ times as long as broad, tapering, greatest breadth at the last-formed chamber, early portion biserial, later uniserial, circular in transverse section in the adult; chambers fairly distinct, the early biserial chambers increasing rapidly in size as added, uniserial chambers in the adult somewhat overlapping, subglobular; sutures distinct, slightly depressed, early sutures oblique in the adult, at right angles to the elongate axis; wall slightly roughened, finely hispid; aperture in the adult terminal, with a distinct, tubular neck. Length 0.30 to 0.35 mm., diameter 0.15 mm.

The types are from the lower part of the Taylor marl on the east bank of a road cut near the crest of a hill 14.4 miles south of Paris and 0.9 mile north of Lake City, Delta County, Tex.

This species differs from *R. hispidula* Cushman in the shorter biserial stage, the more definite uniserial stage with more globular adult chambers and tapering test.

Taylor marl, lower part. Texas, Delta County (206).

Rectogümbelina cretacea Cushman

Plate 47, figures 2, 3

Rectogümbelina cretacea Cushman, Cushman Lab. Foram. Research Contr., vol. 8, p. 6, pl. 1, figs. 11, 12, 1932; idem, Special Pub. 4, pl. 21, fig. 4, 1933; idem, Special Pub. 5, pl. 26, fig. 11, 1933; idem, Contr., vol. 14, p. 20, pl. 3, figs. 15, 16, 1938.

Test consisting of 2 unequal portions, the early portion consisting of several pairs of globular chambers arranged as in *Gümbelina*, the adult stage uniserial, formed usually by 3 subglobular or slightly pyriform chambers, slightly overlapping, the apertural end extended out into a tapering neck; sutures distinct, depressed; wall smooth, translucent, very finely perforate; aperture circular, at the end of the tubular neck. Length 0.25 to 0.35 mm., breadth 0.08 to 0.10 mm., thickness 0.05 to 0.07 mm.

This species is known only from a locality assigned to the Arkadelphia marl. It is possible that this locality may represent basal Midway, but it contains other species that typically belong to the Arkadelphia marl. *Rectogümbelina cretacea* is a larger species than *R. texana* and holds the *Gümbelina* stage much longer, but it has very few uniserial chambers.

Navarro age (?). Arkadelphia marl (?). 5½ miles northeast of Hope, Hempstead County, Ark.

Genus PSEUDOTEXTULARIA Rzehak, 1886

Pseudotextularia varians Rzehak

Plate 47, figures 4–9

Pseudotextularia varians Rzehak, K. k. Naturh. Hofmus. Annalen, vol. 10, pt. 2, p. 217, pl. 7, figs. 1–3, 1895.
Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 17, pl. 2, figs. 4a, b, 1926; Jour. Paleontology, vol. 1, p. 157, pl. 27, figs. 2a, b, 1927.
White, idem, vol. 3, p. 40, pl. 4, figs. 15a, b, 1929.
Morrison, Am. Assoc. Petroleum Geologists Bull., vol. 13, p. 1066, 1929.
Voorwijk, Royal Amsterdam Acad. Proc., vol. 40, No. 2, p. 7, pl. 1, figs. 14, 15, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 21, pl. 4, figs. 1–4, 1938.
Cushman and Todd, idem, vol. 19, p. 65, pl. 11, fig. 17, 1943.
Pseudotextularia elegans Rzehak var. *varians* Glaessner, Problems of paleontology, vol. 1, p. 101, pl. 1, figs. 3–5, text fig. 1c, 1936.
Gümbelina fruticosa Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 35, pl. 14, figs. 8, 9, 1899.

Test large, in the early stages definitely textularian, alternating series of chambers on either side of an elongate axis, after which isolated chambers are formed near the periphery, subglobular in form, resulting in a spiral series about the margin, the central area being somewhat depressed; sutures distinct except in the early portion; wall of the textularian chambers longitudinally costate, later ones irregularly punctate. Length up to 1.50 mm., breadth about 1.00 mm., thickness from 0.40 to 1.00 mm.

This is a very variable species. In certain individuals, apparently the textularian series is held throughout the life history, and the test may become much compressed. In others the globular chambers are developed very early, so that they make up most of the test, and the end view may be circular or, as in the figured specimen, elliptical. Many specimens that are nearly circular in transverse section in the early stages become more or less compressed in later growth.

In addition to the references cited above, Vanderpool lists this form or allied forms from the Austin chalk and Upson clay of Maverick County, Tex. (Jour. Paleontology, vol. 4, pp. 254, 255, 1930). White gives varietal names, var. *mendezensis* (pl. 47, fig. 9) and var. *textulariformis* (pl. 47, fig. 8) to two Mexican forms. The former is somewhat compressed and the latter shows the small chambers that develop in the microspheric form of the species both in America and in Europe.

This species is common in and very characteristic of the Mendez shale of the Tampico Embayment region, Mexico. Many samples are available, particularly from Hacienda el Limon and the region extending southward to Guerrero, San Luis Potosi, Mexico. It is common along the San Luis Potosi-Tampico Railroad from kilometer 576.03 to 577.96. The species seems to be rare in the Texas Cretaceous, although it has been recorded occasionally. It has recently been recorded from the Upper Cretaceous of Cuba, and it is known in the Upper Cretaceous of Europe.

Navarro group.
Kemp clay. Texas, Williamson County (11).
Corsicana marl. Texas, Navarro County (27); Limestone County (30); Travis County (39).

Genus PLANOGLOBULINA Cushman, 1927

This genus seems to be directly derived from *Pseudotextularia* by the addition of the chambers in a single plane. In the adult, it is similar to *Ventilabrella*, but that genus develops directly from *Gümbelina*, with no intermediate stages. It is most common in the Upper Cretaceous of Mexico and Europe, but at least one species occurs in the Taylor marl.

Planoglobulina taylorana Cushman

Plate 47, figures 10, 11

Planoglobulina taylorana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 23, pl. 4, figs. 9, 10, 1938.

Test short and broad, early portion biserial, later with the chambers arranged about a terminal depression, and last portion having the chambers in one plane; chambers globular throughout; sutures slightly depressed; wall coarsely perforate. Length up to 0.60 mm., breadth 0.50 to 0.55 mm., thickness 0.25 mm.

The types are from the basal Taylor marl on the Dallas road 1.5 miles east of Garland, Dallas County, Tex.

This species differs from *P. acervulinoides* (Egger) Cushman in the fewer chambers and lack of surface ornamentation. It was fairly common at the type locality, but has not yet been found elsewhere in our material.

Taylor marl, lower part. Texas, Dallas County (224).

Planoglobulina acervulinoides (Egger) Cushman
Plate 47, figures 12–15

Gümbelina acervulinoides Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 36, pl. 14, figs. 17, 18, 20–22, 1899.
Pseudotextularia acervulinoides Cushman, Washington Acad. Sci. Jour., vol. 15, p. 134, 1926; Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 17, 1926.
Planoglobulina acervulinoides (Egger) Cushman, idem, vol. 3, pl. 13, fig. 5, 1927; Jour. Paleontology, vol. 1, p. 158, pl. 27, fig. 3, 1927; Cushman Lab. Foram. Research Special Pub. 1, pl. 33, figs. 8, 9; pl. 34, fig. 5, 1928.
White, Jour. Paleontology, vol. 3, p. 33, pl. 4, fig. 6, 1929.
Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 21, fig. 8, 1933; idem, Special Pub. 5, pl. 26, fig. 17, 1933.
Jedlitschka, Naturf. Ver. Troppau Mitt., C.S.R., pl. figs. 15, 16, 1935.
Voorwijk, Royal Amsterdam Acad. Proc., vol. 40, No. 2, p. 8, pl. 1, fig. 19, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 23, pl. 4, figs. 5–8, 1938.

Test much compressed, early stages similar to *Pseudotextularia,* later with the subglobular chambers spread out in one plane; sutures fairly distinct, depressed; wall longitudinally costate. Length up to 0.75 mm., breadth 0.75 mm., thickness 0.10 to 0.15 mm.

This species, first described from the Upper Cretaceous of the Bavarian Alps, occurs at numerous localities in America, particularly in the Mendez shale of Mexico. It is apparently derived from *Pseudotextularia* and is closely allied to *Ventilabrella,* which in turn is derived directly from *Gümbelina.*

The early stages of *Planoglobulina* are much thicker than in *Ventilabrella* owing to the single plane of chambers in the latter genus, whereas the former has them arranged in a generally circular manner as in *Pseudotextularia.*

This species occurs with *Pseudotextularia* in the Tampico Embayment region, but we have not found it in the many collections available from the Upper Cretaceous of Texas. Specimens from the Prairie Bluff chalk are here figured that seem to belong to the species. The early stages are decidedly like *Pseudotextularia,* as may be seen by the figures. It may be that this is the same as the species later recorded as *Ventilabrella plummerae* Sandidge.

Navarro age. Prairie Bluff chalk. Alabama, Wilcox County (99, 100).

Genus VENTILABRELLA Cushman, 1928

The species of this genus show all stages in the development from *Gümbelina.* The microspheric form is usually retarded and often does not develop beyond the biserial stage, whereas the megalospheric form adopts the *Ventilabrella* character at various stages. The series therefore makes a rather bewildering array of forms, which really must be in considerable abundance to show the full range of the species.

Ventilabrella austinana Cushman
Plate 47, figure 16

Ventilabrella austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 26, pl. 4, fig. 19, 1938; idem, vol. 20, p. 92, pl. 14, fig. 7, 1944.
Ventilabrella eggeri Carman (not Cushman), Jour. Paleontology, vol. 3, p. 314, pl. 34, fig. 7, 1929.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 35, pl. 5, fig. 5, 1937.

Test with a large series of biserial chambers and but few expanded chambers in the adult, typically of but 2 rows, compressed; chambers globular in the later portion, uniformly increasing in size; sutures slightly depressed; wall smooth, punctate. Length 0.45 to 0.55 mm., breadth 0.45 to 0.50 mm., thickness 0.15 to 0.20 mm.

The types of the species are from the middle portion of the Gober chalk on the Austin-Randolph road 4 miles north of Leonard, Fannin County, Tex.

The species differs from *V. eggeri* in the fewer and larger adult chambers and smooth surface. The species occurs chiefly in the middle and upper beds of Austin age, and evidently in the Niobrara chalk of Nebraska and Kansas.

Taylor marl, lower part. Texas, Collin County (209).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (277); Austin chalk. Texas, Dallas County (300, 311).
Brownstown marl. Texas, Red River County (318).
Selma chalk (lower part). Mississippi, Itawamba County (351).
Eagle Ford shale. Texas, Grayson County (354).

Ventilabrella eggeri Cushman
Plate 47, figures 17–19

Ventilabrella eggeri Cushman, Cushman Lab. Foram. Research Contr., vol. 4, pl. 1, figs. 10–12, 1928; idem, Special Pub. 5, pl. 26, figs. 14, 15, 1933; idem, Contr., vol. 14, p. 25, pl. 4, figs. 12–14, 1938; idem, vol. 20, p. 92, pl. 14, fig. 8, 1944.
Gümbelina acervulinoides Egger (part), K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 36, pl. 14, fig. 20, 1899.

Test in the early stages biserial, adult rhomboid or fan-shaped, compressed; chambers normally in one plane, distinct, later ones globular; sutures distinct, depressed, often somewhat limbate; wall ornamented with longitudinal costae, especially heavy on the biserial portion; aperture in the early stages as in *Gümbelina,* later with an aperture at each side near the base. Length 0.45 to 0.55 mm., breadth 0.45 to 0.55 mm., thickness 0.10 mm.

The species is apparently found in the region of upper Bavaria in some numbers, as shown by available material. It occurs abundantly in the Texas Cretaceous, particularly in the lower part of the Taylor marl, but it also is found in the upper part of the Austin chalk.

Taylor marl.
Upper part. Texas, Collin County (121); Williamson County (144).
Lower part. Texas, Collin County (208–210, 212–214); Dallas County (217, 219–222, 224, 225, 227); Ellis County (232, 235); Navarro County (236); Hill County (237); McLennan County (238, 239, 241–243); Falls County (244); Travis County (247, 250).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (271).
Gober tongue of Austin chalk. Texas, Fannin County (274, 276, 281); Lamar County (282, 288).
Austin chalk. Texas, Collin County (295); Dallas County (304); Bell County (316).
Selma chalk of upper Austin (?) age. Alabama, Pickens County (352).
Selma chalk (lower part). Mississippi, Itawamba County (351); Lee County (350).
Brownstown marl. Texas, Lamar County (320).

Ventilabrella eggeri Cushman var. glabrata Cushman
Plate 47, figures 20–22

Ventilabrella eggeri Cushman var. *glabrata* Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 26, pl. 4, figs. 15–17, 1938.

Variety differing from the typical form in the ornamentation of the surface, which in the early stages is slightly costate, but in the adult smooth, with the perforations sometimes appearing in a linear series.

The types are from the upper part of Taylor marl, clay pit at Palmer, Ellis County, Tex.

This variety replaces the highly ornamented typical form in the upper part of the Taylor marl, possibly extending into the basal Navarro.

Navarro group, Neylandville marl. Texas, Rockwall County (57); Navarro County (65, 69).
Taylor marl.
Upper part. Texas, Red River County (105); Lamar County (110); Kaufman County (128); Navarro County (134).
Lower part. Texas, Delta County (206); Ellis County (231).
Austin chalk, Gober tongue. Lamar County (286).

Ventilabrella carseyae Plummer
Plate 48, figures 1–5

Ventilabrella carseyae Plummer, Texas Univ. Bull. 3101, p. 178, pl. 9, figs. 7–9, 10, 1931.
Sandidge, Am. Midland Naturalist, vol. 13, p. 362, pl. 31, fig. 29, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 21, figs. 6a, b, 1933.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 28, pl. 3, figs. 13a, b, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 26, pl. 4, figs. 20–24, 1938.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 34, pl. 3, figs. 7, 8, 1938.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 93, pl. 22, figs. 18a, b, 1941.
Cushman and Todd, idem, vol. 19, p. 65, pl. 11, fig. 18, 1943.
Ventilabrella plummerae Sandidge, Am. Midland Naturalist, vol. 13, p. 195, pl. 19, figs. 5, 6, 1932.
Pseudotextularia a, d, Plummer, Texas Univ. Bull. 2644, 1926, p. 172, pl. 2, figs. 1a, b, 4a, b (1927).

Test mostly biserial, especially in the microspheric form, in some specimens showing 3 or more chambers in a horizontal series in the later stages; chambers inflated, rapidly increasing in size as added; sutures distinct, strongly depressed; wall thin, longitudinally costate; aperture large, low, and broad, on the inner basal margin, with a slight lip, and with a supplementary opening on the outer basal margin in the chamber last preceding the expanded portion in the adult. Length 0.45 to 0.55 mm., breadth 0.30 to 0.45 mm., thickness 0.20 to 0.25 mm.

This species is especially abundant and characteristic of rocks of Navarro age above the Nacatoch sand, occurring in the Corsicana marl, Kemp clay, Arkadelphia marl, and Prairie Bluff chalk. It probably occurs in the Ripley formation, although the abundant form from the upper part of the Ripley is here placed under *Planoglobulina acervulinoides* (Egger) Cushman. Specimens are recorded from the Selma chalk of wells in Florida and from the upper zone of the Colon formation of Colombia.

A large part of the specimens do not progress beyond the *Gümbelina* stage, but in any large series a certain number of megalospheric forms show ventilabrelloid chambers. There is considerable range in the inflation of the chambers in the biserial stage, and altogether it is a very variable species. It seems to be a derivative from *Gümbelina plummerae* Loetterle, which is found lower stratigraphically, is less ornamented, and has a lesser tendency to acquire ventilabrelloid chambers than does *V. carseyae.*

It is possible that the species recently described by Voorwijk as *Gümbelina nuttalli* (Royal Amsterdam Acad. Proc., vol. 40, No. 2, p. 5, pl. 2, figs. 1–9, 1937) from the Upper Cretaceous of Havana, Cuba, may belong here. I have seen no original material.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Navarro County (3–5, 7); Falls County (9); Williamson County (11, 12); Travis County (13, 15, 17); Guadalupe County (18, 20, 21).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–28); Limestone County (30, 31); Falls County (32); Travis County (34–42); Caldwell County (44); Guadalupe County (45); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70–73).
Prairie Bluff chalk. Mississippi, Chickasaw County (84, 85). Alabama, Wilcox County (99); Sumter County (102, 103).
Nacatoch sand. Texas, Bowie County (47).

Genus BOLIVINOIDES Cushman, 1927

Bolivinoides austinana Cushman
Plate 48, figure 6

Bolivinoides austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 104, pl. 15, fig. 10, 1937.

Test tapering from the subacute or rounded initial end to the greatest width formed by the last-formed pair of chambers, somewhat compressed, periphery rounded, slightly if at all lobulate; chambers fairly distinct, somewhat inflated in the adult, increasing gradually in size as added; sutures distinct in the later portion; wall smooth, except for a series of deep rounded pits marking the suture lines; aperture elongate, narrow, at the base of the inner margin of the thickened terminal face. Length 0.40 mm., breadth 0.15 mm., thickness 0.10 mm.

The types are from the upper part of the Austin chalk in Pecan Creek 3.4 miles south by east of Troy, Bell County, Tex.

This species differs from *B. decorata* (Jones) Cushman in the more slender form, and the absence of definite lobed projections of the chambers. *B. austinana* is apparently the oldest and most primitive of this genus so far as known.

It occurs typically in the upper beds of Austin age and slightly less typical specimens are found in the lower part of the Taylor marl.

Taylor marl, lower part. Texas, Dallas County (216, 217, 219, 225, 227); McLennan County (239).
Austin age.
Gober tongue of Austin chalk. Texas, Lamar County (287).
Austin chalk. Texas, Dallas County (310); Bell County (316).
Brownstown marl. Texas, Lamar County (320).

Bolivinoides texana Cushman
Plate 48, figure 7

Bolivinoides texana Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 104, pl. 15, fig. 12, 1937.

Test very gradually tapering from the subacute initial end to the greatest breadth somewhat above the middle, thence in many specimens tapering somewhat toward the apertural end, strongly compressed, periphery acute, somewhat lobulate; chambers very distinct, numerous, slightly inflated, increasing rather uniformly to the greatest size above the middle; sutures distinct throughout, somewhat depressed; wall smooth except for the slightly lobulate base of the chambers in the adult; aperture elongate, narrow, at the base of the inner margin of the thickened terminal face. Length 0.40 to 0.45 mm., breadth 0.16 to 0.18 mm., thickness 0.07 to 0.08 mm.

The types are from the lower part of the Taylor marl in a ditch south of the McKinney-Farmersville road 7.2 miles east of the Houston and Texas Central Railroad tracks in McKinney, Tex.

This species differs from *B. decorata* (Jones) Cushman var. *delicatula* Cushman in the very slight development of the lobes, giving a somewhat crenulate appearance to the base of the adult chambers. *B. texana* is probably the ancestor of *B. decorata* var. *delicatula,* which appears higher in the section.

Taylor marl, lower part. Texas, Collin County (211, 212); Dallas County (226).

Bolivinoides decorata (Jones) Cushman

Plate 48, figures 8, 9

Bolivina decorata Jones (in Wright), Belfast Nat. Field Club Proc., 1884–85, appendix 9, p. 330, pl. 27, figs. 7, 8 (1886). Wright (in Welch), Irish Naturalist, p. 179 (list), 1902.
Heron-Allen and Earland, Royal Micr. Soc. Jour., p. 336, 1909; p. 409, pl. 7, figs. 1, 2, 1910.
Macfadyen, Geol. Mag., vol. 69, pl. 35, figs. 20a, b, 1932.
Bolivinoides decorata Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 89, pl. 12, fig. 9, 1927; idem, Special Pub. 5, pl. 26, fig. 18, 1933.
Sandidge, Am. Midland Naturalist, vol. 13, p. 196, pl. 19, fig. 16, 1932.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 4, fig. 9, 1938.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 10, pl. 2, fig. 23, 1944.
Bolivina latticea Carsey, Texas Univ. Bull. 2612, p. 27, pl. 4, fig. 9, 1926.

Test mainly biserial, compressed, rhomboid, the earliest stages in the microspheric form planispiral, the apertural end much thickened and smooth, the remainder of the periphery acute; chambers fairly distinct, somewhat obscured by the ornamentation; wall with the apertural end thickened and smooth, the surface of the broader faces of the test with an oblique ornamentation of broken costae nearly at right angles to the sutures, the costae often broken up into elongate tubercles; aperture rounded at the inner margin of the chamber. Length 0.60 to 0.75 mm., breadth 0.45 to 0.55 mm.

This species was originally described by Jones from the Cretaceous chalk of Keady Hill, County Derry, Ireland. The type figure, though somewhat crude, gives the essential characters, and I have specimens from the Irish chalk for comparison.

This short, broad, generaly rhomboid form, with the strong costate or linear series of tubercles nearly at right angles to the sutures, is characteristic of the Upper Cretaceous of Europe and America. The acute periphery of the general test and its short rhomboid shape will separate it from var. *delicatula* Cushman which occasionally occurs with it.

The typical form of the species occurs in the upper and middle beds of Taylor age, with a few localities in the Navarro group and a single one in the upper part of the Austin chalk. It is also recorded from the Selma chalk of wells in Florida.

Navarro age.
Owl Creek formation. Mississippi, Tippah County (83).
Saratoga chalk. Arkansas, Hempstead County (81).
Ripley formation. Tennessee, McNairy County (95).
Selma chalk (upper part). Alabama, Marengo County (104).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–107); Lamar County (112); Hunt County (115); Collin County (118, 120, 121); Rockwall County (124); Limestone County (136); Williamson County (140); Bexar County (152).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Collin County (169, 171); Kaufman County (173); Rockwall County (175).
Wolfe City sand member of Taylor marl. Texas, Collin County (180–183); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (191, 193, 196).
Lower part of Taylor marl. Texas, Lamar County (201); Delta County (206); Ellis County (234); Bell County (245).
Austin chalk, Gober tongue. Texas, Lamar County (286).

Bolivinoides decorata (Jones) Cushman var. delicatula Cushman

Plate 48, figures 10–14

Bolivina decorata Cushman (not Jones), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 582, pl. 15, fig. 11, 1926.
White, Jour. Paleontology, vol. 3, p. 43, pl. 5, fig. 1, 1929.
Plummer, Texas Univ. Bull. 3101, p. 181, pl. 10, fig. 10, 1931.
Bolivinoides decorata (Jones) Cushman var. *delicatula* Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 90, pl. 12, fig. 8, 1927; Jour. Paleontology, vol. 1, p. 158, pl. 28, fig. 7, 1927.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 99, pl. 14, fig. 9, 1928.
Cushman, Jour. Paleontology, vol. 5, p. 308, pl. 35, figs. 13a, b, 1931.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 42, pl. 13, fig. 2, 1932.
Cushman, Jour. Paleontology, vol. 6, p. 338, pl. 51, figs. 6a, b, 1932; Cushman Lab. Foram. Research Special Pub. 5, pl. 26, fig. 19, 1933; idem, Contr., vol. 20, p. 11, pl. 2, fig. 22, 1944.

Variety differing from the typical form in the much more slender test, the much less definitely marked ornamentation, consisting of lobes confined to the individual chamber rather than continuous costae or rows of tubercles, the thinner wall fairly smooth toward the initial end, and the more rounded periphery.

This variety is fairly common in some parts of the Velasco shale of Mexico and occurs in typical form in the Upper Cretaceous of Trinidad. It is somewhat less common in the Gulf Coastal Plain than the typical form but has much the same range. However, it does not usually occur at the same stations.

Navarro age.
Saratoga chalk. Arkansas, Howard County (79).
Ripley formation. Tennessee, McNairy County (95).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 109); Collin County (119); Rockwall County (124).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); McLennan County (177).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Annona chalk. Texas, Red River County (194–198).
Lower part of Taylor marl. Texas, Red River County (199); Dallas County (223); Kaufman County (228, 229).

Bolivinoides rhomboidea (Cushman) Cushman

Plate 48, figure 15

Bolivina rhomboidea Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 19, pl. 2, figs. 3a, b, 1926.
Bolivinoides rhomboidea Cushman, idem, pt. 4, p. 90, pl. 12, figs. 10a, b, 1927; Jour. Paleontology, vol. 1, p. 158, pl. 28, fig. 12, 1927.
Bolivinoides draco White (not Marsson), idem, vol. 3, p. 45, pl. 5, fig. 2, 1929.
Bolivinoides rhomboidalis Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 21, fig. 9, 1933.

Test small, short, rhomboid in outline, the apertural end much thickened and smooth; chambers and sutures almost entirely obscured by the surface ornamentation, which consists of two short median costae on the basal half of the test with branches to the thickened rim of the test, occasionally anastomosing but not divided into beads. Length 0.50 to 0.60 mm., breadth 0.40 to 0.45 mm., thickness 0.20 to 0.25 mm.

This is a very short rhomboid species related to *B. draco* (Marsson) Cushman and *B. decorata* (Jones) Cushman. It is very common in the Mendez shale of the Tampico Embayment region of Mexico, to which area it seems to be confined. The simple characteristic ornamentation and very broad thickening of the outer face will at once distinguish this species.

Bolivinoides velascoensis (Cushman) Cushman
Plate 48, figure 16

Textularia velascoensis Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 1, p. 18, pl. 3, figs. 1a–c, 1925; Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 584, pl. 15, fig. 8, 1926.
Bolivinoides velascoensis Cushman, Jour. Paleontology, vol. 1, p. 159, pl. 28, fig. 10, 1927; Cushman Lab. Foram. Research Contr., vol. 8, p. 94, 1932.
Gümbelina velascoensis White, Jour. Paleontology, vol. 3, p. 39, pl. 4, fig. 14, 1929.

Test generally biserial, the earliest chambers planispiral in the microspheric form, generally rhomboid in outline, greatly thickened at the smooth apertural end, periphery generally rounded; chambers distinct, not inflated, the earlier planispiral chambers projecting beyond the general outline of the test; sutures distinct, somewhat raised, curved; wall ornamented with a series of irregular raised lines on the surface of the chambers; aperture a low opening at the base of the inner face of the chamber. Length up to 0.75 mm., breadth 0.55 mm., thickness 0.35 mm.

This species is common in some parts of the Velasco shale of Mexico but has not been found in the material from the southern United States. It is most closely allied to *B. trinitatensis* Cushman and Jarvis, from the Upper Cretaceous of Trinidad.

Bolivinoides trinitatensis Cushman and Jarvis
Plate 48, figure 17

Bolivinoides trinitatensis Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 99, pl. 14, figs. 10a, b, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 43, pl. 13, figs. 3a, b, 1932.

Test generally biserial, broadest near the apertural end, tapering to the subacute initial end, whole test thickening rapidly toward the apertural end, which is formed of a smooth thickened area; chambers marked by the highly ornate character of the test, consisting of thin, convex, platelike extensions backward from the thickened terminal face of the chamber having a deep area below, with trusslike raised costae, the areas over the chambers deeply depressed; aperture a somewhat elongate opening marking the suture, which is otherwise obscured by the thickening of the apertural end of the test. Length 0.60 mm., breadth 0.38 mm., thickness 0.20 mm.

This species has been found only in Trinidad. It is most closely allied to *B. velascoensis* (Cushman) Cushman and is a much more highly ornamented relative of the Mexican species.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Genus BOLIVINITA Cushman, 1927

Bolivinita eleyi Cushman
Plate 48, figures 18–20

Textularia obsoleta Eley (not Reuss), Geology in the garden, p. 202, pl. 8, fig. 11C; p. 195, pl. 2, fig. 11, 1859.
Wright, Irish Naturalist, p. 179 (list), 1902.
?Chapman, Western Australia Geol. Survey Bull. 72, p. 16, pl. 12, fig. 116, 1917.
Bolivinita eleyi Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 91, pl. 12, figs. 11a, b, 1927; idem, vol. 7, p. 39, pl. 5, figs. 8a, b, 1931; Jour. Paleontology, vol. 6, p. 338, pl. 51, figs. 7a, b, 1932; Cushman Lab. Foram. Research Special Pub. 4, pl. 21, figs. 20a, b, 1933; idem, Special Pub. 5, pl. 26, fig. 21, 1933.
Brotzen, Sveriges Geol. undersökning, ser. C, No. 396, p. 122, pl. 9, figs. 5a, b, text fig. 41, 1936.

Test somewhat rhomboid, 2 or 3 times as long as broad, greatest width formed by the last 2 chambers, the periphery flattened as are the other 2 broader faces, angles very slightly keeled; sutures somewhat indistinct, limbate; surface finely perforate.

Although not recorded by D'Orbigny from the Cretaceous chalk of the Paris Basin, this species nevertheless occurs in many samples from that region as well as from the chalks of England and Ireland. It has been recorded from the Upper Cretaceous of Arkansas and is often very common in the Upper Cretaceous of Texas in the Taylor marl, especially the chalky facies, and in the upper part of the Austin. It also occurs in the Upper Cretaceous White Chalk of Antigua.

Though this and the following species, *B. planata* Cushman, occur in the upper beds of Taylor age, the two do not as a rule occur together. In fact, out of the 38 stations at which the species are recorded, there are but 4 at which both species occur together.

Taylor age.
Upper part of Taylor marl. Texas, Red River County (106); Lamar County (110); Collin County (119, 120); Kaufman County (131); Travis County (149).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (172); Kaufman County (173).
Wolfe City sand member of Taylor marl. Texas, Collin County (181, 183).
Annona chalk. Texas, Red River County (188a, 192, 193, 198).
Lower part of Taylor marl. Texas, Lamar County (201); Fannin County (203); Kaufman County (228, 229); McLennan County (238); Falls County (244); Bell County (245).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (271).
Gober tongue of Austin chalk. Texas, Fannin County (275).
Brownstown marl. Arkansas, Clark County (349).

Bolivinita planata Cushman
Plate 48, figures 21, 22

Bolivinita planata Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 115, pl. 23, figs. 9a, b, 1927; idem, Special Pub. 5, pl. 26, figs. 22a, b, 1933.

Test compressed, tapering, edges truncate, concave, broad faces flattened; chambers distinct; sutures limbate but not raised; wall smooth and unornamented; aperture at the peripheral margin of the last-formed chamber. Length 0.50 mm., breadth 0.25 mm., thickness 0.08 mm.

This species is to be distinguished from the much narrower *B. eleyi* Cushman, which also occurs in the Upper Cretaceous. *Bolivinita planata* is found in the upper beds of Taylor age, including the Pecan Gap chalk and the Wolfe City sand of Texas and rarely in the Ripley formation of Tennessee.

Navarro age.
Ripley formation. Tennessee, Henderson County (96).
Neylandville marl. Texas, Kaufman County (58).
Taylor marl.
Upper part. Texas, Collin County (119, 120); Rockwall County (124); Williamson County (140).
Pecan Gap chalk member. Texas, Collin County (170–172); Rockwall County (176); Kaufman County (174).
Wolfe City sand member. Texas, Collin County (180); Navarro County (188).
Lower part. Kaufman County (229); Ellis County (234).

Bolivinita selmensis Cushman
Plate 49, figures 1, 2

Bolivinita selmensis Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 58, pl. 7, figs. 3, 4, 1933; Geol. Soc. America Bull., vol. 47, p. 419, pl. 1, figs. 7a, b, 1936.

Test minute, gently tapering from the subacute initial end, broad faces distinctly concave, the narrow sides strongly convex; chambers distinct, increasing gradually in size as added; sutures distinct, somewhat limbate;

wall smooth, very finely perforate, translucent, especially in the middle of the chambers on the flattened faces; aperture narrow, at the inner margin of the last-formed chamber. Length 0.20 to 0.22 mm., breadth 0.07 to 0.11 mm., thickness 0.06 to 0.08 mm.

This is a minute but very distinctive species, with its very strongly concave faces, broadly convex sides, and the very thin wall in the middle of each chamber on the broad face. The types are from the Ripley formation of Tennessee, and it also occurs in material of Navarro age from Georges Bank.

Navarro age. Ripley formation. Tennessee, McNairy County (94).

Bolivinita costifera Cushman
Plate 49, figure 3

Bolivinita costifera Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 105, pl. 15, fig. 15, 1937.

Test small, about twice as long as broad, gradually tapering from the subacute initial end to the greatest breadth slightly above the middle, thence tapering slightly to the apertural end, periphery broadly rounded, strongly serrate in front view, in transverse section somewhat rhomboid, broader faces flattened or concave; chambers very distinct, increasing gradually in size as added, earlier chambers flattened and compressed, later chambers concave on the broader faces, and convex on the periphery, greatly increasing in thickness; sutures distinct, slightly curved in the early stages, more strongly so in the adult, slightly limbate; wall smooth and polished except for the basal angle of the chamber in the adult, which has a sharp angle that may develop into a raised costa-like ridge; aperture narrow, elongate, at the base of the inner margin of the apertural face. Length 0.25 to 0.30 mm., breadth 0.12 to 0.15 mm., thickness 0.08 to 0.10 mm.

The types are from a locality 5½ miles northeast of Hope, Hempstead County, Ark., assigned to the Arkadelphia marl but possibly belonging to the basal part of the Midway group (Paleocene).

This species most closely resembles *B. selmensis* Cushman, from which it is probably derived, in the sharply concave basal angle of the adult chambers and the development of a distinct costal ridge. The early stage of the species is very similar in its characters to the adult of *B. selmensis* Cushman.

Genus EOUVIGERINA Cushman, 1926
Eouvigerina americana Cushman
Plate 49, figures 4, 5

Eouvigerina americana Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 4, pl. 1, figs. 1a–c, 1926; Tennessee Div. Geology Bull. 41, p. 45, pl. 7, figs. 11a, b, 1931; Jour. Paleontology, vol. 6, p. 339, 1932; Cushman Lab. Foram. Research Special Pub. 5, pl. 26, figs. 32a–c, 1933.
Eouvigerina cretacea White (not Heron-Allen and Earland), Jour. Paleontology, vol. 3, p. 42, pl. 4, fig. 18, 1929.
Morrison, Am. Assoc. Petroleum Geologists Bull., vol. 13, p. 1066 (list), 1929.

Test elongate, tapering, greatest breadth toward the apertural end, composed of numerous chambers; the early chambers somewhat compressed, coiled, forming one volution or less in the microspheric form, chambers of the adult mostly biserial, but the last-formed chambers in fully developed specimens leaving the biserial form and becoming triserial; chambers distinct, polygonal, the upper face flat or slightly convex, the edges of the chamber with a trace of a keel in the adult; sutures distinct and depressed, especially in the later development; wall ornamented; aperture rhomboid, at the end of a short neck, with a phialine lip. Length 0.25 to 0.35 mm., breadth 0.12 to 0.18 mm., thickness 0.08 to 0.12 mm.

This species resembles *E. cretacea* (Heron-Allen and Earland) White, from the Chalk of England. The American species differs in the much more angular chambers, which are not nearly so convex, and in that the chambers of the whole test are more loosely put together.

E. americana is rather widely distributed in the beds of Taylor age.

Navarro age. Ripley formation. Tennessee, McNairy County (94).
Taylor age.
Upper part of Taylor marl. Texas, Lamar County (110).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 183).
Annona chalk. Texas, Red River County (192).
Lower part of Taylor marl. Texas, Lamar County (202); Fannin County (203, 205); Delta County (206); Collin County (211, 212, 214); Dallas County (226); McLennan County (241).
Austin chalk.
Gober tongue. Texas, Lamar County (286).
Ector tongue. Texas, Grayson County (332).

Eouvigerina gracilis Cushman
Plate 49, figure 6

Eouvigerina gracilis Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 5, pl. 1, figs. 2a–c, 1926; idem, Special Pub. 4, pl. 21, figs. 16a–c, 1933; idem, Contr., vol. 20, p. 11, pl. 2, fig. 30, 1944.

Test elongate, slender, tapering, greatest width formed by the last 2 chambers; earliest chambers obscure but the test for the most part made up of biserial chambers, those of the adult last-formed become triserial and more isolated from one another; chambers nearly round in transverse section, inflated; sutures distinct, much depressed; wall roughened by minute spines; aperture rounded, at the end of a short cylindrical neck, with a rather broad phialine lip. Length 0.35 mm., breadth 0.13 mm., thickness 0.10 mm.

This species is nearest to *Eouvigerina aspera* (Marsson) Cushman, but a study of Marsson's material shows the two to be quite distinct. *E. gracilis* is apparently limited to the Taylor marl.

Taylor marl.
Upper part. Texas, Hunt County (116); Collin County (122); Navarro County (134).
Pecan Gap chalk member. Texas, Delta County (166).
Lower part. Texas, Lamar County (201); Collin County (211, 212); Dallas County (220, 226, 227); Kaufman County (229); McLennan County (238).

Eouvigerina hispida Cushman
Plate 49, figures 7, 8

Eouvigerina hispida Cushman, Tennessee Div. Geology Bull. 41, p. 45, pl. 7, figs. 12, 13, 1931.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 29, pl. 3, fig. 15, 1936.

Test elongate, somewhat compressed, periphery rounded, initial end with a spine; chambers for the most part biserial, subglobular, inflated; sutures distinct, depressed; wall ornamented with fine spines thickly covering the entire surface; aperture with a short neck and slight lip. Length up to 0.25 mm., breadth 0.12 mm., thickness 0.10 mm.

In its surface ornamentation this species resembles both *Eovvigerina aspera* (Marsson) Cushman from the Upper Cretaceous of Germany and *E. gracilis* Cushman from the Upper Cretaceous of Texas. The former, however, has a very quadrate transverse section, and the latter much less rounded chambers and nearly straight sutures, and the general form is different. Neither of the above-mentioned species has a basal spine.

As yet this species has only been found at a few stations. The Austin record is subject to some doubt as to its age. It has been recorded from the Mt. Laurel sand of New Jersey.

Navarro age. Selma chalk (upper part). Tennessee, McNairy County (98).
Taylor marl, upper part. Texas, Leon County (138).
Austin(?) age. Selma chalk of upper Austin age(?). Alabama, Pickens County (352).

Eouvigerina austinana Cushman
Plate 49, figure 9

Eouvigerina austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 61, pl. 7, figs. 5a, b, 1933; idem, vol. 20, p. 92, pl. 14, fig. 9, 1944.

Test small, very gradually tapering from the subacute initial end; chambers mostly biserial, somewhat inflated toward the apertural end, gradually increasing in height as added; sutures in the early portion indistinct, later sutures more distinct, slightly depressed; wall finely perforate, smooth; aperture terminal, rounded, with a thick neck and very slight lip. Length 0.20 mm., breadth 0.08 mm., thickness 0.05 mm.

This is a very small, rounded species, but very different from any of the others of the Upper Cretaceous. It is perhaps nearest to *E. gracilis* Cushman, but is a much shorter, smaller species with a thick wall, and the apertural characters are very different.

This species is easily overlooked on account of its small size. So far as seen, it is limited to the upper beds of Austin age and a few occurrences in the lower part of the Taylor marl.

Taylor marl.
Taylor marl, lower part. Texas, Lamar County (201); Dallas County (216, 220); McLennan County (239, 241).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Gober tongue of Austin chalk. Texas, Fannin County (272, 276).
Austin chalk. Texas, Grayson County (291); Collin County (294); Dallas County (308, 309, 340).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320, 321).
Selma chalk (lower part). Mississippi, Itawamba County (351).

Eouvigerina plummerae Cushman
Plate 49, figures 10, 11

Eouvigerina plummerae Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 62, pl. 7, figs. 6, 7, 1933.
Loetterle, Nebraska Geol. Survey Bull. 12, p. 36, pl. 5, fig. 8, 1937.

Test small, very gently tapering, broader faces concave or nearly flattened, narrow sides slightly convex; chambers distinct, increasing rather rapidly in height as added; sutures distinct, very slightly depressed, often somewhat limbate; wall thin, finely perforate, translucent; aperture terminal, rounded, with a short neck and distinct, somewhat phialine lip. Length 0.35 to 0.40 mm., breadth 0.10 to 0.12 mm., thickness 0.05 to 0.07 mm.

This is a small, slender, but very distinctive species, apparently characteristic of the Austin chalk. It is recorded by Loetterle from the Niobrara chalk of Kansas, Nebraska, and South Dakota. It is very distinct from any of the other known species of the genus from the Upper Cretaceous. The flattened concave sides with the angles of the test forming sharp keels, and the strongly limbate sutures make this a very distinctive form.

Austin chalk.
Gober tongue. Texas, Lamar County (285).
Austin chalk. Texas, Collin County (294, 324); Grayson County (335); Dallas County (308, 311, 326); Hill County (313).
Ector tongue. Texas, Grayson County (332).

Eouvigerina aculeata Cushman
Plate 49, figure 13

Eouvigerina aculeata Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 62, pl. 7, figs. 8a, b, 1933.
Loetterle, Nebraska Geol. Survey Bull. 2d ser., Bull. 12, p. 36, pl. 5, fig. 9, 1937.

Test small, tapering, greatest breadth formed by the last pair of chambers, periphery in side view angularly lobate; chambers in the later portion distinct, those of the early portion difficult to distinguish from the exterior, in the adult with a distinct ridge across the upper half of the chamber, slightly concave below; sutures of the early portion indistinct, but of the later portion distinct and somewhat depressed; wall smooth, finely perforate; aperture rounded, with a very short thick neck and a slight phialine lip. Length 0.35 mm., breadth 0.15 mm., thickness 0.12 mm.

This species is rather characteristic of the Austin chalk and basal part of the Taylor marl and is widely distributed. It is recorded by Loetterle from the Niobrara chalk of Nebraska. This species is nearest to *E. americana* Cushman but is much less clear-cut than that species, and the chambers are not nearly so clearly sculptured.

Taylor marl, lower part. Texas, Red River County (199); Collin County (208, 209); Dallas County (216, 217, 219–225, 227); Hill County (237, 239); Falls County (244); Travis County (249).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (274, 275, 278, 281); Lamar County (283–285, 287).
Austin chalk. Texas, Grayson County (289); Collin County (292–295a); Dallas County (297, 303, 305, 306, 310, 345).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320, 321).

Eouvigerina geneae Morrow
Plate 49, figure 12

Eouvigerina geneae Morrow, Jour. Paleontology, vol. 8, p. 195, pl. 30, figs. 13, 16, 17, 19, 1934.
Loetterle, Nebraska Geol. Survey Bull. 2d ser., Bull 12, p. 35, pl. 5, figs. 6, 7, 1937.

Test elongate, slightly tapering, greatest breadth toward apertural end; early chambers biserial, tending to become uniserial in the last 3 or 4 chambers; chambers inflated, rounded; sutures distinct, depressed; well roughened by minute spines; aperture rounded, terminal, at the end of a short cylindrical neck. Length up to 0.56 mm., breadth 0.14 mm.

The types are from the basal Niobrara SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. It is recorded by Loetterle from the Niobrara chalk of Kansas, Nebraska, and South Dakota.

The species has not been found as yet in the material from the Coastal Plain but is to be looked for in the lower portions. Our figure is redrawn from the type specimen.

Genus PSEUDOUVIGERINA Cushman, 1927

Pseudouvigerina plummerae Cushman
Plate 49, figures 14–16

Pseudouvigerina plummerae Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 115, pl. 23, figs. 8a, b, 1927; Tennessee Div. Geology Bull. 41, p. 46, pl. 7, figs. 15, 16, 1931.

Sandidge, Am. Midland Naturalist, vol. 13, p. 197, pl. 19, figs. 9–11, 1932.
Cushman, Geol. Soc. America Bull., vol. 47, p. 419, pl. 1, figs. 13a, b, 1936.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 4, fig. 8, 1938.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 12, 1944; idem, vol. 20, p. 92, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 337, pl. 53, fig. 4, 1944.

Test small, earliest chambers in the microspheric form planispiral, later chambers biserial and those of the adult triserial; chambers distinct, slightly inflated, the periphery truncate and the margins crenulate; sutures slightly depressed, distinct; wall smooth, finely perforate; aperture circular, terminal, without a tooth. Length 0.35 mm., breadth 0.10 mm.

P. plummerae occurs in the present material from the lower beds of Navarro age and the beds of Taylor age, with two records for the uppermost beds of Austin age. It is recorded by Cole from the Selma chalk of wells in Florida. The crenulated angles are typically present, but there is considerable variation.

Navarro age.
Saratoga chalk. Arkansas, Howard County (79).
Ripley formation. Tennessee, McNairy County (94, 95).
Selma chalk (upper part). Mississippi, Union County (92). Tennessee, McNairy County (98).
Neylandville marl. Texas, Red River County (50); Delta County (52); Hunt County (54); Rockwall County (57); Kaufman County (58, 60); Navarro County (64, 66, 68, 69).

Taylor marl.
Upper part. Texas, Red River County (106, 108); Lamar County (110); Collin County (122); Kaufman County (129); Navarro County (134); Leon County (138); Travis County (145, 149); Bexar County (152, 159).
Pecan Gap chalk member. Texas, Delta County (165, 166); Collin County (172); Kaufman County (173); Rockwall County (176).
Wolfe City sand member. Texas, Collin County (183).
Marlbrook marl. Arkansas, Howard County; Hempstead County.
Lower part. Texas, Delta County (206).

Austin age.
Burditt marl (of Adkins). Texas, Travis County (271).
Gober tongue of Austin chalk. Texas, Lamar County (286).
Selma chalk (lower part). Mississippi, Itawamba County (351).

Pseudouvigerina cretacea Cushman
Plate 49, figures 17–20

Pseudouvigerina cretacea Cushman, Tennessee Div. Geology Bull. 41, p. 46, pl. 7, figs. 14a–c, 1931; Jour. Paleontology, vol. 6, p. 339, 1932.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 4, fig. 3, 1938.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 11, pl. 2, fig. 31, 1944.
Pseudouvigerina plummerae Cushman, idem, vol. 5, p. 309, pl. 35, figs. 18a, b, 1931 (not *P. plummerae* Cushman 1927).

Test elongate, fusiform, greatest breadth above the middle, periphery rounded; chambers inflated, distinct, the earlier chambers irregularly biserial, later chambers triserial; sutures distinct, depressed; wall smooth but coarsely perforate; aperture terminal, with a short neck and slightly developed lip. Length of holotype 0.35 mm., breadth 0.15 mm.

This species is very different from *P. plummerae* Cushman and from the other described species referable to this genus. The earlier chambers are distinctly biserial and the later chambers triserial, which, with the neck and lip at the apertural end, place it in this genus. Cole records it from the Selma chalk of well samples in Florida.

Navarro age.
Owl Creek formation. Mississippi, Tippah County (83).
Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94, 95).
Selma chalk (upper part). Alabama, Marengo County (104).

Taylor marl.
Upper part. Texas, Red River County (106); Leon County (138).
Pecan Gap chalk member. Texas, Delta County (166).
Austin age. Burditt marl (of Adkins). Texas, Bell County (269).

Pseudouvigerina seligi (Cushman) Cushman and Todd
Plate 49, figures 21–24

Uvigerina seligi Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 1, p. 1, pl. 4, figs. 1a–c, 1925.
Plummer, Texas Univ. Bull. 3101, p. 186, pl. 14, fig. 10, 1931.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 32, pl. 3, fig. 24, 1936.
Pseudouvigerina seligi Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 65, pl. 11, fig. 19, 1943.
Uvigerina tenuistriata Carsey (not Reuss), Texas Univ. Bull. 2612, p. 42, pl. 1, fig. 1, 1926.

Test minute, less than twice as long as broad; chambers comparatively few, the last 3 making up the larger part of the test, in end view somewhat angled, basal part of each chamber cut under sharply, leaving a somewhat overhanging shoulder; sutures very distinct, depressed; surface minutely roughened, with a few prominent longitudinal costae, those of each chamber independent of adjacent ones; aperture circular, with a short, broad, cylindrical neck and slight phialine lip. Length 0.25 mm., breadth 0.15 mm.

This species is highly ornamented, with costae that are occasionally broken up into spinose projections. A series of figures is given to show some of the variations. *P. seligi* is characteristic of the upper beds of Navarro age.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Williamson County (12); Travis County (15, 17); Guadalupe County (18).
Corsicana marl. Texas, Hunt County (24); Navarro County (25, 27, 28); Limestone County (29, 30); Falls County (32); Travis County (34, 37–42); Caldwell County (44); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (72, 73).
Owl Creek formation. Mississippi, Tippah County (83).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–87). Alabama, Wilcox County (99); Sumter County (101, 102).
Ripley formation. Mississippi, Pontotoc County (90).

Genus SIPHOGENERINOIDES Cushman, 1927
Siphogenerinoides plummeri (Cushman) Cushman
Plate 50, figure 1

Siphogenerina plummeri Cushman, U. S. Nat. Mus. Proc., vol. 67, p. 18, 1926; Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 15, pl. 1, figs. 7a–c, 1926.
Siphogenerinoides plummeri Cushman, idem, vol. 3, p. 63, pl. 13, fig. 16, 1927; idem, Special Pub. 1, p. 239, pl. 33, fig. 27; pl. 34, fig. 16, 1928; idem, Contr., vol. 5, p. 55, 1929.
Plummer, Texas Univ. Bull. 3101, p. 183, pl 9, figs. 1–6, 1931.
Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 21, fig. 18, 1933; idem, Special Pub. 5, pl. 26, figs. 35a, b, 1933.

Test small, elongate, 3½ to 4 times as long as broad, very slightly tapering, greatest width developed by the last-formed chamber, apertural end broadly rounded, initial end in the megalospheric form obtuse, in the microspheric form acute, the early portion much compressed, later rounded in transverse section; chambers distinct, those of the earliest portion, particularly in the microspheric form, biserial and compressed; later chambers uniserial, somewhat inflated, slightly overlapping, and of rather uniform size and shape; sutures distinct, slightly depressed, particularly in the uniserial portion; wall calcareous, perforate, the adult ornamented by 8 to 13 longitudinal costae, rather high and sharp, with the posterior angles tending to project slightly in almost spinose angles or even into short spines at the basal edge, occasionally with short smaller costae between the larger ones; interior of adult chambers with an internal tubular structure connecting the earlier apertures; aperture in the adult terminal, circular or elliptical, with a slight neck and rounded lip. Length 0.65 to 1.00 mm., diameter 0.25 to 0.30 mm.

Mrs. Plummer in the above reference has given excellent figures of this species, showing the details of the aperture and the interior. The early stages are very distinctly biserial and seem to be related to such forms as *Euovigerina* and *Bolivinita*, which occur in the Upper Cretaceous. The presence of an internal tubular structure has led Mrs. Plummer to suggest that *Siphogenerinoides* may have been derived from *Bolivina* by the addition of a uniserial stage. Much further study of *S. plummeri* and related species, together with those of *Eouvigerina*, *Bolivinita*, *Bolivina*, etc., of equivalent formations should be made to determine this point more definitely. Other species developed particularly in northern South America are related to *S. plummeri*, some of which reach a much larger size. All are from the uppermost Cretaceous.

The distribution of *S. plummeri* in the Gulf Coastal Plain shows that it is confined to the upper beds of Navarro age and makes an excellent index fossil for that portion of the Cretaceous when it is present.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Milam County (10).
Arkadelphia marl. Arkansas, Hempstead County (71).
Prairie Bluff chalk. Alabama, Wilcox County (100).
Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94).

Siphogenerinoides cretacea Cushman

Plate 50, figures 2, 3

Siphogenerinoides cretacea Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 58, pl. 9, figs. 14, 15, 1929.
Cushman and Hedberg, idem, vol. 17, p. 93, pl. 22, figs. 20–23, 1941.
Frizzell, Jour. Paleontology, vol. 17, p. 349, pl. 56, fig. 28, 1943.

Test elongate, in the microspheric form tapering, in the megalospheric form with the sides nearly parallel, about 3 times as long as broad, greatest width near the apertural end; chambers distinct, but only very slightly inflated; sutures distinct, slightly depressed, transverse to the long axis of the test; wall ornamented by numerous, fine, longitudinal costae continuous over the sutures; aperture with a short cylindrical neck and slight lip. Maximum length 1.60 mm., breadth 0.45 mm.

This is much the largest of the four species of *Siphogenerinoides* from the Upper Cretaceous. The microspheric form (fig. 3) is very pointed at the initial end, while the megalospheric form (fig. 2) is very broadly rounded. It may be distinguished from *S. parva* Cushman by the much larger size and the costae continuous across the sutures.

Upper Cretaceous. Colon shale. Quebrada Honda, Venezuela. Santander del Norte, Colombia.
Mal Paso shale. Northwestern Peru.

Siphogenerinoides bramlettei Cushman

Plate 50, figures 4, 5

Siphogenerinoides bramletti Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 56, pl. 9, figs. 5, 6, 1929.
Cushman and Hedberg, idem, vol. 17, p. 93, pl. 22, fig. 19, 1941.

Test slender, slightly tapering, about 4 times as long as broad, greatest width at the apertural end; chambers numerous, the later chambers distinct, earlier chambers usually obscured by the ornamentation; sutures of the uniserial chambers distinct, curved backward along the costae; wall ornamented by a few, usually 8 to 10, distinct, platelike, longitudinal costae, running uninterruptedly from the initial end to the base of the last-formed chamber, which is smooth; aperture rounded, without a neck and with only a trace of a thickened lip. Maximum length 0.80 mm., breadth 0.20 mm.

S. bramletti is closely related to *S. plummeri* Cushman and like it is found toward the top of the Cretaceous. It differs from *S. plummeri* in having the costae obsolete on the last-formed chamber, the costae higher, the sutures more curved between the costae, and the lip almost wanting.

Upper Cretaceous. Colon shale. Quebrada Honda, Venezuela. Santander del Norte, Colombia.

Siphogenerinoides parva Cushman

Plate 50, figures 6–8

Siphogenerinoides parva Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 58, pl. 9, figs. 11–13, 1929.
Cushman and Hedberg, idem, vol. 17, p. 93, pl. 22, fig. 25, 1941.

Test elongate, very slightly tapering, the sides nearly parallel, about 4 times as long as broad, greatest width toward the apertural end; chambers numerous, distinct, slightly inflated; sutures distinct and slightly depressed, nearly transverse to the long axis of the test; wall ornamented by numerous, low, longitudinal costae, sometimes becoming obsolete on the last-formed chambers, broken at the sutures, not continuous; aperture with a slight neck and a slight lip, often broken or serrate. Maximum length nearly 1.00 mm., breadth 0.25 mm.

The species may at once be distinguished from the others by the weak costae broken at the sutures, and by the small size.

This species and *S. cretacea* Cushman occur together, but do not occur in the same horizon with *S. bramletti* Cushman.

Upper Cretaceous. Colon shale. Quebrada Honda, Venezuela. Santander del Norte, Colombia.
Mito Juan shale. Santander del Norte, Colombia.

Siphogenerinoides ewaldi (Karsten) Cushman

Plate 50, figures 9–11

Orthocerina ewaldi Karsten, Deutscher Naturforscher u. Aerzte, Amtl. Ber. 32te Versammlung, 1856, p. 114, pl. 6, figs. 3a–c (1858); Geologie ancienne Colombia bolivarienne, Venezuela, Nouvelle Grenade et Ecuador, p. 62, pl. 6, figs. 3a–c, 1886.
Siphogenerinoides ewaldi Cushman, Cushman Lab. Foram. Research Contr., vol. 5, p. 58, 1929.
Cushman and Hedberg, idem, vol. 6, p. 68, pl. 9, figs. 10–12, 1930.
Renz, 8th Am. Sci. Congress Proc., p. 528, 1942.

The identification of this species is somewhat in doubt owing to the fact that Karsten's originals were all represented by internal casts. The molds of the exterior of specimens that we have from the Upper Cretaceous of Colombia are very perfectly preserved, and impressions of these were taken in wax and one of these is here figured. This gives the appearance of the exterior as well as figures showing the internal casts in the matrix. This wax cast shows the costae rather higher and sharper than in either *S. parva* Cushman or *S. cretacea* Cushman and may give a clue to the true characters of Karsten's species.

Upper Cretaceous. Colon shale. District of Escuque, State of Trujillo, Venezuela; also left bank, Dorado River, Tachira, Venezuela.
Tarouba formation. Southern Trinidad.

Siphogenerinoides brevispinosa Cushman
Plate 50, figure 12
Siphogenerinoides brevispinosa Cushman, Cushman Lab. Foram. Research Contr., vol. 15, p. 92, pl. 16, fig. 7, 1939.

Test elongate, the early portion biserial and tapering, later becoming uniserial, generally cylindrical or slightly compressed, with the sides nearly parallel; chambers distinct, somewhat inflated, earliest chambers obscure but later biserial, gradually becoming uniserial in the adult, inflated, somewhat overlapping; sutures distinct, depressed; wall calcareous, thickly set with short spines over the entire surface; aperture elliptical, somewhat projecting, terminal, with a slightly raised lip, particularly on one-half of the rim. Length 0.45 mm., diameter 0.12 mm.

The holotype is from a locality 5½ miles northeast of Hope, Hempstead County, Ark., assigned to the Arkadelphia marl but possibly belonging to the basal part of the Midway group (Paleocene).

This species, known only from the type locality, is a distinctive one, particularly in the finely set spines over the entire exterior. It has not been found elsewhere, although it is fairly common at the type locality.

Family BULIMINIDAE
Genus BULIMINELLA Cushman, 1911
Buliminella fabilis Cushman and Parker
Plate 50, figure 13
Buliminella fabilis Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 7, pl. 2, figs. 5a–c, 1936.

Test small, about twice as long as broad, tapering; chambers distinct, 4 to 5 whorls, the last-formed whorl taking up about ⅔ of the test, the chambers in the last whorl very slightly inflated; sutures distinct, slightly depressed; wall smooth, perforate; aperture loop-shaped. Length 0.16 to 0.20 mm., diameter 0.08 to 0.10 mm.

This species differs from *B. vitrea* Cushman and Parker in the much more slender test, less curved sutures, and the more opaque walls. The species occurs in beds of both Taylor age and Austin age, with records from just below the Austin-Eagle Ford contact.

Taylor marl.
Pecan Gap chalk member. Texas, Kaufman County (173).
Lower part. Texas, Dallas County (216); Kaufman County (229); Ellis County (233); Hill County (237); McLennan County (238, 239); Travis County (247).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Gober tongue of Austin chalk. Texas, Fannin County (274, 280); Lamar County (283).
Austin chalk. Texas, Grayson County (289); Dallas County (296, 306).
Brownstown marl. Texas, Lamar County (320).
Eagle Ford shale. Texas, Dallas County (357, 358).

Buliminella vitrea Cushman and Parker
Plate 50, figure 14
Buliminella vitrea Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 7, pl. 2, figs. 4a–c, 1936.

Test small, about 1½ times as long as broad, slightly tapering; chambers distinct, 3 to 4 whorls, the last-formed whorl constituting more than half the test, slightly inflated; sutures distinct, depressed; wall partially transparent, coarsely perforate; aperture comma-shaped. Length 0.16 to 0.25 mm., diameter 0.08 to 0.15 mm.

This form resembles *Buliminella imbricata* (Reuss) Cushman and Parker but differs from it in the greater curve of the sutures, the inflation of the chambers, and the transparency of the test. The species is most common in the Selma chalk of Mississippi and Tennessee.

Navarro age. Ripley formation. Tennessee, McNairy County (94).
Taylor age. Selma chalk (middle part). Mississippi, Prentiss County (260); Lee County (264, 265, 267).
Austin age. Burditt marl (of Adkins). Texas, Travis County (271).

Buliminella cushmani Sandidge
Plate 50, figure 15
Buliminella cushmani Sandidge, Jour. Paleontology, vol. 6, p. 280, pl. 42, figs. 18, 19, 1932.
Cushman and Parker, Cushman Lab. Foram Research Contr., vol. 12, p. 8, 1936.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 34 (list), pl. 2, fig. 14, 1938.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 337, pl. 53, fig. 5, 1944.

Test small, compactly fusiform, spirally coiled, involute, circular in transverse section, the initial end pointed, apertural end tapering more gradually and rounded at the top; chambers numerous, 4 in the last whorl, slightly inflated; sutures impressed; wall smooth, finely perforate, thin; aperture a comma-like opening at the end of the last chamber, extending from near the apex down to the last whorl. Length of holotype, 0.4 mm.

This species is very similar to *Buliminella carseyae*, but differs from it in being smaller and more compact. Also the chambers are less inflated, and the sutures curve more gracefully than in *B. carseyae*.

The types of this species have not been restudied and the descriptions and figures are copied from Sandidge. Cole records the species from the Selma chalk of well samples from Florida.

Navarro age.
Kemp clay. Texas, Williamson County (11, 12); Guadalupe County (20).
Corsicana marl. Texas, Guadalupe County (45).
Prairie Bluff chalk. Alabama, Sumter County (101).
Saratoga chalk. Arkansas, Hempstead County (82).
Taylor age. Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Austin chalk. Texas, Hill County (314).

Buliminella carseyae Plummer
Plate 50, figures 17–20
Bulimina compressa Carsey (not Bailey), Texas Univ. Bull. 2612, p. 29, pl. 4, fig. 14, 1926.
Buliminella carseyae Plummer, Texas Univ. Bull. 3101, p. 179, pl. 8, fig. 7, 1931.
Cushman, Jour. Paleontology, vol. 6, p. 340, 1932.
Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 8, pl. 2, figs. 6a–c, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 37, pl. 5, figs. 10a, b, 1937.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 34, pl. 2, fig. 14, 1938.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 12, pl. 2, fig. 24, 1944; idem, vol. 20, p. 93, pl. 14, fig. 10, 1944.

Test ovate, about twice as long as broad, initial extremity bluntly pointed; chambers about four in each mature whorl, turgid, smooth; sutures distinctly depressed, disposed at a strong angle to the elongate axis of the test; aperture small, comma-shaped, in a strong depression on the septal face and overhung by a sharp projection of the apex of the last chamber and marked by a minute and very narrow apertural flap extending down the long side of the septal face.

Length of holotype 0.39 mm.; breadth 0.22 mm.

The above description is taken from the original of Mrs. Plummer.

Specimens of this form were found in the lower beds of Navarro age, the beds of Taylor age, and beds of Austin age. Cole records it from the Selma chalk of well samples from Florida, and Loetterle from the Niobrara chalk of Kansas, Nebraska, and South Dakota. It is closely related to *Buliminella laevis* (Beissel) Cushman and Parker but is much smaller and shows much more inflation of the chambers. The Austin forms, occurring in the upper part of the Gober chalk, seem to be rather consistently broader and shorter than the typical forms.

Navarro age.
Selma chalk (upper part). Alabama, Marengo County (104).
Neylandville marl. Texas, Red River County (50); Rockwall County (57); Navarro County (63).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–109); Lamar County (110–112); Hunt County (115); Collin County (121, 122); Rockwall County (124); Kaufman County (126, 130); Leon County (138); Williamson County (140); Travis County (145, 147, 149); Hays County (150); Bexar County (152, 158, 163).
Anacacho limestone (upper part). Texas, Bexar County (164).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (169, 172); Kaufman County (173); Rockwall County (176); McLennan County (177).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Prentiss County (261); Union County (262); Lee County (267).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181, 183); Navarro County (187, 188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (191, 195–198).
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (201, 202); Delta County (206); Dallas County (216, 222, 223, 227); Kaufman County (228, 229); McLennan County (238, 239, 241); Bell County (245); Travis County (249); Comal County (251).

Austin age.
Burditt marl (of Adkins). Texas, Travis County (270).
Gober tongue of Austin chalk. Texas, Fannin County (272–275, 278); Lamar County (284–287).
Austin chalk. Texas, Grayson County (335); Collin County (337); Dallas County (307, 309, 311).
Bonham marl. Texas, Lamar County (327, 331).
Ector tongue of Austin chalk. Texas, Grayson County (332).
Selma chalk (lower part). Mississippi, Itawamba County (351); Lee County (350).

Buliminella carseyae Plummer var. plana Cushman and Parker

Plate 50, figures 16, 21, 22

Buliminella carseyae Plummer var. *plana* Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 8, pl. 2, figs. 7a–c, 1936.
Cushman and Hedberg, idem, vol. 17, p. 94, pl. 22, figs. 26a–c, 1941.
Cushman and Todd, idem, vol. 19, p. 65, pl. 11, fig. 20, 1943.

Test small, about 1½ times as long as broad; chambers distinct, usually 4 whorls, the last-formed whorl forming at least half the test, somewhat inflated; sutures distinct, depressed; wall smooth, perforate; aperture comma-shaped. Length 0.18 to 0.24 mm., diameter 0.10 to 0.15 mm.

This variety differs from *Buliminella carseyae* Plummer in the smaller size of the test and the much smaller inflation of the chambers. All our specimens are from the upper and middle beds of Navarro age.

Upper Cretaceous. Colon shale. Santander del Norte, Colombia.

Navarro age.
Neylandville marl. Texas, Kaufman County (59).
Corsicana marl. Texas, Hunt County (24); Navarro County (27); Falls County (32); Travis County (36, 38); Caldwell County (44); Bexar County (46).
Prairie Bluff chalk. Mississippi, Chickasaw County (84-86). Alabama, Wilcox County (99); Sumter County (101, 102).
Ripley formation. Tennessee, McNairy County (94, 95).

Buliminella colonensis Cushman and Hedberg

Plate 50, figures 23, 24

Buliminella colonensis Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 6, p. 65, pl. 9, figs. 6, 7, 1930.

Test with comparatively few whorls, nearly as broad as long, at least in the microspheric form; initial end pointed, apertural end broadly rounded; chambers 5 or 6 in the last-formed whorl, elongate, rather uniformly increasing in size as added, very slightly inflated; sutures distinct, very slightly depressed; wall smooth; aperture broadly comma-shaped, greatest breadth at the inner end. Length up to 0.40 mm., diameter 0.35 mm.

The types are from the Upper Cretaceous Colon shale, Department of Escuque, State of Trujillo, Venezuela.

This species is very broad, with the last-formed whorl composing most of the area of the test.

Somewhat similar specimens occur in the Upper Cretaceous of Mexico.

Genus BULIMINA D'Orbigny, 1826

Bulimina reussi Morrow

Plate 51, figures 1–5

Bulimina ovulum Reuss, Verstein. böhm. Kreideformation, pt. 1, pl. 8, fig. 57; pl. 13, fig. 73, 1845 (not *Bulimina ovula* D'Orbigny, 1839).
Bulimina murchisoniana Cushman (not D'Orbigny), Jour. Paleontology, vol. 5, p. 309, pl. 35, figs. 14a, b, 1931; idem, vol. 6, p. 340, 1932.
Bulimina reussi Morrow, Jour. Paleontology, vol, 8. p. 195, pl. 29, fig. 12, 1934.
Cushman and Parker, Cushman Lab. Foram. Research Contr,. vol. 11, p. 99, pl. 15, figs. 8, 10, 1935.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 31, pl. 3, fig. 20, 1936.
Cushman and Hedberg, idem, vol. 17, p. 95, pl. 22, figs. 30a–c, 1941.
Frizzell, Jour. Paleontology, vol. 17, p. 350, pl. 57, fig. 2, 1943.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 12, pl. 2, fig. 25, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 337, pl. 53, fig. 6, 1944.
Bulimina brevis Cushman (not D'Orbigny), Cushman Lab. Foram. Research Contr., vol. 7, p. 40, pl. 5, figs. 9a–c, 1931.

Test small, ovate, globular, subcircular in transverse section with greatest breadth above the middle, tapering evenly to a rather sharply rounded initial end; chambers triserial throughout, obscure, enlarging very rapidly in size as they are added; sutures very slightly depressed; wall smooth, very finely perforate; aperture small, subterminal. Height 0.28 mm., breadth 0.16 mm.

The above description is copied from the original of Morrow.

The forms from the Cretaceous of Texas and Tennessee have been compared with topotype material of *Bulimina ovulum* Reuss (not D'Orbigny), with which they appear to be identical. The species was found in its typical form throughout the Taylor formation of Texas, to a somewhat smaller extent in the Selma chalk of Tennessee and Mississippi, and in the Austin chalk of Texas. The Austin specimens somewhat resemble *Bulimina ventricosa* Brotzen.

Mal Paso shale. Northwestern Peru.
Upper Cretaceous. Colon shale. Santander del Norte, Colombia.
Navarro age.
  Saratoga chalk. Arkansas, Howard County (79).
  Ripley formation. Tennessee, Henderson County (96).
  Neylandville marl. Texas, Kaufman County (60–62).
Taylor age.
  Upper part of Taylor marl. Texas, Red River County (105–107, 109); Delta County (114); Hunt County (115); Collin County (119, 122); Rockwall County (124); Kaufman County (125, 126, 130, 131); Navarro County (134); Leon County (138); Milam County (139); Travis County (149); Bexar County (154).
  Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Kaufman County (173); Rockwall County (176).
  Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
  Selma chalk (middle part). Mississippi, Prentiss County (260); Union County (262); Lee County (263–265).
  Wolfe City sand member of Taylor marl. Texas, Collin County (183).
  Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
  Annona chalk. Texas, Red River County (192, 198)
  Lower part of Taylor marl. Texas, Red River County (199); Lamar County (201, 202); Fannin County (205); Delta County (206); Collin County (208, 212); Dallas County (216, 217, 220, 222); Kaufman County (229); Ellis County (231, 234, 235); Falls County (244).
Austin age.
  Burditt marl (of Adkins). Texas, Travis County (271).
  Gober tongue of Austin chalk. Texas, Fannin County (278); Lamar County (283, 286).
  Austin chalk. Texas, Grayson County (291); Collin County (292–295, 324); Dallas County (300, 302–306, 308–311, 326, 339, 342); Hill County (313, 314); Bell County (316).
  Brownstown marl. Texas, Red River County (318); Lamar County (320).
  Bonham marl. Texas, Grayson County (328).

Bulimina reussi Morrow var. navarroensis Cushman and Parker
Plate 51, figure 6

Bulimina reussi Morrow var. *navarroensis* Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 11, p. 100, pl. 15, figs. 11a, b, 1935.
  Cushman and Todd, idem, vol. 19, p. 66, pl. 11, fig. 21, 1943.

This variety differs from the typical form in the smaller size of the test and in the much slighter inflation of the last-formed chambers, together with the much smaller proportion of the whole test that these chambers form. Length 0.16 to 0.25 mm., diameter 0.10 to 0.13 mm.

The species seems to be limited to the beds of Navarro age.

Navarro age.
  Kemp clay. Texas, Navarro County (7); Williamson County (12); Travis County (17).
  Corsicana marl. Texas, Navarro County (25, 27); Limestone County (29, 30); Falls County (32); Travis County (34, 39, 41, 42); Caldwell County (44).
  Ripley formation. Tennessee, McNairy County (94).
  Neylandville marl. Texas, Hunt County (53).

Bulimina aspera Cushman and Parker
Plate 51, figures 7, 10, 13, 15, 16

Bulimina aspera Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 16, p. 44, pl. 8, figs. 18, 19, 1940.
  Cushman and Todd, idem, vol. 19, p. 66, pl. 11, fig. 22, 1943.
  Frizzell, Jour. Paleontology, vol. 17, p. 349, pl. 57, fig. 1, 1943.
Bulimina pupoides Carsey (not D'Orbigny), Texas Univ. Bull. 2612, p. 29, pl. 4, fig. 3, 1926.
  Plummer, idem, Bull. 3101, p. 180, pl. 9, fig. 15, 1931.
  ? Sandidge, Jour. Paleontology, vol. 6, p. 280, pl. 43, fig. 1, 1932.
Bulimina obtusa Cushman and Church (not D'Orbigny), California Acad. Sci. Proc., 4th ser., vol. 18, p. 513, pl. 39, figs. 17–19, 1929.
  Cushman, Tennessee Div. Geology Bull. 41, p. 47, pl. 7, figs. 17, 18, 1931; Jour. Paleontology, vol. 5, p. 309, pl. 35, figs. 15a, b, 1931.
Bulimina subornata Sandidge (not H. B. Brady), Jour. Paleontology, vol. 6, p. 280, pl. 43, fig. 2, 1932.
?*Bulimina elongata* Sandidge (not D'Orbigny), idem, vol. 6, p. 281, pl. 43, fig. 3, 1932.
Bulimina quadrata W. Berry and Kelley (not Plummer), U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 5, pl. 2, fig. 7, 1929.
  Cushman and Parker (part), Cushman Lab. Foram. Research Contr., vol. 11, p. 100, pl. 15, figs. 12, 15, 16 (not figs. 13, 14), 1936.
Bulimina kickapooensis Cole (part), Florida Dept. Cons. Geol. Bull. 16, p. 45, 1938.

Test medium, two or more times as long as broad, slightly tapering, consisting of four to five whorls, initial end bluntly pointed, sometimes with one or two short basal spines; chambers joined at an angle of about 90° or less, slightly inflated; sutures distinct, slightly depressed; wall of initial part of test somewhat roughened, perforate, with the perforations often arranged in regular lines; aperture elongate, at apex of test, with a small, platelike tooth. Length 0.38 to 0.50 mm.; diameter 0.16 to 0.26 mm.

The types are from the upper part of the Taylor marl, 6.15 miles from Kaufman on the road to Crandall, Kaufman County, Tex. The species is very widespread, occurring in beds of Taylor and Navarro age throughout the Gulf coastal region of the United States.

The specimens from the upper part of the Navarro group differ from those of the lower part and the Taylor in not having the small initial spines. In other respects they appear to be identical. The species differs from *Bulimina pupoides* D'Orbigny in the angled character of the chambers, in the much slighter inflation of the chambers, and in the shape of the test, which tapers less and has a blunter initial end. It differs from *B. kickapooensis* Cole in the smaller size, greater inflation of the chambers, the roughened early portion of the test, and the usual presence of one or two short spines.

Navarro age.
  Kemp clay. Texas, Navarro County (4, 5); Williamson County (11, 12); Gaudalupe County (18).
  Corsicana marl. Texas, Hunt County (24); Navarro County (25–28); Limestone County (30, 31); Falls County (32); Travis County (34, 36, 38–40, 43); Bexar County (46).
  Arkadelphia marl. Arkansas, Hempstead County (70–73).
  Saratoga chalk. Arkansas, Clark County (78); Howard County (79); Hempstead County (81).
  Prairie Bluff chalk. Mississippi, Chickasaw County (85, 86). Alabama, Wilcox County (99); Sumter County (101, 102).
  Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
  Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Tennessee, McNairy County (98). Alabama, Marengo County (104).
  Neylandville marl. Texas, Red River County (50); Delta County (51, 52); Hunt County (53, 54); Rockwall County (57); Kaufman County (62); Navarro County (63, 64, 66–69).
Taylor age.
  Upper part of Taylor marl. Texas, Red River County (105–108); Lamar County (110); Delta County (114); Hunt County (115–117); Collin County (119–122); Rockwall County (123); Kaufman County (125, 128–131); Navarro County (132, 134); Leon County (138); Williamson County (140, 142, 144); Bexar County (152, 155, 156, 158, 161, 162).
  Marlbrook marl. Arkansas, Clark County (252).
  Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (169–171); Rockwall County (176).
  Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181, 183).
  Annona chalk. Texas, Bowie County (189, 190).

Selma chalk (middle part). Mississippi, Alcorn County (257); Prentiss County (260, 261); Union County (262).
Lower part of Taylor marl. Texas, Delta County (206); Kaufman County (229); Ellis County (234).

Bulimina trihedra Cushman
Plate 51, figure 17

Bulimina trihedra Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 591, pl. 17, figs. 6a, b, 1926; Jour. Paleontology, vol. 1, p. 160, pl. 27, fig. 5, 1927.
Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 11, p. 100, pl. 15, figs. 9a, b, 1935.

Test small, distinctly trihedral, angles rounded, sides nearly flat or slightly convex; chambers numerous, distinct, inflated, somewhat higher than broad; sutures distinct, depressed; wall smooth and polished, very finely perforate; aperture elongate, oval. Length 0.40 mm., breadth 0.20 mm., thickness 0.20 mm.

This species was originally described from the Cretaceous Velasco shale of Mexico. It also occurs in the Annona and Selma chalks.

Upper Cretaceous. Velasco shale. East bank of river at Huiches, Hacienda el Limon, Vera Cruz, Mexico. Kilometers 574.46 on Tampico-San Luis Potosi Railroad, Mexico.
Taylor age.
Annona chalk. Texas, Bowie County (189).
Selma chalk (middle part). Mississippi, Alcorn County (259).

Bulimina exigua Cushman and Parker
Plate 51, figure 18

Bulmina exigua Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 11, p. 99, pl. 15, figs. 7a, b, 1935.

Test very small, about twice as long as broad, gradually tapering; chambers distinct, overlapping, somewhat inflated, usually 5 whorls; sutures distinct, depressed throughout, forming a slight angle with the horizontal; wall smooth, perforate; aperture rounded. Length 0.10 to 0.17 mm., diameter 0.08 to 0.11 mm.

This species differs from *Bulimina reussi* Morrow in the more gradual increase in size of the chambers toward the apertural end, in the different shape of the aperture, and in its smaller size.

The range is from the lower beds of Taylor age through beds of Austin age.

Taylor marl, lower part. Texas, Dallas County (217); McLennan County (238, 239, 241); Travis County (247, 249).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Gober tongue of Austin chalk. Texas, Lamar County (287).
Austin chalk. Texas, Grayson County (291); Collin County (295); Dallas County (298, 301, 306, 307, 338).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320).
Bonham marl. Texas, Lamar County (331).

Bulimina prolixa Cushman and Parker
Plate 51, figures 19–22

Bulimina puschi Cushman (not Reuss), Tennessee Div. Geology Bull. 41, p. 47, pl. 7, figs. 19a, b, 1931.
Bulimina prolixa Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 11, p. 98, pl. 15, figs. 5a, b, 1935.
Cushman and Todd, idem, vol. 19, p. 66, pl. 11, fig. 23, 1943.
Schenck, Jour. Paleontology, vol. 17, p. 62, 1943.
Cushman and Deaderick, idem, vol. 18, p. 337, pl. 53, fig. 8, 1944.
Cushman and Goudkoff, Cushman Lab. Foram. Research Contr., vol. 20, p. 58, pl. 10, fig. 1, 1944.

Test long and narrow, about 2½ times as long as broad, tapering very slightly through the whole length, triangular in section practically throughout, with the angles broadly rounded, often somewhat twisted on its axis toward the initial end; chambers numerous, 6 to 7 whorls, distinct, those of successive whorls placed directly over each other with adjacent series meeting in a zigzag line; sutures distinct, very slightly depressed; wall smooth, coarsely perforate; aperture elongate, well removed from the juncture of the third preceding chamber. Length 0.25 to 0.27 mm., diameter 0.11 to 0.12 mm.

This form has been wrongly identified as *Bulimina puschi* Reuss. A study of topotype material from Lemberg has definitely shown that species to be arenaceous. Specimens of *B. prolixa* were found in beds of Navarro age and in the upper beds of Taylor age. It occurs also in the Cretaceous of California.

Navarro age.
Corsicana marl. Texas, Limestone County (29, 30).
Ripley formation. Tennessee, McNairy County (94, 95, 97); Henderson County (96).
Neylandville marl. Texas, Kaufman County (60).
Taylor age.
Upper part of Taylor marl. Texas, Navarro County (132).
Selma chalk (middle part). Mississippi, Union County (262).
Marlbrook marl. Arkansas, Howard County.

Bulimina triangularis Cushman and Parker
Plate 51, figure 23

Bulimina triangularis Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 11, p. 97, pl. 15, figs. 4a, b, 1935.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 4, fig. 1, 1938.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 93, pl. 14, fig. 11, 1944.

Test small, 1⅓ times as long as broad, triangular in section, with rounded angles and slightly concave sides; chambers indistinct, about 5 whorls; sutures very indistinct, showing only as a slightly darkened line; wall covered on the bottom half with short irregular longitudinal ridges, which sometimes become slightly spinose, the upper half smooth, coasely perforate; aperture loop-shaped with a slight lip. Length 0.21 to 0.28 mm., diameter 0.15 to 0.17 mm.

Except for single records from the Navarro and Austin this species is limited to the Taylor marl and its equivalents. Cole records it from the Selma chalk of well samples from Florida.

Navarro age. Corsicana marl. Texas, Travis County (42).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106); Hunt County (116); Collin County (122); Kaufman County (126).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Wolfe City sand member of Taylor marl. Texas, Collin County (180).
Lower part of Taylor marl. Texas, McLennan County (238, 239).
Austin age. Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Bulimina rudita Cushman and Parker
Plate 51, figure 24

Bulimina ornata Cushman and Parker (not Egger), Cushman Lab. Foram. Research Contr., vol. 11, p. 97, pl. 15, figs. 4a, b, 1935.
Bulimina rudita Cushman and Parker, idem, vol. 12, p. 45, 1936.

Test small, triangular in section with the angles rounded and the sides distinctly concave, occasionally slightly twisted on its axis; chambers numerous, 5 to 6 whorls, distinct, somewhat inflated, arranged in regular series with the adjacent series meeting in a zigzag line; sutures distinct, depressed, sigmoid, slanting at an angle of 45°; wall, except for the central portion of the chambers in the last-formed whorl, covered with short spines, perforate; aperture loop-shaped with a slight lip. Length 0.20 to 0.26 mm., diameter 0.11 to 0.16 mm.

This species has a rather wide range in the Upper Cretaceous.

Navarro age. Prairie Bluff chalk. Mississippi, Chickasaw County (84, 86).
Taylor marl.
Upper part. Texas, Red River County (108).
Wolfe City sand member. Texas, Collin County (180).
Lower part. Texas, Red River County (199); Collin County (208, 209); Dallas County (216); Kaufman County (229); McLennan County (238); Travis County (249).
Austin chalk.
Gober tongue. Texas, Fannin County (273, 274).
Austin chalk. Texas, Dallas County (303).
Ector tongue. Texas, Grayson County (332).

Bulimina kickapooensis Cole
Plate 51, figures 11, 12, 14; plate 66, figure 12

Bulimina kickapooensis Cole, Florida Dept. Cons. Geol. Bull. 16, p. 45, pl. 3, fig. 5, 1938.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 94, pl. 22, fig. 28, 1941.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 337, pl. 53, fig. 7, 1944.
Bulimina elegans Chapman (not D'Orbigny), Quart. Jour. Geol. Soc., vol. 48, p. 516 (list), pl. 15, fig. 9, 1892.
Egger, K. bayer. Akad. Wiss. Abh., Kl. 2, vol. 21, pt. 1, p. 50, pl. 15, fig. 44, 1899.
Bulimina obtusa Egger (not D'Orbigny), idem, vol. 21, pt. 1, p. 50, pl. 15, fig. 51, 1899.
Bulimina quadrata Cushman and Parker (part) (not Plummer), Cushman Lab. Foram. Research Contr., vol. 11, p. 100, pl. 15, figs. 13, 14 (not 12, 15, 16), 1935.

Test about 2½ times as long as broad, megalospheric form tapering very slightly, microspheric rapidly, consisting of 5 or 6 whorls; chambers numerous, distinct, slightly inflated, sharply angled; sutures distinct, slightly depressed; wall smooth, perforate; aperture loop-shaped at apex of test, with a thin, plate-like tooth. Length (of holotype) 0.72 mm., diameter 0.28 mm.

The types are from the Upper Cretaceous, upper part of the Taylor marl, branch of Kickapoo Creek, 1,200 feet south of public road, 1.8 miles northwest of Annona, Red River County, Tex. The species occurs in formations of Navarro age in Alabama, Arkansas, Tennessee, and Texas, of Taylor age in Arkansas and Texas, of Austin age in Alabama, and in the deep well in Florida cited by Cole. It also occurs questionably in the Moreno shale of California and is recorded from the Colon shale of Colombia. It is found in the Senonian of Germany.

Upper Cretaceous. Colon shale. Santander del Norte, Colombia.
Navarro age.
Prairie Bluff chalk. Alabama, Wilcox County (100).
Ripley formation. Tennessee, Henderson County (96).
Neylandville marl. Texas, Navarro County (63).
Saratoga chalk. Arkansas, Hempstead County (81).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–107); Delta County (114); Hunt County (115, 116); Collin County (119–122); Rockwall County (123); Kaufman County (129–131); Navarro County (132); Leon County (138); Williamson County (140, 142); Bexar County (156, 158, 161).
Annona chalk. Texas, Bowie County (189, 190).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (169–171).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181, 183).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Lower part of Taylor marl. Texas, Delta County (206); Ellis County (234).
Austin age.
Selma chalk. Choctaw Bluff, Warrior River, Alabama. (353).

Bulimina kickapooensis Cole var. pingua Cushman and Parker
Plate 51, figures 8, 9; plate 66, figures 15, 16

Bulimina kickapooensis Cole var. *pingua* Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 16, p. 44, pl. 8, figs. 13, 14, 1940.
Cushman and Hedberg, idem, vol. 17, p. 95, pl. 22, fig. 29, 1941.
Cushman and Todd, idem, vol. 19, p. 66, pl. 11, fig. 24, 1943.

This variety differs from the typical form in being shorter and broader, and in having more inflated chambers and more depressed sutures. Length 0.50 to 0.67 mm., diameter 0.30 to 0.35 mm.

The variety was described from the Upper Cretaceous Corsicana marl, Mexia highway at forks of Wortham road, 2.8 miles east-southeast of Cooledge, Limestone County, Tex. It also occurs at other localities in the Corsicana marl, in the Kemp clay of Texas, and in the Prairie Bluff chalk of Mississippi. It occurs in great abundance at some localities and serves as an excellent marker.

Upper Cretaceous. Colon shale. Santander del Norte, Colombia.
Navarro age.
Kemp clay. Texas, Navarro County (4, 5); Williamson County (11, 12); Guadalupe County (18).
Corsicana marl. Texas, Navarro County (25–28); Limestone County (30, 31); Falls County (32); Travis County (38, 40).
Prairie Bluff chalk. Mississippi, Chickasaw County (85, 86).

Bulimina pectinata Cushman and Parker
Plate 52, figure 10

Bulimina pectinata Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 16, p. 45, pl. 8, figs. 20a–c, 1940.

Test medium, triangular in transverse section, somewhat twisted on its axis, broadest part near the apertural end, initial end bluntly pointed, consisting of about 6 whorls; chambers made somewhat indistinct by the ornamentation except in the central part of the sides of the test; sutures indistinct except at the sides, flush with the surface, somewhat darker in color than the rest of the test; wall ornamented along the edges of the chambers by a bluntly toothed border that gives a somewhat fringed appearance to the test, finely perforate; aperture loop-shaped, at apex of test. Length (adult specimens) 0.32 to 0.38 mm., diameter 0.18 to 0.20 mm.

The types are from the upper part of the Taylor marl on the east bank of a road cut near the crest of a hill 14.4 miles south of Paris and 0.9 mile north of Lake City, Delta County, Tex. The species has been found only at the type locality.

The form resembles no other species. It is somewhat similar in shape to *Bulimina rudita* Cushman and Parker but tapers less rapidly and is easily differentiated by the fringelike ornamentation.

Bulimina taylorensis Cushman and Parker
Plate 52, figures 1, 2

Bulimina taylorensis Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 11, p. 96, pl. 15, figs. 3a, b, 1935.

Test small, slightly tapering, about 1½ times as long as broad, except in the rare microspheric form, which is almost twice as long as broad; chambers fairly distinct, 4 to 5 whorls in the megalospheric form, more in the microspheric, overlapping; sutures deep, their presence, except in the last-formed whorl, chiefly indicated by the sharp undercutting below the chamber above; wall finely perforate, with irregular costae spaced rather far apart, causing an irregular fluting of the sharp margin of the chambers, the initial end of the test with one or more spines; aperture an elongate, loop-shaped opening with a distinct lip, opening at the inner margin of the last-formed chamber. Length 0.27 to 0.32 mm., diameter 0.20 to 0.21 mm.

This highly ornamented species occurs at numerous stations in the upper part of the Taylor marl and should make a fairly good index fossil.

Taylor marl, upper part. Texas, Red River County (105–107); Navarro County (132, 134); Bexar County (152).

Bulimina arkadelphiana Cushman and Parker
Plate 52, figures 3, 4

Bulimina arkadelphiana Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 11, p. 96, pl. 15, figs. 1, 2, 1935.

Test small to medium, the megalospheric form being considerably smaller than the microspheric, tapering; chambers numerous, about 5 whorls in the megalospheric form, 8 in the microspheric, later chambers inflated; sutures distinct, deep; wall, except for the last 3 chambers, covered with sharp spines, especially at the margins of the chambers, the last-formed whorl with spines at the margins of the chambers and with only an occasional spine above, finely perforate; aperture typically elongate with a small lip. Length 0.33 to 0.50 mm., diameter 0.23 to 0.30 mm.

Navarro age. Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73). It also occurs in typical form at the locality, supposedly of Arkadelphia age but possibly of Midway age, 5½ miles northeast of Hope, Hempstead County, Ark.

Bulimina limbata White
Plate 52, figure 5

Bulimina limbata White, Jour. Paleontology, vol. 3, p. 48, pl. 5, figs. 9a, b, 1929.

Test bluntly pyramidal with a rounded apertural end, the first few chambers often almost hidden by the later ones, giving the blunt appearance to the test; sutures limbate, raised, and ending in spines in some of the early chambers; aperture very large.

Length of holotype 1.00 mm., breadth 0.60 mm.

The types of this species are from the Papagallos shales of Mexico, where it is common. It also occurs less commonly in the Mendez shales.

Bulimina mendezensis White
Plate 52, figure 6

Bulimina mendezensis White, Jour. Paleontology, vol. 3, p. 49, pl. 5, fig. 10, 1929.

Test broadly oval; wall smooth, last chambers relatively large; characterized by a relatively large, rounded aperture, with a number of slight folds radiating from it.

Length 0.50 to 0.55 mm., breadth 0.30 to 0.35 mm.

The types of this species are from Upper Cretaceous Mendez shale 200 meters north of La Noria on the road to Noria, northwest of Tampico, Mexico.

The folds about the aperture are not always well-marked. It is rather rare in our Mexican material.

Bulimina incisa Cushman
Plate 52, figure 7

Bulimina incisa Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 592, pl. 17, figs. 9a, b, 1926.
White, Jour. Paleontology, vol. 3, p. 47, pl. 5, fig. 6, 1929.

Test small, oval, circular in transverse section, greatest breadth toward the apertural end, initial end rounded; chambers comparatively few, distinct, especially the later chambers; sutures distinct, depressed, the basal edge of each chamber with numerous re-entrants, which apparently are cut in along the suture lines; wall smooth or with faint longitudinal lines; aperture broadly oval. Length 0.40 to 0.45 mm., diameter 0.30 mm.

The types are from the Upper Cretaceous Velasco shale in well samples from Hacienda el Limon, Vera Cruz, Mexico, and the species is characteristic of the Velasco shale of that region.

The peculiar sculpturing along the suture lines is the best mark of this species.

Bulimina velascoensis (Cushman) White
Plate 52, figure 8

Gaudryina velascoensis Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 1, p. 20, pl. 3, fig. 7, 1925; Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 587, pl. 16, fig. 9, 1926; Jour. Paleontology, vol. 1, p. 149, pl. 28, fig. 2, 1927.
Bulimina velascoensis White, Jour. Paleontology, vol. 3, p. 50, pl. 5, fig. 13, 1929.

Test broadest toward the apertural end, early portion somewhat triangular in tranverse section, later portion somewhat angular in transverse section, angles broadly rounded; chambers not inflated; usually indistinct, especially in the earlier portion; sutures somewhat sinuous, slightly if at all depressed, distinct only in the later portion; wall rather distinctly perforate, the perforations often in lines, generally somewhat longitudinally arranged on the test; aperture with the inner end somewhat expanded. Length 0.50 to 0.60 mm., diameter 0.30 mm.

The types are from the Upper Cretaceous Velasco shale in Tamalte Arroyo, Hacienda el Limon, San Luis Potosi, Mexico.

The species is characteristic of the Velasco shale.

Bulimina trinitatensis Cushman and Jarvis
Plate 52, figure 9

Bulimina trinitatensis Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 102, pl. 14, figs. 12a, b, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 44, pl. 13, figs. 4a, b, 1932.

Test somewhat longer than broad, rounded in transverse section, chambers distinct, with the lower border extended into an overhanging plate that is marked on the upper side by an irregular network of reticulate areas, the outer angles ending in short spines; aperture elongate, comma-shaped, the apertural face smooth. Length 0.50 mm., diameter 0.30 mm.

The types are from the Upper Cretaceous of Lizard Springs, near Guayaguayare, southeastern Trinidad. The species also occurs in a well sample from Lizard Springs at a depth of 725 feet and in the Velasco shale of Hacienda el Limon, Mexico.

This is a very highly ornamented and specialized species.

Bulimina laddi Cushman and Hedberg
Plate 66, figure 11

Bulimina laddi Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 94, pl. 22, figs. 27a–c, 1941.

Test about 3 times as long as broad, fusiform, consisting of about 3 whorls, initial end tapering to a point, with a short but distinct spine; chambers distinct, somewhat inflated, rounded, increasing rapidly in height as added, those of the last-formed whorl in the adult making up nearly ⅔ of the size of the test; sutures distinct, depressed; wall smooth, perforate; aperture narrow, elongate, with a slight lip. Length 0.50 to 0.55 mm., diameter 0.18 to 0.20 mm.

The types of this species are from the upper zone of the Colon shale, Quebrada Mito Juan, Department of Santander del Norte, Colombia.

This species differs from *B. kickapooensis* Cole in the more slender form, higher and narrower chambers, and pointed, spinose initial end.

Bulimina petroleana Cushman and Hedberg

Plate 66, figure 13

Bulimina petroleana Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 95, pl. 22, figs. 31a–c, 1941.
Cushman and Goudkoff, idem, vol. 20, p. 59, pl. 10, fig. 2, 1944.

Test about 1½ times as long as broad, consisting of 6 to 8 whorls, the greatest diameter above the middle formed by the last whorl of chambers, which makes up about ½ the test, rapidly tapering to the subacute initial end which occasionally has a short spine; chambers distinct, inflated in the later portion, increasing rapidly in size as added; sutures distinct, later ones strongly depressed; wall of the earlier portion ornamented with numerous fine costae, last whorl usually smooth; aperture broadly loop-shaped. Length 0.40 to 0.45 mm., diameter 0.25 mm.

The types are from the upper zone of the Colon shale, Quebrada La Petrolea, Department of Santander del Norte, Colombia. It is also recorded from the Cretaceous of California.

This species differs from *B. arkadelphiana* Cushman and Parker, in the more regularly tapering test, the very fine costae, and the unornamented last whorl.

Genus NEOBULIMINA Cushman and Wickenden, 1928

Neobulimina canadensis Cushman and Wickenden

Plate 52, figures 11, 12

Neobulimina canadensis Cushman and Wickenden, Cushman Lab. Foram. Research Contr., vol. 4 p. 13, pl. 1, figs. 1, 2, 1928.
Cushman, Tennessee Div. Geology Bull. 41, p. 48, pl. 8, figs. 1a–c, 1931; Cushman Lab. Foram. Research Special Pub. 4, pl. 22, figs. 24a, b, 1933; idem, Special Pub. 5, pl. 27, figs. 15a–c, 1933.
Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 9, pl. 2, figs. 9, 10, 1936.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 31, pl. 3, fig. 22, 1936.
Frizzell, Jour. Paleontology, vol. 17, p. 350, pl. 57, fig. 3, 1943.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 66, 1943.
Cushman, idem, vol. 20, p. 93, pl. 14, figs. 12, 13, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 337, pl. 53, figs. 9, 10, 1944.

Test elongate, fusiform, greatest width near the middle, tapering slightly toward either end, about 2½ times as long as wide in adult specimens, early triserial stage of 12 to 18 chambers, the biserial adult stage of 4 to 6 chambers, each part making about one-half the mass of the test; chambers distinct, subglobular, inflated; sutures very distinct, depressed; wall calcareous, coarsely perforate, in some of the thicker-walled specimens appearing almost reticulate, no other surface ornamentation; aperture in the early triserial portion oblique and "comma-shaped," in the adult biserial stage broader, the portion at the basal edge of the chamber broad and the elongate axis nearly at right angles to the margin of the chamber; the whole aperture in the adult at the base of a distinct depression. Length 0.30 mm., breadth 0.13 mm., breadth of biserial portion 0.12 mm., thickness 0.09 mm.

The microspheric form is often somewhat irregular and twisted. It is usually less common than the megalospheric. The species was originally described from the Upper Cretaceous Bearpaw shale of Lethbridge, Alberta. It has apparently a long range in the Upper Cretaceous.

Navarro age.
Corsicana marl. Texas, Limestone County (29, 30); Falls County (32); Bexar County (46).
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Selma chalk (upper part). Mississippi, Union County (92). Tennessee, McNairy County (98).
Neylandville marl. Texas, Delta County (52); Hunt County (53, 54); Kaufman County (58, 62); Navarro County (68).
Taylor age.
Upper part of Taylor marl. Texas, Collin County (122); Kaufman County (125, 126, 129); Williamson County (140, 142, 144); Bexar County (154, 156, 158, 159).
Pecan Gap chalk member of Taylor marl. Texas, Kaufman County (173); Rockwall County (176).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (257); Prentiss County (260); Lee County (264, 265, 268).
Wolfe City sand member of Taylor marl. Texas, Hunt County (185, 186); Navarro County (187).
Marlbrook marl. Arkansas, Hempstead County.
Annona chalk. Texas, Red River County (192).
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (201, 202); Fannin County (203, 205); Collin County (211, 212, 214, 215); Dallas County (220–223, 227); Kaufman County (228); Ellis County (231, 233, 235); Navarro County (236); Hill County (237); McLennan County (241); Travis County (249).
Austin age.
Burditt marl (of Adkins). Texas, Travis County (270).
Gober tongue of Austin chalk. Texas, Fannin County (278).
Austin chalk. Texas, Grayson County (289, 291); Collin County (324); Dallas County (296, 297, 301–303, 306, 307, 310, 325, 342).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320).
Bonham marl. Texas, Lamar County (327, 331).
Selma chalk (lower part). Mississippi, Itawamba County (351).
Eagle Ford shale. Texas, Dallas County (355, 357).

Neobulimina irregularis Cushman and Parker

Plate 52, figure 13

Neobulimina irregularis Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 9, pl. 2, figs. 8a, b, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 38, pl. 5, fig. 12, 1937.

Test elongate, practically the same width throughout except for the initial end, which is tapering; about 5 times as long as broad in the microspheric form, shorter in the megalospheric; about 5 whorls in the triserial stage and 4 in the biserial stage of the adult form; chambers distinct, globular, irregular; sutures distinct, depressed; wall coarsely perforate; aperture broadly loop-shaped, extending from the base of the last-formed chamber. Length 0.20 to 0.43 mm., diameter 0.08 to 0.20 mm.

Specimens of this form were found in the lower part of the Taylor marl, Austin chalk, and the Eagle Ford shale. Loetterle records it from the Niobrara chalk of Kansas, Nebraska, and South Dakota.

Taylor marl, lower part. Texas, Lamar County (201); Kaufman County (229).
Austin chalk.
Gober tongue. Texas, Lamar County (285, 287).
Austin chalk. Texas, Grayson County (328, 333–335); Collin County (324, 337); Dallas County (299, 301, 304, 338, 340, 341, 344, 345).
Ector tongue. Texas, Grayson County (332).

Eagle Ford shale. Texas, Grayson County (354); Dallas County (355, 362); Hill County (368, 369).
Upper Cretaceous. Boyne beds 1 mile east of Babcock, Manitoba, Canada.

Neobulimina spinosa Cushman and Parker
Plate 52, figure 14

Neobulimina spinosa Cushman and Parker, Cushman Lab. Foram. Research Contr., vol. 12, p. 9, pl. 2, figs. 11a, b, 1936.
Cushman, idem, vol. 20, p. 12, 1944.

Test small, about 1½ times as long as broad, widest portion of the test at a point two-thirds of the distance from the initial end, the initial end irregularly covered with short spines, sometimes as much as one-third of the way up the test; chambers inflated, 9 in the triserial portion and 2 in the biserial; sutures distinct, depressed; wall transparent or partially so, coarsely perforate; aperture loop-shaped with a distinct, slightly flaring lip, nearly terminal. Length 0.16 to 0.25 mm., diameter 0.10 to 0.17 mm.

Specimens of this species were found in the lower beds of Navarro age and throughout the beds of Taylor age.

Navarro age.
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Neylandville marl. Texas, Delta County (52); Kaufman County (58, 62); Navarro County (64, 69).
Taylor age.
Upper part of Taylor marl. Texas, Kaufman County (125, 129); Navarro County (132); Milam County (139); Williamson County (140, 142, 144); Travis County (145, 149); Bexar County (154, 156, 158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Kaufman County (173).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (257–259); Prentiss County (260); Union County (262); Lee County (264–266).
Wolfe City sand member of Taylor marl. Texas, Collin County (180).
Annona chalk. Texas, Red River County (192).
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (202); Dallas County (221).

Genus ENTOSOLENIA Ehrenberg, 1848
Entosolenia marginata (Walker and Jacob) Williamson
Plate 52, figure 15

Under this name are placed those compressed *Lagena*-like forms with a single peripheral keel. The forms show considerable variation and some of them at least show an entosolenian tube.

Navarro age. Ripley formation. Tennessee, McNairy County (94).

Entosolenia orbignyana (Seguenza) Cushman
Plate 52, figures 16–19

This species is distinguished from the preceding by an additional flange on each side and generally parallel to the periphery. Well-preserved specimens in some of the Cretaceous samples show an entosolenian tube and display much variation in the general shape and relative strength of the flanges.

Upper Cretaceous. Pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.
Velasco and Mendez shales. Hacienda el Limon, Mexico.
Navarro age. Ripley formation. Tennessee, McNairy County (94).

Genus VIRGULINA D'Orbigny, 1826
Virgulina tegulata Reuss
Plate 53, figures 1–4

Virgulina tegulata Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 40, pl. 13, fig. 81, 1845.
Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 4, pl. 1, figs. 8–12, 1937; idem, vol. 20, p. 12, pl. 2, fig. 26, 1944; idem, vol. 20, p. 93, pl. 14, fig. 14, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 338, pl. 53, fig. 11, 1944.

Test elongate, 3 to 5 times as long as broad, only slightly compressed, periphery broadly rounded, twisted, especially in the early portion; chambers distinct, very slightly inflated, higher than broad, earliest chambers spiral, adult chambers biserial; sutures distinct, very little depressed, very slightly oblique; wall smooth, finely perforate; aperture elongate, narrow, running from the inner margin of the last-formed chamber nearly to the apex. Length 0.45 to 0.60 mm., breadth 0.12 to 0.15 mm.

The species occurs in Europe only in the Turonian. In America it occurs in the lower beds of Navarro age, the beds of Taylor age, and through the beds of Austin age, with one locality in the upper part of the Eagle Ford shale.

Navarro age. Ripley formation. Tennessee, McNairy County (94, 95, 97); Henderson County (96).
Taylor age.
Upper part of Taylor marl. Texas, Kaufman County (129); Milam County (139); Williamson County (141, 142); Travis County (145); Bexar County (154, 159, 162).
Marlbrook marl. Arkansas, Clark County (252); Hempstead County.
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (258, 259); Prentiss County (260); Union County (262); Lee County (264, 265).
Lower part of Taylor marl. Texas, Collin County (208); Dallas County (221, 223, 225–227); Kaufman County (228, 229); McLennan County (239, 241); Falls County (244); Travis County (249).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270, 271).
Gober tongue of Austin chalk. Texas, Fannin County (278, 281); Lamar County (283–285, 287).
Austin chalk. Texas, Grayson County (291, 335); Collin County (293, 295, 324); Dallas County (299, 300, 302, 304–308, 311, 340, 344).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320). Arkansas, Sevier County (347).
Bonham marl. Texas, Lamar County (327, 331); Grayson County (328).
Selma chalk (lower part). Mississippi, Itawamba County (351).
Eagle Ford shale. Texas, Grayson County (354).

Virgulina navarroana Cushman
Plate 53, figures 5–7

Virgulina navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 63, pl. 7, figs. 9, 10, 1933; Geol. Soc. America Bull., vol. 47, p. 419, 1936; Cushman Lab. Foram. Research Special Pub. 9, p. 6, pl. 1, figs. 14–16, 1937.
Cushman and Todd, idem, Contr., vol. 19, p. 66, pl. 11, fig. 25, 1943.

Test elongate, tapering, greatest breadth toward the apertural end, periphery broadly rounded, initial end in many specimens with a short spine; chambers distinct, slightly inflated, irregularly spiral in the early portion, becoming distinctly biserial in the adult, the last-formed chamber somewhat more elongate than the earlier chambers; sutures distinct, slightly depressed, wall smooth, coarsely perforate; aperture broadly elliptical, somewhat comma-shaped, with a slight rim. Length 0.40 mm., breadth 0.10 to 0.12 mm., thickness 0.08 to 0.10 mm.

This is a distinctive species and widely distributed, particularly in the upper part of the Navarro group.

Navarro group.
Kemp clay. Texas, Hopkins County (1); Williamson County (12); Travis County (13–17); Guadalupe County (18).
Corsicana marl. Texas, Hunt County (24); Navarro County (25, 27); Travis County (34, 37); Caldwell County (44); Bexar County (46); Limestone County (30).

Genus BOLIVINA D'Orbigny, 1839

Bolivina incrassata Reuss

Plate 53, figures 8–11

Bolivina incrassata Reuss, Haidinger's Naturwiss, Abh., vol. 4, p. 29, pl. 4, fig. 13, 1851; Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, 1861, p. 332 (1862).
Olszewski, Akad. umiej. Krakowie, Sprawozd. Kom. Fizyj., vol. 9, p. 123, 1875.
Egger, K. bayer. Akad. Wiss., Math-naturh. Abt., Abh., Kl. 2, vol. 21, pt. 1, p. 45, pl. 16, figs. 4, 5, 1899; K. bayer. Akad. Wiss., Math.-phys. Kl., Sitzungsber., Jahrg. 11, p. 23, pl. 1, fig. 18, 1909.
Franke, Naturh. Ver. preuss. Rheinlande u. Westfalens Verh., 69 Jahrg., vol. 59, 1912, p. 265 (1913); Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 21, pl. 2, fig. 8, 1925.
Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 19, pl. 2, figs. 1a, b, 1926; vol. 2, pt. 4, p. 86, pl. 12, figs. 1a, b, 1927; Jour. Paleontology, vol. 1, p. 161, pl. 28, fig. 11, 1927.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 153, pl. 14, fig. 6, 1928.
White, Jour. Paleontology, vol. 3, p. 43, pl. 4, figs. 19a, b, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 49, pl. 8, figs. 2–4, 1931; Jour. Paleontology, vol. 5, p. 310, pl. 2, figs. 17a, b, 1931.
Sandidge, idem, vol. 6, p. 281, pl. 41, fig. 21, 1932.
Macfadyen, Geol. Mag., vol. 69, pl. 35, figs. 19a, b, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 22, fig. 26, 1933; idem, Special Pub. 5, pl. 27, fig. 28, 1933.
Cushman and Campbell, idem, Contr., vol. 11, p. 73, pl. 11, fig. 10, 1935.
Cushman, idem, Special Pub. 9, p. 38, pl. 5, figs. 19–28, 1937.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 3, fig. 1, 1938.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 338, pl. 53, fig. 12, 1944.
Bolivina incrassata Reuss var. *lata* Egger, K. bayer. Akad. Wiss., Math.-naturh, Abt., Abh., Kl. 2, vol. 21, pt. 1, p. 46, pl. 16, figs. 8, 9, 1899.
Textilaria elongata von Hagenow, Neues Jahrb., 1842, p. 570.
Bolivina elongata Marsson, Naturw. Ver. Neu-Vorpommern u. Rügen Mitt., Jahrg. 10, p. 155, 1878.
Bolivina primatumida White, Jour. Paleontology, vol. 3, p. 44, pl. 4, figs. 20a, b, 1929.

Test stout, moderately compressed, periphery rounded, about 2½ times as long as broad, greatest breadth toward the apertural end; chambers numerous, usually distinct, slightly inflated; sutures fairly distinct, strongly oblique, very slightly depressed, occasionally becoming limbate; wall thick and usually opaque, very finely perforate, usually smooth but occasionally the earliest chambers marked by extremely fine traces of longitudinal markings; aperture elongate, oval, without a definite lip. Length up to 1.00 mm. or more, breadth 0.30 to 0.40 mm., thickness 0.15 to 0.18 mm.

This species is very widely distributed in Europe and America. It occurs in the beds of Taylor age and is abundant at many places. It is common in the lower beds of Navarro age, its highest level seeming to be in the Saratoga chalk. In Mexico is occurs, at many places abundantly, in the Mendez formation but does not occur in the Velasco shale of Mexico nor in its equivalent in Trinidad. Cole records it from the Selma chalk of well samples from Florida.

The species is represented in the present collections from the upper Senonian of Europe at numerous localities. It occurs in the Mendez shale at numerous localities along the Tampico-San Luis Potosi Railroad near Coco, Hacienda el Limon, San Luis Potosi, Mexico, and at many localities southward along the Tamuin River.

Navarro age.
Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80).
Ripley formation. Tennessee, Henderson County (96).
Selma chalk (upper part). Alabama, Marengo County (104).
Neylandville marl. Texas, Rockwall County (57); Kaufman County (58).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–109); Lamar County (110, 112); Delta County (114); Hunt County (115, 116); Collin County (118, 120–122); Rockwall County (123); Kaufman County (126, 128, 130); Navarro County (132–134); Williamson County (140, 142); Travis County (146); Bexar County (152, 155, 161).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (170).
Selma chalk (middle part). Tennessee, Hardin County (255).
Wolfe City sand member of Taylor marl. Texas, Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (191).
Lower part of Taylor marl. Texas, Delta County (206); Kaufman County (229); Ellis County (234).

Bolivina decurrens (Ehrenberg) Marsson

Plate 53, figures 12, 13

Grammostomum? decurrens Ehrenberg, Mikrogeologie, pl. 30, fig. 17, 1854.
Bolivina decurrens Marsson, Naturw. Ver. Neu-Vorpommern u. Rügen Mitt., Jahrg. 10, p. 156, pl. 3, fig. 24, 1878.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, p. 46, pl. 16, figs. 17, 18, 1899; Naturw. Ver. Regensburg Ber., vol. 12, 1907–09, p. 13, pl. 5, figs. 20, 21, 31 (1910).
Franke, Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 20, pl. 2, fig. 6, 1925.
Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 88, pl. 12, fig. 4, 1927.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 152, pl. 13, fig. 3, 1928.
Cushman and Campbell, Cushman Lab. Foram. Research Contr., vol. 11, p. 73, pl. 11, fig. 9, 1935.
Cushman, idem, Special Pub. 9, p. 39, pl. 5, figs. 29, 30, 1937.

Test elongate, about 3 times as long as broad, much compressed, periphery subacute, the early portion dentate; chambers very slightly overlapping, increasing rather regularly in size as added, distinct, slightly inflated, oblique, in the early portion with the peripheral basal margin of each with a distinct angular projection; sutures distinct, slightly depressed, strongly oblique, nearly straight; wall smooth, rather coarsely perforate; aperture elongate, narrow, tending in the adult to become somewhat terminal. Length 0.35 to 0.40 mm., breadth 0.15 mm., thickness 0.05 to 0.08 mm.

This species was described by Ehrenberg from the Upper Cretaceous of Europe, and it is recorded from numerous localities, as noted in the references given above. The species seems to be very rare, being found as single specimens in the upper beds of Navarro age. It is present in cores at a depth of 545 feet from a well east of Richland, Navarro County, Tex. Somewhat similar specimens occur in the Cretaceous of Venezuela.

Navarro age.
Kemp clay. Texas, Williamson County (12).
Corsicana marl. Texas, Limestone County (29); Travis County (37, 38); Caldwell County (44).
Prairie Bluff chalk. Mississippi, Chickasaw County (85). Alabama, Sumter County (101).

Bolivina cretosa Cushman
Plate 53, figures 14–17

Bolivina cretosa Cushman, Cushman Lab. Foram. Research Special Pub. 6, p. 49, pl. 7, fig. 10, 1936; idem, Special Pub. 9, p. 43, pl. 6, figs. 2–5, 1937; idem, Contr., vol. 20, p. 12, pl. 2, fig. 27, 1944.
Bolivina sp. Cushman, Tennessee Div. Geology Bull. 41, p. 50, pl. 8, fig. 7, 1931.

Test fusiform, small, about twice as long as broad, much compressed, periphery acute; chambers distinct, low and broad, very slightly overlapping, increasing in breadth as added; sutures distinct, very slightly if at all depressed, often somewhat limbate, very strongly oblique, slightly curved; wall smooth or with occasional coarse punctae arranged in longitudinal lines; aperture narrow, elongate. Length 0.20 to 0.30 mm., breadth 0.12 to 0.15 mm., thickness 0.05 mm.

The holotype of this species is from the Upper Cretaceous Selma chalk ½ mile west of Guys, McNairy County, Tenn. The species is very small, with very strongly oblique sutures and narrow chambers. It may be related to *B. watersi* Cushman, of Navarro age, and it is perhaps the ancestral form of that species. *B. cretosa* seems to be most common in the uppermost beds of Taylor age with a few specimens from beds of Ripley age in Tennessee.

Navarro age.
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Selma chalk (upper part). Tennessee, McNairy County (98).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (108, 109); Hunt County (115); Collin County (122); Kaufman County (125–129, 131); Navarro County (132, 134); Leon County (138); Milam County (139); Williamson County (141, 142, 144); Travis County (145, 149); Bexar County (152, 156, 158).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
Selma chalk (middle part). Mississippi, Alcorn County (257); Union County (262); Lee County (264, 265).
Lower part of Taylor marl. Texas, Collin County (214); Kaufman County (228); Ellis County (234).

Bolivina watersi Cushman
Plate 53, figure 18

Bolivina watersi Cushman, Cushman Lab. Foram. Research Contr., vol. 2, p. 88, pl. 12, fig. 6, 1927; idem, Special Pub. 9, p. 41, pl. 5, fig. 33, 1937.

Test minute, tapering, broadest near the apertural end, thickest along the median line, about 2½ times as long as broad, periphery subacute; chambers distinct, numerous, somewhat curved, inflated, increasing rather uniformly in size as added; sutures distinct, depressed, strongly curved, with broad depressions between the chambers that are due to the somewhat tumid form of the base of the chambers; wall rather coarsely perforate, deeply indented over the upper part of each chamber; aperture narrow, elongate. Length 0.25 mm., breadth 0.10 to 0.12 mm.

The types of this species are from the Upper Cretaceous Navarro formation east of Richland, Navarro County, Tex. It is very small and easily overlooked, but it keeps its distinctive characters, which should easily identify it. The ornamentation is somewhat variable, some of the best preserved specimens showing numerous longitudinal costae over the surface of the chambers, as indicated in the figure. The species is most common in the beds of Navarro age, particularly the portion below the horizons of the Nacatoch sand, although there are rare specimens from the upper Navarro and from scattered localities in beds of Taylor age. It may be that this species should be considered a variety of *Bolivina linearis* (Ehrenberg) Marsson.

Navarro age.
Kemp clay. Texas, Falls County (9); Guadalupe County (18).
Corsicana marl. Texas, Falls County (32).
Prairie Bluff chalk. Mississippi, Chickasaw County (86).
Neylandville marl. Texas, Red River County (50); Delta County (52); Hunt County (54); Navarro County (68, 69).
Taylor marl.
Upper part. Texas, Red River County (107); Lamar County (110); Bexar County (160, 161).
Wolfe City sand member. Texas, Collin County (183).
Lower part. Texas, Delta County (206).

Bolivina pondi Cushman
Plate 53, figure 19

Bolivina pondi Cushman, Tennessee Div. Geology Bull. 41, p. 50, pl. 8, figs. 5a, b, 1931; Cushman Lab. Foram. Research Special Pub. 9, p. 43, pl. 6, fig. 1, 1937.

Test elongate, about 3½ times as long as broad, somewhat compressed, periphery broadly rounded, sides nearly parallel for most of their length after the early triangular portion; chambers distinct, increasing in height toward the apertural end, slightly overlapping, somewhat inflated; sutures distinct, slightly depressed, strongly oblique, slightly curved; wall ornamented with fine longitudinal costae, stronger toward the base and becoming obsolescent toward the apertural end; aperture narrow, elongate, widest at the upper end. Length 0.40 mm., breadth 0.12 mm., thickness 0.05 mm.

The types are from the Upper Cretaceous Ripley formation on the New Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. (94). There are no further records for this species, although specimens are fairly numerous at the type locality.

Bolivina selmaensis Cushman
Plate 53, figure 20

Bolivina selmaensis Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 42, pl. 5, fig. 37, 1937.
Bolivina tenuis Marsson var. *selmaensis* Cushman, Tennessee Div. Geology Bull. 41, p. 49, pl. 8, figs. 6a, b, 1931.

Test about 1½ times as long as broad, much compressed, periphery subacute; chambers distinct, few in number, elongate, very slightly overlapping, much broader than high, slightly inflated; sutures distinct, slightly depressed, strongly oblique; wall smooth, except the early portion, which has irregular longitudinal costae very slightly developed; aperture narrow, in the median line, the inner end slightly expanded.

The holotype of this species is from the Upper Cretaceous Selma chalk on the New Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. (94). It has not been found elsewhere. The species somewhat resembles Marsson's *Bolivina tenuis* from the Upper Cretaceous of northern Germany, but our species is less regular and is distinctly ornamented.

Bolivina velascoensis Cushman
Plate 53, figure 21

Bolivina velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 586, pl. 16, figs. 1a, b, 1926; Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 88, 1927; idem, Special Pub. 9, p. 41, pl. 5, fig. 32, 1937.

Test about twice as long as broad, strongly compressed, sides parallel for most of their length, initial portion triangular, periphery rounded; chambers fairly distinct, numerous, broader than high, increasing in height toward the apertural end, strongly overlapping, very slightly inflated; sutures fairly distinct, strongly oblique, earlier ones curved, with an irregular sculpture, later sutures depressed; wall smooth except for the peculiar ornamentations over the sutures, rather coarsely punctate; aperture elongate, elliptical. Length 0.50 mm., breadth 0.25 mm., thickness 0.05 mm.

The types of this species are from the Upper Cretaceous Velasco shale in well samples from Hacienda el Limon, Vera Cruz, Mexico. There are no other records of its occurrence. The holotype is here refigured.

Bolivina explicata Cushman and Hedberg
Plate 53, figures 22, 23

Bolivina explicata Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 6, p. 66, pl. 9, figs. 8, 9, 1930.
Cushman, idem, Special Pub. 9, p. 42, pl. 5, figs. 35, 36, 1937.

Test very stout, greatest breadth near the apertural end, thence gradually tapering to the initial end, in end view nearly circular; chambers fairly distinct, biserial, with the basal portion extended into numerous fingerlike processes with deep depressions between, apertural face somewhat smooth; sutures fairly distinct, following the line of the depressions and passing under the fingerlike processes; wall very coarsely perforated; aperture at the base of the apertural face, but in adults becoming somewhat terminal. Length 0.80 mm., diameter 0.50 mm.

The types of this species are from the Upper Cretaceous Colon shale, Department of Escuque, State of Trujillo, Venezuela.

In some respects this species resembles species of *Loxostoma*, and perhaps should be included in that genus, as the aperture in the largest forms becomes nearly terminal. It also resembles *Bolivinoides* in the thickened last chamber, but the early chambers are not distinct enough to show its full development. It is related to some of the large forms of the Upper Cretaceous of Texas but is much more highly developed than any of these.

Genus LOXOSTOMA Ehrenberg, 1854
Loxostoma cushmani Wickenden
Plate 53, figures 24–31

Loxostomum cushmani Wickenden, Royal Soc. Canada Trans., 3d ser., vol. 26, sec. 4, p. 91, pl. 1, figs. 6a, b, 1932.
Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 171, pl. 20, figs. 9–13, 1937.
Cushman and Deaderick, idem, Contr., vol. 18, p. 63, pl. 15, figs. 11–13, 1942.
Cushman, idem, vol. 20, p. 12, pl. 2, fig. 28, 1944; idem, vol. 20, p. 94, pl. 14, fig. 17.
Loxostomum clavatum Cushman (not Cushman, 1927), Jour. Paleontology, vol. 6, p. 340, pl. 51, figs. 8a, b, 1932.

Test elongate, narrow, slightly tapering, very little if at all compressed, periphery broadly rounded, earlier portion distinctly biserial, tending to become uniserial in the adult; chambers distinct, particularly in the later portion, inflated toward the apertural end, slightly overlapping; sutures distinct, in the early portion not depressed, gradually becoming deeply depressed in the adult, with distinct reentrants and lobular processes between in the adult, sutures in the early portion nearly horizontal, later becoming more oblique; wall of the early portion either smooth or with slight longitudinal costae, the adult smooth except for the crenulations at the base of the chambers; aperture in the adult becoming rounded and terminal. Length up to nearly 1.00 mm., breadth 0.20 mm.

The types of this species are from the Upper Cretaceous Boyne beds 1½ miles south-southwest of Treherne, Manitoba, Canada. The species was also recorded from localities 4½ miles west of Miami and ½ mile northwest of Babcock, Manitoba.

This is a very common species in the Upper Cretaceous of the Coastal Plain of the United States, ranging from the upper beds of Austin age to the upper beds of Taylor age, with a single record of not entirely typical specimens from the Saratoga chalk of Navarro age. This species is subject to considerable variation in the surface characters, but the general shape and development of the test remains constant. In its earliest development specimens frequently do not show any of the reentrants at the base of the chambers and tend somewhat less to become uniserial. As the species developed in the upper beds of Austin age, however, the full characters were taken on and continue through to the Taylor. The species is closely related to *L. clavatum* (Cushman) Cushman, which occurs in its typical form only in the Taylor marl. The distinction between the two at some localities is more or less bridged over by intermediate forms.

Navarro age. Saratoga chalk. Arkansas, Hempstead County (80).
Taylor age.
Upper part of Taylor marl. Texas, Limestone County (136); Leon County (138).
Anacacho limestone (upper part). Texas, Bexar County (164).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (169, 171); Kaufman County (173); Rockwall County (175); Delta County (166).
Wolfe City sand member of Taylor marl. Texas, Collin County (180).
Annona chalk. Texas, Red River County (192–194, 198).
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (201, 202); Fannin County (203, 204); Collin County (207, 210, 212, 214, 215); Dallas County (220, 222, 226); Kaufman County (228, 229); Ellis County (231); Hill County (237); McLennan County (238–242); Bell County (245); Travis County (247, 249, 250); Comal County (251).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (274–276, 279); Lamar County (283, 287, 288).
Austin chalk. Texas, Collin County (295); Bell County (316).
Selma chalk of upper Austin age. Alabama, Pickens County (352).
Brownstown marl. Texas, Red River County (318); Lamar County (320, 321). Arkansas, Sevier County.
Ector tongue of Austin chalk. Texas, Grayson County (332).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Loxostoma gemmum (Cushman) Cushman
Plate 54, figures 1–3

Bolivina gemma Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 87, pl. 12, figs. 3a, b, 1927.
Loxostoma gemmum Cushman, idem, Special Pub. 9, p. 172, pl. 20, figs. 14–16, 1937.

Test elongate, somewhat tapering, compressed, periphery rounded, biserial throughout, slightly twisted in the earlier portion; chambers distinct, numerous, increasing rather regularly in size and breadth as added, very slightly inflated in the adult; sutures distinct, somewhat limbate, very slightly depressed toward the periphery, the inner margin raised, forming a zigzag row of beadlike ornamentations of clear shell material, particularly in the earlier half of the test; wall thick, very finely perforate, smooth except for the beaded ornamentation, occasionally with fine striations toward the base; aperture elongate, elliptical, somewhat curved, in the adult becoming terminal. Length up to 1.00 mm., breadth 0.30 mm., thickness 0.12 to 0.15 mm.

The types of this species are from the Upper Cretaceous Arkadelphia clay 7 miles north by west of Hope, Hempstead County, Ark. The species is limited to the upper beds of Navarro age. It is distinctly ornamented and makes an excellent marker for this part of the section.

Navarro age.
- Kemp clay. Texas, Travis County (17); Guadalupe County (18, 21).
- Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).
- Prairie Bluff chalk. Mississippi, Chickasaw County (87).
- Selma chalk (upper part). Mississippi, Union County (92).

Loxostoma clavatum (Cushman) Cushman

Plate 54, figures 4–9

Bolivina clavata Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 4, p. 87, pl. 12, figs. 5a, b, 1927.

Loxostoma clavatum (Cushman) Cushman, Jour. Paleontology, vol. 6, p. 340, pl. 51, figs. 8a, b, 1932; Cushman Lab. Foram. Research Special Pub. 9, p. 171, pl. 20, figs. 6–8, 1937; idem, Contr., vol. 20, p. 94, pl. 14, fig. 16, 1944.

Test elongate, very tapering, club-shaped, the last-formed portion nearly circular in section, periphery broadly rounded, early portion somewhat twisted, biserial throughout; chambers numerous, distinct, the later chambers somewhat inflated, the lower margin with backwardly projecting, short, blunt lobes, with depressed areas between, increasing rapidly in size in the adult, somewhat overlapping; sutures fairly distinct, early sutures about at right angles to the periphery, later slightly oblique; wall finely perforate, the earlier chambers finely pitted in longitudinal lines, in the adult smooth except for the crenulations at the base of the chambers; aperture elongate, ovate, the broadest end in the apertural face, in the adult becoming cut off from the base of the chamber and tending to become terminal. Length up to 1.00 mm., diameter 0.25 mm.

The types of this species are from the Taylor marl in the clay pit of the Dallas Brick Co., ½ mile west of Mesquite, Tex. The species is largely limited to the lower beds of Taylor age.

As already noted under *Loxostoma cushmani* Wickenden, that species is closely related to *L. clavatum*, although the difference in shape, the greater tendency for the former to become uniserial, and the greater development of the crenulations in the latter seem to distinguish the two. The two species very seldom occur together. Still greater development of a crenulated margin and enlarged test in the adult is seen in the species here noted as *Bolivina explicata* Cushman and Hedberg. It may be that more material of *B. explicata* will show that it is a *Loxostoma*.

Navarro age. Ripley formation. Tennessee, Henderson County (96).

Taylor marl, lower part. Texas, Collin County (207, 211–214); Dallas County (220–223, 226); Kaufman County (229); Ellis County (230–232); Navarro County (236); Hill County (237); McLennan County (242).

Austin chalk.
- Gober tongue. Texas, Fannin County (281).
- Ector tongue. Texas, Grayson County (332).
- Selma chalk (lower part). Mississippi, Itawamba County (351).

Loxostoma plaitum (Carsey) Cushman

Plate 54, figures 10–14

Bolivina plaitum Carsey, Texas Univ. Bull. 2612, p. 26, pl. 4, fig. 2, 1926.

Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 4, pl. 1, fig. 14, 1929.

Loxostoma plaitum Cushman, Tennessee Div. Geology Bull. 41, p. 51, pl. 8, fig. 9, 1931; Geol. Soc. America Bull., vol. 47, p. 419, pl. 1, figs. 10a, b, 1936.

Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 61, pl. 11, fig. 1, 1937.

Loxostoma plaitum Plummer, Texas Univ. Bull. 3101, p. 182, pl. 10, figs. 5–7, 1921.

Sandidge, Am. Midland Naturalist, vol. 13, p. 363, pl. 31, fig. 22, 1932.

Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 31, pl. 3, fig. 23, 1936.

Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 169, pl. 20, figs. 1–4, 1937.

Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 95, pl. 23, fig. 1, 1941.

Cushman and Todd, idem, vol. 19, p. 67, pl. 11, fig. 26, 1943.

Cushman, idem, vol. 20, p. 93, pl. 14, fig. 15, 1944.

Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 338, pl. 53, fig. 13, 1944.

Test 5 to 6 times as long as broad in the adult, elongate, slender, slightly tapering, greatest breadth toward the apertural end, slightly twisted, compressed, tending to become somewhat uniserial in the adult, periphery rounded; chambers numerous, distinct, increasing rather rapidly in height toward the apertural end; earlier chambers biserial, inflated slightly if at all, later chambers strongly inflated and failing to completely reach across the test; sutures distinct, slightly depressed, often somewhat limbate, earlier sutures strongly oblique, slightly curved, later sutures strongly curved; wall smooth, finely perforate; aperture tending to become terminal in the adult, narrowly ovate. Length 0.50 to 0.75 mm., breadth 0.12 to 0.15 mm., thickness 0.08 to 0.10 mm.

The types of this species are from lower Navarro clays in a steep 80-foot slope on the right bank of Onion Creek just east of the bridge (known as Jones Crossing) on the Austin-Bastrop highway, Travis County, Tex. The species is abundant in beds of Navarro age and widely distributed, somewhat less common in the upper beds of Taylor age. It is present in material of Navarro age from Georges Bank in the western Atlantic Ocean and in the upper zone of the Colon shale of Colombia.

The form in the uppermost beds of Navarro age tends to become broader, but it tends less strongly toward the uniserial condition. There is considerable range in the adult in the number of chambers that become high and inflated.

Navarro age.
- Kemp clay. Texas, Navarro County (7); Williamson County (12); Guadalupe County (21).
- Corsicana marl. Texas, Bowie County (23); Hunt County (24); Navarro County (25–28); Limestone County (29–31); Falls County (32); Travis County (34–43); Caldwell County (44).
- Arkadelphia marl. Arkansas, Hempstead County (71).
- Owl Creek formation. Mississippi, Tippah County (83).
- Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (99, 100); Sumter County (101–103).
- Nacatoch sand. Texas, Bowie County (47).
- Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94, 95, 97); Henderson County (96).
- Selma chalk (upper part). Mississippi, Union County (92). Tennessee, McNairy County (98). Alabama, Marengo County (104).
- Neylandville marl. Texas, Red River County (50); Delta County (51, 52); Hunt County (53–55); Rockwall County (57); Kaufman County (58, 62); Navarro County (64–66, 68, 69).
- Saratoga chalk. Arkansas, Clark County (78).

Taylor age.

Upper part of Taylor marl. Texas, Red River County (106, 107); Lamar County (110); Delta County (114); Collin County (118, 122); Kaufman County (125–129); Navarro County (134); Leon County (138); Travis County (149); Bexar County (152, 156, 158).

Marlbrook marl. Arkansas, Howard County.

Selma chalk (middle part). Mississippi, Alcorn County (257); Prentiss County (261); Lee County (265, 266).

Lower part of Taylor marl. Texas, Delta County (206); Collin County (207, 212); Ellis County (230); Bell County (245).

Austin age. Selma chalk (lower part). Mississippi, Lee County (350).

Loxostoma plaitum (Carsey) Cushman var. limbosum Cushman

Plate 54, figure 15

Loxostoma plaitum (Carsey) Cushman var. *limbosum* Cushman, Tennessee Div. Geology Bull. 41, p. 52, pl. 8, fig. 10, 1931; Cushman Lab. Foram. Research Special Pub. 9, p. 170, pl. 20, fig. 5, 1937.

Cushman and Todd, idem, Contr., vol. 19, p. 67, pl. 11, fig. 27, 1943.

Bolivina plaita Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 4, pl. 1, fig. 14, 1929.

Loxostomum plaitum Cushman (not Carsey), Jour. Paleontology, vol. 5, p. 310, pl. 33, figs. 16a, b, 1931.

Variety differing from the typical form in the sutures, which, particularly in the early portion, are very strongly limbate and raised.

The holotype of this variety is from the Selma chalk on the New Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. The variety is more common than the typical form at some localities in the lower and middle beds of Navarro age.

Navarro age.

Kemp clay. Texas, Williamson County (11); Travis County (17).

Corsicana marl. Texas, Limestone County (29, 30); Milam County (33); Bexar County (46).

Nacatoch sand. Texas, Bowie County (47, 48).

Ripley formation. Tennessee, McNairy County (94, 95).

Selma chalk (upper part). Tennessee, McNairy County (98).

Saratoga chalk. Arkansas, Clark County (78); Hempstead County (80, 81).

Loxostoma minutissimum Cushman

Plate 54, figure 16

Loxostoma minutissimum Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 45, pl. 7, fig. 19, 1938.

Test minute, elongate, about 3 times as long as broad, somewhat compressed periphery slightly lobulate, rounded in end view; chambers distinct, early chambers much broader than high, in the adult much higher than broad, later chambers inflated; sutures distinct, slightly depressed, earlier sutures strongly oblique, later sutures strongly curved; wall smooth; aperture in the adult terminal, oval, with a distinct lip. Length 0.25 to 0.30 mm., breadth 0.10 to 0.12 mm., thickness 0.07 to 0.08 mm.

The types are from the lower part of the Taylor marl, east bank of a road cut near the crest of a hill 14.4 miles south of Paris and 0.9 mile north of Lake City, Delta County, Tex. (206).

This species differs from *L. plaitum* (Carsey) Cushman in the smaller size, fewer chambers, and rapid increase in relative height of the adult chambers.

It is abundant at the type locality but on account of its small size may be easily overlooked.

Loxostoma limonense (Cushman) Cushman

Plate 54, figure 17

Bolivina incrassata Reuss var. *limonensis* Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 19, pl. 2, fig. 2, 1926.

Loxostomum plaitum Cushman and Jarvis (not Carsey), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 44, pl. 13, fig. 7, 1932.

Loxostomum limonense Cushman, Cushman Lab. Foram. Research Special Pub. 9, p. 173, pl. 20, fig. 28, 1937.

Test often 5 times as long as broad, very elongate, slender, tapering, compressed, periphery rounded; chambers numerous, somewhat overlapping, for the most part increasing rather uniformly in size as added, the last-formed chambers in the adult often much higher than the previous chambers and slightly inflated; sutures distinct, very slightly if at all depressed except in the last-formed portion, where they are rather strongly depressed and somewhat strongly curved, in the earlier portion nearly straight and oblique; wall smooth, finely perforate; aperture elongate, narrow, tending to become terminal in the adult. Length 1.50 mm., breadth 0.30 mm., thickness 0.18 mm.

The types are from the Upper Cretaceous Mendez shale near Guerrero, San Luis Potosi, Mexico. The species occurs in well samples from Mendez and Velasco shales in Hacienda el Limon, San Luis Potosi, Mexico, and in typical form in the Upper Cretaceous of Lizard Springs, near Guayaguayare, southeastern Trinidad. This species has not yet been found in the Coastal Plain of the United States.

Genus BIFARINA Parker and Jones, 1872

Bifarina saxipara (Ehrenberg) Parker and Jones

Plate 54, figure 18

Dimorphina saxipara Ehrenberg, Mikrogeologie, pl. 32, pt. ii, fig. 27, 1854.

Bifarina saxipara Parker and Jones, Annals and Mag. Nat. History, ser. 4, vol. 10, p. 198, 1872.

Cushman, Cushman Lab. Foram. Research Special Pub. 4, pl. 28, fig. 1, 1933; idem, Special Pub. 9, p. 197, pl. 22, fig. 27, 1937.

This is the genotype species of *Bifarina*. A copy is given of the original figure from the Cretaceous of Mississippi. It is a figure of a specimen imbedded in balsam and viewed by transmitted light and is very unsatisfactory. It may even possibly be a *Rectogümbelina, Nodosarella,* or another such form. It must be left as very problematical.

Family ELLIPSOIDINIDAE

Genus PLEUROSTOMELLA, Reuss, 1860

Pleurostomella austinana Cushman

Plate 54, figures 19–21

Pleurostomella austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 64, pl. 7, fig. 13, 1933.

Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 40, pl. 6, fig. 4, 1937.

Test very elongate, slender, periphery broadly rounded; chambers loosely biserial in the adult, inflated, increasing in length as added; sutures distinct, strongly depressed; wall smooth, very finely perforate; aperture ovate, the greatest breadth toward the outer end, the basal portion somewhat contracted, with small, flattened, toothlike projections at either side near the base. Length 0.40 mm., diameter 0.08 mm.

The holotype is from the Austin chalk in a road cut between two railroad underpasses on the north edge of the town of Howe, Grayson County, Tex.

This is a very long, slender species tending toward

Nodosarella in its development, the chambers, except the very early ones, being loosely biserial. There are numerous records from the Austin chalk of Texas. The species apparently occurs in the Niobrara chalk of Kansas, Nebraska, and South Dakota.

Austin age.
Austin chalk. Texas, Collin County (292); Grayson County (333–335); Dallas County (296–298, 308, 311, 344); Hill County (314).
Ector tongue of Austin chalk. Texas, Grayson County (332).

Pleurostomella watersi Cushman
Plate 54, figures 22, 23

Pleurostomella watersi Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 63, pl. 7, figs. 11, 12, 1933.

Test elongate, slender, gradually increasing in breadth toward the apertural end, periphery broadly rounded, sides somewhat lobulate; chambers distinct, inflated, increasing in height and size toward the apertural end, biserial, but the axis somewhat twisted; sutures distinct, strongly depressed; wall smooth, very finely perforate; aperture large, often slightly higher than broad, the base somewhat contracted into flat toothlike projections. Length 0.50 to 0.60 mm., breadth 0.13 to 0.15 mm., thickness 0.10 to 0.12 mm.

The holotype is from the Bonham marl in a roadside ditch 7.8 miles south of Sherman, Grayson County, Tex. (328).

This is a distinctive species of the Austin with its shape somewhat clavate, especially marked in the microspheric form, and its aperture large and high.

Austin age.
Austin chalk. Texas, Dallas County (298, 338); Grayson County (335).
Bonham marl. Texas, Grayson County (328).

Pleurostomella nitida Morrow
Plate 54, figure 24

Pleurostomella nitida Morrow, Jour. Paleontology, vol. 8, p. 196, pl. 30, figs. 22a, b, 1934.

Test elongate, somewhat compressed, front view narrow, the sides nearly straight and tapering slightly; chambers few, inflated, later chambers rather elongate, apertural end of the last-formed chambers somewhat extended, face appearing sigmoidally curved as seen from side view; sutures distinct, depressed; wall smooth, finely perforate; aperture subterminal, elliptical, apparently not toothed. Length 0.58 mm., breadth 0.13 mm., thickness 0.12 mm.

The holotype is from the Hartland shale member of the Greenhorn formation, sec. 31, T. 21 S., R. 22 W., Hodgeman County, Kans. The specimens from the Austin chalk noted below are probably this species.

Austin chalk. Texas, Collin County (294).

Pleurostomella subnodosa Reuss
Plate 55, figures 1–9

Pleurostomella subnodosa Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 40, p. 204, pl. 8, fig. 2, 1860; idem, vol. 46, pt. 1, 1862, p. 59 (1863); idem, vol. 52, pt. 1, p. 453, 1865.
Beissel, Preuss. geol. Landesanstalt Abh., new ser., vol. 3, p. 64, pl. 12, figs. 30–38, 1891.
Egger, K. bayer. Akad. Wiss., Math.-naturh. Abt., Abh., Kl. 2, vol. 21, pt. 1, p. 48, pl. 16, figs. 27, 28, 1899.
Heron-Allen and Earland, Royal Micr. Soc. Jour., p. 411, pl. 11, fig. 3, 1910.
Franke, Greifswald Univ., Geol.-paleont. Inst., Abh., vol. 6, p. 22, pl. 2, figs. 11a, b, 1925.
Chapman, New Zealand Geol. Survey Paleontology Bull. 11, p. 41, pl. 9, fig. 10, 1926.
Cushman and Harris, Cushman Lab. Foram. Research Contr., vol. 3, p. 131, pl. 25, figs. 23, 26, 1927.
Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 129, pl. 11, figs. 28a, b, 1928.
White, Jour. Paleontology, vol. 3, p. 53, pl. 5, fig. 15, 1929.
Cushman, idem, vol. 6, p. 341, pl. 51, figs. 9–11, 1932.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 4, fig. 7, 1938.
Macfadyen, Geol. Mag., vol. 79, p. 139 (list), 1942.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 13, pl. 2, fig. 29, 1944.

Test elongate, tapering from the initial end to the greatest breadth at the last-formed chamber; early chambers completely biserial, later chambers becoming irregularly uniserial; chambers distinct, nearly circular in transverse section, somewhat inflated; sutures distinct, slightly depressed, the later sutures only slightly oblique; wall smooth, finely perforate; aperture at the side of the chamber, with an overhanging lip and an interior flat tooth. Length up to 1.10 mm., breadth 0.20 to 0.22 mm.

This species has been widely recorded, but the foregoing references are accompanied by figures that seem to belong here. It occurs in Europe in the upper part of the Cretaceous and in the American Cretaceous only in the Taylor marl, the Pecan Gap chalk, Annona chalk, and Wolfe City sand. Cole records it from the Selma chalk of well samples from Florida. It also occurs in the Mendez shale of the Tampico Embayment region of Mexico.

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–107); Lamar County (110, 111); Hunt County (115); Collin County (118, 119, 121); Williamson County (140).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (169, 171, 172); Delta County (165, 166).
Wolfe City sand member of Taylor marl. Texas, Collin County (181, 183).
Annona chalk. Texas, Bowie County (189, 190).
Lower part of Taylor marl. Texas, Delta County (206); Ellis County (234).

Pleurostomella subnodosa Reuss var. gigantia White
Plate 55, figure 10

Pleurostomella subnodosa Reuss var. *gigantia* White, Jour. Paleontology, vol. 3, p. 53, pl. 5, fig. 16, 1929.

Under this name White figures a form from the Upper Cretaceous of the Tampico Embayment region of Mexico that is close to *P. torta* Cushman. A copy of White's figure is given here.

Pleurostomella clavata Cushman
Plate 54, figure 25

Pleurostomella clavata Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 590, pl. 16, fig. 5, 1926.
Cushman and Harris, Cushman Lab. Foram. Research Contr., vol. 3, p. 132, pl. 25, fig. 19, 1927.
White, Jour. Paleontology, vol. 3, p. 52, pl. 5, fig. 14, 1928.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 44, pl. 13, figs. 8a, b, 1932.

Test somewhat fusiform, nearly circular in transverse section, greatest diameter toward the apertural end, composed of a few chambers, periphery very slightly, if at all, lobulate; sutures distinct but not depressed; wall smooth, finely perforate; aperture at the base of the last-formed chamber, very large, arched. Length 0.65 to 1.00 mm., diameter 0.25 to 0.45 mm.

The holotype is from the Velasco shale in the well of the Marland Oil Co. of Mexico, Franco-Espanola No.

5., at 375 feet, Hacienda el Limon, Vera Cruz, Mexico. It also occurs in the Upper Cretaceous of Trinidad from a pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, and Calex C well at 116 feet at Lizard Springs.

Pleurostomella torta Cushman

Plate 55, figure 11

Pleurostomella torta Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 18, pl. 2, fig. 7; 1926.
Cushman and Harris, idem, vol. 3, p. 132, pl. 25, fig. 16, 1927.

Test large, subcylindrical, composed of few chambers, sides nearly parallel, slightly lobate, circular in transverse section; chambers biserial throughout, the axis of the early portion somewhat twisted; sutures distinct, limbate, slightly depressed; wall smooth; aperture elliptical with a slight lip and a platelike tooth with a central indentation. Maximum length 2.10 mm., maximum breadth 0.65 mm.

The holotype is from the Upper Cretaceous Mendez shale east of Pujal, San Luis Potosi, Mexico.

This is one of the largest species of the genus and is characterized by the distinctly limbate sutures and in many of the specimens by the peculiarly twisted axis of the early portion.

Pleurostomella velascoensis Cushman

Plate 55, figure 12

Pleurostomella velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 590, pl. 16, figs. 4a, b, 1926.
Cushman and Harris, Cushman Lab. Foram. Research Contr., vol. 3, p. 132, pl. 25, fig. 20, 1927.

Test elongate, composed of few chambers, biserial throughout, inflated, the periphery lobulate; sutures distinct, depressed except in the early portion; wall smooth, finely perforate; the aperture becoming nearly terminal, the inner border cut down to the previously formed chamber. Length 0.80 mm., breadth 0.25 mm., thickness 0.25 mm.

The holotype is from the Velasco shale in the well of the Marland Oil Co. of Mexico, Franco-Espanola No. 5, at 270 feet, Hacienda el Limon, Vera Cruz, Mexico.

This species is unusual for this genus, which usually has the aperture open and at one side rather than terminal. It somewhat resembles figures which Egger has referred to *Pleurostomella alternans* Schwager but which are evidently not that species. His specimens were from the Upper Cretaceous of Bavaria.

Genus ELLIPSOPLEUROSTOMELLA A. Silvestri, 1903

Ellipsopleurostomella curta Cushman

Plate 55, figures 13, 14

Ellipsopleurostomella curta Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 590, pl. 16, figs. 6a, b, 1926.
Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 102, pl. 14, figs. 18, 19, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 45, pl. 13, figs. 9, 10, 1932.

Test short and stout, composed of a very few chambers somewhat inflated; the sutures distinct, but very slightly, if at all depressed; wall smooth and finely perforate; aperture an elongate, narrow, curved slit, as is usual in the genus. Length 0.45 mm., breadth 0.25 mm., thickness 0.25 mm.

The holotype is from the Velasco shale in the well of the Marland Oil Co., of Mexico, Franco-Espanola No. 5, at 445 feet, Hacienda el Limon, Vera Cruz, Mexico.

This species is very short and stout but has the characteristic aperture of the genus.

It occurs in typical form in the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Genus NODOSARELLA Rzehak, 1895

Nodosarella coalingensis Cushman and Church

Plate 55, figures 15, 16

Nodosarella coalingensis Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 514, pl. 39, figs. 20–22, 1929.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 28, fig. 27, 1933; Foraminifera, Ed. 3, Key, pl. 28, fig. 27, 1940.

Test elongate, tapering, greatest breadth made by the last-formed chamber; early chambers biserial, later chambers irregularly uniserial; sutures distinct, depressed; wall smooth throughout; aperture terminal, semicircular with a curved portion forming the inner margin and standing well above the general contour of the apertural end of the test, which is somewhat drawn out. Length of largest specimen 1.15 mm., diameter 0.40 mm.

The holotype is from the Upper Cretaceous beds in the California Northern Petroleum Co.'s Well 19, sec. 2, T. 21 S., R. 14 E., Mount Diablo meridian, Fresno County, Calif., at a depth of 1,135 feet.

This is a much more tapering species than others of the genus. The early biserial portion includes several chambers, and when the irregular uniserial chambers are added they at once begin to enlarge greatly in size over the earlier ones. Rare specimens in our Upper Cretaceous material seem identical with this species. Two of these are figured, one showing the long, slender, apertural neck.

Upper Cretaceous, Mendez shale. South of Rancho Nuevo, Tamuin River, and km. 569.6 on Panuco-San Luis Potosi railroad, Mexico.

Nodosarella texana Cushman

Plate 55, figure 18

Nodosarella texana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 46, pl. 8, fig. 1, 1938; idem, vol. 20, p. 94, pl. 14, fig. 18, 1944.

Test very slender, elongate, distinctly curved, very slightly tapering; chambers distinct, slightly overlapping, increasing rather regularly in length as added, last chambers in the adult 3 to 4 times as long as broad, very slightly inflated; sutures very slightly depressed in the later portion; wall smooth; aperture subterminal, with an arched, hoodlike portion over the opening. Length 1.50 to 1.75 mm., breadth 0.15 mm.

The types are from the basal part of the Taylor marl, Farmersville road 5 miles east of McKinney, Collin County, Tex.

The species occurs in the present material only at localities in the upper part of the Austin and in the basal part of the Taylor marl. It differs from *N. gracillima* Cushman in the distinctly curved test, and the chambers are much longer in the adult. The type locality is either basal Taylor or upper Austin and must be close to the contact.

Taylor marl, lower part. Texas, Collin County (209); Dallas County (224).

Austin age.

Gober tongue of Austin chalk. Texas, Lamar County (282–284).
Austin chalk. Texas, Dallas County (310).
Brownstown marl. Texas, Lamar County (320).
Selma chalk (lower part). Mississippi, Itawamba County (351).

Nodosarella primitiva Cushman
Plate 55, figure 17

Nodosarella primitiva Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 46, pl. 8, fig. 2, 1938.

Test elongate, slightly tapering, earliest portion biserial, later uniserial; chambers distinct, inflated, increasing gradually in size as added, slightly overlapping, slightly longer than broad in the adult; sutures distinct, somewhat depressed; wall smooth; aperture terminal, with one side raised to form a slight hood above the aperture. Length 0.55 to 0.70 mm., breadth 0.15 mm.

The types are from the upper part of the Taylor marl along a branch of Kickapoo Creek 1,200 feet south of a public road 1.8 miles northwest of Annona, Red River County, Tex. (106).

The species occurs in the upper and middle parts of the Taylor marl, including the Pecan Gap chalk and Wolfe City sand members. Very similar forms occur in the Mendez shale of the Tampico Embayment region of Mexico, but most of the Mexican specimens are slightly larger than those from Texas. One of the Mexican specimens was figured as *Ellipsosiphogenerina* sp. (Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 591, pl. 20, fig. 12, 1926).

N. primitiva differs from *N. gracillima* Cushman in the shorter test, slightly more tumid and fewer chambers, and greater tendancy to have biserial chambers in the earlier portion.

The specimens I have referred to *Ellipsopleurostomella pleurostomelloides* Heron-Allen and Earland (Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 18, pl. 2, fig. 6, 1926) probably belong here.

Taylor marl.
- Upper part. Texas, Red River County (106); Collin County (119, 120, 122); Travis County (145).
- Pecan Gap chalk member. Texas, Hunt County (168).
- Wolfe City sand member. Texas, Collin County (180, 183).

Nodosarella gracillima Cushman
Plate 55, figures 19–21

Nodosarella gracillima Cushman, Cushman Lab. Foram. Research Contr., vol. 9, p. 64, pl. 7, figs. 14a, b, 1933; idem, vol. 20, p. 13, pl. 2, fig. 32, 1944.

Nodosarella sp., Morrow, Jour. Paleontology, vol. 8, p. 197, pl. 29, figs. 2, 3, 1934.

Test very elongate, slender, slightly tapering, greatest breadth toward the apertural end, circular in transverse section; early chambers biserial, later ones uniserial, rectilinear; chambers distinct, inflated, increasing in size and length toward the apertural end; sutures distinct, strongly depressed; wall smooth, very finely perforate; aperture semielliptical, at one side of the end of the last-formed chamber. Length 0.90 mm., diameter 0.15 mm.

The holotype of this species is from the upper portion of the Austin chalk on a public road running north about 6.5 miles east by north of Allen, Collin County, Tex.

This very slender and distinctive form of *Nodosarella* is found at the top of the Austin chalk and in the lower part of the Taylor marl. It also occurs in the Niobrara chalk of Kansas.

Taylor marl.
- Lower part. Texas, Collin County (209); Dallas County (224).
- Pecan Gap chalk member. Texas, Delta County (166).

Austin chalk.
- Gober tongue. Texas, Fannin County (275); Lamar County (284).
- Austin chalk. Texas, Grayson County (290); Dallas County (326); Hill County (314).

Nodosarella striata White
Plate 55, figure 22

Nodosarella striata White, Jour. Paleontology, vol. 3, p. 54, pl. 5, fig. 18, 1929.

Test elongate, rectilinear throughout; surface very finely striate. Height of type specimen, 0.85 mm.; greatest diameter 0.27 mm.

The type is from the Velasco shale at Columbus Station on the Tampico-Monterey Railroad, Mexico.

I have not found this form elsewhere.

Genus ELLIPSONODOSARIA A. Silvestri, 1900

Ellipsonodosaria minuta Cushman
Plate 56, figure 1

Ellipsonodosaria minuta Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 48, pl. 8, fig. 6, 1938.

Test small, slender, slightly curved, gradually tapering initial end with a distinct spine; chambers distinct, later chambers somewhat inflated, very slightly overlapping, increasing very gradually in length in the adult, becoming somewhat inflated, somewhat pyriform; sutures distinct, strongly limbate, later sutures strongly depressed; wall of the early chambers smooth or slightly costate longitudinally, later becoming progressively spinose on the lower half of the chamber, later still in the adult entirely covered with short spines but not costate. Length up to 0.75 mm., diameter 0.07 to 0.08 mm.

The types are from the lower part of the Taylor marl along Bear Creek 0.8 mile south by east of Lavon, Collin County, Tex. (207).

This is a much smaller species than *E. alexanderi* Cushman and has the longitudinal costae more marked. It may be the ancestral form of that species, which seems to be confined in its typical form to the upper part of the Taylor marl.

Ellipsonodosaria stephensoni Cushman
Plate 56, figures 2–7

Ellipsonodosaria stephensoni Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 52, pl. 9, figs. 10–15, 1936.
- Cushman and Todd, idem, vol. 19, p. 67, pl. 11, fig. 28, 1943.
- Cushman, idem, vol. 20, p. 94, pl. 13, figs. 31, 32, 1944.
- Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 338, pl. 53, figs. 14–16, 1944.

Test slightly elongate, tapering, slightly arcuate; chambers distinct, increasing rather rapidly in diameter and increasing much in length as added, slightly pyriform in adult, greatest breadth toward the base, somewhat inflated; sutures distinct, depressed, somewhat limbate; wall smooth except for a ring of very short backwardly pointing spines near the base of the chamber, in the adult occasionally with a few scattered spines above, early chambers smooth; aperture with a distinct ring and slight lip, the opening itself, when well preserved, crescentic, with a distinct tooth. Length up to slightly more than 1.00 mm., diameter 0.08 to 0.10 mm.

The types of this species are from the Taylor marl 7.5 miles from Terrell on the road to Crandall, Kaufman County, Texas.

This species is widely distributed in the upper beds of Taylor age and occurs also in beds of Navarro and Austin age. It may be distinguished from *E. annulifera* Cushman and Bermudez in the spines of the basal portion of the chambers and in the more pyriform shape of the chambers.

Navarro age.
- Kemp clay. Texas, Navarro County (4); Guadalupe County (18).
- Corsicana marl. Texas, Hunt County (24); Navarro County (27); Limestone County (30).
- Arkadelphia marl. Arkansas, Hempstead County (70, 72, 73).

Neylandville marl. Texas, Red River County (50); Delta County (51, 52); Rockwall County (57); Kaufman County (62); Navarro County (63, 66, 69).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 108); Delta County (114); Hunt County (116); Collin County (119, 120); Kaufman County (125, 128, 129, 131); Navarro County (134); Milam County (139); Williamson County (143, 144); Bexar County (158, 159, 161, 162).
Pecan Gap chalk member of Taylor marl. Texas, Collin County (170).
Selma chalk (middle part). Tennessee, Hardin County (255).
Marlbrook marl. Arkansas, Howard County; Hempstead County.
Annona chalk. Texas, Bowie County (189).
Lower part of Taylor marl. Texas, Delta County (206); Ellis County (235).
Austin age. Selma chalk (lower part). Mississippi, Lee County (350).

Ellipsonodosaria stephensoni Cushman var. speciosa Cushman
Plate 56, figure 8

Ellipsonodosaria stephensoni Cushman var. *speciosa* Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 47, pl. 8, fig. 3, 1938.
Cushman and Hedberg, idem, vol. 17, p. 96, pl. 33, figs. 7, 8, 1941.

Variety differing from the typical form in the adult chambers, which are strongly pyriform and have the spines covering the surface of the chamber instead of confined to the basal margin.

The types of the variety are from the Arkadelphia marl 6 miles north by west of Hope, Hempstead County, Ark. (72).

Similar specimens occur in the Colon shale of Colombia.

Ellipsonodosaria pseudoscripta Cushman
Plate 56, figure 9

Ellipsonodosaria pseudoscripta Cushman, Cushman Lab. Foram. Research Contr., vol. 13, p. 103, pl. 15, fig. 14, 1937.

Test small, slender, gently tapering from the greatest breadth formed by the last chamber toward the initial end, very slightly curved; chambers distinct, pyriform, slightly greater in diameter toward the base, increasing gradually in size and relative length as added, uniserial except in the microspheric form where the earliest chambers tend to be biserial; sutures distinct, slightly depressed, more strongly so in the adult, slightly limbate; wall ornamented with very fine spines, short, and in the adult sometimes appearing as short, broken, longitudinal costae; aperture terminal, rounded, but with one side flattened with a lip, and with a narrow tooth projecting into the opening. Length 0.60 to 0.75 mm., diameter 0.08 mm.

The types are from the Taylor marl (upper) 1.9 miles west-southwest of Prairie Hill, Limestone County, Tex.

The species is small but distinctive and keeps its characters constantly. The spines are small and backwardly pointing, in the adult chamber assuming a peculiar arrangement in longitudinal lines and becoming hardly more than raised ridges.

This species differs from *E. horridens* Cushman in the much smaller, more tapering test, and the finer ornamentation.

Navarro age.
Prairie Bluff chalk. Mississippi, Chickasaw County (85).
Neylandville marl. Texas, Navarro County (63).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106); Lamar County (111); Rockwall County (124); Navarro County (134); Limestone County (136).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Wolfe City sand member of Taylor marl. Texas, Collin County (183).
Annona chalk. Texas, Red River County (192, 198).
Lower part of Taylor marl. Texas, Red River County (199); Collin County (211); Dallas County (216); Kaufman County (229); McLennan County (243); Falls County (244).
Austin chalk, Gober tongue. Texas, Fannin County (278).

Ellipsonodosaria exilis Cushman
Plate 56, figures 10, 11

Ellipsonodosaria exilis Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 51, pl. 9, figs. 1, 2, 1936.

Test very elongate, slender, slightly curved, initial end with a straight acerose spine, diameter increasing very little if at all from the proloculum to the apertural end; chambers distinct, increasing rather gradually and uniformly in length as added, very slender, inflated; sutures distinct, slightly limbate, in some specimens very slightly depressed; wall smooth, thin; aperture terminal with a crescentic opening and indication of a slight tooth. Length up to 3.00 mm., diameter 0.35 mm.

The types are from the Upper Cretaceous upper part of the lower part of the Taylor marl in a road cut 14.4 miles south of Paris and 0.9 mile north of Lake City, Delta County, Tex. (206).

This species also occurs in the Pecan Gap chalk and in the Annona chalk. It may be distinguished from *E. granti* (Plummer) Cushman in the much more slender test and very thin wall.

Taylor age.
Pecan Gap chalk member of Taylor marl. Texas, Kaufman County (173).
Annona chalk. Texas, Red River County (193).
Lower part of Taylor marl. Texas, Delta County (206).

Ellipsonodosaria alexanderi Cushman
Plate 56, figures 12–15

Ellipsonodosaria alexanderi Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 52, pl. 9, figs. 6–9, 1936.

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 of this species 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 species is rather characteristic of the upper part of the Taylor marl. It differs from *E. granti* (Plummer) Cushman in the much shorter chambers and ornamentation of the surface.

Navarro group, Neylandville marl. Texas, Red River County (50).
Taylor marl.
Upper part. Texas, Red River County (105, 106, 108); Lamar County (110); Collin County (122); Navarro County (132, 134); Williamson County (140).
Wolfe City sand member. Texas, Collin County (181).
Lower part. Texas, Delta County (206).

Ellipsonodosaria alexanderi Cushman var. impensia Cushman
Plate 56, figures 16–18

Ellipsonodosaria alexanderi Cushman var. *impensia* Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 48, pl. 8, figs. 4, 5, 1938.
Cushman and Todd, idem, vol. 19, p. 67, pl. 11, fig. 29, 1943.
Frizzell, Jour. Paleontology, vol. 17, p. 350, pl. 57, fig. 4, 1943.

Variety differing from the typical form in the greater amount of spinosity, the early chambers in the microspheric form having numerous spines; in the more fusiform shape of the adult chambers, those in the typical form being somewhat pyriform; and in the greater number of spines on the adult chambers, with the spines pointing in a less backward direction than those on the typical form. The variety is also considerably larger than the typical form.

The types are from the Corsicana marl on the Mexia road 2.75 miles east of Cooledge, Limestone County, Tex.

The variety replaces the typical form in the upper part of the Navarro group, being abundant in the Corsicana marl and somewhat less so in the Kemp clay. It occurs in the Arkadelphia marl and in the Prairie Bluff chalk, and is recorded from the Upper Cretaceous, Mal Paso shale, of Peru.

The relation may not be a varietal one, and the two forms may be distinct species.

Navarro age.
Kemp clay. Texas, Navarro County (3, 4); Williamson County (11, 12); Guadalupe County (18).
Corsicana marl. Texas, Hunt County (24); Navarro County (25–28); Limestone County (30, 31); Travis County (34, 42).
Arkadelphia marl. Arkansas, Hempstead County (70, 73).
Prairie Bluff chalk. Mississippi, Chickasaw County (85, 86). Alabama, Wilcox County (100).

Ellipsonodosaria dentata-glabrata Cushman
Plate 56, figures 19, 20

Ellipsonodosaria dentata-glabrata Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 54, pl. 9, figs. 22, 23, 1936.

Test elongate, slightly tapering, slightly arcuate, initial end without a spine; chambers distinct, increasing gradually in diameter and length as added, in the adult becoming inflated; sutures distinct, somewhat limbate, becoming more depressed in the adult; wall smooth except in the median portion where the chamber has a ring of a few closely appressed spines, wanting in the early portion and also on the adult chambers; aperture rounded with a slight neck and tooth. Length 1.00 to 1.25 mm., diameter 0.15 mm.

The types of this species are from the Neylandville marl (*Exogyra-Cancellata* zone) in a gully west of the Paris highway 7¼ miles northeast of Cooper, Delta County, Tex. (52). It seems to be limited to the lower beds of Navarro age.

This species differs from *E. annulifera* Cushman and Bermudez in the less limbate sutures, lack of initial spine, and the few appressed spines in the median portion.

Navarro age.
Ripley formation. Tennessee, Henderson County (96).
Neylandville marl. Texas, Delta County (52).

Ellipsonodosaria horridens Cushman
Plate 56, figures 21–23

Ellipsonodosaria horridens Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 53, pl. 9, figs. 19–21, 1936.
Cushman and Hedberg, idem, vol. 17, p. 96, pl. 23, figs. 2–6, 1941.

Test elongate, slightly tapering, straight or very slightly arcuate; chambers pyriform, increasing somewhat in length as added, diameter increasing slightly; sutures distinct, strongly depressed; wall ornamented by numerous short, sharp, backward pointing spines on the lower half of each chamber; aperture apparently crescentic with a slight tooth. Length probably up to 4.00 mm., diameter 0.20 mm.

The types of this species are from the Ripley formation on the New Corinth highway 13.5 miles south of Selmer, McNairy County, Tenn. Fragmentary specimens occur in the Colon shale of Colombia.

This species differs from *E. adolphina* (D'Orbigny) Cushman in the much more elongate chambers and the less regularly arranged spines.

Navarro age. Ripley formation. Tennessee, McNairy County (94).
Taylor age. Selma chalk (middle part). Tennessee, Hardin County (255).

Ellipsonodosaria? granti (Plummer) Cushman
Plate 56, figures 24–26

Nodosaria granti Plummer, Texas Univ. Bull. 2644, p. 83, pl. 5, figs. 9a–d, 1927.
Ellipsonodosaria? granti Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 51, pl. 9, figs. 3–5, 1936.
Cushman and Todd, idem, vol. 19, p. 67, pl. 11, fig. 30, 1943.

Rather large forms in the Navarro clays evidently belong to *Ellipsonodosaria* and resemble the species described by Mrs. Plummer from the Midway group (Paleocene) of Texas. The ascription of the present material to this species is somewhat doubtful, as the aperture was originally described as "round and radiate." The figured specimens are from the clay pit of the Corsicana Brick Co., 2 miles north of Corsicana Courthouse, Corsicana, Tex. It also occurs at various localities in the upper beds of Navarro age, and somewhat questionable specimens occur in the upper part of the Taylor marl.

Navarro age.
Kemp clay. Texas, Navarro County (4); Williamson County (11, 12); Guadalupe County (18).
Corsicana marl. Texas, Navarro County (25–27); Limestone County (30, 31); Falls County (32).
Arkadelphia marl. Arkansas, Hempstead County (73).
Prairie Bluff chalk. Mississippi, Chickasaw County (85, 86).
Taylor marl, upper part. Texas, Travis County (149).

Ellipsonodosaria? jarvisi Cushman
Plate 24, figure 28; plate 56, figures 27–29

Ellipsonodosaria? jarvisi Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 53, pl. 9, figs. 16–18, 1936.
Dentalina cf. *D. adolphina* Cushman and Jarvis (not D'Orbigny), Cushman Lab. Foram. Research Contr., vol. 4, p. 97, pl. 14, fig. 6, 1928.
Dentalina annulata Cushman and Jarvis (not Reuss), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 30, pl. 10, fig. 1, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 86, pl. 14, fig. 27, 1940.

Test elongate, tapering, rapidly increasing in diameter from the subacute initial end, slightly arcuate; chambers distinct in the early portion, somewhat broader than long, in the adult with the length and breadth about equal, becoming much inflated and subspherical; sutures distinct except in the earliest portion, becoming more and more depressed at the apertural end in the adult; wall ornamented by weak longitudinal costae occasionally showing traces of spines at the lower end and occupying the middle portion of the chamber; aperture terminal, broadly crescentic, with a slight tooth, a distinct short neck and broad lip that is marked with radial striations. Length 1.50 mm., diameter 0.25 mm.

The holotype is from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. It occurs in similar form in the Velasco shale of Mexico.

This form was once referred to D'Orbigny's species, but it is a much stouter, thicker form, with very little trace of actual spines and with the apertural lip very broad and distinct.

None of the specimens has the apertural end perfectly preserved, but the general appearance of the species would seem to place it in *Ellipsonodosaria.*

Ellipsonodosaria subnodosa (Guppy) Nuttall

Plate 56, figures 30, 31

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

Ellipsonodosaria subnodosa Nuttall, Quart. Jour. Geol. Soc., vol. 84, p. 95, pl. 6, fig. 20, 1928.

Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 102, pl. 14, figs. 15, 16, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 45, pl. 13, figs. 11–13, 1932.

A number of specimens from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, and also from the Velasco shale of the Tampico Embayment region of Mexico, closely resemble Guppy's species, which was described from Trinidad. The adult chambers are closely similar in all specimens, but the early portions range from broadly rounded to pointed and probably represent the microspheric and megalospheric forms.

Ellipsonodosaria sp.

Plate 56, figures 32, 33

Ellipsonodosaria sp., Cushman, Tennessee Div. Geology Bull. 41, p. 52, pl. 8, figs. 11–13, 1931.

Numerous specimens in the Selma chalk of Tennessee, some of which are figured here, seem to belong to *Ellipsonodosaria,* although none of the numerous specimens show the full apertural characters. They are from the Selma chalk (middle part) on Jim Wilkin's property, 300 yards northwest of Union Church, Hardin County, Tenn. (255).

Genus ELLIPSOGLANDULINA A. Silvestri, 1900

Ellipsoglandulina exponens (H. B. Brady) Silvestri

Plate 56, figures 34–36

Ellipsoidina exponens H. B. Brady in Jukes-Brown and Harrison, Quart. Jour. Geol. Soc., vol. 48, p. 198, 1892.

Guppy, Zool. Soc. London Proc., p. 650, pl. 41, fig. 13, 1894.

Ellipsoglandulina exponens A. Silvestri, Pont. accad. sci. Nuovi Lincei Atti, vol. 54, pp. 103–109, 1901.

Nuttall, Quart. Jour. Geol. Soc., vol. 84, p. 95, pl. 6, fig. 17, 1928.

Cushman and Jarvis, Cushman Lab. Foram. Research Contr., vol. 4, p. 103, pl. 14, fig. 17, 1928; U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 45, pl. 13, figs. 14–16, 1932.

Figures are given of specimens from the Upper Cretaceous of Trinidad that may belong to Brady's species. Specimens are so rare that no sufficient series could be obtained.

Upper Cretaceous. Boulders in conglomerate on "Bon Accord" estate, ¼ mile from Pointe-à-Pierre railroad station, San Fernando, Trinidad; Calex C well, 116 feet, Lizard Springs, and pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Ellipsoglandulina velascoensis Cushman

Plate 56, figure 37

Ellipsoglandulina velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 590, pl. 16, figs. 7a, b, 1926; Cushman Lab. Foram. Research Special Pub. 5, pl. 28, figs. 29a, b, 1933; Foraminifera, Ed. 3, pl. 28, figs. 29a, b, 1940.

Test small, fusiform, greatest width about the middle, thence tapering to the bluntly pointed ends; chambers few, much overlapping; sutures distinct; wall smooth, finely perforate; aperture an elongate, narrow curved slit at one side, near the end of the last-formed chamber. Length 0.35 mm., breadth 0.20 mm., thickness 0.20 mm.

The holotype of this species is from the Velasco shale in the well of the Marland Oil Co. of Mexico, Franco-Espanola No. 5, at 390 feet, Hacienda el Limon, Vera Cruz, Mexico.

Family ROTALIIDAE

Genus PATELLINA Williamson, 1858

Patellina sp.

Plate 57, figure 1

Patellina sp., Cushman, Tennessee Div. Geology Bull. 41, p. 52, pl. 8, figs. 14a–c, 1931.

Figures are given of a species evidently belonging to this genus, but specimens are not in sufficient numbers to warrant full description and naming of the species. It is from the Ripley formation 13½ miles south of Selmer, McNairy County, Tenn. (94).

Genus LAMARCKINA Berthelin, 1851

Lamarckina ripleyensis Cushman

Plate 57, figure 2

Lamarckina ripleyensis Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 8; pt. 2, pl. 5, figs. 6a–c, 1926; Tennessee Div. Geology Bull. 41, p. 53, pl. 9, figs. 1a–c, 1931; Cushman Lab. Foram. Research Special Pub. 5, pl. 29, figs. 20a–c, 1933; Foraminifera, Ed. 3, pl. 29, figs. 20a–c, 1940.

Test longer than broad, dorsal side convex, ventral side flattened, consisting of about 1½ coils, 8 to 9 chambers in the last-formed coil; chambers very distinct, only slightly inflated; sutures distinct, on the dorsal side limbate, raised, the inner end being more distinct than the peripheral end; periphery carinate, the carina fusing with the raised sutures; surface between the sutures rather coarsely punctate, ventral side smooth and highly polished, umbilicate, the last-formed chamber, when complete, with a large semicircular lip above the aperture; sutures and chambers often obscured by the secondary thickening of the ventral side. Length 0.50 mm., breadth 0.40 mm., thickness 0.20 mm.

The types of this species are from the Cretaceous Owl Creek formation of Owl Creek, Tippah County, Miss. (83). It is also common in the Ripley formation, New Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. (94).

Genus VALVULINERIA Cushman, 1926

Valvulineria plummerae Loetterle

Plate 57, figures 3, 4

Gyroidina nitida Plummer (not Reuss), Texas Univ. Bull. 3101, p. 191, pl. 14, fig. 5, 1931.

Valvulineria plummerae Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 41, pl. 6, figs. 5, 6, 1937.

Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 13, pl. 3, fig. 1, 1944; idem, vol. 20, p. 95, pl. 14, fig. 20, 1944.

Test trochoid, dorsal side flattened or slightly umbonate at the center, ventral side slightly convex, periphery broadly rounded; chambers distinct, slightly inflated, 8 to 10 in the adult whorl, of rather uniform shape, increasing very gradually in size as added, on the ventral side with a large lobe covering the umbilical region; sutures distinct, depressed, nearly radial on the ventral side, very slightly curved dorsally; wall smooth, very finely perforate; aperture a low opening extending from a point near the periphery on the ventral side toward the umbilicus. Diameter 0.35 to 0.45 mm., height 0.15 to 0.22 mm.

The types of the species are from the Fort Hays limestone member of the Niobrara formation 4.7 miles east and 0.5 mile north of St. James, Nebr. Mrs. Plummer's specimens were from the Lower Cretaceous Washita formation of Texas. Loetterle also records it from the lower part of the Smoky Hill chalk member of the Niobrara formation of Nebraska.

In the present material the species is found most commonly in beds of Austin age and Taylor age.

Navarro age.
- Corsicana marl. Texas, Travis County (43).
- Selma chalk (upper part). Mississippi, Union County (92). Alabama, Marengo County (104).
- Saratoga chalk. Arkansas, Hempstead County (81).
- Neylandville marl. Texas, Red River County (50).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (105); Hunt County (116); Kaufman County (125, 128); Bexar County (155).
- Ozan formation. Arkansas, Little River County (254).
- Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
- Selma chalk (middle part). Mississippi, Alcorn County (258); Lee County (266).
- Lower part of Taylor marl. Texas, Lamar County (201, 202); Delta County (206); Collin County (210); Dallas County (216, 217, 219, 224); McLennan County (240); Falls County (244).

Austin age.
- Gober tongue of Austin chalk. Texas, Fannin County (281).
- Austin chalk. Texas, Dallas County (310).
- Brownstown marl. Texas, Lamar County (321).
- Selma chalk (lower part). Mississippi, Itawamba County (351).

Valvulineria infrequens Morrow
Plate 57, figure 5

Valvulineria infrequens Morrow, Jour. Paleontology, vol. 8, p. 197, pl. 30, figs. 3a–c, 1934.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 64, pl. 15, figs. 17–19, 1942.
Cushman, idem, vol. 20, p. 95, pl. 14, fig. 22, 1944.

Test trochoid, dorsal side moderately convex, ventral side concave, periphery rounded; chambers distinct, somewhat inflated, about 6 in the adult whorl, of uniform shape but increasing rapidly in size as added, with the last-formed chamber much larger and more inflated on the ventral side, normally with a weak lobe over the umbilical region; sutures distinct, strongly depressed, slightly curved ventrally, strongly curved dorsally; wall smooth, distinctly perforate; aperture a low and elongate opening on the ventral side. Diameter 0.35 to 0.45 mm., height 0.15 to 0.20 mm.

The types of this species are from the basal Niobrara chalk in the SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. In the present material is is found most commonly in the beds of Austin age and lower beds of Taylor age.

Taylor age.
- Ozan formation. Arkansas, Little River County (254).
- Lower part of Taylor marl. Texas, McLennan County (239); Travis County (249).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269).
- Austin chalk. Texas, Collin County (295, 324); Dallas County (301–307); Hill County (313).
- Brownstown marl. Texas, Lamar County (320). Arkansas, Sevier County.
- Bonham marl. Texas, Lamar County (327).
- Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Valvulineria allomorphinoides (Reuss) Cushman
Plate 57, figures 6, 7

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.
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.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 96, pl. 23, figs. 9a–c, 1941.

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, ventrally nearly radial, slightly 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.

In Europe this species seems most characteristic of the Senonian. In the American material it occurs in the upper beds of Austin age and is best developed in the Taylor marl. It occurs in the Mendez shale 5 kilometers southeast of Tamuin, San Luis Potosi, Mexico, and in the Colon shale of Santander del Norte, Colombia. In the Cretaceous material from Trinidad somewhat similar specimens occur at Lizard Springs, near Guayaguayare, but these specimens usually have more than the usual number of chambers. Further study may show this form to be distinct, and also the Navarro form.

Navarro age.
- Prairie Bluff chalk. Alabama, Sumter County (101).
- Ripley formation. Tennessee, McNairy County (94).
- Neylandville marl. Texas, Navarro County (68).

Taylor marl, lower part. Texas, Delta County (206); Collin County (212); McLennan County (240, 241).

Austin age.
- Burditt marl (of Adkins). Texas, Bell County (269).
- Gober tongue of Austin chalk. Texas, Fannin County (275); Lamar County (285).
- Austin chalk. Texas, Collin County (295); Dallas County (301, 304–306, 311).
- Brownstown marl. Texas, Lamar County (320).

Valvulineria cretacea (Carsey) Cushman and Todd
Plate 57, figure 8

Rotalia cretacea Carsey, Texas Univ. Bull. 2612, p. 48, pl. 5, figs. 1a, b, 1926.
Sandidge, Am. Midland Naturalist, vol. 13, p. 364, pl. 33, figs. 7, 8, 1932.
Valvulineria cretacea Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 67, pl. 12, fig. 1, 1943.

Test trochoid, small, biconvex, dorsal side less convex than the ventral, periphery subacute; chambers distinct, numerous, 10 to 15 in the adult, not inflated, of uniform shape and very gradually increasing in size as added, on the ventral side with a projection over the umbilicus, rather thin and sometimes broken away; sutures distinct, not depressed, limbate, very slightly curved; wall smooth, very finely perforate; aperture a low opening on the ventral side. Diameter 0.30 to 0.40 mm., height 0.08 to 0.12 mm.

This is a small but distinct species, apparently belonging to *Valvulineria*, as the ventral lobe is usually distinct. It is very abundant and is characteristic of the beds of Navarro age, although a few somewhat similar specimens occur in material from several localities in beds of Taylor age. Sandidge records this species from the Ripley of Alabama.

Navarro age.
Kemp clay. Texas, Falls County (9); Williamson County (11, 12); Travis County (14, 17); Guadalupe County (18, 21).
Corsicana marl. Texas, Navarro County (25–27); Limestone County (30, 31); Falls County (32); Travis County (35–41); Caldwell County (44); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70).
Prairie Bluff chalk. Mississippi, Chickasaw County (85). Alabama, Wilcox County (100).
Neylandville marl. Texas, Delta County (52); Hunt County (55); Kaufman County (68).

Taylor age.
Upper part of Taylor marl. Texas, Hunt County (115); Kaufman County (131); Bexar County (158).
Annona chalk. Texas, Red River County (193).
Lower part of Taylor marl. Texas, Fannin County (205); Collin County (215).

Valvulineria cf. V. umbilicatula (D'Orbigny) Cushman
Plate 57, figures 9–12

Valvulineria cf. *V. umbilicatula* (D'Orbigny), Cushman, Tennessee Div. Geology Bull. 41, p. 53, pl. 9, figs. 2–5, 1931.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 68, pl. 12, fig. 2, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 339, pl. 53, figs. 17, 18, 1944.
Gyroidina umbilicata Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 43, pl. 6, figs. 3a–c, 1931.

The series of specimens illustrated represent the considerable variation in this species as it occurs in the Selma chalk of Tennessee. Specimens range from strongly planoconvex to almost equally biconvex, although the dorsal side is usually flattened or even somewhat concave. The number of chambers is rather constant, in adult specimens usually 6. The chambers on the ventral side have a strongly developed lobe that covers the umbilicus.

In the present collections this form ranges from the level of the Kemp clay downward to the level of the Saratoga chalk, with one locality in the upper part of the Taylor marl. The same form also occurs in the Upper Cretaceous of Antigua.

Navarro age.
Kemp clay. Texas, Guadalupe County (18).
Corsicana marl. Texas, Limestone County (29, 30); Travis County (34, 41).
Prairie Bluff chalk. Mississippi, Chickasaw County (84). Alabama, Wilcox County (99); Sumter County (101).
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Selma chalk (upper part). Alabama, Marengo County (104).
Saratoga chalk. Arkansas, Clark County (78).
Taylor age.
Upper part of Taylor marl. Texas, Rockwall County (124).
Marlbrook marl. Arkansas, Clark County.

Genus GYROIDINA D'Orbigny, 1826
Gyroidina depressa (Alth) Cushman and Church
Plate 58, figures 1–4

Rotalina depressa Alth, Haidinger's Naturw. Abh., vol. 3, p. 266, pl. 13, fig. 21, 1850.
Gyroidina depressa Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 515, pl. 41, figs. 4–6, 1929.
Plummer, Texas Univ. Bull. 3101, p. 190, pl. 13, fig. 3, 1931.
Cushman, Tennessee Div. Geology Bull. 41, p. 54, pl. 9, figs. 7, 8, 1931; Jour. Paleontology, vol. 5, p. 311, pl. 36, figs. 2a–c, 1931; idem, vol. 6, p. 341, 1932.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 46, pl. 14, fig. 1, 1932.
Sandidge, Jour. Paleontology, vol. 6, p. 283, pl. 43, figs. 16–18, 1932.
Wickenden, idem, vol. 6, p. 206, pl. 29, figs. 9a–c, 1932.
Cushman, Geol. Soc. America Bull., vol. 47, p. 419, 1936.
Loetterle, Nebraska Geol. Survey Bull. 2d ser., Bull. 12, p. 42, pl. 6, figs. 7a–c, 1937.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 97, pl. 23, figs. 11, 12, 1941.
Cushman and Deaderick, idem, vol. 18, p. 64, pl. 15, figs. 14–16, 1942.
Cushman and Todd, idem, vol. 19, p. 68, pl. 12, fig. 4, 1943.
Cushman, idem, vol. 20, p. 13, pl. 3, fig. 2, 1944; idem, vol. 20, p. 95, pl. 14, fig. 23, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 339, pl. 53, figs. 19, 20, 1944.
Rotalia cretacea Carsey, Texas Univ. Bull. 2612, p. 48, pl. 5, figs. 7a, b, 1926.
Rotalia beccarii (Linné) D'Orbigny var. *ripleyensis* W. Berry (in Berry and Kelley), U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 15, pl. 3, figs. 10–12, 1929.

Test much compressed, trochoid, biconvex, the dorsal side in many specimens nearly flat, periphery rounded, umbilicus in many specimens open; chambers numerous, 10 to 12 in the last-formed whorl, distinct; sutures distinct, on the dorsal side nearly flush with the surface, slightly limbate, curved; on the ventral side slightly curved, nearly radial, slightly depressed; wall smooth; aperture on the ventral side between the periphery and the umbilicus, low. Diameter 0.25 to 0.55 mm., height 0.10 to 0.25 mm.

The types are from the Upper Cretaceous of Lemberg. Topotypes have been available for study, and the common American species seems to be the same, although subject to considerable variation in the number of chambers, degree of openness of the umbilicus, and convexity of the test.

So far as can be seen from available specimens, it ranges nearly throughout the Upper Cretaceous.

Navarro age.
Corsicana marl. Texas, Navarro County (27).
Prairie Bluff chalk. Alabama, Wilcox County (100).
Selma chalk (upper part). Mississippi, Prentiss County (91). Tennessee, McNairy County (98). Alabama, Marengo County (104).
Ripley formation. Tennessee, McNairy County (94, 95, 97); Henderson County (96).
Neylandville marl. Texas, Hunt County (53); Rockwall County (57); Kaufman County (58, 60); Navarro County (63, 64, 66, 69).
Saratoga chalk. Arkansas, Howard County (79).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (106–108); Hunt County (116); Collin County (122); Kaufman County (129, 131); Navarro County (132, 134); Milam County (139); Williamson County (140, 142); Travis County (145); Guadalupe County (151); Bexar County (154, 156, 158, 159).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Selma chalk (middle part). Mississippi, Union County (262); Lee County (264, 265). Tennessee, Hardin County (255).
Wolfe City sand member of Taylor marl. Texas, Hunt County (186).
Lower part of Taylor marl. Texas, Red River County (199); Fannin County (203); Delta County (206); Collin County (207, 209, 211, 212, 214); Dallas County (220–223); Kaufman County (228); Ellis County (235); Navarro County (236); Hill County (237); McLennan County (238); Williamson County (246); Travis County (249, 250).

Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270).

Gober tongue of Austin chalk. Texas, Fannin County (273, 275, 279, 280); Lamar County (283–287).
Selma chalk of upper Austin age. Alabama, Pickens County (352); Warrior River (353).
Austin chalk. Texas, Collin County (292, 294, 295, 324); Dallas County (297–303, 306–308, 311, 325, 342, 343); Grayson County (335); Hill County (314); Bell County (315, 316).
Brownstown marl. Texas, Red River County (318); Lamar County (320). Arkansas, Sevier County.
Ector tongue of Austin chalk. Texas, Grayson County (332).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).
Eagle Ford shale. Texas, Dallas County (359).

Gyroidina depressa (Alth) Cushman and Church var. colombiana Cushman and Hedberg

Gyroidina depressa (Alth) Cushman and Church var. *colombiana* Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 97, pl. 23, figs. 13a–c, 1941.

Variety differing from the typical in having a subacute periphery and more open umbilical area.

The types are from the lower zone of the Colon shale, Quedrada la Petroles, Colombia.

Gyroidina nitida (Reuss) Morrow
Plate 58, figure 5

Rotalina nitida Reuss, Geognostische Skizzen Böhmen, vol. 2, pt. 1, p. 214, 1844; Verstein. böhm. Kreideformation, pt. 1, p. 35, pl. 8, fig. 52; pl. 12, figs. 8, 20, 1845.
Gyroidina nitida Morrow, Jour. Paleontology, vol. 8, p. 197, pl. 30, figs. 1a–c, 1934.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 42, pl. 6, figs. 8a–c, 1937.
Frizzell, Jour. Paleontology, vol. 17, p. 351, pl. 57, figs. 6a–c, 1943.

Under this specific name Reuss figures a small species from the Cretaceous of Bohemia. Similar specimens occur in the Austin chalk particularly and have been recorded by Morrow from the Niobrara of Kansas and by Loetterle from the Niobrara of Kansas, Nebraska, and South Dakota.

Some of the specimens seem to merge with *G. girardana* (Reuss) Cushman, and it is difficult to separate them. The other American records for *G. nitida* will be found under other species.

Gyroidina globosa (Hagenow) Cushman
Plate 58, figures 6–8

Nonionina globosa Hagenow, Neues Jahrb., 1842, p. 574.
Rotalia globosa Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, 1861, p. 330, pl. 7, figs. 2a, b (1862).
Gyroidina globosa Cushman, Jour. Paleontology, vol. 5, p. 310, pl. 35, figs. 19a–c, 1931.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 47, pl. 14, figs. 3, 4, 1932.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 97, pl. 23, figs. 14a–c, 1941.
Cushman, idem, vol. 20, p. 13, pl. 3, fig. 3, 1944.
Cushman and Goudkoff, idem, vol. 20, p. 61, pl. 10, fig. 6, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 339, pl. 53, figs. 21, 22, 1944.
Gyroidina naranjoensis White, Jour. Paleontology, vol. 2, p. 296, pl. 40, fig. 5, 1928.

This species differs from the two preceding species in the very broadly rounded periphery and deep ventral side. The last whorl varies considerably in its position in relation to the preceding whorls, sometimes slightly overlapping and higher, in other specimens failing to come up to the previous whorl. The whole test is very rounded. It is not as common as the two preceding species. So far as the present collections show, it is characteristic of the beds of Taylor age, with a few specimens from the upper beds of Austin age and the lower beds of Navarro age. It occurs in the lower part of the Colon shale of Colombia and in California. Specimens from Mexico and Trinidad may possibly belong here.

Navarro age.
Selma chalk (upper part). Mississippi, Prentiss County (91).
Neylandville marl. Texas, Rockwall County (57).
Saratoga chalk. Arkansas, Hempstead County (81); Howard County (79).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (109); Collin County (120, 122); Rockwall County (124); Kaufman County (128, 131); Travis County (145).
Marlbrook marl. Arkansas, Howard County.
Ozan formation. Arkansas, Little River County (254).
Anacacho limestone (upper part). Texas, Bexar County (164).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Collin County (169, 170, 172); McLennan County (177).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Lee County (267).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181, 183).
Annona chalk. Texas, Red River County (191, 192, 195–198).
Lower part of Taylor marl. Texas, Lamar County (201, 202); Collin County (214); Dallas County (216, 217); Kaufman County (228); Ellis County (234); McLennan County (243); Bell County (245).

Austin chalk.
Gober tongue. Texas, Fannin County (275, 279); Lamar County (288).
Austin chalk. Texas, Grayson County (291); Collin County (292–295, 324); Hill County (313); Bell County (316).

Gyroidina girardana (Reuss) Cushman
Plate 58, figure 9

Rotalina girardana Reuss, Deutsche geol. Gesell. Zeitschr., vol. 3, p. 73, pl. 5, fig. 34, 1851.
Gyroidina girardana Cushman, Jour. Paleontology, vol. 5, p. 311, pl. 36, figs. 1a–c, 1931; Cushman Lab. Foram. Research Special Pub. 5, pl. 30, fig. 3, 1933.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 2, fig. 13, 1938.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 68, pl. 12, fig. 3, 1943.
Cushman, idem, vol. 20, p. 13, 1944; idem, vol. 20, p. 95, pl. 14, fig. 24, 1944.

Test trochoid, planoconvex, dorsal side flattened or even slightly concave, ventral side subconical with the umbilical region open, periphery with a distinct angle at the dorsal edge; chambers fairly distinct, of rather uniform shape, increasing very slowly in size as added, usually about 8 in the adult whorl, inflated very slightly if at all; sutures fairly distinct, slightly depressed, nearly radial on both ventral and dorsal sides; wall smooth; aperture between the periphery and umbilicus on the ventral side, low. Diameter 0.70 to 0.80 mm., height 0.35 to 0.40 mm.

Specimens with distinctly angled periphery are common from beds of Austin, Taylor, and Navarro ages. They are variable in the amount of the angle of the periphery but in general seem to form a single series. It is recorded by Cole from the Selma chalk in well samples from Florida.

Navarro age.
Kemp clay. Texas, Navarro County (7); Williamson County (11, 12).
Corsicana marl. Texas, Navarro County (27, 28); Falls County (32); Bexar County (46); Limestone County (30).
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Selma chalk (upper part). Alabama, Marengo County (104).

Neylandville marl. Texas, Red River County (50); Navarro County (63, 66, 68, 69).
Saratoga chalk. Arkansas, Clark County (78); Howard County (79); Hempstead County (81).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–107); Lamar County (110); Delta County (114); Hunt County (115, 116); Kaufman County (129); Navarro County (132, 134); Leon County (138); Williamson County (140); Travis County (149); Hays County (150); Bexar County (152, 158, 159).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (171).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Prentiss County (260).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 182); Navarro County (188).
Annona chalk. Texas, Bowie County (189).
Lower part of Taylor marl. Texas, Red River County (199); Fannin County (205); Delta County (206); Collin County (208, 212); Dallas County (219, 220, 222, 223); Kaufman County (229); Ellis County (234); McLennan County (238, 241); Falls County (244); Travis County (250).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (271).
Gober tongue of Austin chalk. Texas, Fannin County (276, 278); Lamar County (283, 285, 286).
Austin chalk. Texas, Collin County (295); Dallas County (300–309, 344).
Selma chalk of upper Austin age. Alabama, Pickens County (352).
Selma chalk (lower part). Mississippi, Itawamba County (351); Lee County (350).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320).
Ector tongue of Austin chalk. Texas, Grayson County (332).

Gyroidina arkadelphiana Cushman
Plate 58, figure 10

Gyroidina arkadelphiana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 49, pl. 8, fig. 7, 1938.

Test planoconvex, dorsal side flattened or slightly concave, ventral side strongly convex, with a large, deep umbilicus, periphery rounded, somewhat angled and raised at the edge of the dorsal surface; chambers numerous, averaging about 10 in the adult whorl, increasing rather rapidly in size and depth on the ventral side; sutures distinct, radial, slightly depressed; wall smooth on the ventral side, on the dorsal side ornamented with raised areas, in the later whorls parallel to the periphery and double; aperture elongate, at the inner margin of the last-formed chamber on the ventral side. Height 0.30 to 0.40 mm., diameter 0.40 to 0.50 mm.

The types are from the Arkadelphia marl 4.5 miles east of Washington in a creek ½ mile north of Reed's store, Hempstead County, Ark.

This species differs from *G. subangulata* (Plummer) White in the radial sutures, large umbilicus, and peculiar ornamentation of the dorsal side. It is known only from the Arkadelphia marl.

Navarro age. Arkadelphia marl. Arkansas, Hempstead County (70, 73).

Gyroidina beisseli White
Plate 58, figure 11

Gyroidina beisseli White, Jour. Paleontology, vol. 2, p. 291, pl. 39, fig. 7, 1928.
Eponides haidingerii Cushman and Jarvis (not D'Orbigny), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 47, pl. 14, figs. 5a–c, 1932.

Dorsal side slightly convex; usually six chambers in the last whorl; sutures not limbate, curved on the dorsal side, radial, meeting in a point and very indistinct on the ventral side, all sutures flush; periphery rounded; aperture a slit at the middle of the base of the last chamber. Diameter of type specimen, 0.6 mm.; thickness, 0.35 mm.

The types of this species are from the Upper Cretaceous Mendez shale 200 meters south of Noria on the road to La Noria, northwest of Tampico, Mexico. White records it as "a rare form from the middle of the San Felipe through the lower portion of the Velasco."

Very similar specimens occur in Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, Trinidad.

Genus STENSIÖINA Brotzen, 1936

Stensiöina excolata (Cushman) Cushman and Dorsey
Plate 66, figure 17

Truncatulina excolata Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 22, pl. 3, figs. 2a, b, 1926.
Gyroidina excolata White, Jour. Paleontology, vol. 2, p. 293, pl. 40, fig. 2, 1928.
Stensiöina excolata (Cushman) Cushman and Dorsey, Cushman Lab. Foram. Research Contr., vol. 16, p. 4, pl. 1, figs. 6a–c, 1940.

Test of medium size, trochoid, planoconvex, dorsal side flattened and almost completely involute, ventral side strongly convex, approaching a hemisphere in side view, peripheral margin acute, keeled, umbilical area smooth; chambers indistinct, uniform in shape, but increasing rapidly in size as added, usually 9 in the last-formed whorl; sutures on the dorsal side distinct, raised, spiral suture very indistinct, showing only in the earliest portion, suture lines marked by irregular, variously twisted, gently curved costae, on the ventral side sutures quite indistinct, slightly depressed, gently curved; wall perforate, smooth on the ventral side, intermediate areas on the dorsal side roughened; aperture an elongate, low, arched opening at the base of the last-formed chamber on the ventral side, closer to the umbilical area than to the periphery. Diameter 0.50 mm., thickness 0.25 mm.

This species differs from *S. exsculpta* in its flattened dorsal surface, indistinct spiral suture and its greater thickness in relation to the diameter.

Both *S. excolata* and the other American species, *S. americana*, are more distinctly involute on the dorsal side than are the European species.

This species occurs in the Mendez shale in a railroad cut near Coco (type locality) and also near Las Palmas, both in Hacienda el Limon, San Luis Potosi, Mexico. White also records it from this general region.

Stensiöina americana Cushman and Dorsey
Plate 65, figure 14

Stensiöina americana Cushman and Dorsey, Cushman Lab. Foram. Research Contr., vol. 16, p. 5, pl. 1, figs. 7a–c, 1940.
Cushman, idem, vol. 20, p. 14, pl. 3, fig. 4, 1944.
Cibicides excolata Cushman (not *Truncatulina excolata* Cushman, 1926), Jour. Paleontology, vol. 5, p. 315, pl. 36, figs. 8a–c, 1931; idem, vol. 6, p. 345, 1932.
Stensiöina excolata Cole, Florida Dept. Cons. Geol. Bull. 16, p. 35, pl. 3, figs. 2, 3, 1938.

Test small, trochoid, dorsal side flattened with central portion slightly concave, ventral side broadly convex with ventral periphery forming an angle less than 90° with the dorsal side, thickness less than one-half the diameter, peripheral margin acutely keeled, ventrally umbonate, but the umbilical area flat to depressed; chambers distinct, uniform in shape, increasing regularly in size as added, usually 8 in the last-formed whorl; sutures on the dorsal side distinct, raised, spiral suture indistinct, irregular and broken, suture lines marked by irregular, broken, gently curved costae, on the ventral side the sutures slightly depressed, gently curved, marked by narrow bands of clear shell material; wall coarsely perforate, ventrally smooth, dorsally with intermediate areas roughened and occasionally bearing irregular costae or nodes; aperture an elongate, low, arched slit, midway between the umbilical area and the periphery. Diameter 0.30 to 0.40 mm., thickness 0.15 mm.

The types are from the upper part of the Taylor marl, along a branch of Kickapoo Creek 1,200 feet south of a public road 1.8 miles northwest of Annona, Red River County, Tex.

This species may be distinguished from *Stensiöina excolata* (Cushman) Cushman and Dorsey by its smaller size, more clearly marked spiral suture, and concave dorsal side.

In the present collections the species ranges from beds of Navarro age through beds of Taylor age. It is characteristic of the upper part of the Taylor marl. Cole records it from the Selma chalk in well samples from Florida.

Navarro age.
- Prairie Bluff chalk. Alabama, Sumter County (101).
- Selma chalk (upper part). Alabama, Marengo County (104).
- Saratoga chalk. Arkansas, Hempstead County (81); Howard County (79).

Taylor age.
- Upper part of Taylor marl. Red River County (105–109); Lamar County (110, 112); Hunt County (115); Collin County (122); Kaufman County (130).
- Pecan Gap chalk member of Taylor marl. Texas, Delta County (165); Hunt County (168); Collin County (169, 171, 172).
- Wolfe City sand member of Taylor marl. Texas, Collin County (181–183); Navarro County (188).
- Annona chalk. Texas, Bowie County (189, 190); Red River County (196).
- Lower part of Taylor marl. Texas, Ellis County (234).

Genus EPONIDES Montfort, 1808

Eponides haidingerii (D'Orbigny) Cushman

Plate 57, figures 13, 14

Rotalina haidingerii D'Orbigny, Foram. Foss. Bass. Tert. Vienne, p. 154, pl. 8, figs. 7–9, 1846.

Eponides haidingerii (D'Orbigny) Cushman, Tennessee Div. Geology Bull. 41, p. 54, pl. 8, figs. 15, 16, 1931.

Test nearly circular in outline, in side view with a fairly high spire, dorsal side very convex, ventral side flattened or sometimes somewhat concave, periphery rounded; chambers in several whorls, 6 or 7 in the adult whorl, distinct, slightly inflated on the ventral side; sutures on the dorsal side slightly limbate, oblique, flush with the surface, on the ventral side slightly depressed, nearly radiate; wall smooth, distinctly perforate; aperture ventral between the umbilicus and the periphery, with a slight lip. Diameter 0.50 mm., height 0.30 mm.

The figured specimens are from the Selma chalk on the New Corinth highway 13½ miles south of Selmer, McNairy County, Tenn. (127). I have failed to find similar specimens elsewhere in American Cretaceous material. The specimens referred to this species from the Upper Cretaceous of Trinidad are not correctly assigned.

Eponides simplex (White) Cushman

Plate 57, figure 15

Gyroidina simplex White, Jour. Paleontology, vol. 2, p. 296, pl. 40, fig. 7, 1928.

Test nearly planoconvex, dorsal side slightly convex, ventral side deeply convex; usually six chambers to the last whorl; sutures radial, flush, indistinct, meeting in a point on the ventral side; chambers much appressed, long and narrow; periphery somewhat sharply rounded; aperture a long slit in the base of the last chamber, near the periphery. Diameter of type specimen, 0.6 mm.; thickness 0.3 mm.

The types of this species are from Upper Cretaceous Mendez shale 900 meters west of the International Petroleum Co. well Cacalilao No. 75, west of Tampico, Mexico. White gives the following statement of range: "This species is abundant in the middle portion of the Mendez and rare from there through the lower portion of the Velasco."

A form from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad, referred to *Gyroidina nitida* (Reuss) Morrow (Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 47, pl. 14, figs. 2a–c, 1932), may belong here and is figured.

Eponides? spinea (Cushman) Cushman

Plate 57, figure 16

Truncatulina spinea Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 22, pl. 2, figs. 10a–c, 1926.

Eponides spinea Cushman, Jour. Paleontology, vol. 1, p. 165, pl. 27, figs. 1a–c, 1927.

Test small, planoconvex, the dorsal side flat or often slightly concave, ventral side very strongly convex; periphery acute, marked by a series of spines, one for each chamber, either simple or with secondary small spinose projections at the base; chambers, about 7 in the adult whorl, indistinct; sutures indistinct except on the ventral side, where they may be slightly depressed; aperture ventral, elongate. Diameter 0.35 mm., thickness 0.18 mm.

The types are from Upper Cretaceous Mendez shale on the Guerrero-Taninul road, San Luis Potosi, Mexico. Though this species has apparently a limited vertical distribution, it occurs at numerous localities and should make a good index fossil for this portion of the Mendez. Specimens usually do not show the details of structure well. So far as can be seen it is probably an *Eponides*.

Genus ROTALIA Lamarck, 1804

Rotalia fimbriatula Cushman and Hedberg

Plate 58, figure 12

Rotalia fimbriatula Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 6, p. 69, pl. 9, figs. 13a–c, 1930.

Test with the ventral side nearly flat, dorsal side convex, periphery subacute, lobed, ventral side with a large central plug; chambers 8 to 10 in the adult whorl, somewhat inflated, distinct on the ventral side, less so on the dorsal; sutures on the dorsal side indistinct, nearly radial, somewhat limbate, on the ventral side, distinct, depressed, radial; wall of dorsal side strongly papillate, with fairly large papillae, ventrally smooth, somewhat less papillate, becoming smooth near the periphery as growth progresses; aperture a low opening at the margin of the last-formed chamber on the ventral side between the periphery and central plug. Diameter 0.30 mm., height 0.15 mm.

The types of this species are from the Upper Cretaceous of the Rio Lebrija about 1½ kilometers west of Chichira, Department of Santander, eastern Colombia. The species is widely distributed in this region and in the Upper Cretaceous of the State of Tachira, Venezuela, but has not been seen in our material from the Gulf Coastal Plain.

Genus EPISTOMINA Terquem, 1883

Epistomina caracolla (Roemer) Franke

Plate 59, figures 1, 2

Gyroidina caracolla Roemer, Verstein. norddeutschen Kreidegebirges, p. 97, pl. 15, fig. 22, 1840–41.

Pulvinulina caracolla Chapman, Royal Micr. Soc. Jour., p. 7, pl. 1, figs. 9a–c, 1898.
Epistomina caracolla Franke, Greifswald Univ., Geol.-palaeont. Inst., Abh., vol. 6, p. 88, pl. 8, figs. 10a–c, 1925.
Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 517, pl. 40, figs. 10(?), 11–13, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 55, pl. 10, figs. 1a–c, 1931.
Loetterle, Nebraska Geol. Survey Bull. 2d ser., Bull. 12, p. 62, pl. 11, figs. 2a–c, 1937.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 98, pl. 23, figs. 19a–c, 1941.
Cushman and Todd, idem, vol. 19, p. 69, pl. 12, fig. 5, 1943.
Discorbis ripleyensis W. Berry (in Berry and Kelly), U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 11, pl. 3, figs. 16–18, 1929.

Test biconvex, periphery acute and slightly keeled, dorsally showing the earlier whorls, ventrally involute; chambers distinct, 6 to 8 in the last-formed whorl, not inflated, of uniform shape, very gradually increasing in size as added; sutures strongly limbate, flush with the surface or raised in worn specimens; dorsally gently curved, ventrally nearly radiate or slightly tangential; wall smooth, the sutures usually lighter than the remainder, and the areas of the chambers often with a pattern of light and dark that is due to thickenings; apertures on the ventral side just below the periphery and also along the ventral margin of the chamber. Diameter 0.40 to 0.65 mm., height 0.25 to 0.35 mm.

This species is very distinctive in appearance when well preserved. It is widely distributed in the upper part of the Cretaceous of Europe and America. It is recorded from California and occurs in the Gulf Coastal Plain. Other records include the Pierre shale of South Dakota and Nebraska and the Colon shale of Colombia.

Navarro age.
Kemp clay. Texas, Navarro County (7); Travis County (13, 14, 17); Guadalupe County (18).
Corsicana marl. Texas, Limestone County (29, 30).
Owl Creek formation. Mississippi, Tippah County (83).
Nacatoch sand. Arkansas, White County (76).
Ripley formation. Tennessee, McNairy County (95, 97).
Selma chalk (upper part). Mississippi, Union County (92). Tennessee, McNairy County (98).
Neylandville marl. Texas, Delta County (51, 52); Hunt County (53–55); Rockwall County (57); Navarro County (68, 69).
Taylor marl.
Upper part. Texas, Rockwall County (124); Navarro County (134); Hays County (150).
Pecan Gap chalk member. Texas, Collin County (170).
Wolfe City sand member. Texas, Navarro County (187).
Lower part. Texas, Collin County (215).

Genus SIPHONINA Reuss, 1850
Siphonina prima Plummer
Plate 59, figures 3–5

Siphonina prima Plummer, Texas Univ. Bull. 2644, p. 148, pl. 12, figs. 4a–c, 1927.
Cushman, U. S. Nat. Mus. Proc., vol. 72, art. 20, p. 2, pl. 2, figs. 4a–c, 1927.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 33, pl. 4, fig. 3, 1936.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 69, pl. 12, fig. 6, 1943.

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 of this species are from the Midway (Paleocene) of Texas. It occurs in the upper beds of Navarro age, in the Ripley formation of Mississippi, part of the Corsicana marl and Kemp clay of Texas, and the Selma chalk of Tennessee, especially that portion which is of the age of the Prairie Bluff chalk of Alabama. It is also recorded from the Navesink marl of New Jersey.

There is considerable variation in this species, as will be seen by the figures on the plate. An attempt was made to separate these different forms, but as they do not seem to hold their characters in large series all have been included under the one name.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Williamson County (12).
Corsicana marl. Texas, Navarro County (25); Falls County (32); Travis County (34, 36, 39–41); Caldwell County (44); Bexar County (46); Limestone County (30).
Arkadelphia marl. Arkansas, Hempstead County (70).
Owl Creek formation. Mississippi, Tippah County (83).
Prairie Bluff chalk. Mississippi, Chickasaw County (84–86). Alabama, Wilcox County (99); Sumter County (101, 102).
Ripley formation. Mississippi, Pontotoc County (90). Tennessee, McNairy County (94).

Family CASSIDULINIDAE
Genus CERATOBULIMINA Toula, 1920
Ceratobulimina cretacea Cushman and Harris
Plate 59, figures 6, 7

Ceratobulimina cretacea Cushman and Harris, Cushman Lab. Foram. Research Contr., vol. 3, p. 173, pl. 29, figs. 1a–c; pl. 30, fig. 11, 1927.
Cushman, Tennessee Div. Geology Bull. 41, p. 56, pl. 10, figs. 2a–c, 1931.
Plummer, Am. Midland Naturalist, vol. 17, p. 460, text fig. 5, 1936.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 70, pl. 12, fig. 7, 1943.

Test small, slightly longer than broad, usually 7 chambers in the last-formed whorl; sutures distinct, somewhat limbate but not raised; wall smooth, polished; aperture extending slightly into the last-formed chamber in a rounded triangular opening, covered in well preserved specimens with a weakly developed thin plate attached above the inner end of the aperture. Length 0.40 to 0.45 mm., breadth 0.30 to 0.35 mm., thickness 0.20 to 0.25 mm.

The types of this species are from the Corsicana marl of the Mexia oil field, Mexia, Tex. The species is fairly common in the Kemp clay of Texas and occurs in the Coon Creek tongue of the Ripley formation of Tennessee and the Ripley formation of Mississippi. Rare specimens that are similar occur in material from Arkansas referred to the Nacatoch sand.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Navarro County (3); Travis County (17); Guadalupe County (20).
Corsicana marl. Texas, Limestone County (29, 30).
Owl Creek formation. Mississippi, Tippah County (83).
Nacatoch sand. Arkansas, White County (76).
Ripley formation. Tennessee, McNairy County (97).
Selma chalk (upper part). Mississippi, Union County (92).
Saratoga chalk. Arkansas, Howard County (79).

Genus PULVINULINELLA Cushman, 1926
Pulvinulinella texana Cushman
Plate 59, figures 8, 9

Pulvinulinella texana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 49, pl. 8, fig. 8, 1938; idem, vol. 20, p. 14, pl. 3, fig. 5, 1944.

Test small, trochoid, biconvex, ventral side slightly more convex than dorsal, periphery with a definite, sharp, thin, flangelike keel, not lobulated; chambers fairly distinct, about 8 in final whorl, increasing rather evenly in size as added; sutures on the ventral side distinct, nearly radiate, very slightly curved, somewhat depressed, on the dorsal side very strongly oblique, curved, very slightly depressed, for the most part rather indistinct; wall smooth, distinctly and rather coarsely perforate; aperture consisting of two distinct portions, one, somewhat oval or quadrangular, in the apertural face, nearly parallel to the periphery, extending as a narrow slit at the base of the last-formed chamber toward the umbilicus. Diameter 0.35 to 0.45 mm., thickness 0.12 to 0.15 mm.

The types are from a locality near the base of the upper part of the Taylor marl, branch of Kickapoo Creek 1,200 feet south of a public road 1.8 miles northwest of Annona, Red River County, Tex.

This species differs from *P. alata* (Marsson) Cushman, in having a larger number of chambers in the adult whorl, more nearly biconvex form, and the aperture more rounded.

Navarro age.
- Neylandville marl. Texas, Navarro County (66).
- Saratoga chalk. Arkansas, Hempstead County (80, 81); Howard County (79).

Taylor age.
- Upper part of Taylor marl. Red River County (106, 107); Lamar County (112); Hunt County (115, 116); Kaufman County (125, 128); Navarro County (132).
- Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Collin County (170, 172).
- Annona chalk. Texas, Red River County (196).
- Lower part of Taylor marl. Texas, Kaufman County (229); Ellis County (234); McLennan County (238); Falls County (244).

Pulvinulinella glabrata Cushman

Plate 59, figure 10

Pulvinulinella glabrata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 66, pl. 11, fig. 4, 1938.
Cushman and Todd, idem, vol. 19, p. 70, pl. 12, fig. 8, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 339, pl. 53, figs. 23, 24, 1944.

Test very small, trochoid, biconvex, ventral side umbilicate, periphery subacute; chambers distinct, about 6 in the adult whorl, of uniform shape, increasing very gradually in size as added, not inflated; sutures on the dorsal side slightly limbate, strongly oblique, very slightly curved, not depressed, on the ventral side nearly radial, slightly depressed; wall smooth and polished; aperture elongate, elliptical, in the axis of coiling, ventrally just below the periphery. Diameter 0.20 to 0.25 mm., height 0.10 mm.

The types are from the Corsicana marl 1/4 mile west of Kimbro and 2 miles south of Manda, Travis County, Tex.

The species occurs in beds of Navarro age and rarely in beds of Taylor age. It differs from *Pulvinulinella texana* Cushman in having no keel, fewer chambers, umbilicate ventral side, and polished surface.

Navarro age.
- Corsicana marl. Texas, Travis County (34, 36, 40–42).
- Arkadelphia marl. Arkansas, Hempstead County (73).
- Ripley formation. Tennessee, McNairy County (94).

Taylor age.
- Upper part of Taylor marl. Texas, Hunt County (115).
- Marlbrook marl. Arkansas, Clark County.

Pulvinulinella navarroana Cushman

Plate 60, figure 1

Pulvinulinella navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 66, pl. 11, fig. 5, 1938.

Test biconvex, trochoid, periphery acute, with a distinct keel; chambers fairly distinct, about 10 in the adult whorl, of rather uniform shape, increasing very gradually in size as added, not inflated; sutures distinctly limbate, strongly oblique on the dorsal side, ventrally nearly radial, somewhat sigmoid, ending in an umbonal clear area at the center; wall distinctly perforate, slightly granular; aperture narrow, elongate, in the plane of coiling, just ventral to the periphery. Diameter 0.50 to 0.55 mm., height 0.20 to 0.22 mm.

The types are from the basal part of the Kemp clay, branch of Mustang Creek 1 mile west-southwest of Noack and 900 feet downstream from road, Williamson County, Tex.

The distribution of this species seems to be confined to beds of Navarro age. It differs from *Pulvinulinella texana* Cushman in the larger number of chambers, more distinctly limbate sutures that tend to become sigmoid on the ventral side and much straighter on the dorsal side.

Navarro age.
- Kemp clay. Texas, Navarro County (7); Williamson County (12).
- Corsicana marl. Texas, Falls County (32).
- Arkadelphia marl. Arkansas, Hempstead County (73).
- Prairie Bluff chalk. Alabama, Sumter County (101).

Pulvinulinella ripleyensis Sandidge

Plate 60, figure 2

Pulvinulinella ripleyensis Sandidge, Am. Midland Naturalist, vol. 13, p. 315, pl. 29, figs. 7–9, 1932.

Test biconvex, conical on ventral side, a small umbilical knob at the apex, slightly rounded on dorsal side, peripheral margin acute, not flanged; chambers numerous, 5 in last whorl; wall smooth; sutures distinct, flush, visible as fine dark lines; on dorsal side spiral suture coils toward proloculum at center of test, transverse sutures crossing whorls at short curved lines bending contrary to the direction of coiling; on ventral side transverse sutures extend from central apex to margin, curving away from the apertural faces of the chambers; aperture a narrow slit on the ventral side at the base of the last-formed chamber, near the periphery, parallel to the plane of coiling. Diameter of the holotype, 0.15 mm.

The types of this species are from beds of Ripley age in a low cut on the Montgomery-Greenville highway just opposite the Sandy Ridge Negro School, about 8½ miles north of Fort Deposit, Lowndes County, Ala. Sandidge records it from the lower part of the Navarro of Texas. The only material available that seems to be identical is from the Prairie Bluff chalk, U. S. Highway 80, 2.4 miles east-southeast of the Southern Railway underpass at Livingston, Sumter County, Ala. (101).

Pulvinulinella? florealis (White) Cushman

Plate 59, figures 11, 12

Gyroidina florealis White, Jour. Paleontology, vol. 2, p. 293, pl. 40, figs. 3a–c, 1928.
Pulvinulinella alata Cushman and Jarvis (not Marsson), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 48, pl. 15, figs. 1, 2, 1932.

Test trochoid, planoconvex, ventral side very strongly convex, dorsal side flattened or even slightly concave except in the center, which is slightly raised; periphery strongly keeled and developing a flat carina, which is often broken; chambers usually 6 to 8 in the adult whorl, distinct, inflated on the ventral side, but little if at all on the dorsal side; sutures distinct, those of the ventral side sigmoidally curved and very slightly depressed, those of the dorsal side strongly oblique, distinctly limbate; wall smooth, but distinctly perforate; aperture ventral, developing a linear opening close to and parallel with the peripheral margin. Diameter 0.80 to 1.00 mm., height 0.50 mm.

The types of this species are from the Upper Cretaceous Velasco shale from a 60-foot sample in the International Petroleum Co. well Cacalilao No. 112, west of Tampico, Mexico. White gives its range as rare from the uppermost beds of the Papagallos to the lower Velasco but becoming common toward the upper portion of that formation. Specimens are figured here from the Upper Cretaceous of a pit at Lizard Springs, near Guayaguayare, Trinidad, which seem to be the same as the specimen from the Velasco shale of Mexico. The generic position of this species is somewhat in doubt as the apertural characters are difficult to determine.

Pulvinulinella cf. P. alata (Marsson) Cushman

A few specimens have already been recorded as this species from the Saratoga chalk (Cushman, Jour. Paleontology, vol. 5, p. 311, pl. 36, figs. 5a–c, 1931) and from the Pecan Gap chalk (idem, vol. 6, p. 342, 1932). These have been compared with topotypes of Marsson's species from the Senonian of the Island of Rügen, Germany, and, though much like them, are not in sufficient numbers to make the identity of the American forms certain.

Navarro age. Saratoga chalk. Arkansas, Howard County (79).
Taylor marl, Pecan Gap chalk member. Texas, Delta County (167).

Pulvinulinella velascoensis (Cushman) Cushman and Jarvis
Plate 60, figure 3

Truncatulina velascoensis Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 1, p. 20, pl. 3, fig. 2, 1925; Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 606, pl. 21, fig. 8, 1926.
Pulvinulinella velascoensis Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 48, pl. 14, figs. 6a–c, 1932.
Rotalia velascoensis White, Jour. Paleontology, vol. 2, p. 290, pl. 39, figs. 5a–c, 1928.

Test nearly bilaterally symmetrical, with a very thin, broad keel; chambers all visible from the dorsal side, only those in the last-formed whorl from the ventral side, about 10 chambers in the last-formed whorl, fewer in the earlier whorls; chambers distinct, especially from the ventral side; sutures on the dorsal side raised and confluent, on the ventral side slightly depressed, curved; wall smooth on the ventral side, the dorsal side with an excavated area over each chamber; aperture elongate, narrow, on the ventral side of the last-formed chamber nearly in the axis of coiling. Diameter up to 1.20 mm., height 0.40 mm.

The types are from the Upper Cretaceous Velasco shale 5 km. southwest of La Bolsa, on the west side Moctezuma River, Hacienda Santa Ines, San Luis Potosi, Mexico. This is a common and rather striking species in the Velasco shale of Mexico. It is also found in typical form in the Upper Cretaceous material from a pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

Genus CASSIDULINA D'Orbigny, 1826
Cassidulina cretacea Cushman
Plate 60, figure 4

Cassidulina cretacea Cushman, Tennessee Div. Geology Bull. 41, p. 56, pl. 10, figs. 3a–c, 1931.

Test small, compressed, periphery rounded, becoming subacute; chambers distinct, broadly rhomboid, 4 pairs making up the last-formed whorl; sutures distinct, very slightly if at all depressed; wall smooth; aperture elongate, narrow, at the middle of the inner margin of the chamber. Diameter 0.25 mm., thickness 0.12 mm.

The types of this species are from the Coon Creek tongue of the Ripley formation, Dave Week's place on Coon Creek, McNairy County, Tenn. (97).

This is a very small and an apparently primitive species of the genus. It has been found only in the material from Coon Creek.

Family CHILOSTOMELLIDAE
Genus ALLOMORPHINA Reuss, 1850
Allomorphina minuta Cushman
Plate 60, figure 6

Allomorphina minuta Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 72, pl. 13, figs. 3a–c, 1936; idem, vol. 20, p. 14, pl. 3, fig. 7, 1944.

Test small, trochoid, with a depressed spire, ventral side flattened or slightly convex, dorsal side slightly convex, periphery rounded; chambers triserially arranged, enlarging rapidly as added, slightly inflated; sutures rather indistinct, except in the last whorl, very slightly depressed; wall smooth, distinctly perforate; aperture on the ventral side with a distinct, arched, overhanging lip. Length 0.15 mm., breadth 0.12 mm., height 0.08 mm.

The types of this species are from the Gober tongue of the Austin chalk in an east-facing slope on the public road east of the junction with U. S. Highway 69 1 mile east of Trenton, Fannin County, Tex. It is a very small species and easily overlooked.

Taylor marl. Pecan Gap chalk member. Texas, Delta County (166).
Austin chalk.
Gober tongue. Texas, Fannin County (278).
Austin chalk. Texas, Dallas County (306).

Allomorphina trochoides (Reuss) Cushman and Jarvis
Plate 60, figure 7

Globigerina trochoides Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 36, pl. 12, fig. 22, 1845; Haidinger's Naturw. Abh., vol. 4, pt. 1, p. 37, pl. 3, fig. 5, 1851.
Valvulina trochoides Franke, Preuss. geol. Landesanstalt Abh., new ser., vol. 111, p. 162, pl. 15, figs. 2a–c, 1928.
Allomorphina trochoides Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 49, pl. 15, figs. 3a–c, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 71, 1936.

Test triserial, consisting of a conical early portion and an inflated later portion made up of the last 3 chambers in the adult; chambers of the early portion rather indistinct, last 3 greatly inflated and subglobular; sutures of the last portion distinct and depressed, early sutures obscure; wall smooth; aperture an elongate slit at the base of the last-formed chamber. Length 0.35 mm., diameter 0.30–0.35 mm.

This species was described by Reuss from the Upper Cretaceous of central Europe. A form assigned to this species occurs in the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. A somewhat similar form occurs in the Velasco shale of the Tampico Embayment region of Mexico. It is possible that the form from Trinidad may be related to *A. velascoensis* Cushman.

Allomorphina navarroana Cushman
Plate 60, figure 5

Allomorphina navarroana Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 73, pl. 13, figs. 1a–c, 1936.
Cushman and Todd, idem, vol. 19, p. 70, pl. 12, fig. 9, 1943.

Test of rather small size, trochoid, slightly longer than broad, height and breadth about equal, spire low but test not much compressed, periphery generally rounded; chambers distinct, very slightly inflated in early portion, last 2 of the final whorl making up a very large proportion of the test, triserially arranged in the young, almost biserial in the adult; sutures distinct, very slightly depressed; wall smooth, finely perforate; aperture ventral, elongate, low, with a distinct, overhanging lip. Length 0.30–0.35 mm., breadth 0.25 mm., thickness 0.25 mm.

The types are from the Corsicana marl in the Corsicana marl pit near Corsicana, Navarro County, Tex.

This species differs from *A. velascoensis* Cushman in the lower, less pointed spire, and less inflated chambers, with the last two making up a very large part of the test. The species tends toward *Chilostomella*. It is characteristic of the Corsicana marl and occurs also in the Kemp clay.

Navarro age.
Kemp clay. Texas, Williamson County (12).
Corsicana marl. Texas, Navarro County (25, 27); Travis County (39).

Allomorphina velascoensis Cushman
Plate 60, figure 8

Allomorphina velascoensis Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 604, pl. 20, figs. 20a–c, 1926; Cushman Lab. Foram. Research Contr., vol. 12, p. 72, pl. 13, figs. 2a–c, 1936.
Cushman and Hedberg, idem, vol. 17, p. 98, pl 23. fig. 15, 1941.

Test small, in dorsal view subtriangular, in side view broadly oval, consisting of a few chambers, 3 making up each coil, the chambers rapidly increasing in size as added, inflated; sutures distinct but only slightly depressed; aperture on the ventral side near the central point, with a distinct overhanging lip. Length 0.30 mm., breadth 0.30 mm., thickness 0.22 mm.

The only records for this species are from the Upper Cretaceous Velasco shale of the Tampico Embayment region of Mexico and the Colon shale of Colombia.

Genus CHILOSTOMELLA Reuss, 1850
Chilostomella cf. C. ovoidea Reuss
Plate 66, figure 14

Chilostomella cf. *ovoidea* Reuss, Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 98, pl. 23, fig. 16, 1941.

Specimens somewhat questionably referred to this species are rare in the Colon shale of Colombia.

Genus PULLENIA Parker and Jones, 1862
Pullenia americana Cushman
Plate 60, figures 13, 14

Pullenia americana Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 76, pl. 13, figs. 4, 5, 1936.
Pullenia quinqueloba Cushman and Church (not Reuss), California Acad. Sci. Proc., 4th ser., vol. 18, p. 517, pl. 41, figs. 10, 11, 1929.
Cushman, Tennessee Div. Geology Bull. 41, p. 57, pl. 10, figs. 4a, b, 1931; Jour. Paleontology, vol. 5, p. 313, pl. 36, figs. 3a, b, 1931; idem, vol. 6, p. 342, 1932.
Sandidge, Am. Midland Naturalist, vol. 13, p. 365, pl. 33, figs. 1, 2, 1932.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 7, pl. 1, fig. 16, 1943.
Cushman, idem, vol. 20, p. 14, pl. 3, fig. 6, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 339, pl. 53, fig. 25, 1944.

Test planispiral in the adult, completely involute, much compressed, slightly umbilicate, periphery rounded; chambers distinct, somewhat inflated, 5 to 6 in the adult coil, increasing very gradually in size as added; sutures distinct, somewhat depressed, slightly curved; wall smooth, finely perforate; aperture elongate, at the base of the apertural face, low at the sides, considerably higher in the middle. Height 0.35 to 0.45 mm., breadth 0.30 to 0.40 mm., thickness 0.20 to 0.25 mm.

The types are from the Taylor marl along a public road 5 miles southeast of Taylor, Tex., and 1 mile southeast of a bridge over the Mustang Creek from the crest of the north-facing slope of the creek valley.

It differs from *P. coryelli* White in the much greater compression of the test, higher apertural face, and wider aperture in the central portion.

The species is characteristic of the upper beds of Taylor age but is found also in the lower beds of Navarro age.

Navarro age.
Corsicana marl. Texas, Bexar County (46).
Prairie Bluff chalk. Alabama, Wilcox County (99); Sumter County (101, 102).
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Selma chalk (upper part). Alabama, Marengo County (104).
Neylandville marl. Texas, Kaufman County (60); Navarro County (63, 64).
Saratoga chalk. Arkansas, Hempstead County (81).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (106, 107); Hunt County (115, 116); Collin County (121); Rockwall County (124); Williamson County (142); Bexar County (162).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (257, 259); Lee County (265, 267).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181, 183); Navarro County (188).
Annona chalk. Texas, Red River County (196–198).

Pullenia cretacea Cushman
Plate 60, figure 9

Pullenia cretacea Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 75, pl. 13, figs. 8a, b, 1936.
Cushman and Hedberg, idem, vol. 17, p. 98, pl. 23, figs. 17a, b, 1941.
Cushman and Todd, idem, vol. 19, p. 7, pl. 1, figs. 14a, b, 1943.
Pullenia quaternaria Cushman (not Reuss), Tennessee Div. Geology Bull. 41, p. 57, pl. 10, figs. 5a, b, 1931; Jour. Paleontology, vol. 5, p. 313, pl. 36. figs. 4a, b, 1931; idem, vol. 6, p. 343, 1932.
Sandidge, idem, vol. 6, p. 284, pl. 44, figs. 16, 17, 1932.
Pullenia coryelli Loetterle (not White), Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 63, pl. 11, figs. 3a, b, 1937.

Test subglobular, planispiral in the adult, completely involute, often somewhat compressed, very slightly umbilicate, periphery broadly rounded; chambers distinct, slightly if at all inflated, about 5 in the adult coil, increasing gradually in size as added; sutures distinct, depressed very slightly if at all, radial, or slightly curved; wall smooth, distinctly perforate; aperture elongate, narrow, at the base of the apertural face, extending from one umbilicus to the other, with a slightly overhanging lip. Diameter 0.30 to 0.35 mm., thickness 0.20 to 0.28 mm.

The types are from the Selma chalk 1½ miles west of Sardis on the Sardis-Henderson road, Henderson County, Tenn.

The species has a range similar to that of *P. americana* Cushman, occurring in the lower beds of Navarro age and upper beds of Taylor age. Loetterle apparently had the species from the Pierre shales of South Dakota and

Nebraska, and it is recorded from the Colon shale of Colombia.

P. cretacea may be distinguished from *P. americana* by its much broader form in front view and broadly rounded periphery.

Navarro age.
- Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
- Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Tennessee, McNairy County (98). Alabama, Marengo County (104).
- Neylandville marl. Texas, Red River County (50); Hunt County (53, 54); Kaufman County (58, 60–62); Navarro County (63, 66–68).
- Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80, 81).

Taylor age.
- Upper part of Taylor marl. Texas, Red River County (105–108); Lamar County (110, 111); Hunt County (115); Collin County (120, 122); Kaufman County (125, 128, 129, 131); Navarro County (132, 134); Bexar County (152).
- Anacacho limestone (upper part). Bexar County (164).
- Ozan formation. Arkansas, Little River County (254).
- Selma chalk (middle part). Mississippi, Prentiss County (260, 261); Lee County (264, 266).
- Wolfe City sand member of Taylor marl. Texas, Navarro County (188).
- Lower part of Taylor marl. Texas, Delta County (206).

Pullenia minuta Cushman
Plate 60, figure 12

Pullenia minuta Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 77, pl. 13, figs. 7a, b, 1936.
Cushman and Todd, idem, vol. 19, p. 8, pl. 1, fig. 17, 1943; idem, vol. 19, p. 70, pl. 12, fig. 10, 1943.

Test minute, planispiral in adult, completely involute, very slightly umbilicate, compressed, periphery broadly rounded, tending to become slightly angled in the last portion; chambers distinct, somewhat inflated, about 5 in the adult coil, increasing regularly in size as added, uniform in shape; sutures distinct, somewhat depressed, distinctly curved, often sigmoid; wall smooth, finely perforate; aperture low, of even height, extending from one umbilicus to the other. Length 0.18–0.20 mm., breadth 0.15 mm., thickness 0.10 mm.

The types of the species are from the Corsicana marl in the clay pit of the Corsicana Brick Co. near Corsicana, Tex.

It is characteristic of the upper beds of Navarro age.

Navarro age.
- Kemp clay. Texas, Navarro County (7); Williamson County (12).
- Corsicana marl. Texas, Hunt County (24); Navarro County (26, 27); Falls County (32); Travis County (40); Bexar County (46); Limestone County (30).
- Prairie Bluff chalk. Mississippi, Chickasaw County (85).

Pullenia coryelli White
Plate 60, figures 10, 11

Pullenia coryelli White, Jour. Paleontology, vol. 3, p. 56, pl. 5, fig. 22, 1929.
Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 50, pl. 15, figs. 5a, b, 1932.
Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 74, 1936.
Cushman and Todd, idem, vol. 19, p. 6, pl. 1, figs. 18a, b, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 339, pl. 53, fig. 26, 1944.
Pullenia sphaeroides Cushman (not D'Orbigny), Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 605, pl. 21, figs. 2a, b, 1926.

Test subspherical, periphery very broadly rounded, slightly umbilicate; chambers distinct, but not inflated, increasing slowly in size as added, 6 or 7 in the final coil; sutures distinct, very slightly if at all depressed; wall smooth, finely perforate; aperture an elongate, curved opening, at the base of the apertural face from the umbilical region on one side to that on the other, with a slightly overhanging lip. Diameter up to 0.50 mm.

This species was originally described from the Upper Cretaceous Velasco shale of the Tampico Embayment region of Mexico. It occurs also in the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

It is somewhat larger than *P. cretacea* Cushman and has more chambers in the adult coil.

Navarro age. Saratoga chalk. Arkansas, Howard County (79).
Taylor age. Marlbrook marl. Arkansas, Howard County.

Pullenia jarvisi Cushman
Plate 60, figure 15

Pullenia jarvisi Cushman, Cushman Lab. Foram. Research Contr., vol. 12, p. 77, pl. 13, figs. 6a, b, 1936.
Cushman and Todd, idem, vol. 19, p. 9, pl. 1, figs. 15a, b, 1943.
Pullenia quinqueloba Cushman and Jarvis (not Reuss), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 49, pl. 15, figs. 4a, b, 1932.

Test planispiral in the adult, completely involute, periphery in side view lobulate, in front view broadly rounded, somewhat depressed, umbilici deep; chambers distinct, somewhat inflated, about 5 in the adult coil, of uniform shape, increasing rather rapidly in size as added; sutures distinct, depressed, somewhat sigmoid; wall smooth, finely perforate; aperture low, extending from one umbilicus to the other, higher in the median line, apertural face strongly convex. Length 0.60 mm., breadth 0.55 mm., thickness 0.30 mm.

The types are from the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. The species occurs also in the Upper Cretaceous Velasco shale of the Tampico Embayment region of Mexico.

It may be distinguished from *P. coryelli* White by the more compressed test, fewer chambers, higher apertural face and more lobulate periphery.

Family GLOBIGERINIDAE
Genus HASTIGERINELLA Cushman, 1927
Hastigerinella moremani Cushman
Plate 61, figures 1–3

Hastigerinella moremani Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 86, pl. 11, figs. 1–3, 1931.

Test somewhat trochoid, but the spire very much depressed so that the chambers are for the most part in a single plane in the adult whorl; chambers in the early portion globular, later becoming more elongate, clavate, and slightly expanded toward the tip, usually 5 chambers in each whorl; sutures distinct, slightly depressed; wall finely spinose throughout, slightly more so toward the tip of the elongate chambers; aperture mostly ventral, with a slightly overhanging lip. Diameter 0.18 to 0.25 mm., thickness 0.05 to 0.08 mm.

The types are from the Eagle Ford shale 1 mile north of Lovelace, Hill County, Tex. (369).

This species represents a primitive form of the genus, and unless specimens are found in the Lower Cretaceous it indicates the beginnings of this genus. The early stages of the species are trochoid and closely allied to Globigerinas of the same formation. The later chambers are gradually more and more elongate. In a superficial way they resemble *Globigerina subdigitata* Carman, from the Niobrara chalk of Wyoming, and also *G. digitata* H. B. Brady, from the present ocean. The chambers are distinctly clavate, somewhat similar to those of *Hastigerinella watersi* Cushman, from the Austin chalk, but are very different in their shape in the adult chambers, as a comparison of the two forms will show.

Hastigerinella alexanderi Cushman
Plate 61, figures 4–7

Hastigerinella alexanderi Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 87, pl. 11, figs. 6–9, 1931.

Test nearly planispiral, the early chambers largely concealed from both sides; chambers greatly expanded in the adult coil, consisting typically of 6 chambers, but occasionally of only 5, the earliest subglobular, but quickly expanding and greatly elongating, tapering rather uniformly to a pointed outer end; sutures distinct, slightly depressed; wall nearly smooth, or finely hispid; aperture nearly at the peripheral margin at the base of the chambers, with a very slight lip. Diameter 0.60 to 0.75 mm., thickness 0.10 to 0.12 mm.

The types are from yellowish calcareous clay of Austin chalk age in the eastern slope of a deep road cut between two railroad underpasses near the north edge of the town of Howe, Grayson County, Tex.

This species represents the highest development of the genus so far known in the Upper Cretacous. The very elongate chambers give a stellate appearance to the test, and the shape of the individual chambers is very distinct from that of any of the other known species.

Austin age.
Bonham marl. Texas, Grayson County (328).
Lower part of Austin chalk. Texas, Grayson County (335).

Hastigerinella watersi Cushman
Plate 61, figures 8, 9

Hastigerinella watersi Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 86, pl. 11, figs. 4, 5, 1931.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 46, pl. 7, figs. 6a, b, 1937.

Test slightly trochoid, the spire very much depressed so that all the chambers appear to be nearly in one plane; earliest chambers subglobular and very small compared to the later chambers, the spire that they form being in a depressed area of the dorsal side, later chambers gradually increasing in size, and in the adult whorl becoming more and more elongate, the final chambers being about 5 times as long as broad, the base widest, thence gradually and slightly tapering toward the outer end, which is again expanded to form a slightly bulbous tip; sutures distinct, depressed; wall finely spinose throughout, the outer end of each chamber slightly coarser, and possibly forming the base of elongate spines; aperture on the ventral side, and extending toward the periphery, with a slight overhanging lip. Diameter 0.80 mm., thickness 0.10 mm.

The types are from yellowish calcareous clay of Austin chalk age in the eastern slope of a deep road cut between two railroad underpasses near the north edge of the town of Howe, Grayson County, Tex.

This species represents a decided advance over its predecessors. The spire is depressed so that the species represents a development apparently from *Globigerinella*. In the early stages, in the last-formed whorl, the chambers somewhat resemble those of *Hastigerinella moremani* Cushman, but in the adult, the peculiar elongate, tapering chambers with a distinct bulbous tip are markedly different and distinctive. From the coarseness of the spines at the tips of the adult chambers it is to be expected that there were developed when the form was living, very elongate spines similar to those developed in the Recent species of the genus.

Austin chalk.
Bonham marl. Texas, Grayson County (328).
Lower part of Austin chalk. Texas, Grayson County (335).

Hastigerinella simplex Morrow
Plate 61, figure 10

Hastigerinella simplex Morrow, Jour. Paleontology, vol. 8, p. 198, pl. 30, figs. 6a, b, 1934.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 46, pl. 7, figs. 5a, b, 1937.

Test moderately trochoid; chambers in the early portion globular, the penultimate chamber becoming slightly elongate and the final chamber strongly elongate and evenly rounded at the end; chambers about 4 in the final whorl; sutures distinct, moderately depressed; wall finely spinose; aperture indistinct. Diameter 0.50 mm., thickness about 0.2 mm.

As originally noted by Morrow, this species is very close to *Globigerina*, and the earlier portion would certainly be placed under that genus. The types are from the Upper Cretaceous Greenhorn formation, Hartland shale member, sec. 31, T. 21 S., R. 22 W., Hodgeman County, Kans. Loetterle records it from the Niobrara chalk of Nebraska and South Dakota. It occurs in the present material from the Austin chalk.

Family HANTKENINIDAE
Genus SCHACKOINA Thalmann, 1932
Schackoina multispinata (Cushman and Wickenden) Cushman
Plate 61, figures 11, 12

Hantkenina multispinata Cushman and Wickenden, Cushman Lab. Foram. Research Contr., vol. 6, p. 40, pl. 6, figs. 4–6, 1930.
Cushman, idem, vol. 7, p. 88, pl. 11, figs. 10, 11, 1931.
Howe and Wallace, Jour. Paleontology, vol. 8, p. 36, pl. 5, fig. 16, 1934.
Schackoina multispinata Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 35, figs. 9, 10, 1933.

Test planispiral in general, the adult chambers slightly out of alinement; earlier chambers globular but very early developing a distal tubular extension, in general in a radial position; later chambers polyhedral and with as many as 5 tubular processes, 3 chambers making up each coil; sutures fairly distinct, slightly depressed; wall smooth, calcareous, thick, finely perforate; aperture a low, arched opening at the base of the chamber, in the earlier stages in the median line but in the adult extending outward to the umbilical area, at least on one side, with a thin lip over the opening. Length of adult about 0.24 mm., thickness at umbilicus 0.09 mm., at periphery of last chamber 0.18 mm.

The types of this species are from the Upper Cretaceous, NE¼ sec. 11, T. 6 N., R. 8 W. of 1st principal meridian, on the north bank of the Boyne River, southern Manitoba. It also occurs in a band of calcareous shale on the south bank of the Vermillion River half a mile above the crossing of a trail into Riding Mountain Forest Reserve. Specimens apparently identical occur at the following localities:

Taylor marl, Pecan Gap chalk member. Texas, Rockwall County (176).
Austin chalk, lower part. Texas, Grayson County (335).

Schackoina trituberculata (Morrow) Loetterle
Plate 61, figures 13–16

Hantkenina trituberculata Morrow, Jour. Paleontology, vol. 8, p. 195, pl. 29, figs. 24, 26–28, 1934.
Schackoina trituberculata Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 47, pl. 7, figs. 7a, b, 1937.

Test small, almost planispiral; chambers globular in all stages, usually nearly spherical, in last whorl possessing from 1 to 3 long, distal, tubular extensions sometimes more than twice the length of the diameter of the globose part of the chamber. If only one tube occurs it lies in the median plane, if two they lie on either side of this plane, and if three occur one is median and the others paired beside it. The tubes join the bulbous chamber quite abruptly with very little flaring. There are usually three chambers in the last whorl though occasionally four. Length of longest specimen 0.75 mm.; diameter of last chamber 0.16 mm.

The types are from the Upper Cretaceous Hartland shale member of the Greenhorn formation, sec. 31, T. 21 S., R. 22 W., Hodgeman County, Kans. Morrow also records it from the Smoky Hill member of the Niobrara formation of Kansas. Loetterle records it from the Niobrara formation of Nebraska and South Dakota; also from the Smoky Hill member.

Family GLOBOROTALIIDAE
Genus GLOBOTRUNCANA Cushman, 1927
Globotruncana canaliculata (Reuss) Cushman
Plate 61, figures 17, 18

Rosalina canaliculata Reuss, Akad. Wiss. Wien, Math.-naturwiss. Kl., Denkschr., vol. 7, pt. 1, p. 70, pl. 26, fig. 4, 1854.

Globigerina canaliculata Egger, K. bayer. Akad. Wiss., Math.-naturh, Abt., Abh., Kl. 2, vol. 21, pt. 1, p. 172, pl. 21, figs. 15–17, 24–26, 1899.

Globotruncana canaliculata Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 116, pl. 23, figs. 11a–c, 1927.
White, Jour. Paleontology, vol. 2, p. 282, pl. 38, fig. 3, 1928.
Cushman, idem, vol. 6, p. 343, pl. 51, figs. 14a–c, 1932.
Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, p. 65, pl. 15, figs. 23–27, 1942.
Cushman, idem, vol. 20, p. 14, pl. 3, fig. 8, 1944.
Cushman and Goudkoff, idem, vol. 20, p. 62, pl. 10, fig. 10, 1944.

Test with the dorsal and ventral sides generally parallel, or even slightly concave, with raised edges; chambers few, usually 5 to 7 in the adult whorl, increasing rather rapidly but regularly in size as added, not inflated, dorsal wall of each flat or slightly concave, ventral side flat or slightly convex; sutures very distinct, tangential on the dorsal side and raised on the ventral side, nearly radial; wall smooth in the middle of the chambers but the sutures and periphery with raised beads or short, blunt spines; aperture along the ventral margin of the last-formed chamber. Diameter 0.25 to 0.45 mm., thickness 0.05 to 0.12 mm.

The types of this species are from the Senonian of Europe. A typical specimen from Bavaria is figured here for comparison. In the American Cretaceous it is widely distributed and has a fairly long range, as have many of these pelagic species. There is considerable variation in specimens, even from the same sample, but in general those forms with nearly parallel faces and truncate or grooved periphery have been included here.

Navarro age.
Corsicana marl. Texas, Travis County (43).
Neylandville marl. Texas, Hunt County (55); Rockwall County (57); Kaufman County (62); Navarro County (66, 67).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (106, 108, 109); Lamar County (110–112); Hunt County (116); Collin County (119–122); Rockwall County (124); Kaufman County (129, 131); Navarro County (132); Williamson County (140, 141, 143); Travis County (145); Bexar County (158, 161).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Collin County (169–172); McLennan County (177).
Wolfe City sand member of Taylor marl. Texas, Collin County (181–183); Hunt County (184); Navarro County (188).
Annona chalk. Texas, Bowie County (189); Red River County (188a, 191, 192, 194, 196).
Lower part of Taylor marl. Texas, Lamar County (202); Fannin County (203, 204); Collin County (207, 213, 215); Dallas County (220, 227); Kaufman County (228); McLennan County (242, 243); Travis County (247, 248).

Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (276).
Austin chalk. Texas, Grayson County (290, 333); Dallas County (302, 304, 325, 342, 345); Hill County (312).
Selma chalk of upper Austin age (?). Alabama, Warrior River (353).
Bonham marl. Texas, Lamar County (327, 330).
Brownstown marl. Arkansas, Sevier County.

Globotruncana fornicata Plummer
Plate 61, figure 19

Globotruncana fornicata Plummer, Texas Univ. Bull. 3101, p. 198, pl. 13, figs. 4–6, 1931.
Sandidge, Jour. Paleontology, vol. 6, p. 285, pl. 44, figs. 12, 13, 1932.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 37, pl. 4, fig. 13, 1936.
Cushman and Hedberg, Cushman Lab. Foram. Research Contr., vol. 17, p. 99, pl. 23, figs. 18a–c, 1941.
Cushman and Todd, idem, vol. 19, p. 71, 1943.
Cushman, idem, vol. 20, p. 15, pl. 3, fig. 11, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 340, pl. 53, fig. 28, 1944.

Globotruncana convexa Sandidge, Jour. Paleontology, vol. 6, p. 285, pl. 44, figs. 9–11, 1932.

Test biconvex, periphery truncate and lobate, chambers 7 in final convolution, long narrow, strongly curved, smooth; dorsal sutures finely beaded, very strongly oblique and slightly curved; ventral sutures elevated and curved strongly forward in maturity, depressed and more nearly radial in youth; umbilicus broad and open; apertures from last 3 or 4 chambers of the final whorl into the umbilicus. Average diameter 0.4 mm.; commonly up to 0.5 mm.

Though there is considerable variation in this species, as in others of the genus, it is one of the best characterized. In the present material it ranges from the lower beds of Taylor age to the level of the Neylandville marl. It is most abundant in the upper beds of Taylor age.

It is probable that Sandidge's species belongs here.

Navarro age.
Corsicana marl. Texas, Limestone County (30).
Neylandville marl. Texas, Delta County (52); Hunt County (55); Rockwall County (57); Kaufman County (60–62); Navarro County (63, 66, 68, 69).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 109); Lamar County (111); Delta County (114); Hunt County (115); Collin County (119, 120); Kaufman County (125, 130); Navarro County (132); Milam County (139); Williamson County (140–142, 144); Travis County (145, 149); Hays County (150); Guadalupe County (151); Bexar County (152, 155, 156, 158, 159, 161, 162).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Collin County (169, 171).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (258); Prentiss County (261); Lee County (264).
Wolfe City sand member of Taylor marl. Texas, Collin County (182, 183); Hunt County (184); Navarro County (187, 188).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Annona chalk. Texas, Red River County (191, 198).
Lower part of Taylor marl. Texas, Lamar County (201); Fannin County (203, 204); Delta County (206); Collin County (207, 208, 211–215); Dallas County (220); Kaufman County (228); Ellis County (232, 235); Hill County (237); McLennan County (238, 242, 243); Bell County (245); Travis County (247, 248).

Globotruncana marginata (Reuss) Thalmann
Plate 62, figures 1, 2

Rosalina marginata Reuss, Verstein. böhm. Kreideformation, pt. 1, p. 36, pl. 8, figs. 54, 74; pl. 13, fig. 68, 1845.
Globotruncana marginata Thalmann, Eclogae geol. Helvetiae, vol. 27, p. 414, 1934.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 15, pl. 3, fig. 9, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 340, pl. 53, fig. 29, 1944.

This species has been referred to *Globigerina* by many authors, but the figures are not usually very definite and have not been referred to here. The species was described by Reuss from the "Plänermergel," Turonian, of Bohemia. The specimens in the Reuss collections in Dresden, Vienna, and Cambridge have been studied, and they are all in agreement. One of the specimens from the last collection is figured here. The Reuss collections all show specimens evidently derived from a globigerinid ancestry, but the later chambers especially are compressed, have definite dorsal and ventral keels, and the periphery becomes truncated. The chambers have a characteristic overlapping appearance, and are not added in a plane but each in a slightly oblique position. There is considerable variation, as in other species of the genus, but our American forms are apparently identical with those named by Reuss. His figures are too minute to be of much value.

Specimens referred here are most abundant in the beds of Austin age and lower beds of Taylor age. Occasional specimens occur somewhat higher in the section, but there is always a possibility that they may represent reworked material.

Navarro age. Neylandville marl. Texas, Kaufman County (61); Navarro County (66, 68, 69).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105); Hunt County (117); Collin County (120); Kaufman County (125); Navarro County (134); Milam County (139); Williamson County (144); Travis County (149).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Ozan formation. Arkansas, Little River County (254).
Selma chalk (middle part). Mississippi, Lee County (268).
Annona chalk. Texas, Red River County (197, 198).
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (200–202); Fannin County (203); Collin County (207–214); Dallas County (219, 221–225, 227); Kaufman County (229); Ellis County (232, 234, 235); Navarro County (236); Hill County (237); McLennan County (238–240, 242, 243); Falls County (244); Bell County (245); Travis County 248, 250).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (320, 321).
Gober tongue of Austin chalk. Texas, Fannin County (272–277); Lamar County (283–285).
Austin chalk. Texas, Grayson County (289, 290, 333, 335, 336); Collin County (293–295, 324); Dallas County (296–299, 302, 303, 305–308, 310, 326, 338, 342, 345); Hill County (313, 314).
Selma chalk of upper Austin age (?). Alabama, Pickens County (352); Warrior River (353).
Selma chalk (lower part). Mississippi, Itawamba County (351).
Brownstown marl. Texas, Red River County (319); Lamar County (320, 321).
Bonham marl. Texas, Lamar County (327, 329–331); Grayson County (328).
Ector tongue of Austin chalk. Texas, Grayson County (332).
Eagle Ford shale. Texas, Dallas County (361).

Globotruncana ventricosa White
Plate 62, figure 3

Globotruncana canaliculata (Reuss) Cushman var. *ventricosa* White, Jour. Paleontology, vol. 2, p. 284, pl. 38, fig. 5, 1928.
Globotruncana ventricosa Brotzen, Sveriges geol. Undersökning, ser. C, No. 396, p. 171, pl. 13, figs. 4a–c, text fig. 63, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20. p. 96, 1944.

Specimens with a rather flat dorsal side and very convex ventral side are found in the present material, principally in that from the Austin chalk. These may be referred to White's form, which seems to be specifically different from *G. canaliculata* (Reuss) Cushman and has a lower range. A copy of White's figure is given. His types are from Mexico, where the species is recorded as most abundant in the Papagallos formation.

Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (272, 274, 276).
Austin chalk. Texas, Grayson County (289–291, 335); Collin County (292, 293, 295, 324); Dallas County (296, 300, 301, 303, 304, 307, 311, 326, 344); Hill County (313, 314).
Selma chalk of upper Austin age. Alabama, Warrior River (353).
Bonham marl. Grayson County (328).
Selma chalk (lower part). Mississippi, Itawamba County (351).

Globotruncana arca (Cushman) Cushman
Plate 62, figures 4, 5

Pulvinulina arca Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 23, pl. 3, figs. 1a–c, 1926.
Globotruncana arca Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 91, pl. 19, fig. 11, 1927; Jour. Paleontology, vol. 1, p. 169, pl. 28, figs. 28a–c, 1927.
Cushman and Church, California Acad. Sci. Proc., 4th ser., vol. 18, p. 518, pl. 41, figs. 1–3, 1929.
Cushman, Jour. Paleontology, vol. 6, p. 343, pl. 51, figs. 13a–c, 1932.
Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 37, pl. 4, figs. 14a, b, 1936.
Cole, Florida Dept. Cons. Geol. Bull. 16, p. 36, pl. 4, figs. 11, 12, 1938.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 71, pl. 12, fig. 11, 1943.
Cushman, idem, vol. 20, p. 15, pl. 3, fig. 10, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 340, pl. 53, fig. 30, 1944.
Globigerina rosetta Carsey, Texas Univ. Bull. 2612, p. 44, pl. 5, figs. 3a–c, 1926.

This species seems to be much more limited in its range than the many records would indicate. The species is biconvex, the dorsal side with a low but rather regular spire, the ventral side convex but with a large umbilical depression. The periphery is somewhat variable even in a single specimen and may have a single keel or have a tendency to a somewhat obliquely truncate border. The chambers are usually 6 or 7 in the final whorl, of rather regular form, the borders somewhat raised and somewhat beaded.

The types are from the Upper Cretaceous Mendez shale near Huiches, Hacienda el Limon, San Luis Potosi, Mexico. It is fairly common in the Mexican material, particularly that from the Mendez. In Texas the species is almost entirely restricted to the Taylor marl with occasional occurrences in the Neylandville and Corsicana marls of the Navarro group.

Globotruncana arca (Cushman) Cushman var. contusa (Cushman) Cushman
Plate 62, figure 6

Pulvinulina arca Cushman var. *contusa* Cushman, Cushman Lab. Foram. Research Contr., vol. 2, pt. 1, p. 23, 1926.

Variety differing from the typical form in the very high spire, with the sides angled and concave between the angles.

The types are from a locality near Coco, Haciendo el Limon, San Luis Potosi, Mexico.

The species resembles *G. conica* var. *plicata* White, but, as figured, that form has many fewer whorls.

Globotruncana conica White
Plate 61, figure 20

Globotruncana conica White, Jour. Paleontology, vol. 2, p. 285, pl. 38, figs. 7a–c, 1928.

This form differs from the others in being convex on the dorsal side and that to concave on the ventral side, with a single keel. Diameter of type specimen, 0.7 mm.; thickness 0.4 mm.

A copy of the type figure is given here. The types are from the Mendez shale 2.2 kilometers east of Guerrero, Mexico. No specimens have been found in the material examined that could be referred to this species, although it has been recorded from the Texas area.

Globotruncana conica White var. plicata White
Plate 61, figure 21

Globotruncana conica White var. *plicata* White, Jour. Paleontology, vol. 2, p. 285, pl. 38, figs. 8a–c, 1928.

This form differs from the preceding in being fluted or having folds on the dorsal side, starting at or near the top and widening toward the base, causing the outline as seen from above, to appear fluted or polygonal. Diameter of type specimen, 0.8 mm.; thickness, 0.55 mm.

The types of the variety are from the Mendez shale 2.2 kilometers east of Guerrero, Mexico.

This may be the same as *G. arca* var. *contusa* (Cushman). A copy of the type figure is given here.

Globotruncana cretacea Cushman
Plate 62, figure 7

Globotruncana cretacea Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 67, pl. 11, figs. 6a–c, 1938; idem, vol. 15, p. 92, pl. 16, figs. 8a–c, 1939.
Globotruncana arca Cushman (not Cushman, 1926), Tennessee Div. Geology Bull. 41, p. 59, pl. 11, figs. 6a–c, 1931.
Plummer, Texas Univ. Bull. 3101, p. 195, pl. 13, figs. 7–9, 11, 1931.
Cushman, Geol. Soc. America Bull., vol. 47, p. 419, pl. 1, figs. 14a–c, 1936.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 47, pl. 7, figs. 8a, b, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 96, 1944.

Test planoconvex, dorsal side flattened, slightly convex or even slightly concave, ventral side convex, usually strongly so, periphery usually with a single keel, somewhat lobulate; chambers distinct, the last-formed almost semicircular in dorsal view, slightly overlapping, ventrally somewhat inflated, the side in the later chambers often becoming more than 45°; sutures very distinct, dorsally strongly curved, conspicuously beaded and raised, ventrally slightly depressed; wall smooth and conspicuously but finely perforate over the chambers, but the border of each chamber raised and the periphery somewhat spinose; sutures on the dorsal side beaded; aperture ventral, opening into the umbilical cavity, which is often partially covered by a thin platelike structure. Diameter 0.40 to 0.65 mm., thickness 0.15 to 0.35 mm.

The type is from the Ripley formation 1½ miles west of Sardis on the Sardis-Henderson road, Henderson County, Tenn. (96).

This species differs from *G. arca* (Cushman) in the fewer chambers in the whorl, flatter dorsal side, typically more convex ventral side, more definitely oblique sides to the chambers on the ventral side, and differently shaped chambers.

The species, like others of the genus, is very variable but is usually easily distinguished from the others of the Upper Cretaceous. It is abundant in the beds of Austin and Taylor ages and ranges upward into the lower beds of Navarro age.

Navarro age.
Nacatoch sand. Texas, Bowie County (48).
Selma chalk (upper part). Alabama, Marengo County (104).
Ripley formation. Tennessee, Henderson County (96).
Neylandville marl. Texas, Red River County (50); Delta County (51, 52); Rockwall County (57); Kaufman County (58, 60, 62); Navarro County (63, 64, 66, 68, 69).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 106); Lamar County (110, 112); Fannin County (113); Hunt County (115, 116); Collin County (120, 121); Rockwall County (124); Kaufman County (125, 128–131); Navarro County (132); Limestone County (136); Leon County (138); Milam County (139); Williamson County (142–144); Travis County (149); Hays County (150); Guadalupe County (151); Bexar County (152–154).
Anacacho limestone (upper part). Texas, Bexar County (164).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (169–172); Kaufman County (173); Rockwall County (175); McLennan County (177).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Lee County (267).
Wolfe City sand member of Taylor marl. Texas, Collin County (180–183); Navarro County (188).
Annona chalk. Texas, Bowie County (189); Red River County (192–198).
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (200); Delta County (206); Collin County (208, 209, 211); Dallas County (216, 217, 219, 221–225); Kaufman County (228, 229); Ellis County (234); Navarro County (236); Hill County (237); McLennan County (238–241); Falls County (244); Bell County (245); Williamson County (246); Travis County (249, 250); Comal County (251).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269); Travis County (270, 271).
Gober tongue of Austin chalk. Texas, Fannin County (272–277, 280, 281); Lamar County (282, 283, 285, 286, 288).
Austin chalk. Texas, Grayson County (290, 291, 333, 335, 336); Collin County (293–295, 324); Dallas County (296–303, 307–310, 339, 342–345); Hill County (313, 314); Bell County (315, 316); Hays County (317).
Selma chalk of upper Austin age (?). Alabama, Pickens County (352); Warrior River (353).
Brownstown marl. Texas, Red River County (319).
Bonham marl. Texas, Grayson County (328); Lamar County (331).
Ector tongue of Austin chalk. Texas, Grayson County (332).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Globotruncana calcarata Cushman
Plate 62, figure 8

Globotruncana calcarata Cushman, Cushman Lab. Foram. Research Contr., vol. 3, p. 115, pl. 23, figs. 10a, b, 1927.
White, Jour. Paleontology, vol. 2, p. 285, pl. 38, figs. 6a–c, 1928.
Cushman, Cushman Lab. Foram. Research Special Pub. 5, pl. 35, figs. 14a–c, 1933.
Thalmann, Eclogae geol. Helvetiae, Band 27, No. 2, p. 413 (list), 1934.

Test trochoid, planoconvex; dorsal side flattened or very slightly convex, ventral side convex, umbilicate in the center; sides angled, periphery subacute with distinct spines; chambers distinct, about 6 in the adult whorl, of rather uniform shape, increasing gradually in size as added; sutures distinct, on the dorsal side limbate, slightly raised and beaded, on the ventral side slightly depressed; wall smooth except for the raised sutures and a slight roughening on the ventral side; aperture a low opening on the ventral side. Diameter, with spines, 0.40 to 0.60 mm., thickness 0.25 to 0.35 mm.

The types are from the Pecan Gap chalk in a cut on the Gulf, Colorado, & Santa Fe Railway at the north edge of Farmersville, Tex. White records it from Mexico just below the top of the Papagallos formation. In our material it is limited in its vertical distribution to the lower beds of Navarro age and the beds of Taylor age, most abundant in the Pecan Gap chalk and Wolfe City sand members of the Taylor marl.

Navarro age. Neylandville marl. Texas, Navarro County (63).
Taylor age.
Upper part of Taylor marl. Texas, Hunt County (116); Collin County (118–122); Kaufman County (130); Navarro County (132); Williamson County (142); Bexar County (160).
Pecan Gap chalk member of Taylor marl. Texas, Hunt County (168); Collin County (170–172).
Wolfe City sand member of Taylor marl. Texas, Navarro County (188).
Annona chalk. Texas, Bowie County (189).
Lower part of Taylor marl. Texas, Ellis County (234).

Genus GLOBOROTALIA Cushman, 1927

Globorotalia micheliniana (D'Orbigny) Cushman

Plate 63, figures 2, 3

Rotalina micheliniana D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 31, pl. 3, figs. 1–3, 1840.
Globorotalia micheliniana Cushman, Cushman Lab. Foram. Research Contr., vol. 7, p. 45, pl. 6, figs. 8a–c, 1931; idem, Special Pub. 5, pl. 35, fig. 13, 1933; Foraminifera, Ed. 3, pl. 35, fig. 13, 1940; Cushman Lab. Foram. Research Contr., vol. 20, p. 15, pl. 3, fig. 13, 1944.
Gyroidina micheliniana Cushman, Jour. Paleontology, vol. 6, p. 342, pl. 51, figs. 12a–c, 1932.
Eponides micheliniana Plummer, Texas Univ. Bull. 3101, p. 192, pl. 14, fig. 11, 1931.
Truncatulina refulgens (Montfort) D'Orbigny var. *conica* Carsey, Texas Univ. Bull. 2612, p. 46, pl. 4, fig. 15, 1926.
Gyroidina alabamensis Sandidge, Jour. Paleontology, vol. 6, p. 283, pl. 43, figs. 13–15, 1932.

Test planoconvex, dorsal side flattened or even slightly concave, ventral side conical, umbilicate; periphery acute, sometimes with a slight keel, usually entire or very slightly lobulate; chambers fairly distinct, 6 or 7 in the final whorl, increasing very gradually in size, and of uniform shape; sutures fairly distinct, not depressed, strongly oblique dorsally; wall smooth; aperture elongate, at the margin of the final chamber on the dorsal side. Diameter 0.50 to 0.65 mm., height 0.40 to 0.55 mm.

The types of this species are from the White Chalk of the Paris Basin. The form figured by Reuss under D'Orbigny's name from the Turonian of Bohemia seems on examination of topotype material to be close to *G. subconica* Morrow. Topotype material from the Paris Basin shows that the American species is probably identical with that of D'Orbigny. It occurs at many places in great numbers. In America the species seems to be largely confined to beds of Taylor age and is especially abundant in the more chalky phases of the upper and middle beds. Specimens from the lower beds of Taylor age and the occasional specimens from beds of Austin age are usually smaller and slightly more keeled and thus connect with the following species.

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–109); Lamar County (110–112); Delta County (114); Hunt County (115, 116); Collin County (120, 121); Rockwall County (123, 124); Kaufman County (130); Limestone County (136); Williamson County (140); Travis County (149); Hays County (150); Bexar County (154, 155, 161).
Anacacho limestone (upper part). Texas, Bexar County (164).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (169–172); Rockwall County (175); McLennan County (177).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Lee County (266).
Wolfe City sand member of Taylor marl. Texas, Collin County (180–183); Navarro County (188).
Annona chalk. Texas, Bowie County (189, 190); Red River County (188a, 191–198).
Lower part of Taylor marl. Texas, Red River County (199); Delta County (206); Collin County (208); Dallas County (222); Kaufman County (228, 229); Ellis County (234); McLennan County (238); Bell County (245).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (272–275); Lamar County (285, 286).
Austin chalk. Texas, Grayson County (290).
Selma chalk of upper Austin age (?). Alabama, Warrior River (353).
Ector tongue of Austin chalk. Texas, Grayson County (332).

Globorotalia cushmani Morrow

Plate 62, figure 9

Globorotalia cushmani Morrow, Jour. Paleontology, vol. 8, p. 199, pl. 31, figs. 2a, b, 4a, b, 1934.

Test trochoid, dorsal side moderately convex with chambers flattened or slightly inflated, dorsal sutures roundly curving, producing a scalloped periphery; the anterior margin sometimes raised slightly, ventral side strongly convex with the chambers strongly inflated, sutures deeply grooved and nearly radiate; only the last whorl, of 4 to 6 chambers visible, the periphery sharply rounded and thickened into a narrow rim. Diameter of larger figured specimen 0.7 mm.; thickness 0.25 mm.

The types of this species are from the Hartland shale member of the Greenhorn formation in sec. 31, T. 21 S., R. 31 W., Hodgeman County, Kans.

In the present material the species is found in collections from the lower part of the Austin chalk and from one locality in the Eagle Ford shale.

It is possible that the form from the Eagle Ford of Texas referred by Moreman to *"Globotruncana arca* (Cushman)" (Jour. Paleontology, vol. 1, p. 100, pl. 16, figs. 16, 17, 1927) may belong here.

Austin chalk. Texas, Collin County (337); Dallas County (296, 298, 340, 342).
Eagle Ford shale. Texas, Dallas County (362).

Globorotalia membranacea (Ehrenberg) White

Plate 63, figure 5

Planulina membranacea Ehrenberg, Mikrogeologie, pl. 25, 1A, fig. 41; pl. 26, fig. 43, 1854.
Pulvinulina membranacea Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 608, pl. 21, fig. 10, 1926.
Globorotalia membranacea White, Jour. Paleontology, vol. 2, p. 280, pl. 38, figs. 1a–c, 1928.
Cushman and Todd, Cushman Lab. Foram. Research Contr., vol. 19, p. 71, pl. 12, fig. 12, 1943.
Cushman, idem, vol. 20, p. 16, pl. 3, fig. 12, 1944.

Test compressed, trochoid, biconvex, periphery subacute but not keeled; chambers distinct, slightly inflated, particularly on the ventral side, increasing very rapidly in size as added, about 5 normally in the adult whorl; sutures distinct, dorsally slightly curved, limbate, ventrally depressed, nearly radial; wall smooth, finely perforate; aperture a low opening on the ventral margin of the last-formed chamber. Length 0.40 to 0.60 mm., breadth 0.30 to 0.45 mm., thickness 0.15 to 0.20 mm.

This species is often very abundant in the Upper Cretaceous Velasco shale of Mexico.

Navarro group. Corsicana marl. Texas, Limestone County (30).
Taylor marl. Pecan Gap chalk member. Texas, Delta County (165).

Globorotalia subconica Morrow
Plate 63, figure 4

Globorotalia subconica Morrow, Jour. Paleontology, vol. 8, p. 200, pl. 30, figs. 11a–c, 18, 1934.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 43, pl. 6, figs. 10a–c, 1937.

Test planoconvex, subconical, dorsal side slightly convex or flat, the sides of the cone flare near the periphery giving them a gently concave profile, umbilical cavity at the apex, small but distinct, periphery keeled or very sharply rounded; chambers indistinct, about 6 in last whorl; sutures on ventral side may be slightly depressed but are not depressed on dorsal side, curved; wall smooth finely perforate; aperture elongate, extending along the inner edge of the last chamber. Height of holotype 0.36 mm., thickness 0.18 mm.

The types are from the basal part of the Niobrara formation of Kansas. The holotype has been redrawn and shows the oblique sutures noted by Loetterle.

Globorotalia subconica differs from *G. micheliniana* (D'Orbigny) Cushman in the smaller size, larger number of chambers in the whorl, and much more distinct early whorls on the dorsal side. It is slightly larger on the average than *G. umbilicata* Loetterle, has the periphery more nearly entire, and has a higher cone on the ventral side. It occurs in the lower part of the Taylor marl and particularly in the upper part of the Austin chalk.

Taylor marl, lower part. Texas, Lamar County (201, 202); Collin County (209, 210); Dallas County (227); McLennan County (240); Falls County (244); Comal County (251).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (276, 279, 280); Lamar County (282, 284, 287, 288).
Austin chalk. Texas, Grayson County (291); Collin County (292, 295); Dallas County (307, 310); Bell County (315).
Brownstown marl. Texas, Lamar County (321).

Globorotalia umbilicata Loetterle
Plate 63, figure 1

Globorotalia umbilicata Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 43, pl. 6, figs. 9a–c, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 96, pl. 14, fig. 19, 1944.

Test a low, broad, truncated cone, gently to strongly concave on the dorsal face, strongly convex on the ventral face, broadly and deeply umbilicate ventrally, sides gently convex; chambers numerous, 8 or 9 in the final whorl, narrow, curved, increasing slowly in size as added, last few slightly inflated; sutures strongly and regularly curved, indistinct on the dorsal face; aperture a low, arched slit extending from near the periphery toward the umbilicus; wall calcareous, finely perforate. Diameter of dorsal face of holotype, 0.35 mm.; thickness of holotype parallel axis of coiling, 0.12 mm.

This species, if I have rightly interpreted it, has a lower conical ventral side and a somewhat larger number of chambers, and the periphery is usually distinctly lobulate, and the umbilicus is more open.

The type is from the Niobrara chalk of Nebraska. Specimens referred here to *G. umbilicata* occur at numerous localities in the beds of Austin age and at a few localities in the lower beds of Taylor age.

Taylor marl.
Pecan Gap chalk member. Texas, Kaufman County (173); McLennan County (177).
Lower part. Texas, Red River County (199); Lamar County (202); Fannin County (203); Collin County (210, 212, 214); Dallas County (216, 217, 219, 220, 224, 227); Ellis County (232, 235); Hill County (237); McLennan County (239–241).
Austin age.
Gober tongue of Austin chalk. Texas, Fannin County (278, 281); Lamar County (283, 284, 287, 288).
Austin chalk. Texas, Grayson County (289, 335, 336); Collin County (293, 294, 324); Dallas County (297, 298, 306, 310, 341, 342); Hill County (312).
Selma chalk of upper Austin age (?). Alabama, Pickens County (352).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320, 321).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Globorotalia? multiloculata Morrow
Plate 62, figures 10, 11

Globorotalia? multiloculata Morrow, Jour. Paleontology, vol. 8, p. 200, pl. 31, figs. 3a, b, 5a, b, 1934.

Test trochoid, biconvex, compressed; dorsal side strongly convex, ventral side moderately convex; chambers numerous, seven to nine in final whorl, very distinct, inflated, narrowly rounded but not keeled at their periphery, tending in the last whorl to be produced ventrally in the direction of the axis of coiling; umbilical area large and rather deep; sutures strongly depressed; wall finely perforate. Diameter 0.7 mm., thickness 0.3 mm.

This species seems to be the most primitive of the three species of *Globorotalia* here described from the Greenhorn formation. It is evidently very close to *Globigerina*. Since the other two species are definitely not *Globigerina*, and yet all three species are obviously quite closely related, it seems best to consider this species in the same genus. There is a suggestion of the development of the keeled periphery of *Globorotalia* in the sharply rounded margin of the chambers appearing in edge view, about intermediate between *Globorotalia greenhornensis* and typical *Globigerina*. The similar aspect of the ventral side in these species is also striking. *G. multiloculata* is quite common locally in the Greenhorn formation associated with the two species just described. It is easy to distingush because of its numerous chambers and globigerine aspect with a narrowed periphery.

The types are from the Hartland shale member of the Greenhorn formation, sec. 31, T. 21 S., R. 22 W., Hodgeman County, Kans.

The type specimen is redrawn here. The species is very close to the border line between *Globigerina* and *Globorotalia*.

Globorotalia velascoensis (Cushman) Cushman
Plate 63, figure 6

Pulvinulina velascoensis Cushman, Cushman Lab. Foram. Research Contr., vol. 1, p. 169, pl. 27, figs. 7–9, 1927; Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 608, pl. 21, figs. 9a, b, 1926.
Globorotalia velascoensis (Cushman) Cushman, Jour. Paleontology, vol. 1, p. 169, pl. 27, figs. 7–9, 1927.
White, idem, vol. 2, p. 281, pl. 38, fig. 2, 1928.
Globotruncana arca Cushman and Jarvis (not Cushman), U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 50, pl. 15, figs. 7a–c, 1932.

Test planoconvex, dorsal side flat or slightly convex, ventral side strongly convex, deeply umbilicate; periphery subacute, lobulate; chambers distinct, inflated, enlarging rapidly as added and becoming much broader in the adult, 5 to 7 in the final whorl; sutures distinct, strongly oblique and slightly curved on the dorsal side, nearly radial or somewhat tangential, nearly straight on the ventral side; wall roughened with low, spinose processes; aperture ventral, a low slit opening into the large umbilicus and extending nearly to the periphery. Diameter 0.50 to 0.65 mm., thickness 0.25 to 0.35 mm.

The types are from the Velasco shale, Tamalte Arroyo, Hacienda el Limon, San Luis Potosi, Mexico. The species is common and characteristic in the Velasco shale of Mexico and occurs also in the Upper Cretaceous beds in the pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. It is somewhat variable, especially in the depth of the ventral side.

Family ANOMALINIDAE
Genus ANOMALINA D'Orbigny, 1826
Anomalina nelsoni W. Berry

Plate 63, figures 8, 9

Anomalina nelsoni W. Berry, in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 14, pl. 2, figs. 19–21, 1929.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 27, pl. 5, figs. 1, 2, 1940.
Cushman and Hedberg, idem, vol. 17, p. 99, pl. 23, figs. 20a–c, 1941.
Cushman and Todd, idem, vol. 19, p. 71, pl. 12, fig. 13, 1943.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 340, pl. 53, fig. 32, 1944.
Cibicides nelsoni Plummer, Univ. Texas Bull. 3501, p. 288, pl. 5, figs. 1–6, 1936.
Valvulineria nelsoni Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 32, pl. 4, figs. 1a, b, 1936.

Test nautiloid, dorsal side nearly flat to slightly concave, ventral side convex; periphery broadly rounded, lobate; chambers numerous, seven to eight in the last-formed coil, inflated, gradually increasing in size; sutures distinct, depressed; wall punctate; umbilical cavity usually filled with shell material; aperture an arched slit with a slight lip above it at the base of the last chamber. Diameter 0.52 mm.

The type is from the Coon Creek tongue of the Ripley formation at Dave Week's place on Coon Creek, 3½ miles south of Enville, 7½ miles north of Adamsville, and ⅛ mile east of the main Hendersonville-Adamsville road, McNairy County, Tenn. The original figure of the holotype is not well drawn and the specimen has been redrawn here.

This has proved to be one of the most common species of the genus in Cretaceous material, ranging from the highest beds of Navarro age down through the upper beds of Taylor age. It is recorded from the Mito Juan formation of Colombia.

Navarro age.
Kemp clay. Texas, Travis County (14).
Corsicana marl. Texas, Bowie County (23); Limestone County (29, 30); Travis County (34, 36, 40).
Arkadelphia marl. Arkansas, Hempstead County (73).
Prairie Bluff chalk. Alabama, Sumter County (101–103).
Nacatoch sand. Texas, Bowie County (47, 48). Arkansas, Hempstead County (75).
Selma chalk (upper part). Mississippi, Prentiss County (91); Union County (92). Tennessee, McNairy County (98). Alabama, Marengo County (104).
Ripley formation. Tennessee, McNairy County (94, 95, 97); Henderson County (96).
Saratoga chalk. Arkansas, Clark County (78); Hempstead County (81, 82).
Neylandville marl. Texas, Red River County (50); Rockwall County (57); Kaufman County (58, 60, 61); Navarro County (64, 66, 68, 69).

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105); Lamar County (110); Rockwall County (123); Kaufman County (130); Navarro County (134); Travis County (145, 149); Hays County (150); Guadalupe County (151); Bexar County (153, 158, 161).
Marlbrook marl. Arkansas, Clark County; Howard County.
Ozan formation. Arkansas, Little River County (254).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Alcorn County (257, 258); Prentiss County (260); Lee County (264–266).
Annona chalk. Texas, Bowie County (189); Red River County (192, 196, 197).
Lower part of Taylor marl. Texas, Bell County (245).

Anomalina bentonensis Morrow

Plate 63, figure 7

Anomalina bentonensis Morrow, Jour. Paleontology, vol. 8, p. 201, pl. 30, figs. 4a, b, 1934.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 28, pl. 5, figs. 3a, b, 1940.

Test small, nearly symmetrical, slightly involute, periphery broadly rounded, earlier whorls partly exposed on both sides at the center; chambers inflated, increasing rather rapidly in size as added, quite uniform in shape, numbering seven to nine in last whorl; sutures strongly impressed, usually curving backward as they pass over the periphery; wall conspicuously perforate; aperture peripheral, passing onto the dorsal side. Diameter of holotype 0.4 mm., thickness 0.2 mm.
This species differs from any known to the writer by being more nearly planispiral and bilaterally symmetrical and in having a broad and evenly rounded periphery.
This species has been found only in the Greenhorn formation, where it is common locally.

The types are from the Hartland shale member of the Greenhorn formation, sec. 31, T. 21 S., R. 22 W., Hodgeman County, Kans.

I have not seen material in our collections that could be referred to this species. The holotype is redrawn on our plate.

Anomalina ammonoides (Reuss) Chapman

Plate 63, figures 10, 11

Rosalina ammonides Reuss, Geognostische Skizzen Böhmen, vol. 2, pt. 1, p. 214, 1844; Verstein. böhm. Kreideformation, pt. 1, p. 36, pl. 8, fig. 53; pl. 13, fig. 66, 1845.
Anomalina ammonides Chapman, Quart. Jour. Geol. Soc., vol. 50, p. 722, 1894.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 28, pl. 5, figs. 4, 5, 1940; idem, vol. 20, p. 16, pl. 3, fig. 14, 1944.

A study of this species named by Reuss shows that most of the references to it by later authors are not correct. On the present plate is a drawing of one of the specimens selected by Reuss and in the Reuss collection of the Museum of Comparative Zoology, Harvard University. This species occurs in typical form in the present collections from the lower beds of Taylor age and the beds of Austin age. Figures of a typical specimen from the Annona chalk are also given.

Taylor age.
Upper part of Taylor marl. Texas, Red River County (105–109); Lamar County (111, 112); Collin County (121); Navarro County (134); Williamson County (142).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168); Collin County (172).
Selma chalk (middle part). Mississippi, Lee County (263).
Wolfe City sand member of Taylor marl. Texas, Collin County (181, 182); Navarro County (188).
Annona chalk. Texas, Bowie County (189); Red River County (196).
Lower part of Taylor marl. Texas, Collin County (208–210); Dallas County (219); Ellis County (234); McLennan County (238); Travis County (250).

Austin age.
Burditt marl (of Adkins). Texas, Travis County (270).
Gober tongue of Austin chalk. Texas, Lamar County (288).
Austin chalk. Texas, Collin County (295); Dallas County (310); Hill County (312).
Selma chalk (lower part). Mississippi, Lee County (350).
Ector tongue of Austin chalk. Texas, Grayson County (332).

Anomalina pseudopapillosa Carsey

Plate 64, figure 1

Anomalina pseudopapillosa Carsey, Texas Univ. Bull. 2612, p. 47, pl. 1, figs. 6a, b, 1926.
Plummer, idem, Bull. 3101, p. 200, pl. 14, fig. 13, 1931.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 29, pl. 5, figs. 6a–c, 1940.
Cushman and Todd, idem, vol. 19, p. 72, pl. 12, fig. 14, 1943.

Test nearly equally biconvex, nearly involute on both sides, the early coils showing slightly on the dorsal, periphery rounded but contracted somewhat; chambers numerous, usually 15 to 18 in the adult whorl, slightly inflated, of uniform shape, increasing very gradually in size as added; sutures distinct, strongly limbate and somewhat raised above the general surface; wall distinctly and coarsely perforate, the surface often granular in appearance, the umbilical region with small raised bosses; aperture near the periphery, with a slight lip. Diameter 0.35 to 0.50 mm., thickness 0.12 to 0.20 mm.

The types of this species are from the Navarro group of Texas. The species is a small one but often is very abundant in the beds of Navarro age, and ranges from the horizons equivalent to the Nacatoch sand upward to the Midway (Paleocene) contact.

Navarro age.
Kemp clay. Texas, Kaufman County (2); Navarro County (4–7); Williamson County (11, 12); Travis County (13–17); Guadalupe County (18, 21).
Escondido formation. Texas, Maverick County (22).
Corsicana marl. Texas, Bowie County (23); Hunt County (24); Navarro County (25–28); Limestone County (30, 31); Travis County (35–37, 43); Caldwell County (44).
Arkadelphia marl. Arkansas, Hempstead County (70–73).
Owl Creek formation. Mississippi, Tippah County (83).
Prairie Bluff chalk. Alabama, Wilcox County (100).
Ripley formation. Mississippi, Pontotoc County (90).
Nacatoch sand. Texas, Bowie County (47). Arkansas, White County (76); Lonoke County (77).

Anomalina clementiana (D'Orbigny) Franke
Plate 63, figures 12, 13

Rosalina clementiana D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 37, pl. 3, figs. 23–25, 1840.
Anomalina clementiana 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.

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.

Specimens similar to typical European forms have been found in the present material, particularly from the upper beds of Taylor age; and they occur in Upper Cretaceous collections of similar age from Antigua and California.

Navarro age. Ripley formation. Tennessee, Henderson County (96); McNairy County (97).
Taylor age.
Upper part of Taylor marl. Texas, Hunt County (115); Navarro County (132); Williamson County (140); Travis County (145); Bexar County (159).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166); Hunt County (168).
Annona chalk. Texas, Bowie County (189).

Anomalina henbesti Plummer
Plate 64, figure 2

Anomalina complanata Cushman (not Reuss), Tennessee Div. Geology Bull. 41, p. 60, pl. 11, figs. 7a–c, 1931.
Sandidge, Am. Midland Naturalist, vol. 13, p. 368, pl. 31, figs. 30, 31, 1932.
Anomalina henbesti Plummer, Texas Univ. Bull. 3501, p. 290, pl. 5, figs. 7–10, 1936.
Cole, Florida Dept. Cons., Geol. Bull. 16, p. 34, pl. 2, figs. 9, 10, 1938.
Cushman and Goudkoff, Cushman Lab. Foram. Research Contr., vol. 20, p. 63, pl. 10, fig. 11, 1944.
Anomalina semicomplanata Cushman, Cushman Lab. Foram Research Contr., vol. 14, p. 68, pl. 12, fig. 1, 1938; idem, vol. 16, p. 29, pl. 5, figs. 9a–c, 1940.
Cushman and Hedberg, idem, vol. 17, p. 99, pl. 23, figs. 23a–c, 1941.

Test planispiral, at least in the adult, much compressed, periphery subacute, earlier coils exposed on both sides at the center; chambers numerous, increasing very slowly in size as added, of nearly uniform shape, the later chambers tending to become slightly inflated; sutures distinct, little if at all depressed, slightly limbate; wall smooth but conspicuously perforate, with a slight thickening in the central region at each side; aperture peripheral, extending slightly onto the dorsal side, with a slight lip. Diameter 0.50 to 0.65 mm., thickness 0.15 to 0.18 mm.

The types are from the Ripley formation 1½ miles west of Sardis on the Sardis-Henderson road, Henderson County, Tenn.

A study of topotypes of *A. complanata* Reuss shows that it is very different from the American species. *A. henbesti* differs in having a subacute instead of a very acute periphery and in being much more umbonate.

In the present material the species seems to be largely limited to the upper beds of Taylor age and the horizons equivalent to the Neylandville marl of the lower part of the Navarro group. It has been recorded from the Upper Cretaceous of California.

Navarro age.
Ripley formation. Tennessee, McNairy County (94); Henderson County (96).
Neylandville marl. Texas, Hunt County (55); Rockwall County (57); Navarro County (64).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (108); Williamson County (141, 143, 144); Travis County (149).
Selma chalk (middle part). Tennessee, Hardin County (255).

Anomalina tennesseensis W. Berry
Plate 64, figure 3

Anomalina tennesseensis W. Berry (in Berry and Kelley), U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 13, pl. 2, figs. 13–15, 1929.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 30, pl. 5, figs. 11a–c, 1940.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 340, pl. 53, figs. 33, 34, 1944.

Test small, nautiloid, slightly compressed laterally, composed of numerous chambers all clearly visible from the dorsal side, only those of the last-formed coil visible on the ventral side; ventral side umbilicate; about seven to eight chambers in last coil, usually about two coils; sutures slightly depressed, more or less distinct; wall thin, coarsely perforate; aperture a narrow curved slit at base of final chamber. Diameter 0.32 mm.

This small species is fairly common in the Ripley. It can be compared to *A. clementina* D'Orbigny in general appearance, but while *A. clementina* has slightly raised ridges on the sutures, *A. tennesseensis* has none. In size the two species are nearly alike, *A. clementina* being only slightly larger.—W. Berry, 1929.

The types are from the Coon Creek tongue of the Ripley formation at Dave Week's place on Coon Creek, 3½ miles south of Enville, 7½ miles north of Adamsville, and ⅛ mile east of main Hendersonville-Adamsville road, McNairy County, Tenn. (97). It has been recorded from the Marlbrook marl of Arkansas.

The only specimens in the present material are from the Selma chalk, of upper Taylor age, 10½ miles south of Corinth, Alcorn County, Miss. (259).

The figures are redrawn from the holotype.

Anomalina pinguis Jennings

Anomalina grosserugosa Plummer (not Gümbel), Texas Univ. Bull. 3101, p. 201, pl. 14, figs. 9a–c, 1931.

Anomalina pinguis Jennings, Bull. Am. Paleontology, vol. 23, No. 78, p. 37, pl. 5, fig. 1, 1936.

Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 16, pl. 3, fig. 15, 1944.

Test nearly equally biconvex, ventral face slightly more convex, coarsely punctate, completely involute on ventral, almost so on dorsal, periphery broadly rounded, chambers 8 to 9 in final whorl, later chambers distinctly inflated, suture depressed between last few chambers, limbate in early chambers; sutures slightly curved; aperture at base of septal face embracing the margin. Diameter 0.50 mm.; thickness 0.25 mm.—Jennings, 1936.

This name was given to a form recorded and figured as "*Anomalina grosserugosa*" from the Corsicana marl at Jones Crossing on Onion Creek in Travis County, Tex. (43). It has also been recorded from the Pecan Gap chalk member of the Taylor marl of Texas and the Navesink marl and Mt. Laurel sand of New Jersey.

Anomalina rubiginosa Cushman

Plate 64, figures 4–6

Anomalina rubiginosa Cushman, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 607, pl. 21, figs. 6a–c, 1926.

Cushman and Jarvis, U. S. Nat. Mus. Proc., vol. 80, art. 14, p. 52, pl. 16, figs. 3–5, 1932.

Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 31, pl. 6, figs. 1–3, 1940.

Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 341, pl. 53, fig. 31, 1944.

Planulina rubiginosa White, Jour. Paleontology, vol. 2, p. 303, pl. 41, figs. 6a–c, 1928.

Test closely coiled, the dorsal side slightly convex, ventral side somewhat concave, periphery broadly rounded, 9 or 10 chambers in the last-formed coil, rather indistinct, as are also the sutures, more distinct in the last few chambers; dorsal side with the wall very coarsely punctate, ventral side, especially in the earlier portion, with very large depressed areas of an irregular form, giving a peculiar appearance to that portion of the test; aperture along the ventral margin of the last-formed chamber. Diameter 0.50 to 0.80 mm., height 0.30 to 0.40 mm.

This is a common and well-marked species in the Velasco shale of Mexico, and it occurs in typical form in the material from Trinidad. Some of the young stages are also shown here. So far as our material from both areas shows, the species does not become sufficiently evolute to warrant placing it in the genus *Planulina*.

The specimens referred to this species from the Saratoga chalk (Cushman, Jour. Paleontology, vol. 5, p. 314, pl. 36, figs. 9a–c, 1931) and from the Annona chalk (idem, vol. 6, p. 344, 1932) belong elsewhere.

Taylor age. Marlbrook marl. Arkansas, Clark County; Hempstead County.

Anomalina velascoensis Cushman

Plate 64, figure 7

Anomalina velascoensis Cushman, Cushman Lab. Foram. Research Contr., vol. 1, pt. 1, p. 21, pl. 3, figs. 3a–c, 1925; Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 607, pl. 21, figs. 7a–c, 1926; Jour. Paleontology, vol. 1, p. 170, pl. 28, figs. 14a, b, 1927; Cushman Lab. Foram. Research Contr., vol. 16, p. 32, pl. 5, figs. 10a–c, 1940.

Test planoconvex, the dorsal side nearly flat, ventral side very broadly rounded, periphery broadly rounded; chambers fairly distinct, 8 or 9 in the last-formed coil; on the dorsal side there is a depressed area coinciding with the line of coiling, the central portion raised in a spiral, later chambers with a slightly depressed area over each chamber, the sutures being somewhat limbate and raised; on the ventral side sutures limbate but not raised above the general surface, curved, in the edge view the thickenings of the dorsal side in many specimens standing up slightly above the general surface; wall generally smooth and finely punctate. Length about 0.50 mm., breadth 0.45 mm., thickness 0.35 mm.

This species is widely distributed throughout most of the Velasco formation and may be distinguished by the very different characters of the dorsal and ventral surfaces, the peculiar spiral thickening of the dorsal side being especially marked.

Genus PLANULINA D'Orbigny, 1826

Planulina eaglefordensis (Moreman) Cushman

Plate 64, figures 8, 9

Anomalina eaglefordensis Moreman, Jour. Paleontology, vol. 1, p. 99, pl. 16, figs. 9a, b, 1927.

Vanderpool, idem, vol. 4, p. 255 (list), 1930.

Planulina eaglefordensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 32, pl. 6, figs. 4, 5, 1940.

Test trochoid, very much compressed, partially evolute, periphery rounded, somewhat lobulate; chambers distinct, slightly inflated, usually 10 to 12 in the adult whorl, of uniform shape, increasing very gradually in size as added; sutures distinct, curved, more strongly so on the dorsal side, somewhat depressed, earlier sutures limbate; wall distinctly perforate; aperture a low opening at the base of the last-formed chamber, with a slight overhanging lip. Diameter 0.50 to 0.70 mm., thickness 0.10 to 0.12 mm.

The types of this species are from the Eagle Ford shale 2 miles north of Hebron, Tex. The species occurs in the present material at a number of localities but seems to be an index fossil for the Eagle Ford.

Eagle Ford shale. Texas, Dallas County (355, 356, 362, 363); Hill County (365, 369).

Planulina austinana Cushman

Plate 64, figure 10

Planulina austinana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 68, pl. 12, figs. 2a–c, 1938; idem, vol. 16, p. 33, pl. 6, figs. 6a–c, 1940.

Test very much compressed, partially evolute on both sides, particularly so on the dorsal side, which is very slightly umbonate; ventral side slightly umbilicate; periphery subacute, lobulate; chambers distinct, somewhat inflated, of uniform shape, increasing very gradually in size as added, 8 to 10 in the adult whorl; sutures distinct, only slightly curved on the dorsal side, ventrally nearly radial, slightly depressed; wall smooth, finely but conspicuously perforate; aperture a low opening at the base of the last-formed chamber at the periphery and extending over along the dorsal side. Diameter 0.50 to 0.55 mm., thickness 0.18 to 0.22 mm.

The types are from the lower part of the Austin chalk in a road cut on the south side of U. S. Highway 80, 2 feet above sidewalk, opposite a Catholic school 3.8 miles west of Union Station, Dallas, Dallas County, Tex.

The species seems to be limited to the Austin chalk. *Planulina austinana* differs from *P. taylorensis* (Carsey) Cushman in its smaller size, more lobulate periphery, more depressed sutures, and lack of a peripheral keel.

Austin chalk. Texas, Grayson County (290, 334–336); Collin County (295, 337); Dallas County (302, 304, 307–309, 311, 326, 338, 340, 343, 344); Hill County (313).

Planulina texana Cushman
Plate 64, figure 11

Planulina texana Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 69, pl. 12, figs. 3a–c, 1938; idem, vol. 16, p. 33, pl. 6, figs. 7a–c, 1940; idem, vol. 20, p. 96, pl. 14, fig. 25, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 341, 1944.

Test much compressed; dorsal side usually flattened but with a central boss, partially evolute; ventral side somewhat less evolute, more convex, periphery subacute, not keeled; chambers distinct, especially those of the last-formed whorl, of uniform shape, increasing rather rapidly in size as added, little if at all inflated; sutures distinct in the last whorl, strongly limbate, slightly raised, thickened toward the inner end, gently curved; wall finely but distinctly perforate, generally smooth, except in the center, where there is usually a raised spiral ridge on the ventral side; aperture a narrow slit with a slightly overhanging lip. Diameter 0.55 to 0.65 mm., thickness 0.18 to 0.22 mm.

The types of this species are from the lower part of the Taylor marl, north fork of Sulphur Creek 2.3 miles southeast of Gober, Fannin County, Tex.

This species differs from *Planulina taylorensis* (Carsey) Cushman, of which it may be the ancestral form, in the smaller size, less keeled and less lobulated periphery, more ornamented sutures, and less well developed apertural lip. *P. texana* is characteristic of the beds of Austin age and lower beds of Taylor age.

Taylor age.
Anacacho limestone (upper part). Texas, Bexar County (164).
Marlbrook marl. Arkansas, Howard County.
Lower part of Taylor marl. Texas, Red River County (199); Lamar County (200); Fannin County (203, 204); Collin County (207–215); Dallas County (224, 227); Ellis County (232); Navarro County (236); McLennan County (239–243); Falls County (244); Travis County (247, 249, 250).
Austin age.
Burditt marl (of Adkins). Texas, Bell County (269).
Gober tongue of Austin chalk. Texas, Fannin County (272, 275–281); Lamar County (282–285, 287, 288).
Austin chalk. Texas, Collin County (294, 295, 324); Dallas County (308, 310); Hill County (312, 314); Bell County (315, 316).
Selma chalk of upper Austin age (?). Alabama, Pickens County (352); Warrior River (353).
Brownstown marl. Texas, Red River County (318, 319); Lamar County (320, 321).
Bonham marl. Texas, Grayson County (328).
Selma chalk (lower part). Mississippi, Lee County (350); Itawamba County (351).

Planulina kansasensis Morrow
Plate 64, figure 12

Planulina kansasensis Morrow, Jour. Paleontology, vol. 8, p. 201, pl. 30, figs. 2a, b, 12a–c, 15a–c, 1934.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 49, pl. 8, figs. 2a–c, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 34, pl. 6, figs. 8a–c, 1940.

Test much compressed, dorsal and ventral sides nearly flat, slightly trochoid and involute; periphery rounded, chambers numerous, 8 to 10 in final whorl, all chambers exposed on the dorsal side, partially covered on the ventral side; sutures distinct between the later chambers, slightly depressed, curved outward and backward; central area on both sides covered by a calcareous deposit varying in thickness from a film to a thick rounded plug, which may be transparent showing the covered chambers; wall smooth, perforate; aperture obscure, extending along the base of the last chamber onto the ventral side. Diameter up to 0.52 mm., thickness 0.12 mm.—Morrow, 1934.

The types of this species are from basal Niobrara chalk, Fort Hays limestone, SE¼ sec. 12, T. 12 S., R. 17 W., Ellis County, Kans. The holotype is redrawn. Loetterle records the species as abundant in the Fort Hays member of the Niobrara formation of Nebraska, Kansas, and South Dakota and less typical in the Smoky Hill member in the same three States. In the present material the species occurs most commonly in the lower beds of Austin age, with specimens at single localities in the Brownstown marl and the upper part of the Austin chalk.

Austin age.
Austin chalk. Texas, Collin County (337); Dallas County (296, 298, 299, 311, 341, 345); Grayson County (334).
Brownstown marl. Arkansas, Sevier County (347).
Bonham marl. Texas, Lamar County (330).
Ector tongue of Austin chalk. Texas, Grayson County (332).

Planulina spissocostata Cushman
Plate 64, figure 13

Planulina spissocostata Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 69, pl. 12, figs. 4a–c, 1938; idem, vol. 16, p. 35, pl. 6, figs. 9a–c, 1940.
Cushman and Hedberg, idem, vol. 17, p. 99, pl. 23, figs. 24a–c, 1941.

Test trochoid, generally planoconvex; dorsal side flattened or even concave in the center, ventral side slightly convex but often somewhat umbilicate in the center; periphery subacute; somewhat evolute on the dorsal side, mostly involute on the ventral side; chambers of the last whorl distinct, those of the earlier whorls obscure, usually 14 to 16 in the final whorl, not inflated, the outer margin strongly raised and thickened on both sides but more strongly so on the dorsal side, of rather uniform shape and increasing very gradually in size as added; sutures of the last whorl distinct, others obscure, strongly curved; wall distinctly perforate, smooth except for the thickened margins of the chambers which form rounded, raised ridges; aperture a low opening at the inner margin of the last-formed chamber. Diameter 0.40 to 0.45 mm., thickness 0.17 to 0.20 mm.

The types of this species are from the upper part of the Taylor marl 2.6 miles east of Barry on the road to Corsicana, Navarro County, Tex.

This species is close to *Anomalina clementiana* (D'Orbigny) Franke but differs in having the raised portions more prominent, a greater number of chambers, and more acute periphery. It occurs in the Colon shale of Colombia.

Navarro group, Neylandville marl. Texas, Navarro County (63).
Taylor marl.
Upper part. Texas, Collin County (122); Navarro County (132.)
Lower part. Texas, Delta County (206); Ellis County (235).

Planulina taylorensis (Carsey) Cushman
Plate 64, figures 14, 15

Anomalina taylorensis Carsey, Texas Univ. Bull. 2612, p. 47, pl. 6, figs. 1a, b, 1926.
Planulina taylorensis Cushman Tennessee Div. Geology Bull. 41, p. 62, pl. 12; figs. 5a–c, 1931; Jour. Paleontology, vol. 5, p. 314, pl. 36, figs. 6a–c, 1931; idem, vol. 6, p. 345, 1932.
Loetterle, Nebraska Geol. Survey Bull., 2d ser., Bull. 12, p. 63, pl. 11, figs. 4a–c, 1937.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 35, pl. 6, figs. 10a–c, 1940.
Cushman and Deaderick, idem, vol. 18, p. 66, pl. 15, figs. 28–31, 1942.
Cushman, idem, vol. 20, p. 16, pl. 3, fig. 17, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 341, pl. 53, fig. 35, 1944.

Test large, nearly planispiral, much compressed, later whorls becoming partially evolute, periphery acute and slightly keeled; chambers very distinct, numerous, 9 or more in the adult whorls, of nearly uniform shape and very gradually increasing in size as added, centers at each side slightly umbonate; sutures very distinct, curved, slightly depressed in the adult, in the young slightly limbate and raised on the ventral side; wall mostly smooth, finely but conspicuously perforate; aperture peripheral and extending onto the dorsal side nearly to the center, with a distinct lip. Diameter up to 1.50 mm. or more, thickness 0.10 to 0.15 mm.

This is a large and conspicuous species, particularly abundant and widespread in the upper beds of Taylor age and the horizons of the Neylandville marl. It is recorded by Loetterle from the Pierre shale of South Dakota and Nebraska.

Navarro age.
Selma chalk (upper part). Mississippi, Prentiss County (91). Tennessee, McNairy County (98).
Ripley formation. Tennessee, McNairy County (94, 95); Henderson County (96).
Saratoga chalk. Arkansas, Hempstead County (81); Howard County (79).
Neylandville marl. Texas, Delta County (51, 52); Rockwall County (57); Kaufman County (60–62); Navarro County (63, 66–68).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 107, 108); Lamar County (110–112); Fannin County (113); Hunt County (115); Collin County (121, 122); Rockwall County (124); Kaufman County (125, 128, 130, 131); Navarro County (134); Limestone County (136); Milam County (139); Williamson County (141); Travis County (145, 149); Hays County (150); Bexar County (152–154, 158, 159, 161).
Marlbrook marl. Arkansas, Clark County; Howard County; Hempstead County.
Ozan formation. Arkansas, Sevier County (253); Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Kaufman County (173); Rockwall County (175); Delta County (165, 166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (257, 259); Prentiss County (260, 261); Union County (262); Lee County (264, 266, 267).
Wolfe City sand member of Taylor marl. Texas, Collin County (183); Navarro County (188).
Annona chalk. Texas, Red River County (191–194, 197).
Lower part of Taylor marl. Texas, Dallas County (216, 217, 219, 222, 223, 225); Kaufman County (228, 229); Ellis County (234); Bell County (245).
Austin age. Brownstown marl. Arkansas, Sevier County.

Planulina correcta (Carsey) Cushman
Plate 65, figure 1

Discorbis correcta Carsey, Texas Univ. Bull. 2612, p. 45, pl. 3, fig. 5, 1926. Plummer, idem, Bull. 3101, p. 188, pl. 14, figs. 1–4, 1931.
Planulina correcta Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 36, pl. 6, figs. 11a–c, 1940.
Cushman and Hedberg, idem, vol. 17, p. 99, pl. 23, figs. 10a–c, 1941.
Cushman and Todd, idem, vol. 19, p. 72, pl. 12, figs. 15a–c, 1943.

Test much compressed, one side more flattened than the other, periphery slightly rounded, lobulate; chambers distinct, very slightly inflated, typically 5 to 9 in the adult whorl, earlier chambers low and broad, later chambers becoming rapidly much higher and increasing greatly in size in the latest portion; sutures distinct, earlier sutures strongly limbate and slightly raised, later sutures not limbate and slightly depressed, curved; wall smooth, finely but distinctly perforate; aperture a low elongate slit with a slight lip. Diameter 0.40 to 0.50 mm., height 0.08 to 0.10 mm.

The types of this species are from the Corsicana marl on the right bank of Onion Creek just east of the bridge known as Jones Crossing on the Austin-Bastrop highway, Travis County, Tex.

This is a very variable species, the microspheric and megalospheric forms often showing considerable differences, the former continuing the low chambers almost throughout whereas the latter have chambers that become much larger in the adult. The species is widely distributed in the beds of Navarro age. Its vertical range in the present material seems to be limited to the beds of Navarro age above the horizons of the Nacatoch sand. It is recorded from the upper part of the Colon shale of Colombia.

Navarro age.
Kemp clay. Texas, Hopkins County (1); Navarro County (4, 5); Falls County (9); Williamson County (11, 12); Travis County (13, 14); Guadalupe County (18, 21).
Corsicana marl. Texas, Hunt County (24); Navarro County 25–28); Limestone County (29–31); Falls County (32); Travis County (34–37, 39, 40, 42, 43); Caldwell County (44); Bexar County (46).
Arkadelphia marl. Arkansas, Hempstead County (70–73).
Prairie Bluff chalk. Mississippi, Chickasaw County (85, 86). Alabama, Wilcox County (99, 100); Sumter County (103).

Planulina nacatochensis Cushman
Plate 65, figure 2

Planulina nacatochensis Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 50, pl. 8, fig. 9, 1938; idem, vol. 16, p. 36, pl. 6, figs. 12a–c, 1940.
Cushman and Goudkoff, idem, vol. 20, p. 63, pl. 10, figs. 13a, b, 1944.

Test much compressed, nearly planispiral in the adult, periphery rounded, evolute throughout, at least in the megalospheric form; chambers distinct, averaging 9 in the adult whorl, increasing very gradually in size as added, somewhat more overlapping on the dorsal side, very little inflated; sutures distinct, slightly limbate, on the ventral side evenly curved, on the dorsal side somewhat sigmoid; wall smooth, finely perforate; aperture extending from the periphery over onto the dorsal side, with a slight, overhanging lip. Diameter 0.40 to 0.50 mm., thickness 0.10 to 0.12 mm.

The types are from the Nacatoch sand of Cyrus Heller's marl bed, Beebe, White County, Ark. (76). It also occurs in the Upper Cretaceous of California.

This species differs from *P. taylorensis* (Carsey) Cushman in the smaller size, rounded periphery, more evolute form, and lack of a central umbo.

Planulina greenhornensis (Morrow) Cushman
Plate 65, figure 3

Globorotalia greenhornensis Morrow, Jour. Paleontology, vol. 8, p. 199, pl. 31, figs. 1a–c, 1934.
Planulina greenhornensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 37, pl. 7, figs. 1a–c, 1940.

Test trochoid, biconvex, dorsal side distinctly convex, ventral side strongly convex; periphery slightly scalloped, chambers numerous, 8 or 9 in final whorl, dorsal side flattened, bordered by a thickened, slightly elevated margin which curves forward from the edge of the preceding chamber to the spiral suture, chambers seen from the ventral side inflated, extended in the direction of the axis of coiling producing a deep, steepsided umbilical area; sutures on the ventral side strongly depressed, curving gently backward; periphery acute, wall finely perforate; aperture umbilical at base of last chamber. Diameter 0.66 mm., thickness 0.22 mm. The characters of *G. greenhornensis* are distinctive and quite constant, making it very easy to distinguish from other species with which it is associated.
This species is very abundant locally and apparently restricted to the Greenhorn formation.—Morrow, 1934.

The type is redrawn here. It seems to belong to *Planulina*. No specimens referable to it have been noted in our material.

Genus CIBICIDES Montfort, 1808

Cibicides stephensoni Cushman
Plate 65, figure 4

Cibicides stephensoni Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 70, pl. 12, fig. 5, 1938; idem, vol. 16, p. 37, pl. 7, figs. 2a–c, 1940; idem, vol. 20, p. 16, pl. 3, fig. 16, 1944.
Cushman and Goudkoff, idem, vol. 20, p. 63, pl. 10, figs. 15a, b, 1944.

Test trochoid, much compressed; dorsal side flattened or even slightly concave, except for the slightly raised umbo; ventral side somewhat convex, also with a central umbo surrounded by a deep groove; periphery subacute; chambers of the last whorl distinct, slightly inflated, 10 to 12 in the adult whorl, of rather uniform shape, increasing gradually in size as added; sutures on the dorsal side somewhat limbate, sometimes slightly raised, curved, ventrally slightly depressed; wall smooth, finely but distinctly perforate; aperture a low opening at the base of the last-formed chamber, with a slight lip. Diameter 0.55 to 0.65 mm., thickness 0.27 to 0.30 mm.

The types of this species are from the Selma chalk of the Pecan Gap chalk age at the upper end of a bluff on the Tombigbee River at Demopolis, Ala.

This species differs from *Cibicides harperi* Sandidge in the smaller size, the more definitely raised costae, and the less sharp periphery.

It occurs most commonly in the upper beds of Taylor age, is especially common in the Pecan Gap chalk, and ranges upward to the Neylandville marl and Saratoga chalk. It also occurs in the Upper Cretaceous of California.

Navarro age.
Selma chalk (upper part). Mississippi, Prentiss County (91).
Ripley formation. Tennessee, McNairy County (94).
Saratoga chalk. Arkansas, Hempstead County (80, 81, 83).
Neylandville marl. Texas, Kaufman County (59).

Taylor age.
Upper part of Taylor marl. Texas, Kaufman County (130); Milam County (139); Williamson County (142); Hays County (150); Bexar County (152, 153, 158).
Ozan formation. Arkansas, Little River County (254).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (165, 166).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Tennessee, Hardin County (255). Mississippi, Union County (262).
Wolfe City sand member of Taylor marl. Texas, Collin County (181).
Annona chalk. Texas, Bowie County (189, 190); Red River County (196, 197).
Lower part of Taylor marl. Texas, Bell County (245).

Cibicides harperi (Sandidge) Cushman
Plate 65, figures 5–7

Anomalina harperi Sandidge, Am. Midland Naturalist, vol. 13, p. 316, pl. 29, figs. 1, 2, 1932.
Cibicides harperi Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 38, pl. 7, figs. 3–5, 1940.
Cushman and Todd, idem, vol. 19, p. 72, pl. 12, fig. 16, 1943.
Cibicides ripleyensis Sandidge? (not *Truncatulina ripleyensis* W. Berry), Am. Midland Naturalist, vol. 13, p. 199, pl. 19, figs. 17–19, 1932.

Test almost equally biconvex, the ventral side somewhat conical, the dorsal side slightly flattened at the center; periphery subacute, smooth in early stages, later becoming lobate; chambers numerous, 9 in the last coil, increasing in size very gradually, early chambers concealed on the dorsal side by a spiral of clear shell material occupying the umbilical area, chambers involute on the ventral side, a small umbo at the center of the coil; sutures slightly limbate on the dorsal side, smooth on the ventral side, curving slightly from the center of both faces to the periphery; wall coarsely punctate; aperture an arched opening at the base of the chambers on the periphery of the penultimate coil, extending a short distance onto the dorsal side under the margin of the chambers. Diameter of the holotype, 0.6 mm.—Sandidge, 1932.

The types are from the Ripley formation in a low bluff where Boguechitto Creek joins the Alabama River, Ala. In the present material, the species occurs in collections from the Ripley formation and from the upper beds of Navarro age.

Navarro age.
Kemp clay. Texas, Navarro County (3).
Corsicana marl. Texas, Limestone County (29, 30); Travis County (34); Bexar County (46).
Prairie Bluff chalk. Alabama, Sumter County (101, 102).

Cibicides subcarinatus Cushman and Deaderick
Plate 65, figures 8–11

Anomalina coonensis W. Berry (not *Truncatulina coonensis* Berry) in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 14, pl. 2, figs. 22–24, 1929.
Cibicides coonensis Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 39, pl. 7, figs. 6–8, 1940.
Cushman and Hedberg, idem, vol. 17, p. 100, pl. 23, figs. 21a–c, 1941.
Anomalina pseudopapillosa Cushman (not Carsey), Tennessee Div. Geology Bull. 41, p. 61, pl. 12, figs. 4a–c, 1931.
Cibicides subcarinatus Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 341, 1944.
Cushman, Cushman Lab. Foram. Research Contr., vol. 20, p. 96, pl. 14, fig. 21, 1944.

Test involute, somewhat compressed, nearly equally biconvex, peripheral margin subcarinate; chambers numerous, usually 12 in the last formed coil, very slightly curving; sutures limbate, slightly raised, comma-shaped, slightly elevated at the edge of the umbilical area; wall punctate; aperture an arched slit at the base of the last chamber, extending toward the umbilicus. Diameter 0.55 mm.—Berry, 1929.

The types are from the Coon Creek tongue of the Ripley formation at Dave Week's place on Coon Creek, 3½ miles south of Enville, 7½ miles north of Adamsville, and ⅛ mile east of the main Hendersonville-Adamsville road, McNairy County, Tenn. The holotype has been redrawn here.

In the present material the species occurs mainly in collections from the upper beds of Taylor age, with specimens also in collections from the lower beds of Navarro age and one record from beds of Austin age. It is recorded from the "Orocue" formation of Quebrada La Petrolea, Colombia.

From a study of the holotypes, it is probable that "*Truncatulina wadei* W. Berry" (in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 12, pl. 3, figs. 13–15, 1929) and "*Anomalina wadei* W. Berry" (idem, p. 14, pl. 3, figs. 20–22, 1929) should be placed within the range of *Cibicides subcarinatus*. The holotypes of these forms have been redrawn here.

Navarro age.
Selma chalk (upper part). Tennessee, McNairy County (98). Alabama, Marengo County (104).
Ripley formation. Tennessee, McNairy County (94, 97).
Neylandville marl. Texas, Rockwall County (57); Navarro County (66).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 106); Lamar County (110); Hunt County (115, 116); Collin County (120); Navarro County (132); Bexar County (152).
Marlbrook marl. Arkansas, Clark County; Hempstead County.
Selma chalk (middle part). Mississippi, Alcorn County (258).
Lower part of Taylor marl. Texas, Delta County (206).
Austin age. Selma chalk (lower part). Mississippi, Itawamba County (351).

Cibicides beaumontianus (D'Orbigny) Brotzen
Plate 65, figure 12

Truncatulina beaumontiana D'Orbigny, Soc. géol. France Mém., 1st ser., vol. 4, p. 35, pl. 3, figs. 17–19, 1840.
Cibicides beaumontiana Brotzen, Sveriges geol. undersökning, ser. C, No. 396, p. 188, 1936.
Cushman, Cushman Lab. Foram. Research Contr., vol. 16, p. 39, pl. 7, figs. 9a–c, 1940; idem, vol. 20, p. 16, pl. 3, fig. 18, 1944.
Cushman and Deaderick, Jour. Paleontology, vol. 18, p. 342, pl. 53, figs. 36, 37, 1944.
Cibicides involuta Cushman (not Reuss), Jour. Paleontology, vol. 5, p. 315, pl. 36, figs. 10a–c, 1931; idem, vol. 6, p. 345, 1932.

Test trochoid, planoconvex; dorsal side flattened or slightly concave, evolute; ventral side strongly convex, involute; periphery acute, slightly lobulate; chambers distinct, usually 7 or 8 in the adult whorl, slightly inflated on the ventral side, increasing rather rapidly in size as added; sutures distinct, earlier sutures slightly limbate, strongly curved, slightly depressed ventrally in the later portion; wall smooth, or slightly thickened above the sutures in the center of the dorsal side; aperture a low opening extending from the periphery well over onto the dorsal side at the base of the last-formed chamber. Diameter 0.75 to 1.00 mm., thickness 0.50 mm.

The types are from the Upper Cretaceous White chalk of Meudon, near Paris. The species is fairly widely distributed in the upper Senonian of Europe. In the present material it ranges from the horizons of the Saratoga chalk down to the horizons of the Annona chalk.

Navarro age. Saratoga chalk. Arkansas, Hempstead County (81); Howard County (79).
Taylor age.
Upper part of Taylor marl. Texas, Red River County (105, 108, 109); Lamar County (110); Rockwall County (124); Kaufman County (130).
Pecan Gap chalk member of Taylor marl. Texas, Delta County (166); Hunt County (168).
Selma chalk of Pecan Gap chalk age. Alabama, Marengo County (256).
Selma chalk (middle part). Mississippi, Alcorn County (259).
Wolfe City sand member of Taylor marl. Texas, Collin County (180, 181); Navarro County (188).
Annona chalk. Texas, Red River County (196).

Cibicides constrictus (Hagenow) Cushman
Plate 65, figure 13

Rotalia constricta Hagenow, Neues Jahrb., 1842, p. 571.
Reuss, Akad. Wiss. Wien, Math-naturwiss. Kl., Sitzungsber., vol. 44, pt. 1, 1861, p. 329, pl. 6, fig. 7 (1862).
Cibicides constricta Cushman, Jour. Paleontology, vol. 5, p. 315, pl. 36, figs. 7a–c, 1931; Cushman Lab. Foram. Research Contr., vol. 16, p. 40, pl. 7, figs. 10a–c, 1940; idem, vol. 20, p. 17, pl. 3, fig. 19, 1944.

Specimens similar to that figured have been referred to *Cibicides constrictus*. They are common in the Saratoga chalk and have been recorded in the Pecan Gap chalk member of the Taylor marl.

Navarro group, Saratoga chalk. Arkansas, Howard County (79); Hempstead County (80, 81).
Taylor marl, Pecan Gap chalk member. Texas, Delta County (165).

Cibicides coonensis (W. Berry) Thalmann
Plate 65, figure 15

Truncatulina coonensis W. Berry (not *Anomalina coonensis* Berry), in Berry and Kelley, U. S. Nat. Mus. Proc., vol. 76, art. 19, p. 12, pl. 3, figs. 1–3, 1929.
Cibicides coonensis Thalmann, Jour. Paleontology, vol. 15, p. 679, 1941.
Cibicides berryi Cushman, Cushman Lab. Foram. Research Contr., vol. 14, p. 71, pl. 12, fig. 6, 1938; idem, vol. 16, p. 40, pl. 7, figs. 11a–c, 1940.

Test free, biconvex, dorsal side less convex than ventral, peripheral margin slightly rounded and slightly subcarinate; chambers numerous, 9 to 10 in the last coil, involute on ventral side, sutures depressed, slightly distinct, wall punctate; aperture an arched opening at the base of the last formed chamber with a slit extending under the dorsal margin of the chambers. Diameter, 0.35 mm.—Berry, 1929.

The types are from the Coon Creek tongue of the Ripley formation at Dave Week's place on Coon Creek, 3½ miles south of Enville, 7½ miles north of Adamsville, and ⅛ mile east of the main Hendersonville-Adamsville road, McNairy County, Tenn. (97). The holotype has been redrawn.

I have not found the species in the present collections.

According to the rules of nomenclature this species should retain the name *Cibicides coonensis* (W. Berry).

A number of papers on the Cretaceous Foraminifera of North and South America have been published since the last revision of the present paper. These contain numerous new species and varieties. Those from regions outside the range of the present paper have not been included here, but some of them may later be found in this area.

The following new species from the area covered by the present paper are noted:

New arenaceous Foraminifera from the Woodbine sand of northern Texas (Tappan, Jour. Paleontology, vol. 15, pp. 359–361, pl. 51, 1941):
Reophax woodbinensis Tappan, n. sp. (p. 359, pl. 51, figs. 10–12).
Flabellammina brachylocula Tappan, n. sp. (p. 360, pl. 51, fig. 9).
Flabellammina denisonensis Tappan, n. sp. (p. 360, pl. 51, figs. 1–8).

Cretaceous Foraminifera from the Brownstown marl of Arkansas (Cushman and Deaderick, Cushman Lab. Foram. Research Contr., vol. 18, pp. 50–66, pls. 9–15, 1942):
Ammobaculites subplanatus Cushman and Deaderick, n. sp. (p. 52, pl. 9, figs. 10, 11).
Darbyella brownstownensis Cushman and Deaderick, n. sp. (p. 56, pl. 11, figs. 1–3).
Dentalina basiplanata Cushman, var. *subsetigera* Cushman and Deaderick, n. var. (p. 58, pl. 11, figs. 5, 6).
Vaginulina texana Cushman, var. *suturocostata* Cushman and Deaderick, n. var. (p. 59, pl. 12, figs. 7–10).

Foraminifera of the lower part of the Mooreville chalk of the Selma group of Mississippi (Cushman, Cushman Lab. Foram. Research Contr., vol. 20, pp. 83–96, pls. 13, 14, 1944):
Pseudoglandulina costulata Cushman, n. sp. (p. 88, pl. 13, fig. 10).

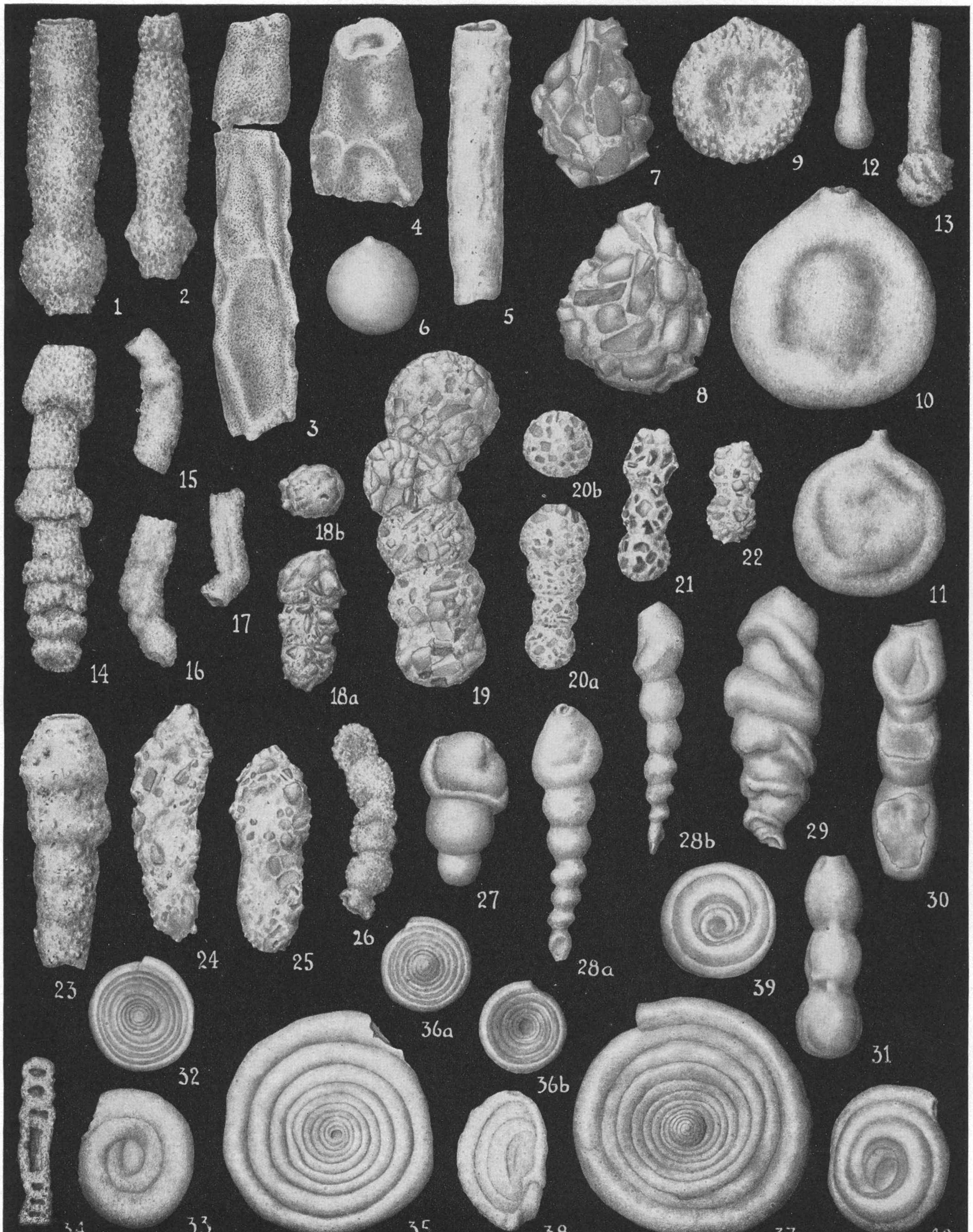
PLATES 1–66

PLATE 1

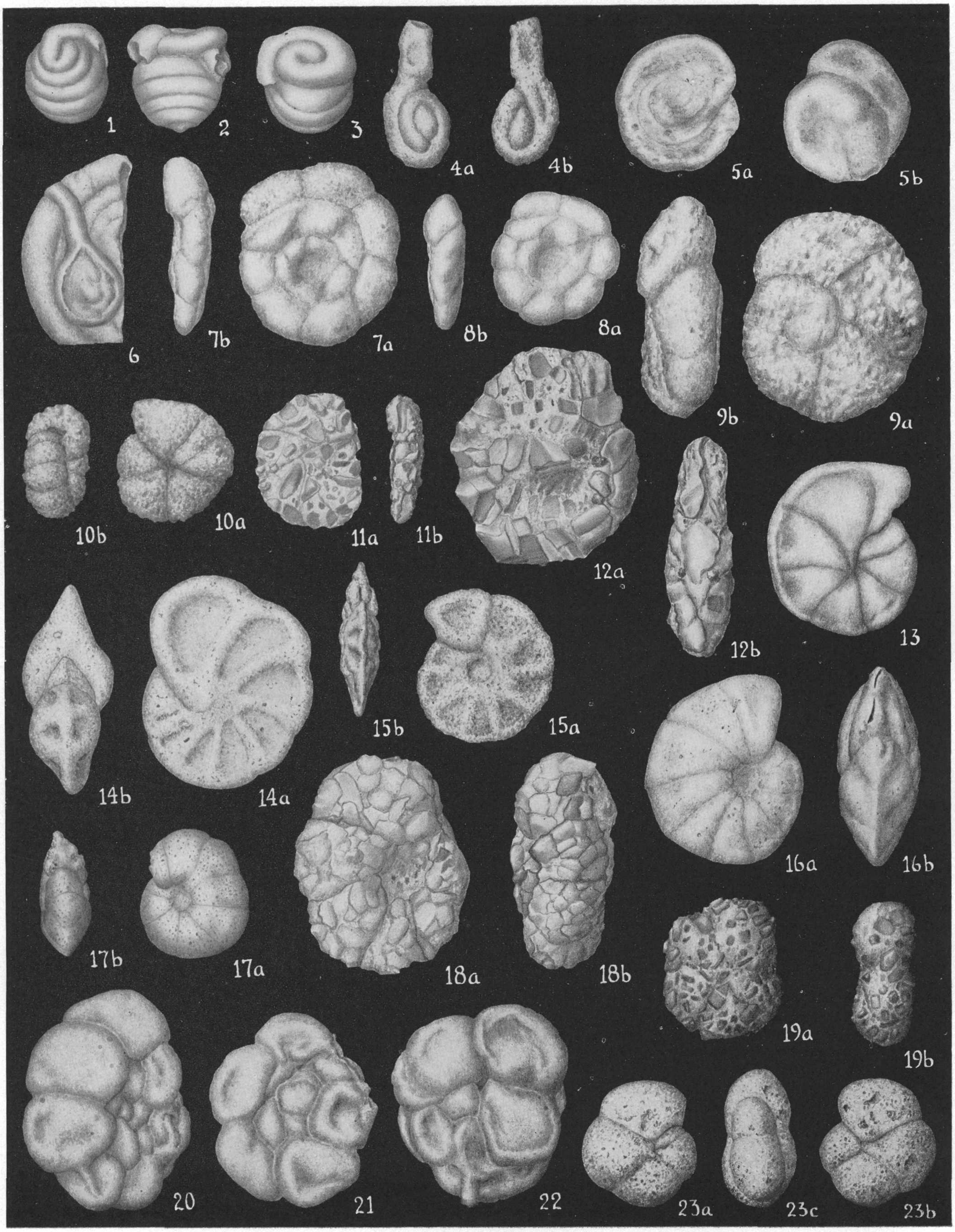
FIGURES 1, 2. *Rhabdammina discreta* H. B. Brady (p. 14). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 38.
3, 4. *Bathysiphon taurinensis* Sacco (p. 14). Lower part of Austin chalk, Grayson County, Tex. (335). × 33.
5. *Bathysiphon alexanderi* Cushman (p. 14). Holotype. Brownstown marl, Red River County, Tex. (318). × 55.
6. *Saccammina rhumbleri* (Franke) Cushman and Jarvis (p. 14). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 38.
7, 8. *Proteonina difflugiformis* (H. B. Brady) Rhumbler (p. 15). Ripley formation, Benton County, Tenn. (93). × 68.
9–11. *Pelosina complanata* Franke (p. 15). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 33.
12, 13. *Hyperammina elongata* H. B. Brady (p. 15). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 38.
14. *Hyperammina*? sp. (p. 15). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 33.
15–17. *Saccorhiza ramosa* (H. B. Brady) Eimer and Fickert (p. 15). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 33.
18–20. *Reophax texanus* Cushman and Waters (p. 16).
- 18. Navarro group, upthrow side of fault, Mexia oil field, Mexia, Tex. *a*, Front view; *b*, apertural view. × 38.
- 19. Kemp clay, 6 miles east of Corsicana, Navarro County, Tex. × 68.
- 20. Corsicana marl, Caldwell County, Tex. (44). *a*, Front view; *b*, apertural view. × 38.

21, 22. *Reophax constrictus* (Reuss) Cushman (p. 16). Prairie Bluff chalk, Wilcox County, Ala. (100). × 38.
23. *Reophax clavulinus* (Reuss) Cushman (p. 16). Selma chalk (lower part), Lee County, Miss. (350). × 38.
24, 25. *Reophax dentalinoides* (Reuss) Cushman (p. 16). Annona chalk, Red River County, Tex. (194). × 38.
26. *Reophax* sp. (p. 17). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 38.
27. *Hormosina globulifera* H. B. Brady (p. 17). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 33.
28–31. *Nodellum velascoense* (Cushman) Cushman and Jarvis (p. 17).
- 28. Velasco shale, Mexico. Holotype, *a*, Front view; *b*, side view. × 58.
- 29–31. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 45.

32. *Ammodiscus glabratus* Cushman and Jarvis (p. 17). Holotype. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 33.
33, 34. *Ammodiscus pennyi* Cushman and Jarvis (p. 17). (After Cushman and Jarvis.) Cretaceous, Trinidad. 33, Holotype. 34, Paratype. × 33.
35. *Ammodiscus cretaceus* (Reuss) Cushman (p. 17). Ripley formation, Henderson County, Tenn. (96). × 33.
36, 37. *Ammodiscoides turbinatus* Cushman (p. 18). (After Cushman and Jarvis.) Cretaceous, Trinidad. 36. *a*, *b*, Opposite sides. × 30.
38–40. *Glomospira gordialis* (Jones and Parker) Cushman (p. 18).
- 38. Upper part of Taylor marl, Delta County, Tex. (p. 114). × 68.
- 39, 40. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 38.



ASTRORHIZIDAE, RHIZAMMINIDAE, SACCAMMINIDAE, HYPERAMMINIDAE, REOPHACIDAE, AND AMMODISCIDAE.



AMMODISCIDAE, LITUOLIDAE.

PLATE 2

FIGURES 1–3. *Glomospira charoides* (Jones and Parker) Cushman var. *corona* Cushman and Jarvis (p. 19). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 58.

4, 5. *Lituotuba lituiformis* (H. B. Brady) Rhumbler (p. 19).
4. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, *b*, Opposite sides. × 33.
5. Velasco shale, Mexico. *a*, *b*, Opposite sides. × 45.

6. *Ammolagena clavata* (Jones and Parker) Eimer and Fickert. (p. 19). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 30.

7, 8. *Trochamminoides velascoensis* Cushman (p. 19). Velasco shale, Mexico. 7, × 55. 8, × 42. *a*, Side view; *b*, peripheral view.

9, 10. *Haplophragmoides eggeri* Cushman (p. 20).
9. Velasco shale, Mexico. Holotype, *a*, side view; *b*, peripheral view. × 55.
10. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, peripheral view. × 30.

11, 12. *Haplophragmoides calcula* Cushman and Waters (p. 19). Corsicana marl, Hunt County, Tex. (24). *a*, Side view; *b*, peripheral view. 11, × 40; 12, × 60.

13–15. *Haplophragmoides excavata* Cushman and Waters (p. 21).
13. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 75.
14. Corsicana marl, Hunt County, Tex. (24). Holotype, *a*, Side view; *b*, peripheral view. × 68.
15. Navarro group, core sample, upthrow side of fault, Mexia oil field, Mexia, Tex. *a*, Side view; *b*, peripheral view. × 50.

16, 17. *Haplophragmoides glabra* Cushman and Waters (p. 20).
16. Corsicana marl, Hunt County, Tex. (24). *a*, Side view; *b*, apertural view. × 75.
17. Navarro group, core sample, upthrow side of fault, Mexia oil field, Mexia, Tex. *a*, Side view; *b*, peripheral view. × 55.

18, 19. *Haplophragmoides rugosa* Cushman and Waters (p. 20).
18. Navarro group just east of Richland, Navarro County, Tex. *a*, Side view; *b*, peripheral view. × 68.
19. Selma chalk (middle part), Alcorn County, Miss. (257). *a*, Side view; *b*, peripheral view. × 75.

20–22. *Haplophragmoides coronata* (H. B. Brady) Cushman (p. 20). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 30.

23. *Haplophragmoides kirki* Wickenden (p. 21). Riding Mountain beds near Millwood, Manitoba. Paratype, *a*, *b*, Opposite sides; *c*, peripheral view. × 90.

PLATE 3

FIGURE 1. *Haplophragmoides fraseri* Wickenden (p. 21). Bearpaw shale, Canada. Paratype, *a*, side view; *b*, peripheral view. × 90.

2. *Haplophragmoides gigas* Cushman (p. 21). Cretaceous, Canada. × 30.

3. *Cribrostomoides trinitatensis* Cushman and Jarvis (p. 22). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 60.

4. *Ammobaculites alexanderi* Cushman (p. 22). Lower part of Taylor marl, Lamar County, Tex. (202). Holotype, *a*, side view; *b*, peripheral view; *c*, apertural view. × 60.

5. *Ammobaculites arenatus* Cushman (p. 22). Arkadelphia marl, Hempstead County, Ark. (72). Holotype. × 23.

6. *Ammobaculites colombianus* Cushman and Hedberg (p. 22). (After Cushman and Hedberg.) Cretaceous, Colombia. Holotype, *a*, side view; *b*, peripheral view. × 38.

7–9. *Ammobaculites coprolithiformis* (Schwager) Cushman (p. 22).
- 7, 8. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 38.
- 9. Corsicana marl, Caldwell County, Tex. (44). *a*, Side view; *b*, apertural view. × 38.

10–16. *Ammobaculites fragmentarius* Cushman (p. 23).
- 10, 11. Ripley formation, Benton County, Tenn. (93). × 68.
- 12–15. Bonham marl, Lamar County, Tex. (329). 12*a*, 13*a*, 14*a*, 15*a*, Side views; 12*b*, apertural view; 13*b*, 14*b*, 15*b*, peripheral views. × 38.
- 16. Lower part of Taylor marl, Ellis County, Tex. (234). *a*, Side view; *b*, basal view. × 38.

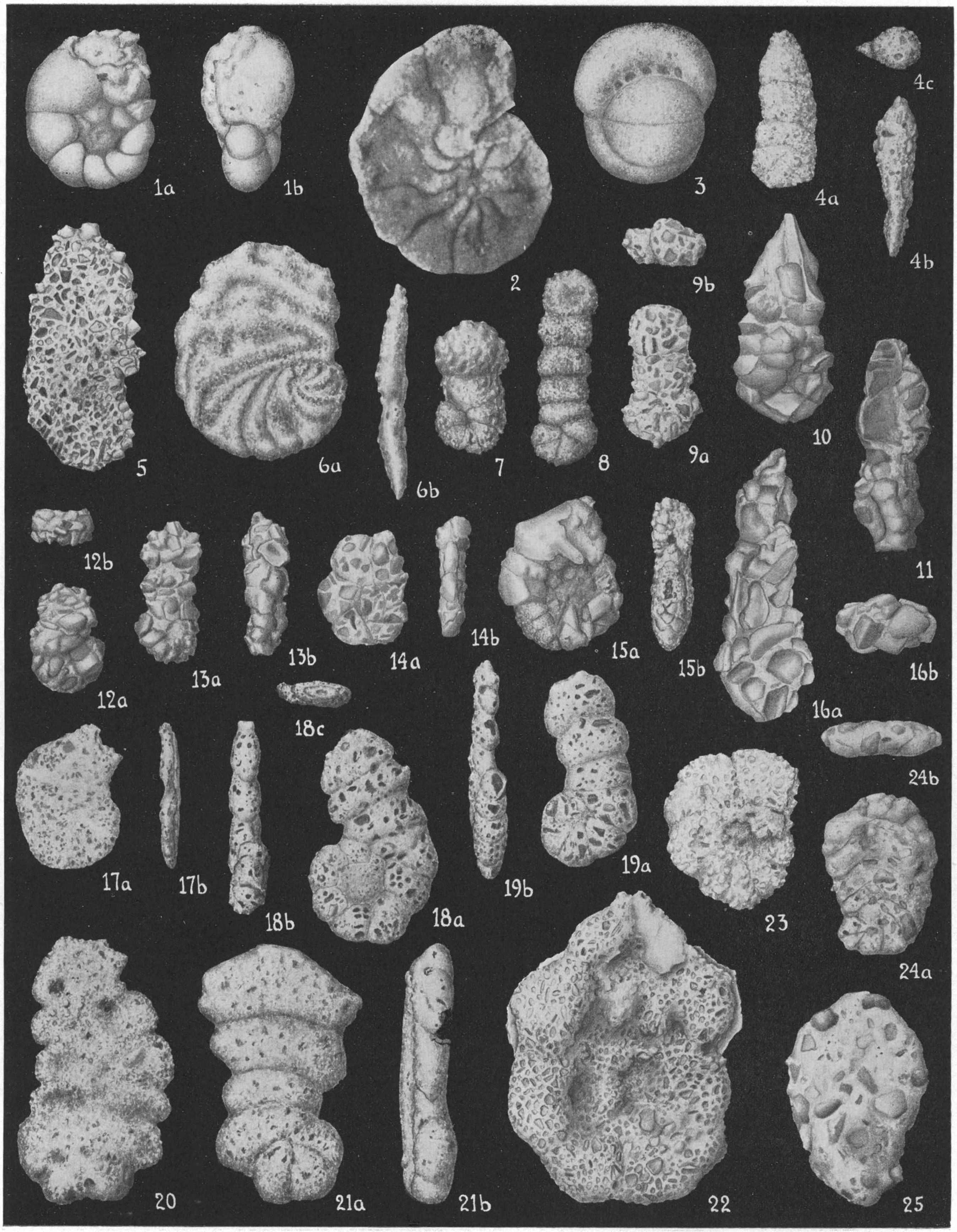
17. *Ammobaculites stephensoni* Cushman (p. 24). Lower part of Taylor marl, McLennan County, Tex. (243). Holotype *a*, side view; *b*, peripheral view. × 38.

18–20. *Ammobaculites subcretaceus* Cushman and Alexander (p. 23).
- 18, 19. Eagle Ford shale, well samples, Texas. *a*, Side view; *b*, peripheral view. × 55.
- 20. Eagle Ford shale near Britton, Tex. (370). × 30.

21. *Ammobaculites taylorensis* Cushman and Waters (p. 23). Taylor marl, well samples, Caldwell County, Tex. Holotype, *a*, side view; *b*, peripheral view. × 38.

22, 23. *Ammobaculites texanus* Cushman (p. 23). Corsicana marl, Bexar County, Tex. (46). 22, Holotype. × 23.

24, 25. *Flabellammina saratogaensis* Cushman (p. 24).
- 24. Saratoga chalk, Howard County, Ark. (79). Holotype, *a*, front view; *b*, apertural view. × 25.
- 25. Marlbrook marl, Little River, Ark. (254). × 38.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LITUOLIDAE.

LITUOLIDAE.

PLATE 4

FIGURES 1, 2. *Flabellammina clava* Alexander and Smith (p. 24). (After Alexander and Smith.) Austin chalk, Tex. × 25.

3–6. *Flabellammina compressa* (Beissel) Alexander and Smith (p. 25). Taylor marl, southeast of Delvalle, Tex. (145). × 38.

7, 8. *Flabellammina magna* Alexander and Smith (p. 25). (After Alexander and Smith.) Taylor marl, Tex. × 15.

9, 10. *Flabellammina rugosa* Alexander and Smith (p. 24). (After Alexander and Smith.) Austin chalk, Texas. × 25.

11, 12. *Frankeina cushmani* Alexander and Smith (p. 25). (After Alexander and Smith). Upper part of Taylor marl, 1.5 miles south of Delvalle, Tex. (145). 12, Holotype. 11, Paratype. × 25.

13, 14. *Frankeina rugosissima* Alexander and Smith (p. 25). (After Alexander and Smith.) Taylor marl, 6 miles northeast of Austin, Tex. 13, Holotype. 14, Paratype. × 20.

PLATE 5

FIGURES 1, 2. *Frankeina taylorensis* Cushman and Waters (p. 25).
1. Holotype. (After Cushman and Waters.) Taylor marl, well samples, Caldwell County, Tex. × 22.
2. (After Alexander and Smith.) Taylor marl, Tex. × 15.

3, 4. *Haplophragmium taylorense* Cushman and Waters (p. 26). (After Cushman and Waters.) Taylor marl, well samples, Caldwell County, Tex. 3, *a*, Side view; *b*, vertical section; *c*, apertural view. 4, Transverse section. × 22.

5. *Cyclammina elegans* Cushman and Jarvis (p. 26). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, side view; *b*, peripheral view. × 30.

6. *Lituola taylorensis* Cushman and Waters (p. 26). (After Cushman and Waters.) Upper part of Taylor marl, Leon County, Tex. (138). Holotype, *a*, front view; *b*, peripheral view; *c*, apertural view. × 8.

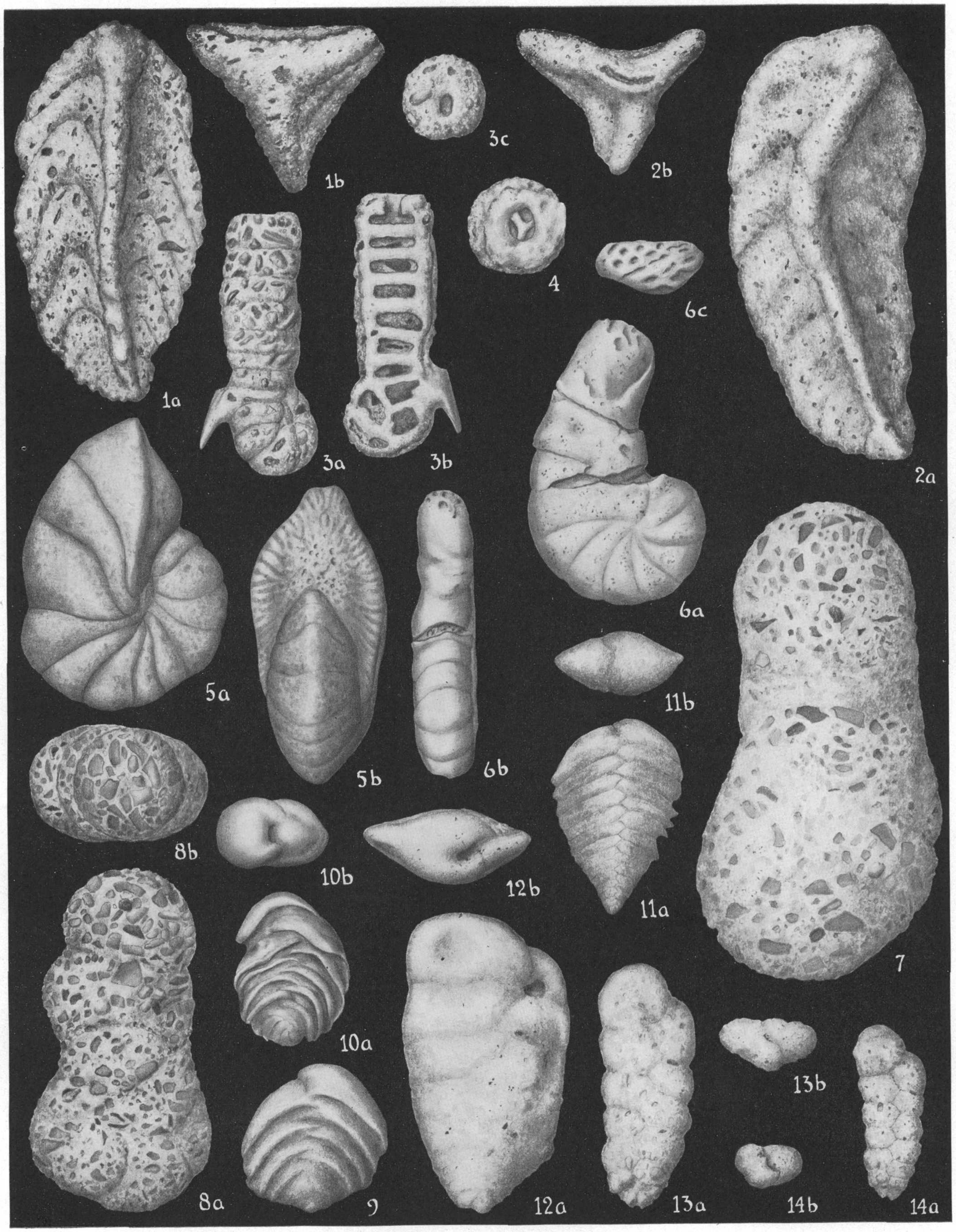
7, 8. *Lituola irregulariter* Cushman (p. 26). Lower part of Taylor marl, Ellis County, Tex. (234). 7, × 30. 8, × 25; *a*, Front view; *b*, apertural view.

9, 10. *Spiroplectammina excolata* (Cushman) Cushman and Jarvis (p. 27). (After Cushman and Jarvis.) Cretaceous, Trinidad. 9, *a*, Front view; *b*, apertural view. × 38.

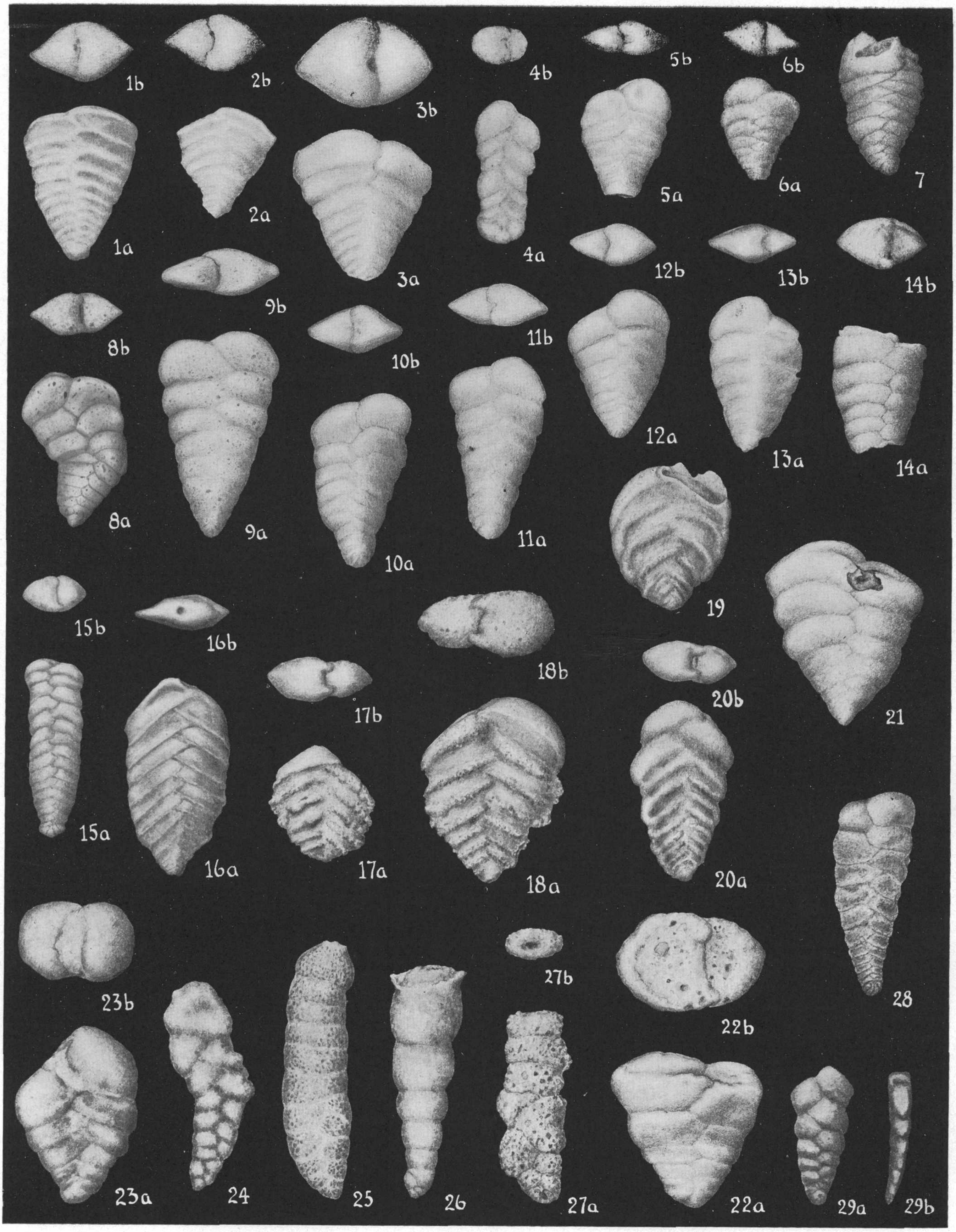
11. *Spiroplectammina dentata* (Alth) Cushman and Jarvis (p. 27). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 30.

12. *Spiroplectammina baudouiniana* (D'Orbigny) Cushman (p. 27). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 25.

13, 14. *Spiroplectammina navarroana* Cushman (p. 27). Kemp clay, Navarro County, Tex. (3). *a*, Front view; *b*, apertural view. 13, Holotype, × 90. 14, Paratype, × 68.



LITUOLIDAE, TEXTULARIIDAE.



TEXTULARIIDAE.

PLATE 6

FIGURES 1–3. *Spiroplectammina laevis* (Roemer) Cushman var. *cretosa* Cushman (p. 27). Upper part of Taylor marl, Collin County, Tex. (121). *a*, Front view; *b*, apertural view. 1, Holotype. 2, 3, Paratypes. ×55.

4. *Spiroplectammina mordenensis* Wickenden (p. 28). (After Wickenden.) Morden beds of Manitoba. *a*, Front view; *b*, apertural view. ×75.

5–14. *Spiroplectammina semicomplanata* (Carsey) Plummer (p. 28).
- 5. Corsicana marl, Travis County, Tex. (36). *a*, Front view; *b*, apertural view. ×68.
- 6, 7. Navarro group, well samples near Richland, Navarro County, Tex. *a*, Front view; *b*, apertural view. ×55.
- 8. Ripley formation, McNairy County, Tenn. (97). *a*, Front view; *b*, apertural view. ×68.
- 9. Corsicana marl, Travis County, Tex. (43). *a*, Front view; *b*, apertural view. ×25.
- 10–13. Prairie Bluff chalk, Moscow Landing, Tombigbee River, Ala. (103). *a*, Front view; *b*, apertural view. ×30.
- 14. Holotype of "*Textularia sagittula* var. *coonensis* W. Berry," redrawn. Ripley formation, McNairy County, Tenn. (97). *a*, Front view; *b*, apertural view. ×55.

15. *Spiroplectammina semicomplanata* (Carsey) Plummer var. *juncea* Cushman (p. 29). Saratoga chalk, Howard County, Ark. (79). Holotype, *a*, front view; *b*, apertural view. ×38.

16. *Spiroplectammina jarvisi* Cushman (p. 29). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, front view; *b*, apertural view. ×42.

17–20. *Textularia ripleyensis* W. Berry (p. 29).
- 17–19. Ripley formation, McNairy County, Tenn. (97). 17, Holotype redrawn, ×38. 18, 19, Topotypes, ×68. *a*, Front view; *b*, apertural view.
- 20. Upper part of Taylor marl (?), well samples, near Richland, Navarro County, Tex. *a*, Front view; *b*, apertural view. ×55.

21, 22. *Textularia subconica* Franke (p. 30). Lower part of Taylor marl, Lamar County, Tex. (200). *a*, Front view; *b*, apertural view. ×45.

23. *Textularia subglabra* Cushman (p. 30). Velasco shale, Mexico. Holotype, redrawn, *a*, front view; *b*, apertural view. ×90.

24. *Gaudryina canadensis* Cushman (p. 34). Paratype, Cretaceous, western Canada. ×55.

25. *Bigenerina hastata* Cushman (p. 30). Holotype, Cretaceous, Canada. ×30.

26. *Bigenerina velascoensis* Cushman (p. 30). Holotype, Velasco shale, Mexico. ×48.

27. *Ammobaculoides navarroensis* Plummer (p. 30). Kemp clay, Travis County, Tex. (15). Topotype, *a*, front view; *b*, apertural view. ×55.

28, 29. *Spiroplectammina lalickeri* Albritton and Phleger (p. 29).
- 28. Lower part of Taylor marl, Travis County, Tex. (247). ×55.
- 29. (After Albritton and Phleger.) Lower part of Taylor marl, Ellis County, Tex. (230). *a*, Front view; *b*, side view. ×45.

PLATE 7

FIGURE 1. *Verneuilina polystropha* (Reuss) H. B. Brady (p. 31). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 60.

2, 3. *Verneuilina canadensis* Cushman (p. 31). Cretaceous, western Canada. Paratypes. × 58.

4–6. *Verneulina bearpawensis* Wickenden (p. 31).
4, 5. Cretaceous, Alberta, Canada. Paratypes, *a*, front view; *b*, apertural view. × 100.
6. Ripley formation, McNairy County, Tenn. (94). *a*, Front view; *b*, side view; *c*, apertural view. × 90.

7. *Verneuilina cretosa* Cushman (p. 31). Austin chalk, Bell County Tex. (316). *a*, Front view; *b*, apertural view. × 25.

8. *Tritaxia manitobensis* Wickenden (p. 31). Cretaceous, Canada. Paratype, *a*, front view; *b*, apertural view. × 70.

9. *Tritaxia jarvisi* Cushman (p. 31). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, front view; *b*, apertural view. × 25.

10, 11. *Tritaxia ellisorae* Cushman (p. 32). Pecan Gap chalk, member of Taylor marl, Rockwall County, Tex. (175). 10, Holotype, *a*, front view; *b*, apertural view. 11, Paratype. × 38.

12, 13. *Gaudryina foeda* (Reuss) Cushman (p. 32). Prairie Bluff chalk, Wilcox County, Ala. (100). × 70.

14. *Gaudryina faujasi* (Reuss) Cushman (p. 32). Upper part of Taylor marl, Bexar County, Tex. (158). *a*, Front view; *b*, apertural view. × 38.

15, 16. *Gaudryina bentonensis* (Carman) Cushman (p. 33).
15. Benton shale, Sheep Mountain, Wyoming. Holotype, *a*, front view; *b*, apertural view. × 70.
16. Bonham marl, Lamar County, Tex. (329). *a*, Front view; *b*, apertural view. × 58.

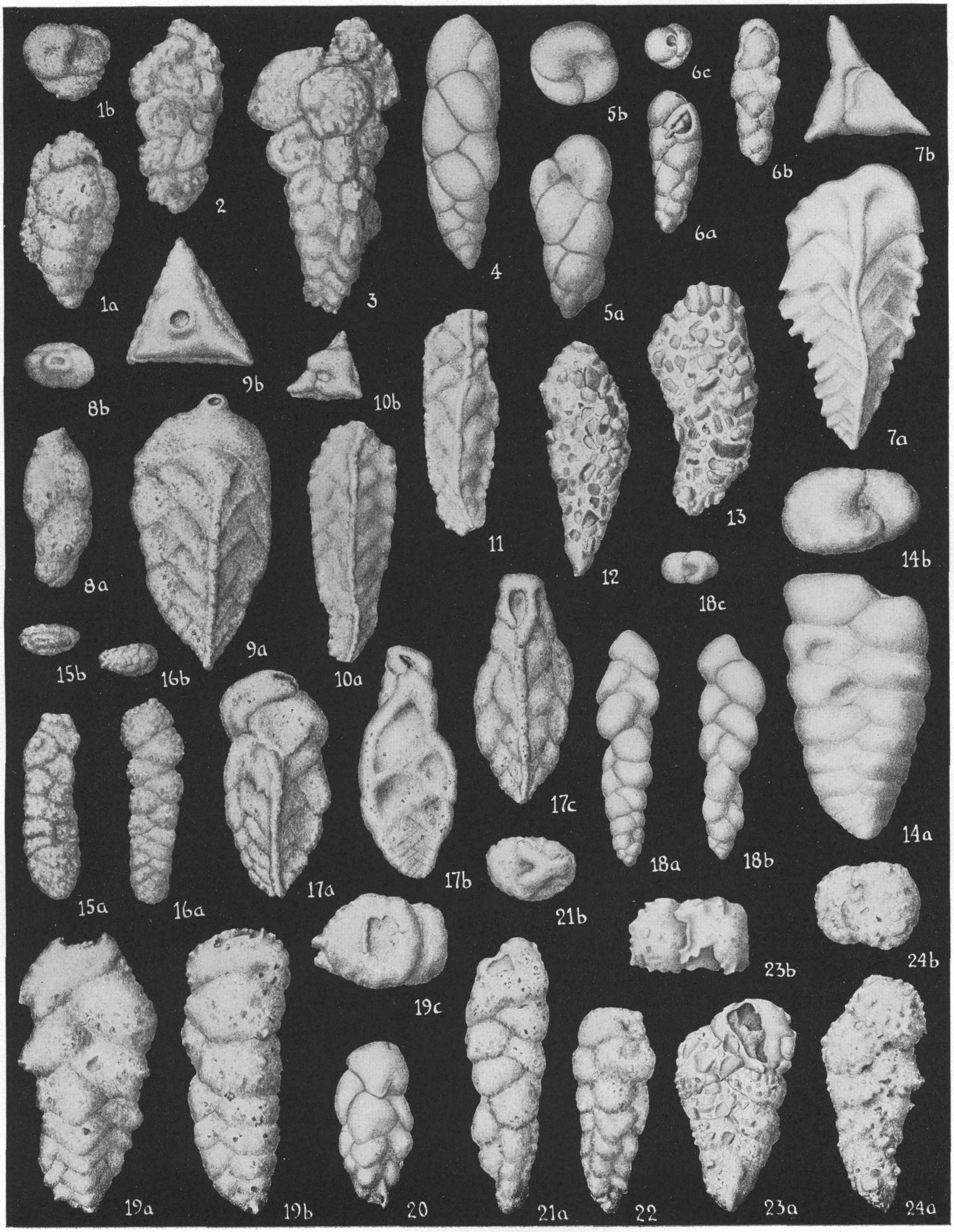
17. *Gaudryina navarroana* Cushman (p. 33). Navarro group, well sample, upthrow side of fault, Mexia oil field, Mexia, Tex. Holotype, *a*, front view; *b*, rear view; *c*, side view. × 55.

18. *Gaudryina painoides* Wickenden (p. 34). Boyne beds, western Canada. Paratype, *a*, front view; *b*, rear view; c, apertural view. × 150.

19. *Gaudryina io* Cushman (p. 33). Wolfe City sand member of Taylor marl, Collin County, Tex. (181). Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 30.

20–22. *Gaudryina bearpawensis* Wickenden. (p. 34). Bearpaw formation, Alberta, Canada. Topotypes, *a*, front view; *b*, apertural view. × 70.

23, 24. *Gaudryina rudita* Sandidge (p. 35).
23. Ripley formation, Henderson County, Tenn. (96). *a*, Front view; *b*, apertural view. × 68.
24. Prairie Bluff chalk, Moscow Landing, Tombigbee River, Ala. (103). *a*, Front view; *b*, apertural view. × 30.



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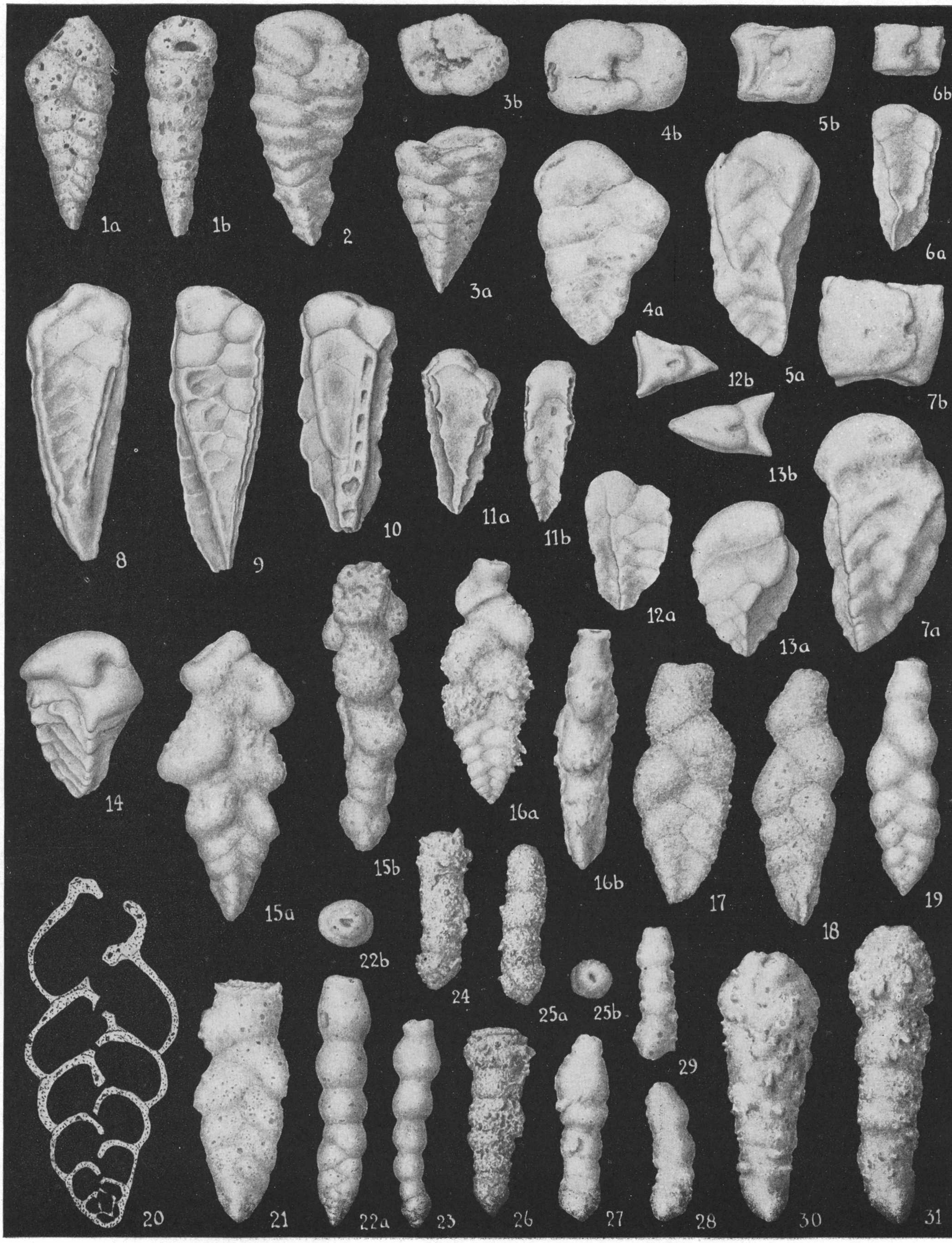


VERNEUILINIDAE.

PLATE 8

FIGURE 1. *Gaudryina rudita* Sandidge (p. 34). Selma chalk (upper part), McNairy County, Tenn. (98). *a*, Front view; *b*, side view. × 33.

2, 3. *Gaudryina quadrans* Cushman (p. 35). Upper part of Taylor marl, Bexar County, Tex. (158). 3, Holotype, *a*, Front view; *b*, apertural view. 2, Paratype. × 38.

4. *Gaudryina laevigata* Franke (p. 33). Upper part of Taylor marl, Red River County, Tex. (107). *a*, Front view; *b*, apertural view. × 38.

5–7. *Gaudryina (Siphogaudryina) austinana* Cushman (p. 35).
- 5, 6. Austin chalk, Collin County, Tex. (295). 5, Holotype. 6, Paratype. *a*, Front view; *b*, apertural view. × 30.
- 7. Gober tongue of Austin chalk, Lamar County, Tex. (288). *a*, Front view; *b*, apertural view. × 30.

8–11. *Gaudryina (Siphogaudryina) stephensoni* Cushman (p. 35).
- 8–10. Wolfe City sand member of Taylor marl, Collin County, Tex. (181). × 78.
- 11. Ripley formation, McNairy County, Tenn. (4). *a*, Front view; *b*, side view. × 68.

12, 13. *Gaudryina (Pseudogaudryina) ellisorae* Cushman (p. 35). Lower part of Taylor marl, Travis County, Tex. (248) 13, Holotype. 12, Paratype. *a*, Front view; *b*, apertural view. × 38.

14. *Gaudryina (Pseudogaudryina) pyramidata* Cushman (p. 36). Cretaceous, Trinidad. × 25.

15–21. *Gaudryinella pseudoserrata* Cushman (p. 36).
- 15. Corsicana marl, Limestone County, Tex. (30). *a*, Front view; *b*. side view. × 58.
- 16. Corsicana marl, Hunt County, Tex. (24). *a*, Front view; *b*, side view. × 58.
- 17, 18, 20. Corsicana marl, Caldwell County, Tex. (44). 20, Vertical section. × 58.
- 19, 21. Arkadelphia marl, Hempstead County, Ark. (72). × 28.

22–31. *Pseudoclavulina clavata* (Cushman) Cushman (p. 36.)
- 22. Lower part of Taylor marl, McLennan County, Tex. (242). *a*, Front view; *b*, apertural view. × 58.
- 23. Gober tongue of Austin chalk, Lamar County, Tex. (288). × 38.
- 24–26. Ripley formation, McNairy County, Tenn. (97). *a*, Front view; *b*, apertural view. × 60.
- 27–31. Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). × 30.

PLATE 9

FIGURES 1, 2. *Pseudoclavulina clavata* (Cushman) Cushman (p. 36). Ripley formation, McNairy County, Tenn. (97). 1, Original of "*Reophax coonensis* W. Berry," redrawn. 2, Original of "*Reophax cylindricus* var. *ripleyensis* W. Berry," redrawn. × 30.

3, 4. *Pseudoclavulina amorpha* (Cushman) Cushman (p. 37). Cretaceous, Mexico. 3, Holotype, × 16. 4, × 30; *a*. Front view; *b*, apertural view.

5. *Pseudoclavulina amorpha* (Cushman) Cushman var. *incrustata* Cushman (p. 37). Saratoga chalk, Howard County, Ark. (79). *a*, Front view; *b*, apertural view. × 25.

6–8. *Pseudoclavulina chitinosa* (Cushman and Jarvis) Cushman (p. 37). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 30.

9. *Pseudoclavulina arenata* (Cushman) Cushman (p. 37). Arkadelphia marl, Hempstead County, Ark. (72). *a*, Front view; *b*, apertural view. × 48.

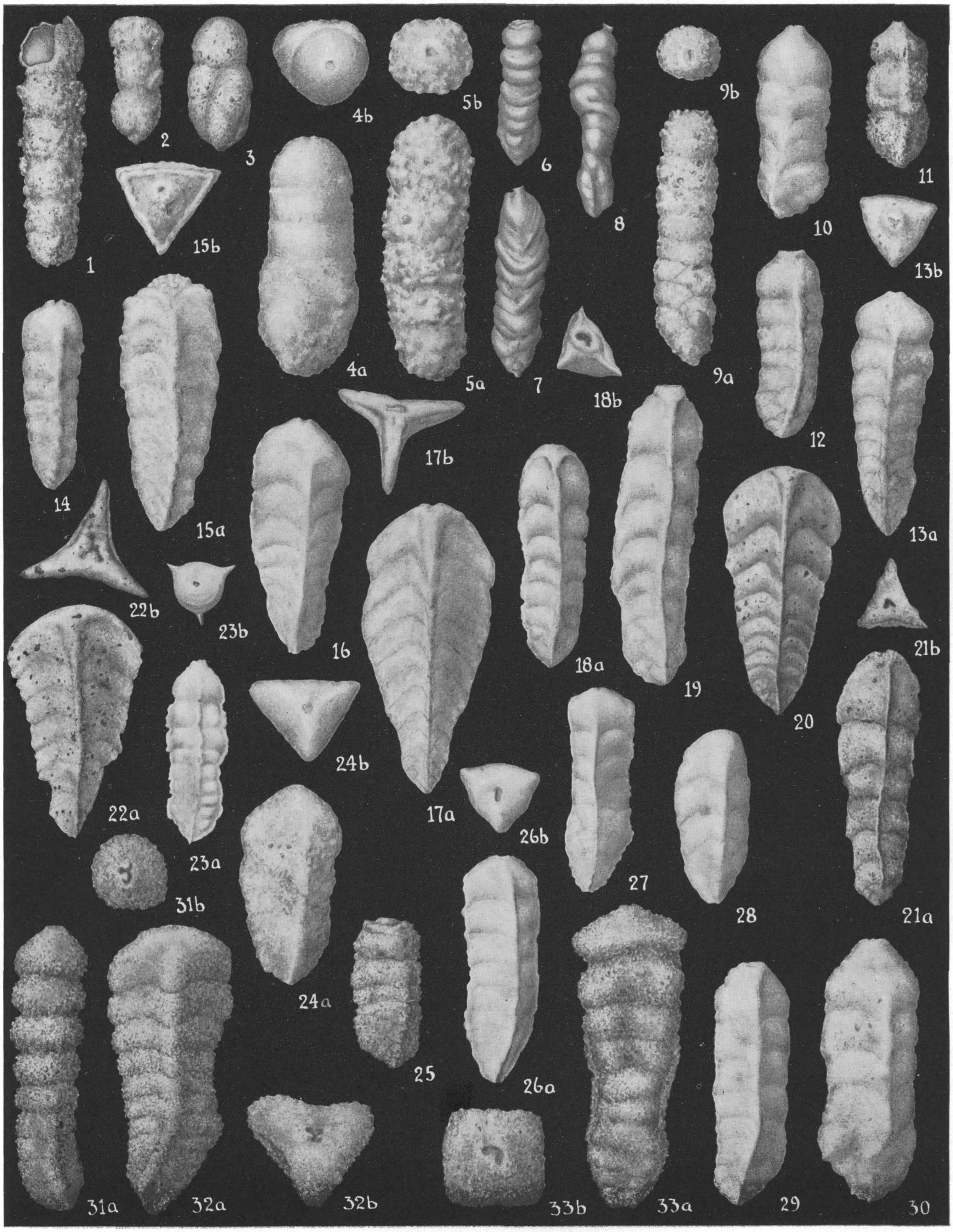
10–16. *Clavulinoides trilatera* (Cushman) Cushman (p. 38).
- 10. Velasco shale, Mexico. Holotype. × 38.
- 11. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 17.
- 12, 13. Saratoga chalk, Howard County, Ark. (79). *a* Front view; *b*, apertural view. × 25.
- 14, 15. Saratoga chalk, Hempstead County, Ark. (80). *a*, Front view; *b*, apertural view. × 25.
- 16. Corsicana marl, Travis County, Tex. (38). × 38.

17–22. *Clavulinoides trilatera* (Cushman) Cushman var. *concava* (Cushman) Cushman (p. 38).
- 17. Saratoga chalk, Howard County, Ark. (79). Holytope, *a*, Front view; *b*, apertural view. × 23.
- 18. Selma chalk (middle part), Prentiss County, Miss. (261). *a*, Front view; *b*, apertural view. × 30.
- 19. Ripley formation, McNairy County, Tenn. (95). × 30.
- 20–22. Ripley formation, Henderson County, Tenn. (96). *a*, Front view; *b*, apertural view. ×25.

23. *Clavulinoides trilatera* ((Cushman) Cushman var. *plummerae* (Sandidge) Cushman (p. 38). (After Sandidge.) Prairie Bluff chalk, Bartons Bluff, Tombigbee River, Ala. *a*, Front view; *b*, apertural view. × 23.

24–30. *Clavulinoides aspera* (Cushman) Cushman (p. 38).
- 24. Cretaceous, Mexico. *a*, Front view; *b*, apertural view. × 38.
- 25. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 30.
- 26, 27. Lower part of Taylor marl, Delta County, Tex. (206). *a*, Front view; *b*, apertural view. ×30.
- 28, 29. Lower part of Taylor marl, Bell County, Tex. (245). × 30.
- 30. Annona chalk, Red River County, Tex. (196). × 30.

31–33. *Clavulinoides aspera* (Cushman) Cushman var. *whitei* (Cushman and Jarvis) Cushman (p. 39). (After Cushman and Jarvis.) Cretaceous, Trinidad. 31, Holotype, *a*, Front view; *b*, apertural view; megalospheric form. 32, 33, Paratypes, *a*, Front view; *b*, apertural view; microspheric form. × 25.



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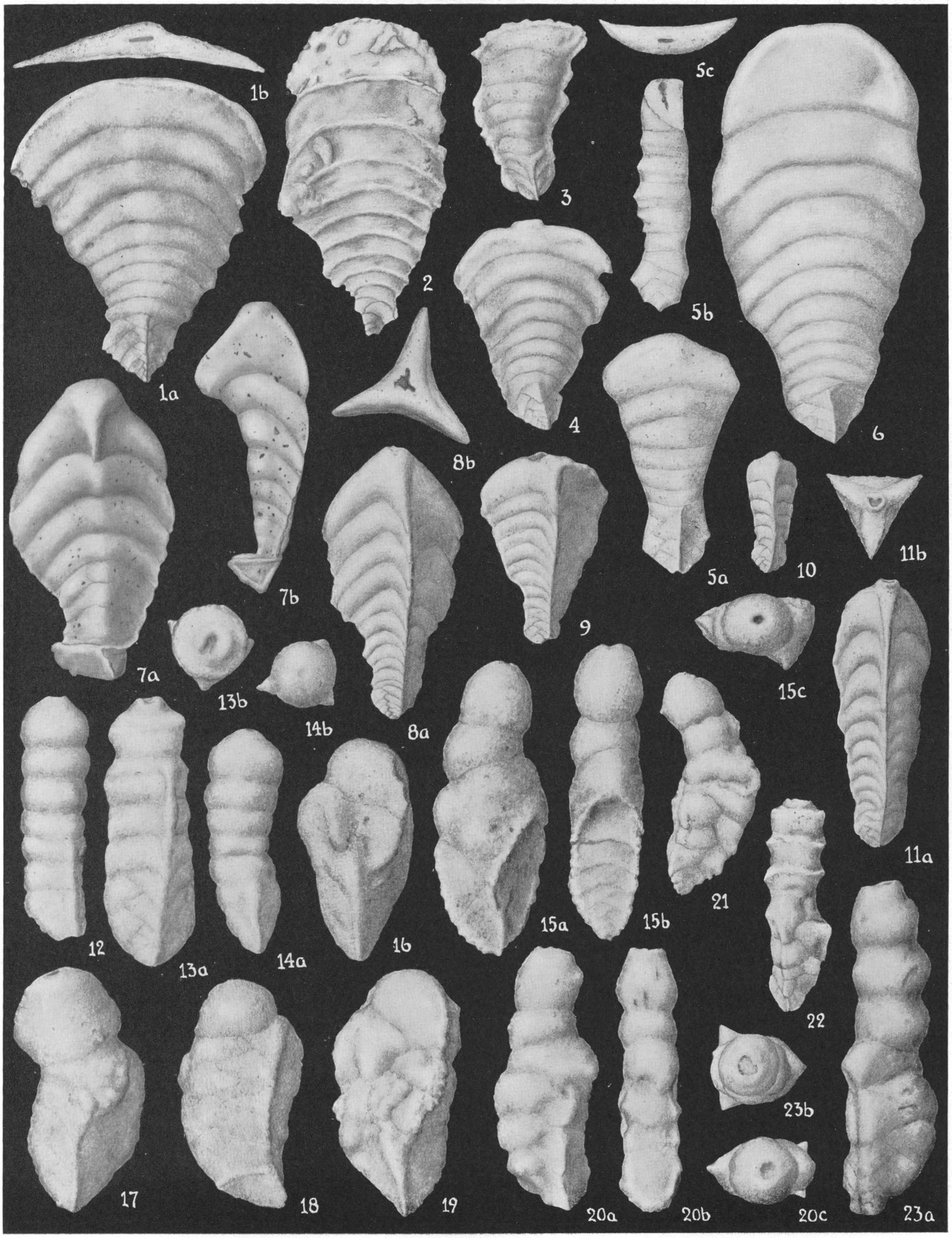


VERNEUILINIDAE.

PLATE 10

FIGURES 1–7. *Clavulinoides compressa* (Cushman) Cushman (p. 39).
- 1–4. Corsicana marl, Limestone County, Tex. (30). *a*, Front view; *b*, apertural view. × 38.
- 5. Navarro group, core sample, upthrow side of fault, Mexia oil field, Mexia, Tex. *a*, Front view; *b*, side view; *c*, apertural view. × 50.
- 6. Corsicana marl, Limestone County, Tex. (29). × 50.
- 7. Ripley formation, Henderson County, Tenn. (96). *a*, Front view; *b*, side view. × 25.

8–11. *Clavulinoides insignis* (Plummer) Cushman (p. 39). Corsicana marl, Navarro County, Tex. (26). 8, 9, Microspheric. 10, 11, Megalospheric. *a*, Front view; *b*, apertural view. × 25.

12–14. *Clavulinoides disjuncta* (Cushman) Cushman (p. 40). Annona chalk at type locality, Texas (188a). 13, Holotype, *a*, front view; *b*, apertural view. 12, 14, Paratypes, *a*, front view; *b*, apertural view. × 38.

15–19. *Pseudogaudryinella capitosa* (Cushman) Cushman (p. 40).
- 15. Selma chalk (lower part), Lee County, Miss. (350). Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 20.
- 16–19. Lower part of Taylor marl, Williamson County, Tex. (246). × 40.

20–23. *Pseudogaudryinella capitosa* (Cushman) Cushman var. *serrulata* (Cushman) Cushman (p. 40). Gober tongue of Austin chalk, Lamar County, Tex. (288).
- 20. Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 30.
- 21–23. Paratypes, *a*, front view; *b*, side view. 21, 22, × 25. 23, × 30.

PLATE 11

FIGURE 1. *Pseudogaudryinella mollis* (Cushman) Cushman (p. 40). Austin chalk, Dallas County, Tex. (311). Holotype, *a*, *b*, opposite sides; *c*, apertural view. × 80.

2–7. *Heterostomella austinana* Cushman (p. 41). Gober tongue of Austin chalk, Fannin County, Tex. (279). 2, Holotype. 3–7, Paratypes. *a*, Front view; *b*, side view; *c*, apertural view. 2–6, × 30; 7, × 58.

8, 9. *Heterostomella boynensis* Wickenden (p. 41). Boyne beds 1 mile east of Babcock, Manitoba. Paratypes, *a*, front view; *b*, apertural view. × 90.

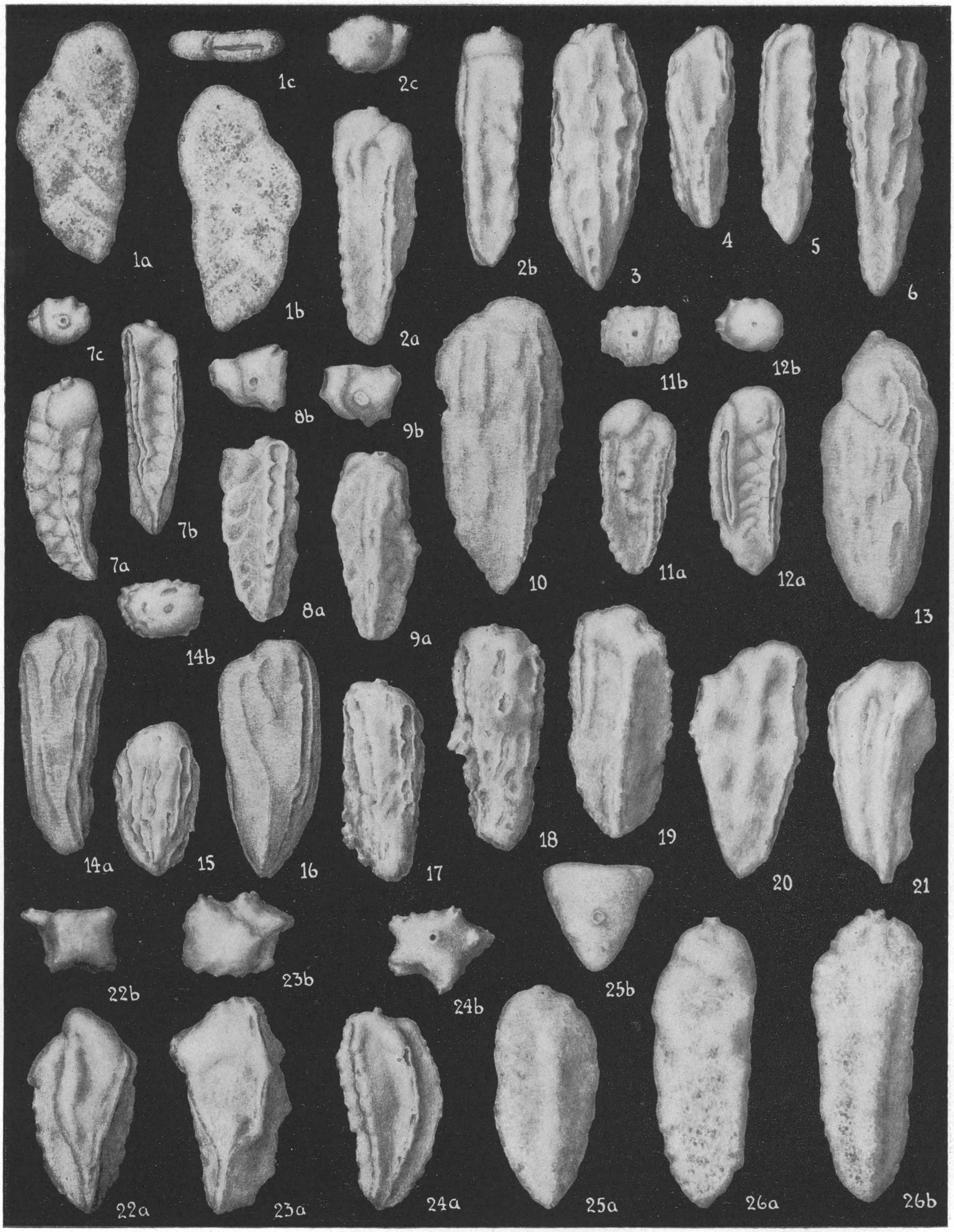
10, 12–21. *Heterostomella americana* Cushman (p. 41).
- 10. Lower part of Taylor marl, Bell County, Tex. (245). Holotype. × 90.
- 12. Ripley formation, McNairy County, Tenn. (94). *a*, Front view; *b*, apertural view. × 55.
- 13. Annona chalk, Red River County, Tex. (196). × 68.
- 14, 16. Upper part of Taylor marl, Red River County, Tex. (108). *a*, Front view; *b*, apertural view. × 68.
- 15. Upper part of Taylor marl, Red River County, Tex. (107). × 55.
- 17, 18. Pecan Gap chalk member of Taylor marl, Collin County, Tex. (169). × 55.
- 19–21. Annona chalk, Red River County, Tex. (195). × 55.

11. *Heterostomella foveolata* (Marsson) Cushman (p. 42). Saratoga chalk, Howard County, Ark. (79). *a*, Front view; *b*, apertural view. × 55.

22, 23. *Heterostomella cuneata* Sandidge (p. 42). Selma chalk (Upper part), Marengo County, Ala. (104). *a*, Front view; *b*, apertural view. × 90.

24. *Heterostomella cuneata* Sandidge var. *curvata* Cushman (p. 42). Selma chalk (upper part), Union County, Miss. (92). *a*, Front view; *b*, apertural view. × 55.

25, 26. *Heterostomella mexicana* Cushman (p. 42). Mendez shale, Mexico.
25, Holotype, *a*, front view; *b*, apertural view. 26, Paratype, *a*, front view; *b*, side view. × 55.



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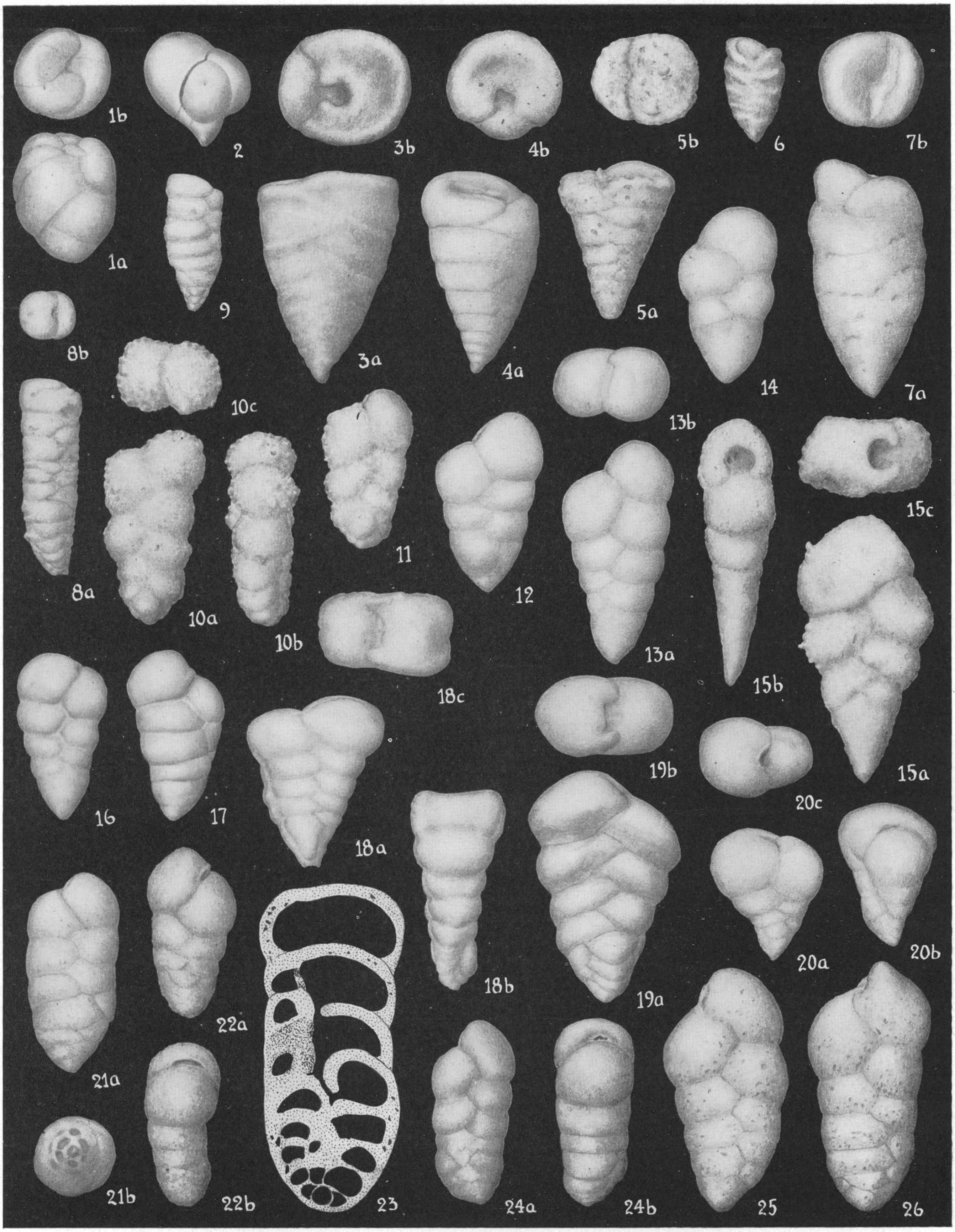


VALVULINIDAE.

PLATE 12

FIGURE 1. *Arenobulimina americana* Cushman (p. 42). Saratoga chalk, Howard County, Ark. (79). Holotype, *a*, front view; *b*, apertural view. × 38.

2. *Eggerella? trochoides* (Reuss) Cushman (p. 43). Ripley formation, Henderson County, Tenn. (96). × 42.

3–5. *Marssonella oxycona* (Reuss) Cushman (p. 43).
3, 4. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 25.
5. Saratoga chalk, Howard County, Ark. (79). *a*, Front view; *b*, apertural view. × 30.

6, 7. *Marssonella indentata* (Cushman and Jarvis) Cushman (p. 44).
6. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 27.
7. Mendez shale, Mexico. *a*. Front view; *b*, apertural view. × 55.

8, 9. *Marssonella ellisorae* Cushman (p. 44). Pecan Gap chalk, Falls County, Tex. (179). *a*, Front view; *b*, apertural view. × 38.

10, 11. *Dorothia concinna* (Reuss) Cushman (p. 44). Upper part of Taylor marl, Williamson County, Tex. (142). *a*. Front view; *b*, side view; *c*, apertural view. × 22.

12–14. *Dorothia conula* (Reuss) Cushman (p. 44). Annona chalk, 6.95 miles east of Clarksville, Red River County, Tex. (198). *a*. Front view; *b*, apertural view. × 42.

15. *Dorothia alexanderi* Cushman (p. 45). Brownstown marl, Lamar County, Tex. (320). Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 38.

16, 17. *Dorothia stephensoni* Cushman (p. 45). Upper part of Taylor marl, Bexar County, Tex. (152). × 55.

18, 19. *Dorothia glabrella* Cushman (p. 45).
18. Lower part of Taylor marl, Ellis County, Tex. (234). Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 38.
19. Upper part of Taylor marl, Red River County, Tex. (106). *a*, Front view; *b*, apertural view. × 38.

20. *Dorothia pontoni* Cushman (p. 46). Ripley formation, Pontotoc County, Miss. (90). *a*, Front view; *b*, side view; *c*, apertural view. × 33.

21–26. *Dorothia bulletta* (Carsey) Plummer (p. 46). Corsicana marl, Limestone County, Tex. (30). 21, *a*, Front view; *b*, basal view. 22, *a*, Front view; *b*, side view. 23, Vertical section. 24, *a*, Front view; *b*, side view. × 58.

PLATE 13

FIGURES 1–4. *Dorothia retusa* (Cushman) Cushman (p. 46). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 38.

5. *Dorothia glabrata* Cushman (p. 46). Corsicana marl, Travis County, Tex. (34). Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 58.

6–12. *Plectina watersi* Cushman (p. 47).

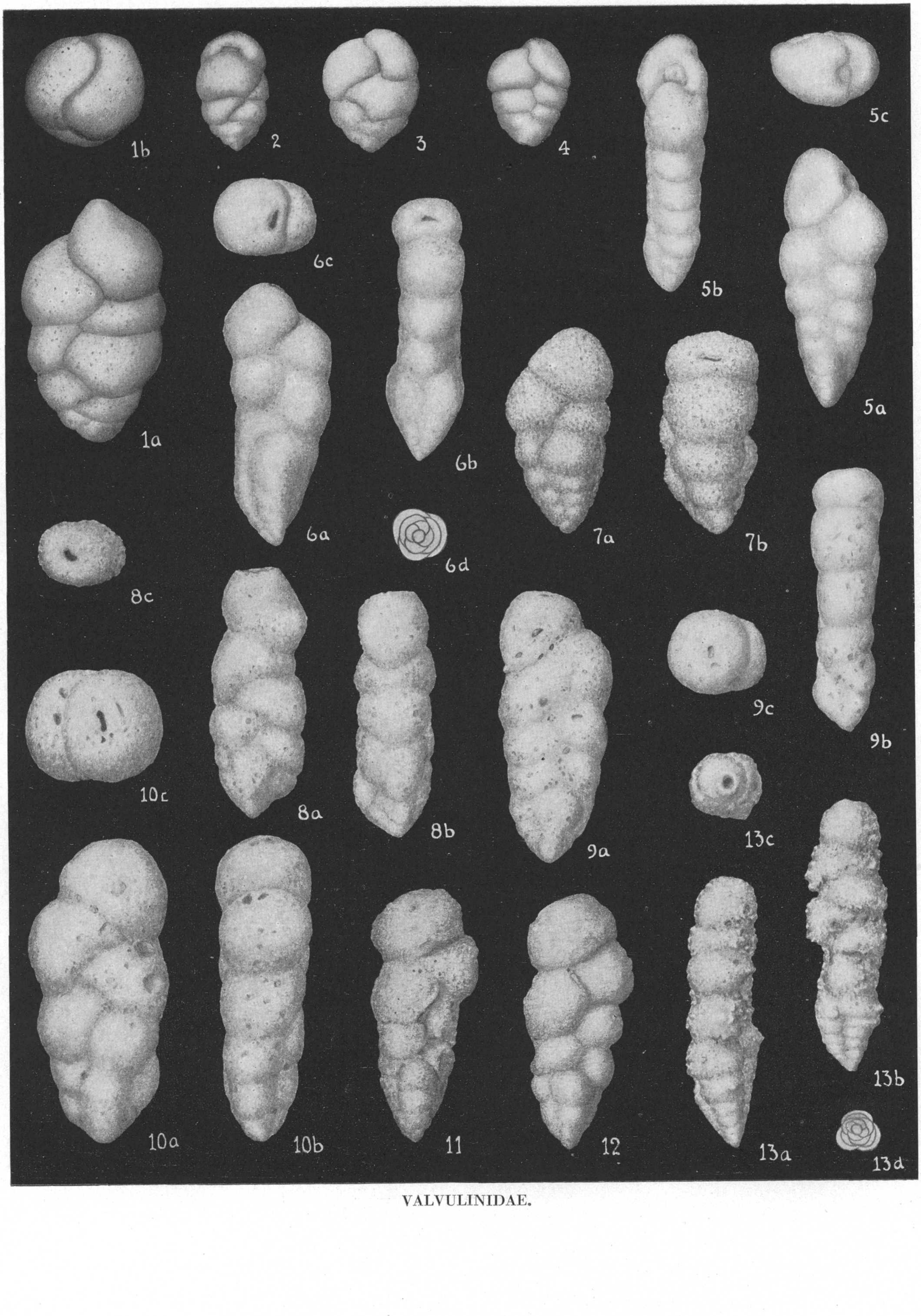
6. Corsicana marl, Navarro County, Tex. (26). Holotype, *a*, front view; *b*, side view; *c*, apertural view; *d*, basal view. × 25.

7. Navarro group, well samples near Richfield, Tex. *a*, Front view; *b*, side view. × 45.

8–10. Kemp clay, Guadalupe County, Tex. (21). *a*, Front view; *b*, side view; *c*, apertural view. × 25.

11, 12. Arkadelphia marl, Hempstead County, Ark. (70). × 28.

13. *Goësella rugulosa* Cushman (p. 47). Arkadelphia marl, Hempstead County, Ark. (70). Holotype, *a*, front view; *b*, side view; *c*, apertural view; *d*, basal view showing arrangement of early chambers. × 30.



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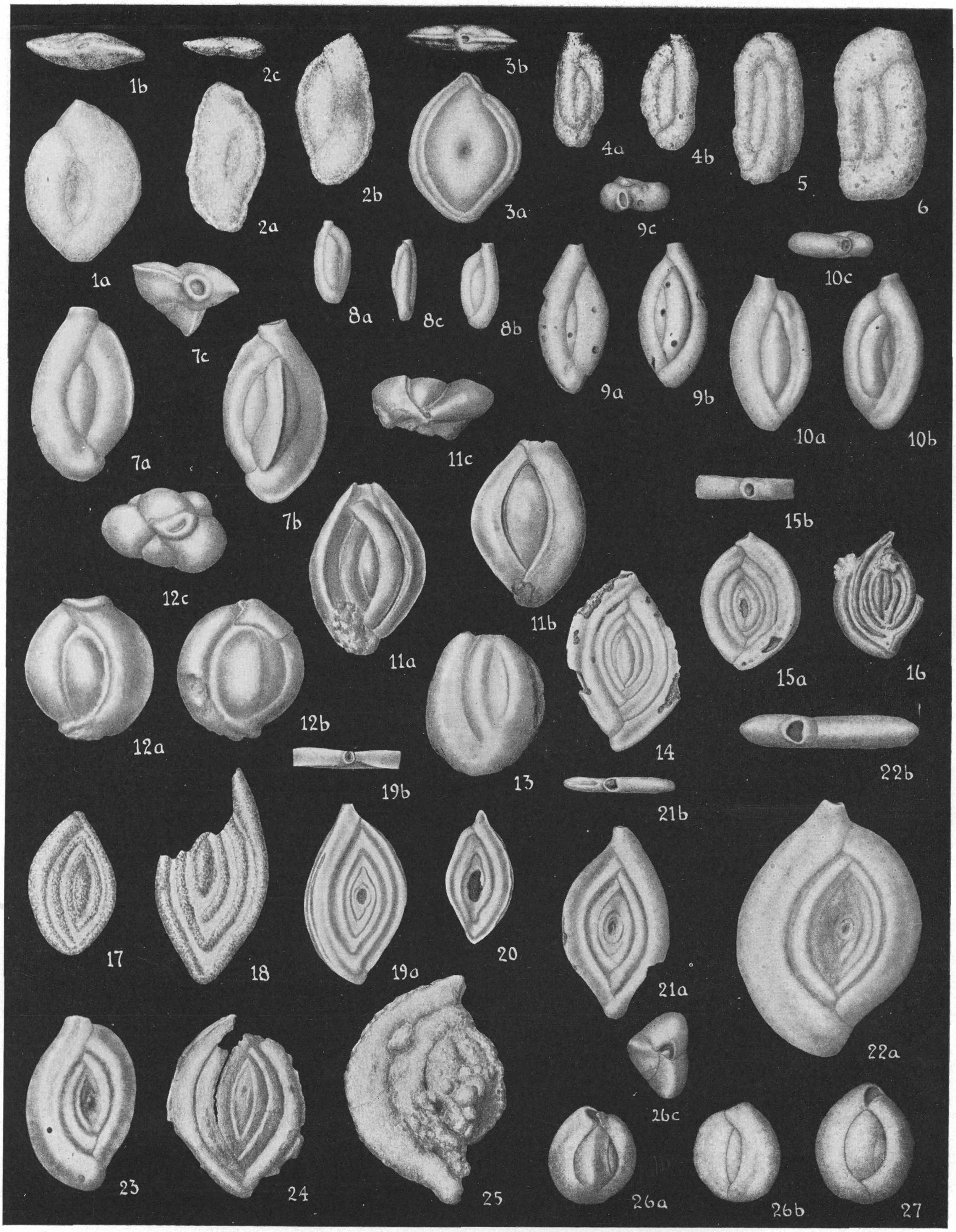


SILICINIDAE, MILIOLIDAE.

PLATE 14

FIGURES 1–3. *Rzehakina epigona* (Rzehak) Cushman var. *lata* Cushman and Jarvis (p. 47).
1, 2. Cretaceous, Mexico. *a*, Front view; *b*, apertural view. × 55.
3. (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, front view; *b*, apertural view. × 30.

4–6. *Miliammina manitobensis* Wickenden (p. 48). Cretaceous, Manitoba. Paratypes, *a*, *b*, opposite sides. × 68.

7. *Quinqueloculina moremani* Cushman (p. 48). Eagle Ford shale, Texas. Holotype, *a*, *b*, opposite sides; *c*, apertural view. × 68.

8–11. *Quinqueloculina antiqua* Franke var. *angusta* Franke (p. 48).
8. Topotype specimen in Franke collection at Arnstadt, Germany. *a*, *b*, Opposite sides; *c*, peripheral view. × 30.
9. From Ripley formation on Dave Weeks place, Coon Creek, McNairy County, Tenn. (97). *a*, *b*, Opposite sides; *c*, apertural view. × 68.
10. Holotype of "*Quinqueloculina coonensis* W. Berry," redrawn. From Ripley formation on Dave Weeks place, Coon Creek, McNairy County, Tenn. (97). *a*, *b*, Opposite sides; *c*, apertural view. × 55.
11. Corsicana marl, San Marcos River, Caldwell County, Tex. (44). Internal casts, *a*, *b*, opposite sides; *c*, apertural view. × 68.

12, 13. *Quinqueloculina* sp. (p. 48).
12. Velasco shale, Hacienda el Limon, Mexico. *a*, *b*, Opposite sides; *c*, apertural view. × 68.
13. Selma chalk (upper part), Bartons Bluff, Tombigbee River, Marengo County, Ala. (104). × 90.

14, 15. *Massilina texasensis* Cushman (p. 48). Kemp clay, Travis County, Tex. (17). 14, Paratype. 15, Holotype. *a*, Front view; *b*, apertural view. × 58.

16–18. *Massilina* sp. (p. 49).
16. Corsicana marl, bluff on Onion Creek, Travis County, Tex. × 68.
17, 18. Basal part of Austin chalk, Dallas County, Tex. (339). × 68.

19–23. *Spiroloculina cretacea* Reuss (p. 49).
19, 20. Lower part of Taylor marl, Ellis County, Tex. (231). *a*, Front view; *b*, apertural view. × 90.
21–23. Lower part of Taylor marl, Ellis County, Tex. (233). *a*, Front view; *b*, apertural view. × 90.

24, 25. *Spiroloculina* sp. (p. 49). Upper part of Taylor marl, Bexar County, Tex. (158). × 55.

26, 27. *Triloculina circularis* Bornemann (p. 49). Ripley formation on Dave Weeks place, Coon Creek, McNairy County, Tenn. (97). 26, Holotype of "*Quinqueloculina wadei* W. Berry," redrawn. *a*, *b*, Opposite sides; *c*, apertural view. × 68.

PLATE 15

FIGURES 1–3. *Trochammina diagonis* (Carsey) Cushman and Waters (p. 49).
1, 2. Corsicana marl, clay pit near Corsicana, Tex. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.
3. Corsicana marl, upthrow side of fault, Mexia oil field, Mexia, Tex. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 64.

4, 5. *Trochammina texana* Cushman and Waters (p. 50).
4. Corsicana marl, clay pit near Corsicana, Tex. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.
5. Corsicana marl, dug well at Tona School, near Quinlan, Tex. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

6. *Trochammina gyroides* Cushman and Waters (p. 50). Corsicana marl, east of Richland, Navarro County, Tex. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 64.

7. *Trochammina albertensis* Wickenden (p. 50). Bearpaw formation, Alberta. Paratype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 90.

8, 10, 11. *Trochammina globigeriniformis* (Parker and Jones) Cushman (p. 51). (After Cushman and Jarvis.) Upper Cretaceous, Trinidad. *a*, Dorsal view; *b*, peripheral view. × 30.

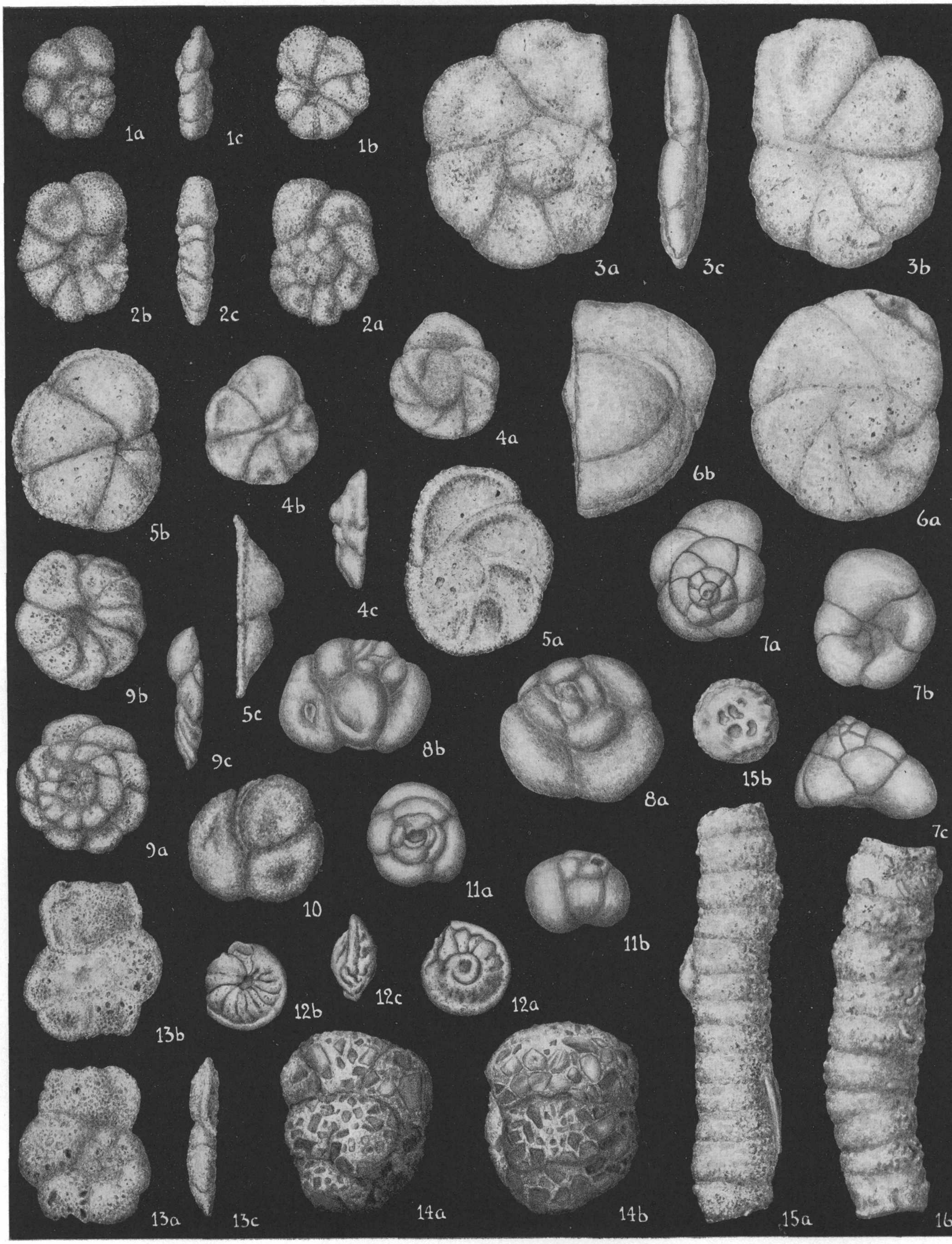
9. *Trochammina ribstonensis* Wickenden (p. 50). Lea Park formation, Imperial Ribstone well No. 1, 700–foot sample, Alberta. Paratype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 135.

12. *Trochammina trinitatensis* Cushman and Jarvis (p. 51). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

13. *Trochammina taylorana* Cushman (p. 51). Lower part of Taylor marl, Ellis County, Tex. (233). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 90.

14. *Trochammina* sp. (p. 51). Ripley formation on Dave Weeks place, Coon Creek, McNairy County, Tenn. (97). *a*, Dorsal view; *b*, peripheral view. × 55.

15, 16. *Polyphragma* sp. (p. 51). Austin chalk, Texas. *a*, Side view; *b*, apertural view. × 23.



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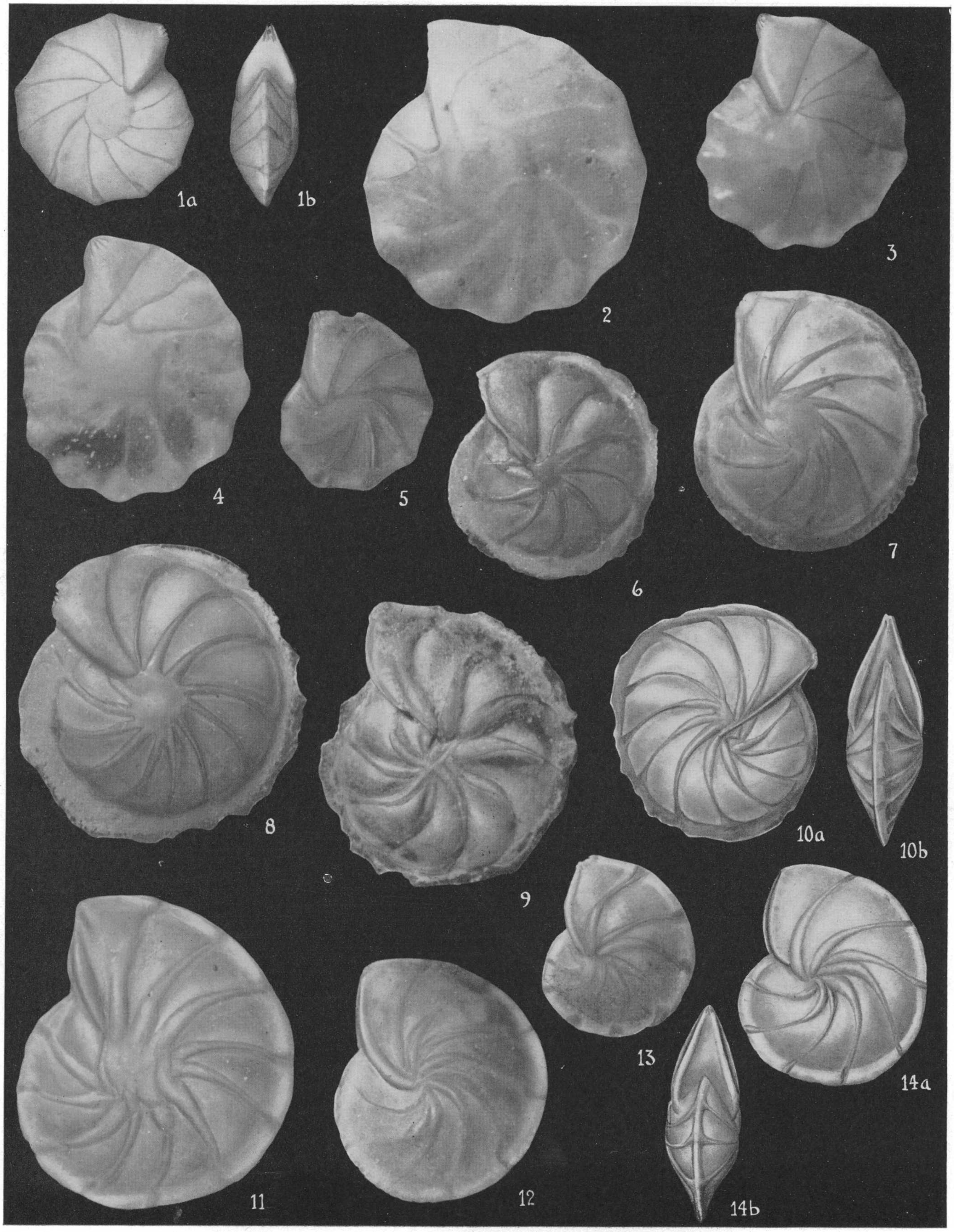

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PLATE 16

FIGURES 1–5. *Robulus pondi* Cushman (p. 52).
1. Ripley formation, Henderson County, Tenn. (96). Holotype, *a*, side view; *b*, apertural view. × 30.
2. Neylandville marl, Rockwall County, Tex. (57). × 30.
3, 5. Upper part of Taylor marl, Milam County, Tex. (139). × 30.
4. Neylandville marl, Delta County, Tex. (52). × 30.

6–8. *Robulus navarroensis* (Plummer) Cushman (p. 51).
6. Corsicana marl, Travis County, Tex. (39). × 30.
7, 8. Corsicana marl, Limestone County, Tex. (22). × 30.

9, 10. *Robulus navarroensis* (Plummer) Cushman var. *extruatus* Cushman (p. 52). Corsicana marl, Limestone County, Tex. (30). 9. Holotype. × 27. 10. Paratype, *a*, side view; *b*, apertural view. × 18.

11–14. *Robulus spisso-costatus* Cushman (p. 52). × 30.
11, 12, 14. Corsicana marl, Limestone County, Tex. (30). 11. Holotype. 12, 14. Paratypes. *a*, side view; *b*, apertural view. × 30.
13. Kemp clay, Williamson County, Tex. (11). × 30.

PLATE 17

FIGURE 1. *Robulus spisso-costatus* Cushman (p. 52). Corsicana marl, Limestone County, Tex. (30). Paratype. × 30.

2. *Robulus navarroensis* (Plummer) Cushman var. *extruatus* Cushman (p. 52). Corsicana marl, Limestone County, Tex. (30). Paratype. × 30.

3–9. *Robulus münsteri* (Roemer) Cushman (p. 53).
 3, 7. Ripley formation, Henderson County, Tenn. (96). 3, × 38. 7, × 30.
 4, 8. Upper part of Taylor marl, Limestone County, Tex. (136). × 30.
 5, 6. Gober tongue of Austin chalk, Lamar County, Tex. (288). 5, × 38. 6, × 30.
 9. Annona chalk at type locality, Texas (188a). *a*, Side view; *b*, apertural view. × 33.

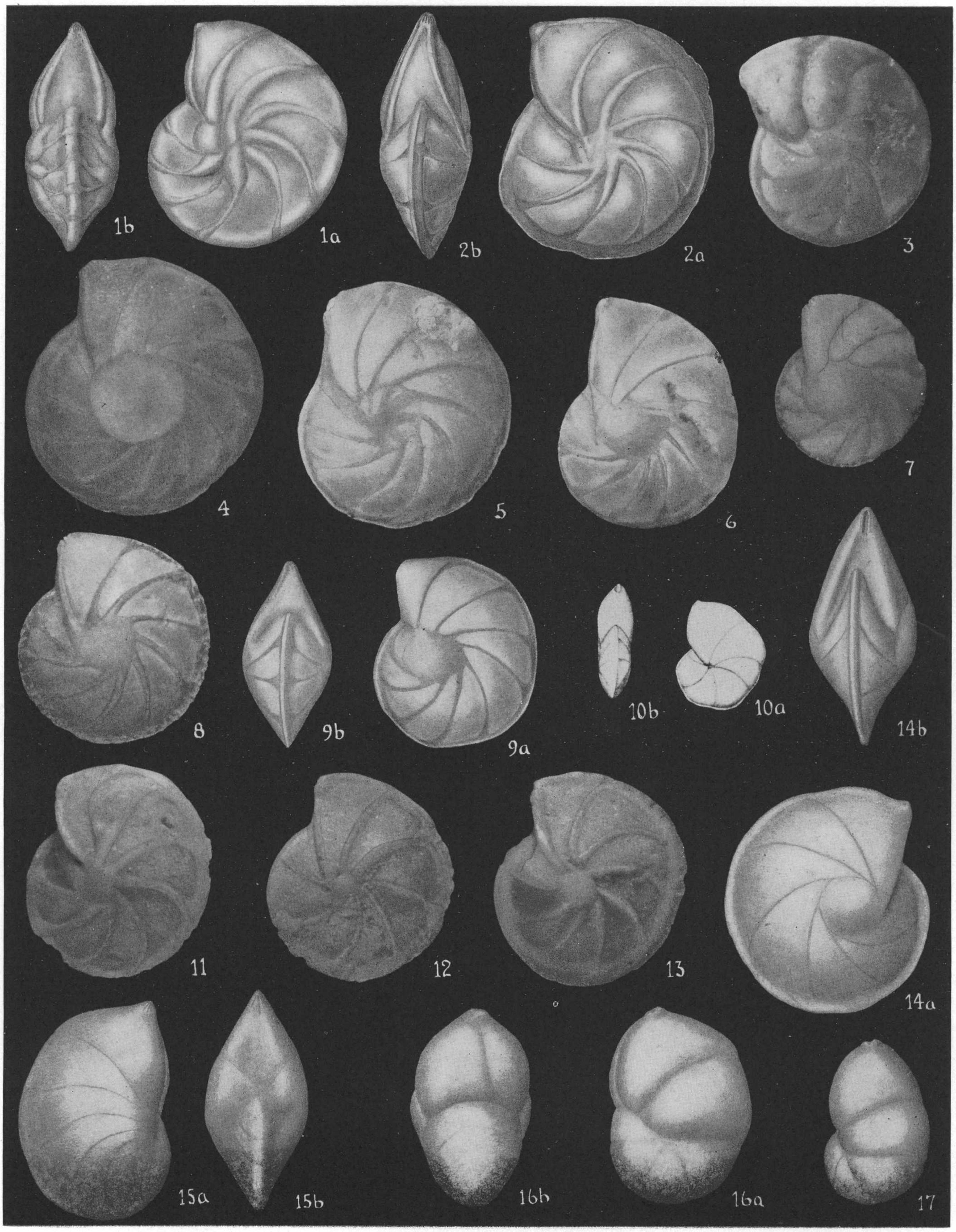
10. *Robulus isidis* (Schwager) Loetterle (p. 54). (After Loetterle.) Fort Hays limestone 4.7 miles east and 0.5 mile north of St. James, Nebr. × 38.

11–13. *Robulus pseudo-secans* Cushman (p. 53). Selma chalk (middle part), Hardin County, Tenn. (255). 11, Holotype. 12, 13, Paratypes. × 30.

14. *Robulus macrodiscus* (Reuss) Cushman and Jarvis (p. 54). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 33.

15. *Robulus discrepans* (Reuss) Cushman and Jarvis (p. 54). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 33.

16, 17. *Robulus oligostegius* (Reuss) Cushman and Jarvis (p. 54). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 33.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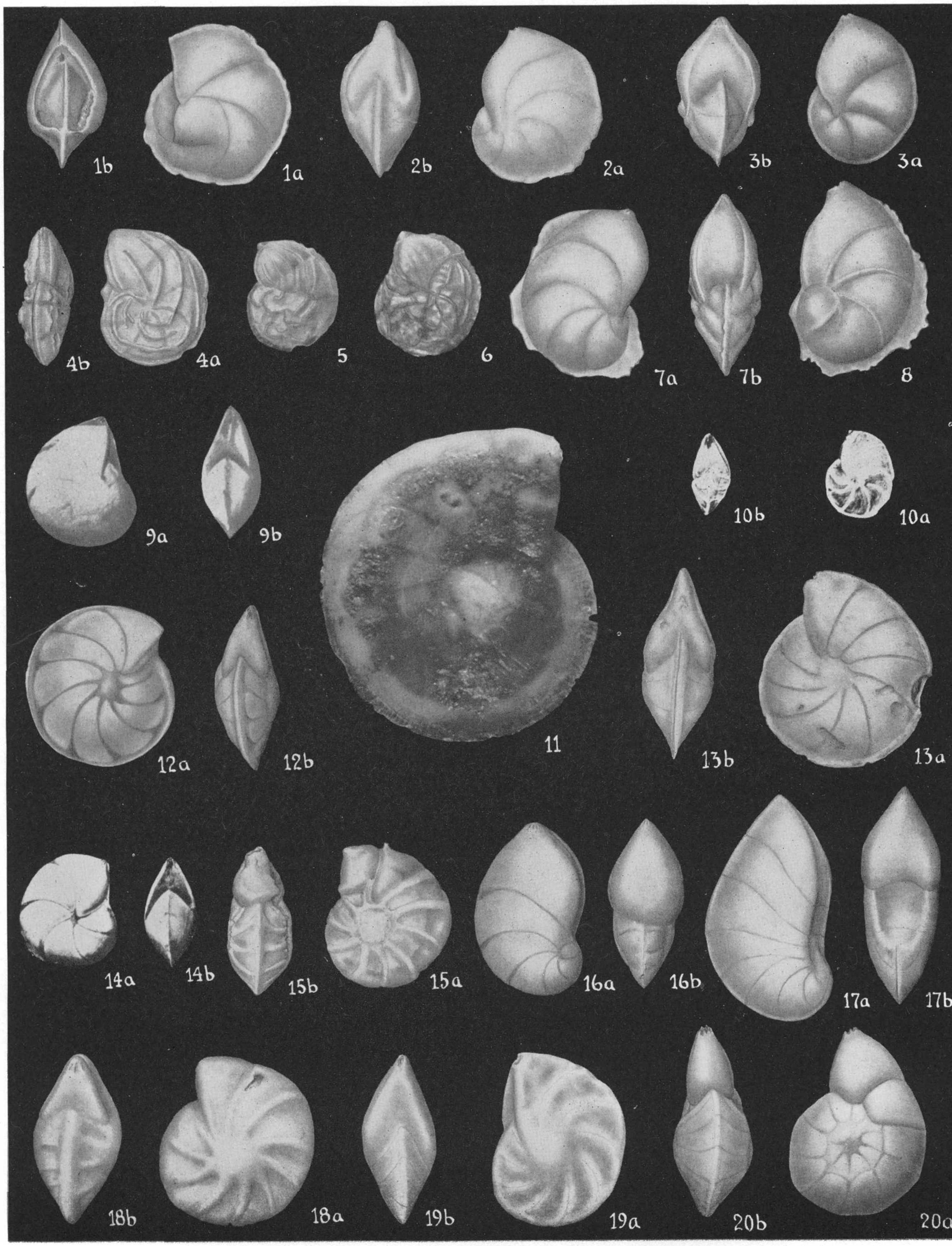
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PLATE 18

FIGURE 1. *Robulus sternalis* (Berthelin) Cushman and Jarvis (p. 54). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 38.

2, 3. *Robulus williamsoni* (Reuss) Cushman (p. 54).
- 2. White chalk, Antigua, British West Indies. *a*, Side view; *b*, apertural view. × 38.
- 3. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 38.

4. *Robulus trinitatensis* Cushman and Jarvis (p. 54) (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype. × 58.

5, 6. *Robulus cf. R. trinitatensis* Cushman and Jarvis (p. 54). Arkadelphia clay, Hempstead County, Ark. (73). × 45.

7, 8. *Robulus subalatus* (Reuss) Cushman and Jarvis (p. 55). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 33.

9. *Robulus alexanderi* Sandidge (p. 55). (After Sandidge.) Bartons Bluff, Tombigbee River, Marengo County, Ala. *a*, Side view; *b*, apertural view. × 33.

10. *Robulus aldrichi* Sandidge (p. 55). (After Sandidge.) Red Bluff, Alabama River. *a*, Side view; *b*, apertural view. × 23.

11. *Robulus* sp. (p. 55). Ripley formation, Henderson County, Tenn. (96). × 27.

12, 13. *Robulus stephensoni* Cushman (p. 55).
- 12. Ripley formation, Henderson County, Tenn. (96). Holotype, *a*, side view; *b*, apertural view. × 27.
- 13. Saratoga chalk at type locality, Arkansas. *a*, Side view; *b*, apertural view. × 25.

14. *Lenticulina jonesi* Sandidge (p. 55). (After Sandidge.) Rocky Bluff, 1 mile above Prairie Bluff, Alabama River, Ala. *a*, Side view; *b*, apertural view. × 30.

15. *Lenticulina kansasensis* Morrow (p. 56). Fort Hays limestone, Kansas. Redrawn form holotype; *a*, side view; *b*, apertural view. × 38.

16. *Lenticulina navicula* (D'Orbigny) Cushman and Jarvis (p. 56). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 38.

17. *Lenticulina nuda* (Reuss) and Jarvis (p. 56). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 55.

18. *Lenticulina sublaevis* Morrow (p. 56). Fort Hays limestone, Kansas. Redrawn from holotype; *a*, side view; *b*, apertural view. × 38.

19. *Lenticulina rotulata* Lamarck (p. 56). Annona chalk at type locality, Texas. *a*, Side view; *b*, apertural view. ×38.

20. *Robulus taylorensis* (Plummer) Cushman (p. 56). Lower part of Taylor marl, Fannin County, Tex. (203). *a*, Side view; *b*, apertural view. × 45.

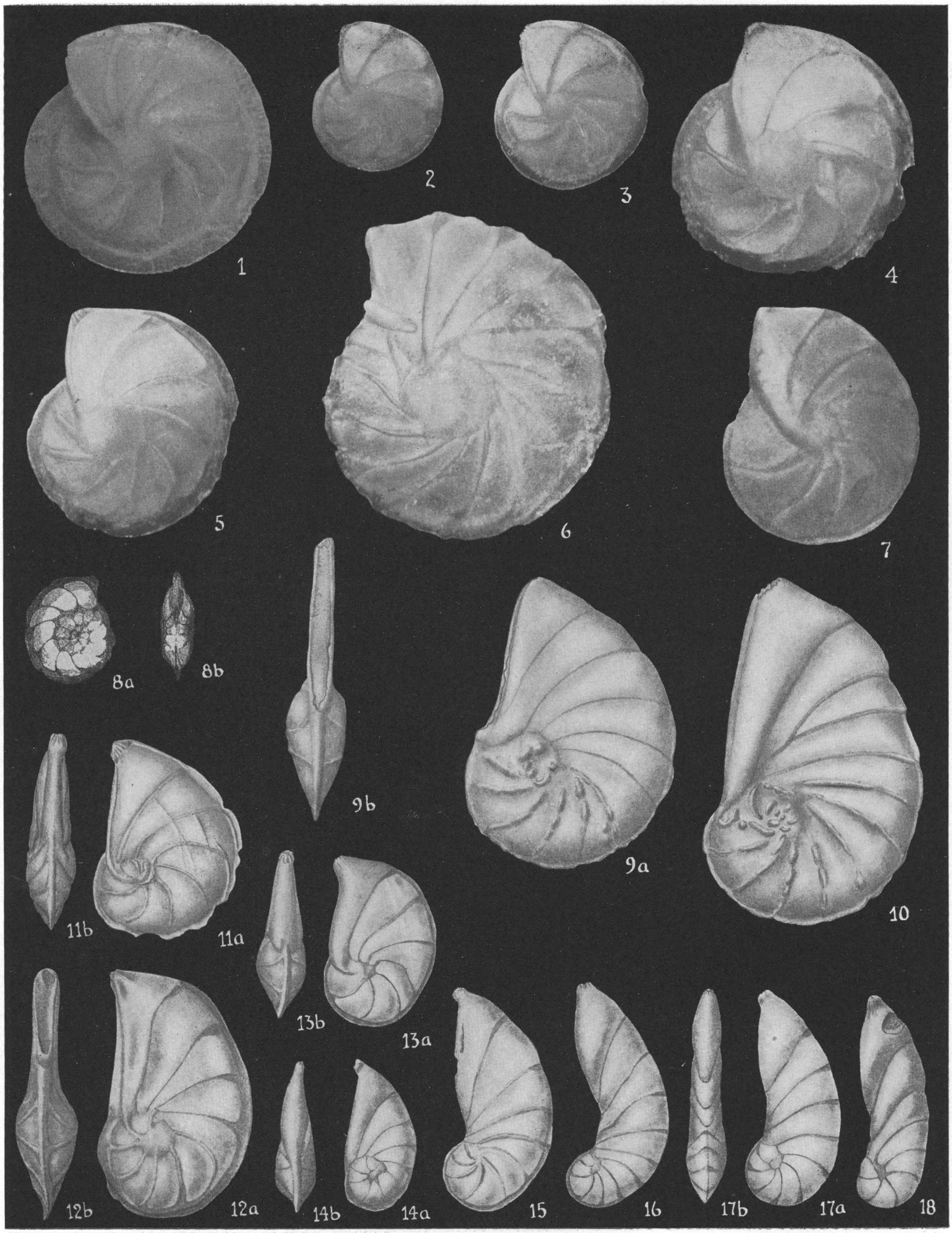
PLATE 19

FIGURES 1–7. *Lenticulina rotulata* Lamarck (p. 56).
1. Neylandville marl, Delta County, Tex. (51). × 30.
2, 3. Upper part of Taylor marl, Milam County, Tex. (139). × 30.
4, 5. Upper part of Taylor marl, Lamar County, Tex. (111). × 30.
6, 7. Gober tongue of Austin chalk, Lamar County, Tex. (288). × 30.

8. *Lenticulina velascoensis* White (p. 57). (After White.) Velasco shale, Mexico. *a*, Side view; *b*, apertural view. × 30.

9, 10. *Planularia advena* Cushman and Jarvis (p. 57). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, peripheral view. × 15.

11–18. *Planularia dissona* (Plummer) Cushman (p. 57). Corsicana marl, Limestone County, Tex. (30). Series showing variation in ornamentation, relative length and amount of uncoiling. *a*, Side view; *b*, apertural view. × 38.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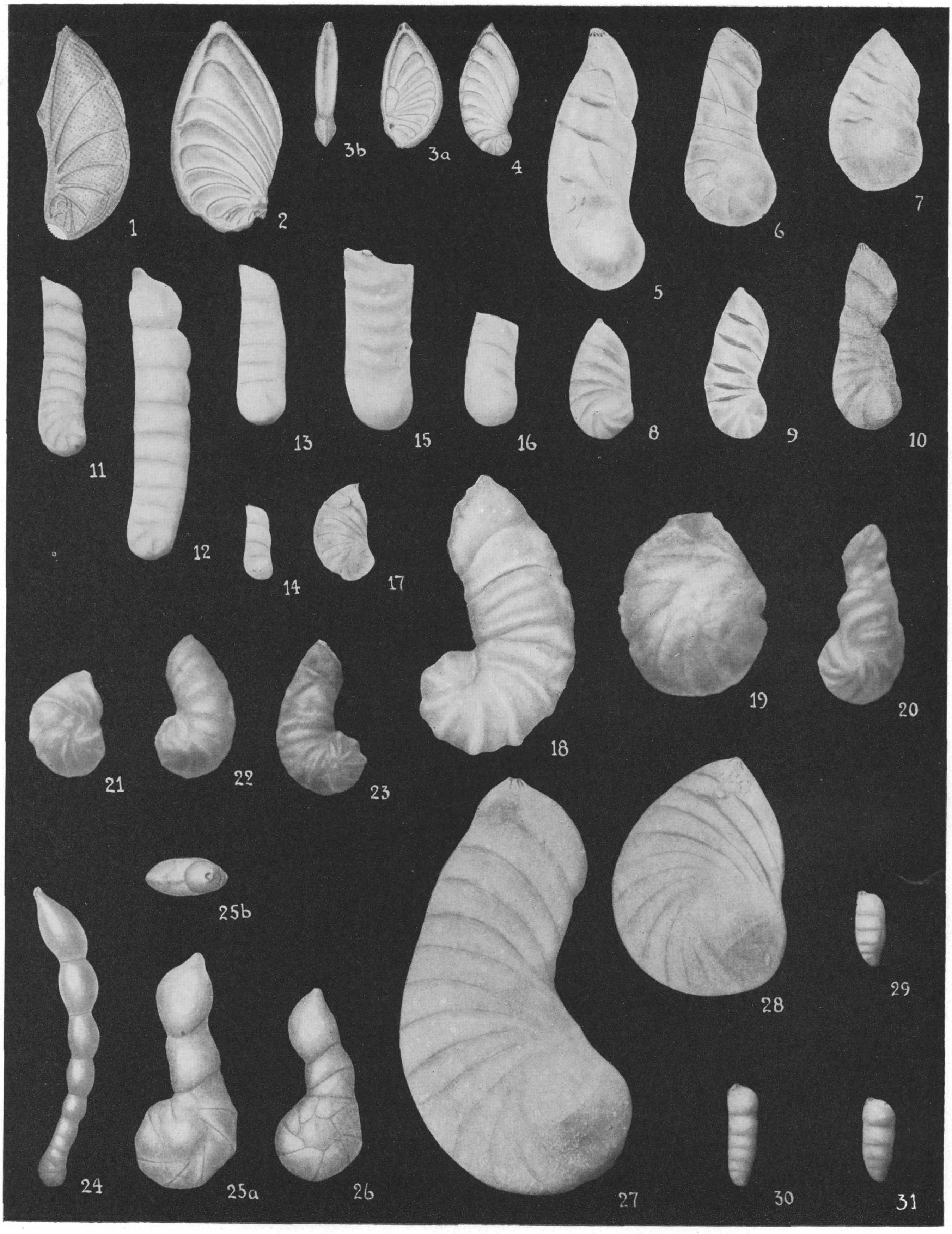
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PLATE 20

FIGURE 1. *Planularia elongata* Ehrenberg (p. 57). (After Ehrenberg.)

2, 3. *Planularia tricarinella* (Reuss) Cushman (p. 57). Pecan Gap chalk at type locality, Texas (167). *a*, Side view; *b*, apertural view. × 55.

4. *Planularia* sp. A (p. 58). Neylandville marl, Navarro County, Tex. (63). × 38.

5–10. *Marginulina austinana* Cushman (p. 59).
- 5–7, 9. Gober tongue of Austin chalk, Fannin County, Tex. (277). 5, Holotype. 6, 7, 9, Paratypes. × 18.
- 8. Brownstown marl, Red River County, Tex. (318). × 18.
- 10. Austin chalk, Collin County, Tex. (295). × 18.

11–16. *Marginulina austinana* Cushman var. *directa* Cushman (p. 59).
- 11. Austin chalk, Collin County, Tex. (324). Holotype. × 18.
- 12–14. Lower part of Taylor marl, Bell County, Tex. (245). × 18.
- 15. Austin chalk, Collin County, Tex. (292). × 18.
- 16. Austin chalk, Collin County, Tex. (293) × 18.

17. *Marginulina austinana* Cushman var. *acescens* Cushman (p. 59). Gober tongue of Austin chalk, Lamar County, Tex. (288). Holotype. × 18.

18–23. *Marginulina inconstantia* Cushman (p. 59).
- 18. Lower part of Taylor marl, Dallas County, Tex. (217). Holotype. × 38.
- 19–23. Lower part of Taylor marl, Dallas County, Tex. (218). Paratypes. × 18.

24. *Marginulina juncea* Cushman (p. 59). Lower part of Taylor marl, McLennan County, Tex. (241). Holotype. × 38.

25, 26. *Marginulina stephensoni* Cushman (p. 59). Lower part of Taylor marl, McLennan County, Tex. (242). 25, Holotype. 26, Paratype. × 38.

27, 28. *Marginulina pseudomarcki* Cushman (p. 60). Upper part of Taylor marl, Travis County, Tex. (149). 27, Holotype. 28, Paratype. × 15.

29–31. *Marginulina dorsata* Cushman (p. 60). Annona chalk, Red River County, Tex. (197). 29, Holotype. 30, 31, Paratypes. × 18.

PLATE 21

FIGURE 1. *Marginulina armata* Reuss (p. 60). Upper part of Taylor marl, Travis County, Tex. (148). × 55.

2, 3. *Marginulina munda* Cushman (p. 60). Upper part of Taylor marl, Kaufman County, Tex. (127). 2, Holotype. 3, Paratype. × 38.

4, 5. *Marginulina* cf. *M. recta* (D'Orbigny) Cushman (p. 60). Lower part of Taylor marl, Red River County, Tex. (106). × 38.

6–10. *Marginulina* cf. *M. elongata* D'Orbigny (p. 60). Annona chalk, Red River County, Tex. (197). × 38.

11–15. *Marginulina taylorana* Cushman (p. 61).
- 11. Upper part of Taylor marl, Hunt County, Tex. (115). Holotype. × 38.
- 12–15. Upper part of Taylor marl, Red River County, Tex. (106). × 18.

16–20. *Marginulina cretacea* Cushman (p. 61).
- 16. Upper part of Taylor marl, Guadalupe County, Tex. (151). Holotype. × 18.
- 17. Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). × 18.
- 18. Annona chalk, Bowie County, Tex. (190). × 18.
- 19. Upper part of Taylor marl, Collin County, Tex. (121). × 18.
- 20. Upper part of Taylor marl, Travis County, Tex. (145). × 18.

21–29. *Marginulina texasensis* Cushman (p. 61).
- 21–24. Pecan Gap chalk, member of Taylor marl, McLennan County, Tex. (177). 21, Holotype. 22–24 Paratypes. × 18.
- 25, 26. Upper part of Taylor marl, Bexar County, Tex. (159). × 18.
- 27. Upper part of Taylor marl, Bexar County, Tex. (156). × 18.
- 28. Upper part of Taylor marl, Travis County, Tex. (149). × 18.
- 29. Upper part of Taylor marl, Williamson County, Tex. (142). × 18.

30, 31. *Marginulina* cf. *M. tripleura* (Reuss) Cushman (p. 61).
- 30. Lower part of Taylor marl, Ellis County, Tex. (233). × 18.
- 31. Upper part of Taylor marl, Bexar County, Tex. (161). × 18.

32–37. *Marginulina bullata* Reuss (p. 62).
- 32. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 42.
- 33, 34. Upper part of Taylor marl, Collin County, Tex. (121). × 18.
- 35. Upper part of Taylor marl, Kaufman County, Tex. (129). × 18.
- 36. Ozan formation, Little River County, Ark. (254). × 18.
- 37. Upper part of Taylor marl, Red River County, Tex. (105). × 18.

38. *Marginulina texasensis* Cushman (p. 61). Saratoga chalk, Howard County, Ark. (79). *a*, Side view; *b*, apertural view. × 42.

39. *Marginulina cretacea* Cushman (p. 61). Annona chalk at type locality, Texas (188a). *a*, Side view; *b*, apertural view. × 42.

40. *Marginulina texasensis* Cushman (p. 61). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, front view. × 25.

41. *Marginulina cf. M. decorata* (Reuss) Cushman and Jarvis (p. 63). (After Cushman and Jarvis.) Cretaceous. Trinidad. × 25.

42–45. *Marginulina silicula* (Plummer) Cushman (p. 62).
- 42, 45. Corsicana marl, Limestone County, Tex. (30). 42, × 12. 45, × 23. *a*, Side view; *b*, apertural view.
- 43, 44. Corsicana marl, Falls County, Tex. (32). × 18.

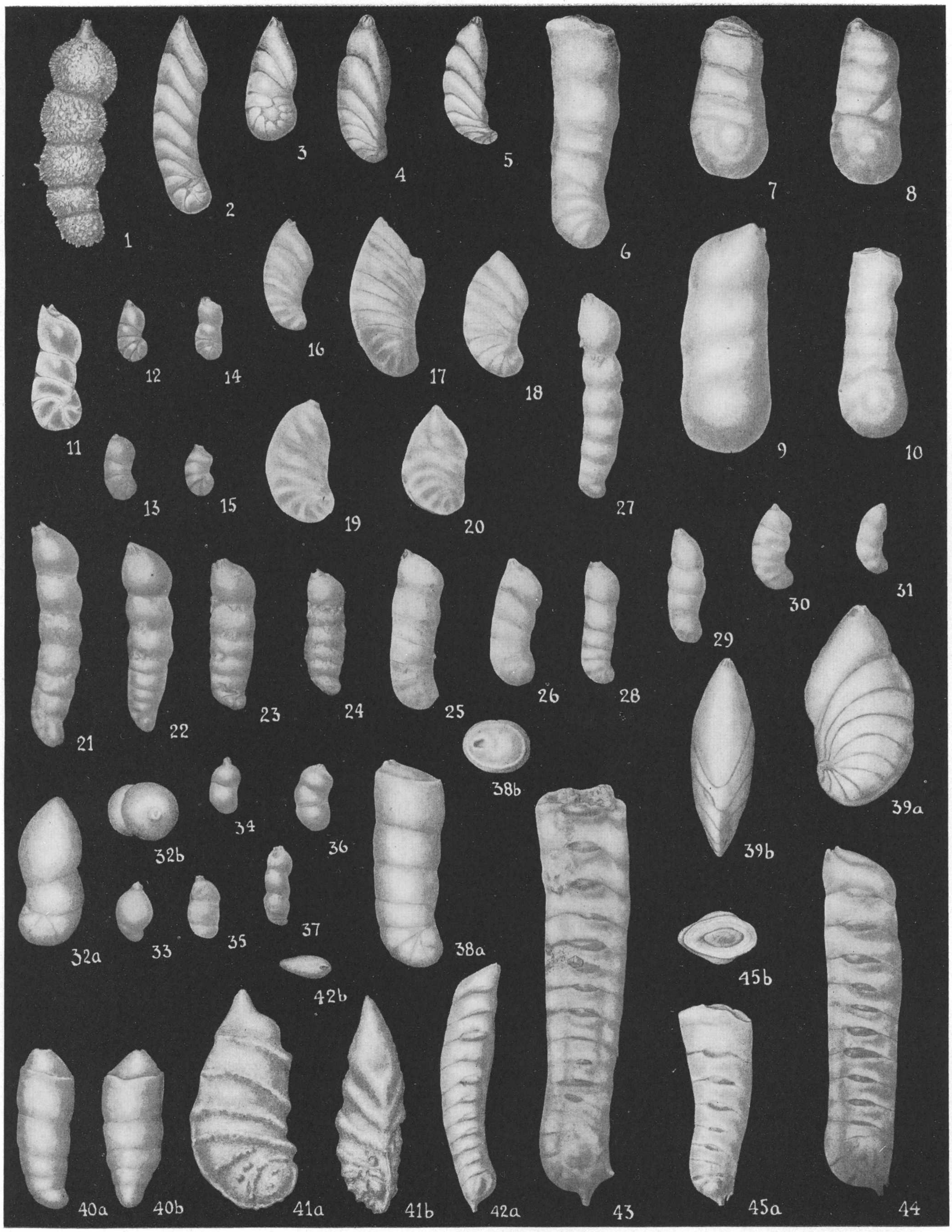
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PLATE 22

FIGURES 1–5. *Marginulina navarroana* Cushman (p. 62).
1, 3. Prairie Bluff chalk, Sumter County, Ala. (102). 1, Holotype. 3, Paratype. × 18.
2, 4, 5. Prairie Bluff chalk, Sumter County, Ala. (101). × 18.

6–10. *Marginulina plummerae* Cushman (p. 62).
6, 7, 9, 10. Corsicana marl, Falls County, Tex. (32). 6, Holotype. 7, 9, 10, Paratype. 6, 7, × 18. 9, 10, × 30.
8. Kemp clay, Travis County, Tex. (17). × 18.

11–14 *Marginulina curvatura* Cushman. (p. 63).
11. Corsicana marl, Travis County, Tex. (36). Holotype. × 38.
12. Corsicana marl, Limestone County, Tex. (31). × 38.
13, 14. Corsicana marl, Limestone County, Tex. (30). *a*, Side view; *b*, apertural view. 13, × 38. 14, × 45.

15, 16. *Marginulina siliqua* Cushman (p. 63). Kemp clay, Williamson County, Tex. (12). 15, Holotype. 16, Paratype. × 38.

17. *Marginulina humilis* (Reuss) Cushman and Church? (p. 63). (After Cushman and Jaryis.) Cretaceous, Trinidad. × 30.

18–20. *Marginulina jarvisi* Cushman (p. 63). Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 42.

21. *Marginulina trinitatensis* Cushman. (p. 64). Cretaceous, Trinidad. Holotype, *a*, side view; *b*, apertural view. × 42.

22. *Marginulina*? *trilobata* D'Orbigny (p. 64). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view; × 20.

23. *Marginulina* sp. A (p. 64). Corsicana marl, Travis County, Tex. (41). × 38.

24. *Marginulina* sp. B (p. 64). Upper part of Taylor marl, Red River County, Tex. (106). × 38.

25–27. *Marginulina* sp. C (p. 64). Upper part of Taylor marl, Bexar County, Tex. (160). × 38.

28. *Dentalina involvens* Cushman (p. 64). Austin chalk, Grayson County, Tex. (290). Holotype, *a*, side view; *b*, apertural view. × 38.

29–33. *Dentalina alternata* (Jones) Plummer (p. 64).
29. Saratoga chalk, Howard County, Ark. (79). × 25.
30, 31. Upper part of Taylor marl, Kaufman County, Tex. (127). *a*, Side view; *b*, apertural view. × 38.
32, 33. Ripley formation, Henderson County, Tenn. (96). × 38.

PLATE 23

FIGURES 1, 2. *Dentalina legumen* Reuss (p. 65).
1. Ripley formation, Henderson County, Tenn. (96). × 35.
2. (After Cushman and Jarvis.) Cretaceous. Trinidad. × 42.

3–6. *Dentalina gracilis* D'Orbigny (p. 65).
3. Prairie Bluff chalk, Chickasaw County, Miss. (84). × 60.
4. Lower part of Taylor marl, Collin County, Tex. (209). × 60.
5. Brownstown marl, Red River County, Tex. (319). × 60.
6. Austin chalk, Grayson County, Tex. (289). × 60.

7–11. *Dentalina lorneiana* D'Orbigny (p. 66).
7, 11. Ripley formation, Henderson County, Tenn. (96). × 90.
8–10. Ripley formation, McNairy County, Tenn. (95). × 90.

12. *Dentalina lorneiana* D'Orbigny var. *spirans* Cushman (p. 66). Holotype. Ripley formation, McNairy County, Tenn. (94). Holotype. × 90.

13, 14. *Dentalina reflexa* Morrow. (p. 66). Niobrara chalk, Ellis County, Kans. Redrawn from original types. × 58.

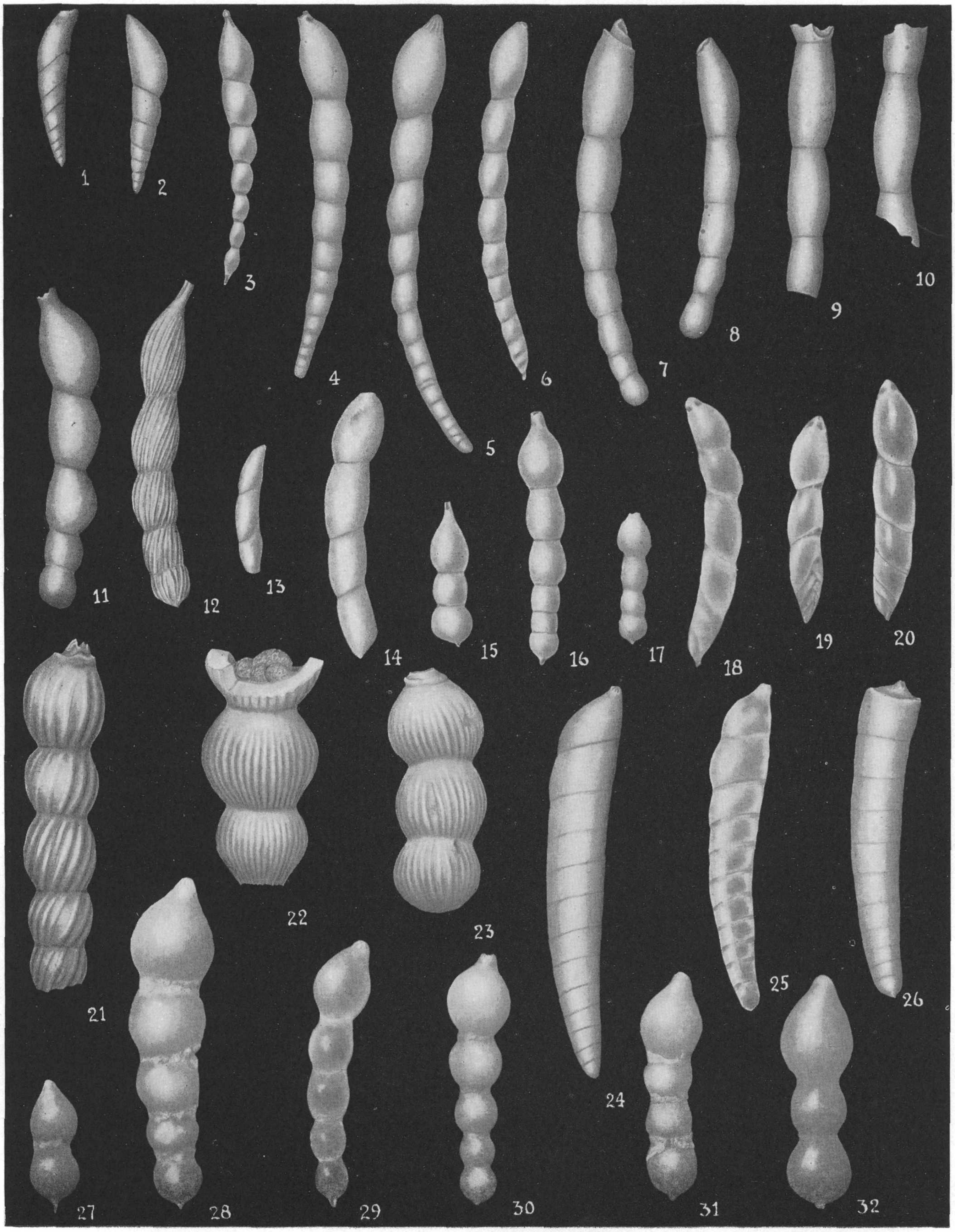
15–17. *Dentalina fallax* Franke (p. 66). Upper part of Taylor marl, Williamson County, Tex. (142). × 38.

18–20. *Dentalina basitorta* Cushman (p. 66). Selma chalk (upper part), Union County, Miss. (92). × 38.

21–23. *Dentalina multicostata* D'Orbigny (p. 67).
21, 22. Lower part of Taylor marl, Delta County, Tex. (206). × 38.
23. Upper part of Taylor marl, Lamar County, Tex. (110). × 38.

24–26. *Dentalina megalopolitana* Reuss (p. 67).
24. Selma chalk (middle part), Hardin County, Tenn. (255). × 38.
25. Saratoga chalk, Howard County, Ark. (79). × 42.
26. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 20.

27–32. *Dentalina catenula* Reuss (p. 67). Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). × 38.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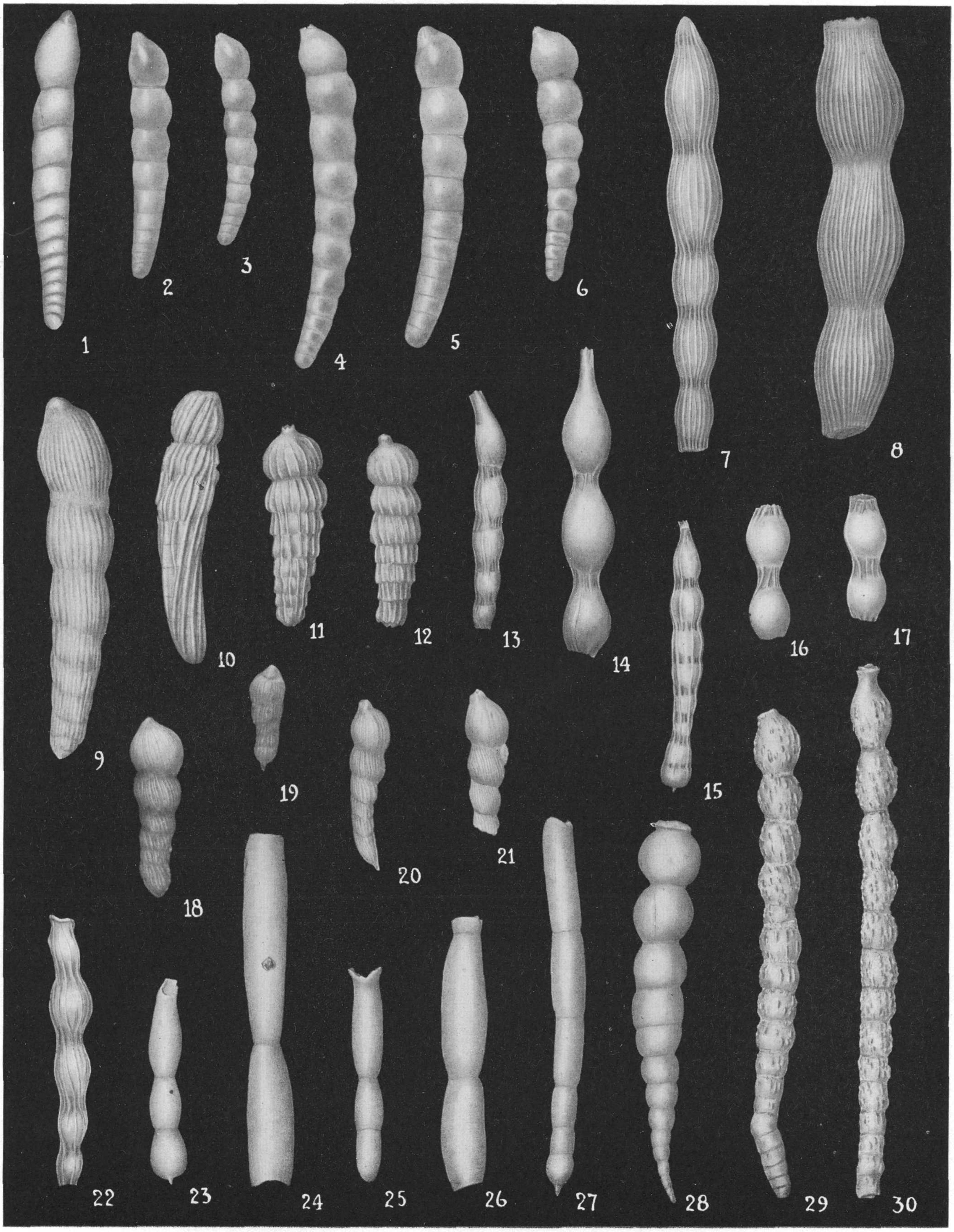
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PLATE 24

FIGURES 1–6. *Dentalina basiplanata* Cushman (p. 68). Corsicana marl, Navarro County, Tex. (26). 1, Holotype. 2–6, Paratypes. × 38.

7, 8. *Dentalina angusticostata* Cushman (p. 70). Corsicana marl, Limestone County Tex. (30). 7, Holotype. 8, Paratype. × 60.

9–12. *Dentalina confluens* Reuss (p. 68).
9. Saratoga chalk, Howard County, Ark. (79). × 42.
10–12. (After Cushman and Jarvis.) Upper Cretaceous, Trinidad. × 20.

13–17, 22. *Dentalina solvata* Cushman (p. 69). Selma chalk (upper part), Prentiss County, Miss. (91). × 38.

18–21. *Dentalina pertinens* Cushman (p. 70). Upper part of Taylor marl, Navarro County, Tex. (132). × 38.

23–27. *Dentalina* cf. *D. consobrina* D'Orbigny (p. 69).
23–25. Ripley formation, McNairy County, Tenn. (94). × 75.
26, 27. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 27.

28. *Ellipsonodosaria? jarvisi* Cushman (p. 136). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 50.

29, 30. *Dentalina crinita* Plummer (p. 69). Corsicana marl, Limestone County, Tex. (30). × 38.

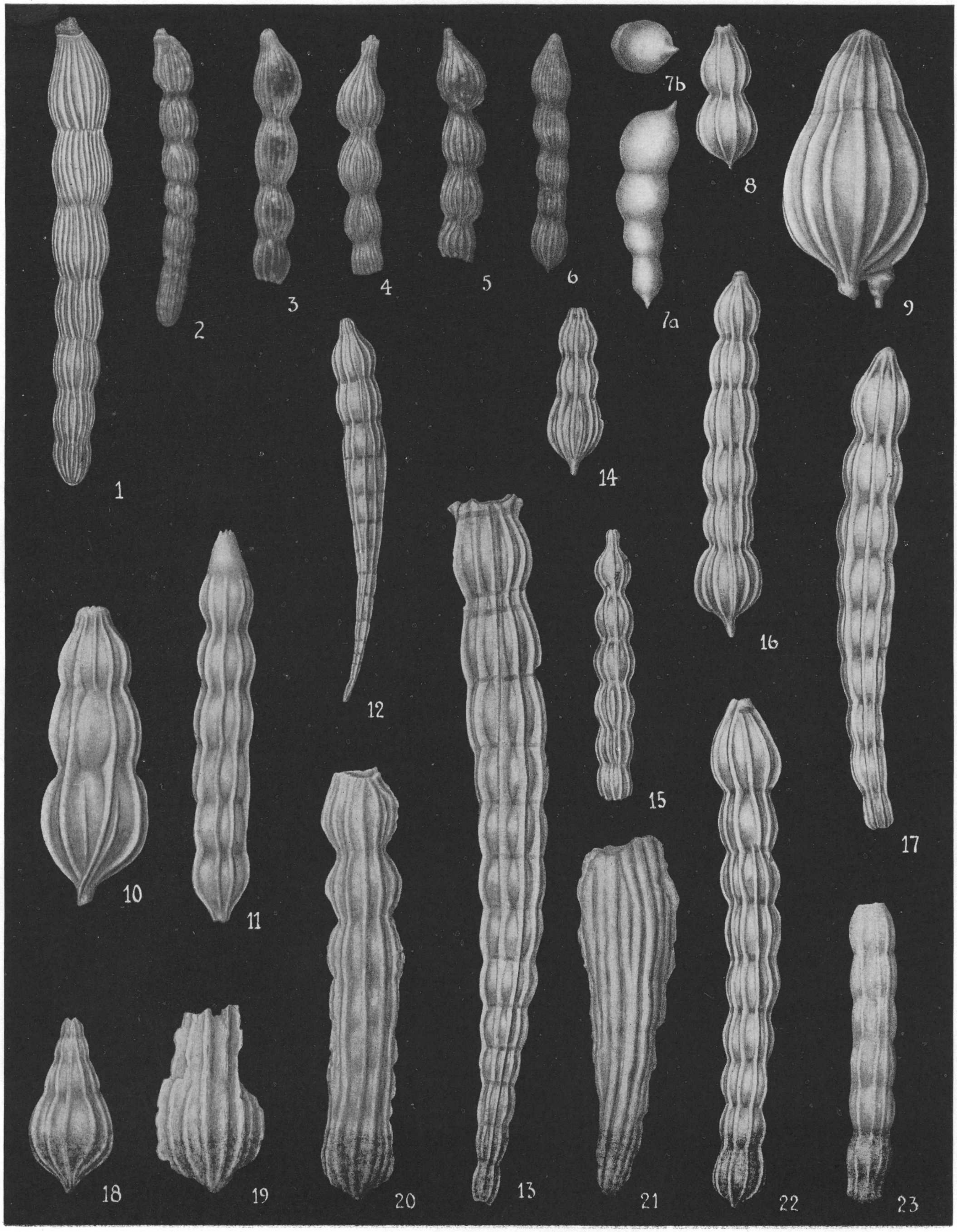
PLATE 25

FIGURES 1–6. *Dentalina delicatula* Cushman (p. 70). Corsicana marl. Travis County, Tex. (35). 1, Holotype, × 60. 2–6, Paratypes. × 38.

7. *Dentalina* sp. (p. 70). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 60.

8–23. *Nodosaria affinis* Reuss (p. 70).

- 8–12. Ripley formation, Henderson County, Tenn. (96). 9, Extreme megalospheric form. 12, Extreme microspheric form. 8–11, × 38. 12, × 30.
- 13–16, 22. Corsicana marl, Limestone County, Tex. (30). × 25.
- 17. Upper part of Taylor marl, Kaufman County, Tex. (127). × 38.
- 18, 20, 21. Saratoga chalk, Howard County, Ark. (79). 18, Extreme megalospheric form. × 25.
- 19. White chalk, Antigua, British West Indies. × 38.
- 23. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 20.



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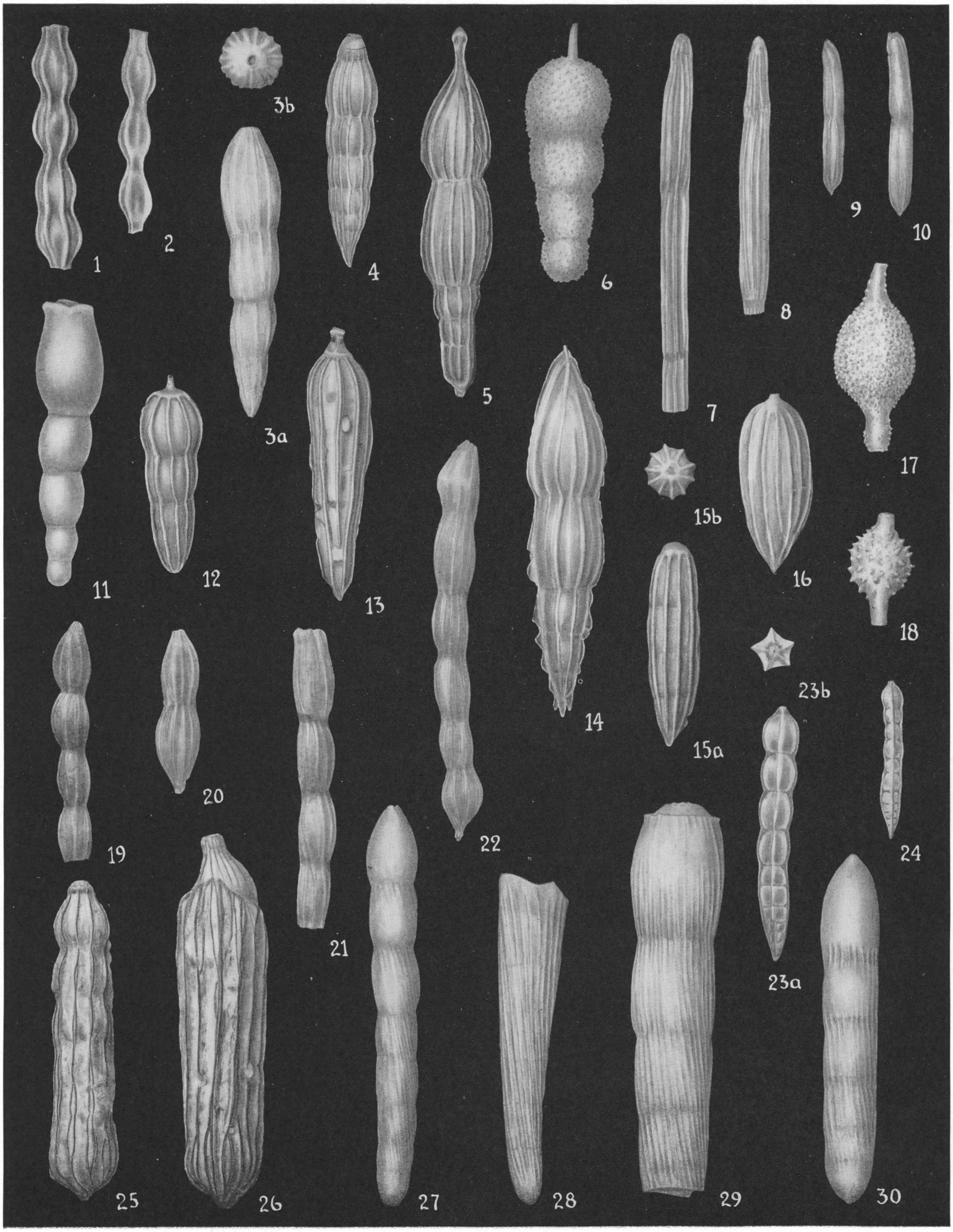

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PLATE 26

FIGURES 1, 2. *Nodosaria distans* Reuss (p. 71). Gober tongue of Austin chalk, Fannin County, Tex. (277). × 38.

3, 4. *Nodosaria alternistriata* Morrow (p. 71).
3. Ellis County, Kans. Holotype, redrawn. × 75.
4. Selma chalk (lower part), Lee County, Miss. (350). × 60.

5. *Nodosaria fusula* Reuss (p. 71). Lower part of Taylor marl, Collin County, Tex. (211). × 150.

6. *Nodosaria aspera* Reuss (p. 72). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 30.

7–10. *Nodosaria gracilitatis* Cushman (p. 72). Lower part of Taylor marl, Delta County, Tex. (206). 7, Holotype. 8–10, Paratypes. × 38.

11. *Nodosaria naumanni* Reuss (p. 72). Lower part of Taylor marl, Ellis County, Tex. (234). × 68.

12, 13. *Nodosaria proboscidea* Reuss (p. 72).
12. Upper part of Taylor marl, Bexar County, Tex. (161). × 68.
13. Selma chalk (middle part). Prentiss County, Miss. (260). × 68.

14. *Nodosaria amphioxys* Reuss (p. 72). Selma chalk (middle part), Prentiss County, Miss. (261). × 110.

15, 16. *Nodosaria obscura* Reuss (p. 73). Ripley formation, Henderson County, Tenn. (96). 15, × 38. 16, × 68.

17, 18. *Dentalina aculeata* D'Orbigny (p. 67).
17. Annona chalk at type locality, Texas (188a). × 48.
18. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 30.

19–22. *Nodosaria corsicanana* Cushman (p. 73).
19–21. Corsicana marl, Limestone County, Tex. (30). × 23.
22. Corsicana marl, Navarro County, Tex. (25). × 23.

23, 24. *Nodosaria navarroana* Cushman (p. 73). Corsicana marl, Navarro County, Tex. (26). *a*, Side view; *b*, apertural view; 23, × 110. 24, × 55.

25, 26. *Nodosaria limonensis* Cushman (p. 74). Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). × 27.

27–30. *Nodosaria velascoensis* Cushman (p. 73). (After Cushman and Jarvis.) Cretaceous, Trinidad. 27, 30, × 30. 28, 29, × 15.

PLATE 27

FIGURES 1, 2. *Nodosaria limbata* D'Orbigny (p. 74). (After Cushman and Jarvis.) Cretaceous, Trinidad. 1, × 42. 2, × 60.

3, 4. *Nodosaria limbata* D'Orbigny var. *basiornata* Cushman and Jarvis (p. 74). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 20.

5. *Nodosaria limbata* D'Orbigny var. *tumidata* Cushman and Jarvis (p. 74). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 20.

6. *Nodosaria brevitesta* Franke (p. 74). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 60.

7. *Nodosaria* cf. *N. marcki* Reuss (p. 74). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 60.

8. *Nodosaria orthopleura* Reuss (p. 74). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 20.

9. *Nodosaria monile* Hagenow (p. 75). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 20.

10–12. *Nodosaria paupercula* Reuss (p. 75). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 20.

13. *Chrysalogonium cretaceum* Cushman and Church (p. 75). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. ×30.

14, 15. *Chrysalogonium texanum* Cushman (p. 75). Lower part of Taylor marl, Lamar County, Tex. (200). 15, Holotype. 14, Paratype. × 45.

16–19. *Chrysalogonium eximium* Cushman (p. 75). Pecan Gap chalk member, of Taylor marl, McLennan County, Tex. (177). × 38.

20–26. *Pseudoglandulina manifesta* (Reuss) Cushman (p. 76).
- 20. Corsicana marl, Limestone County, Tex. (30). × 35.
- 21–25. Corsicana marl, Caldwell County, Tex. (44). × 35.
- 26. Ripley formation, Henderson County, Tenn. (96). × 35.

27, 28. *Pseudoglandulina pygmaea* (Reuss) Cushman (p. 76). Arkadelphia marl, Hempstead County, Ark. (73). × 45.

29. *Pseudoglandulina lagenoides* (Olszewski) Cushman (p. 76). Ripley formation, Henderson County, Tenn. (96). × 115.

30–32. *Pseudoglandulina bistegia* (Olszewski) Cushman and Jarvis (p. 76). (After Cushman and Jarvis.) Upper Cretaceous, Trinidad. 30, 31, × 25. 32, × 42.

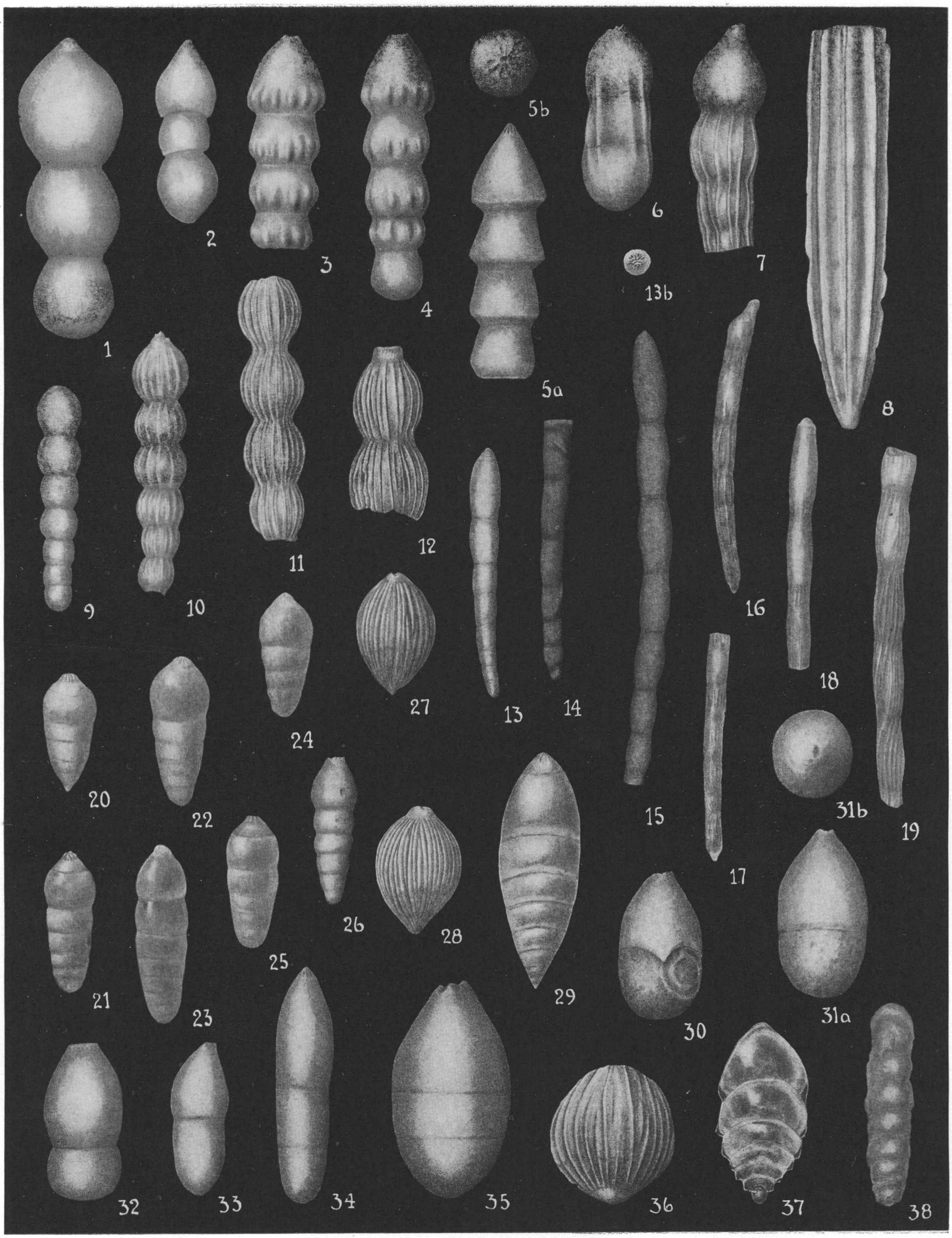
33, 34. *Pseudoglandulina cylindracea* (Reuss) Cushman and Jarvis (p. 76). (After Cushman and Jarvis.) Cretaceous, Trinidad. 33, × 30. 34, × 20.

35. *Pseudoglandulina parallela* (Marsson) Cushman and Jarvis (p. 77). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 42.

36. *Pseudoglandulina* sp. (p. 77). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 42.

37. *Lingulina taylorana* Cushman (p. 77). Lower part of Taylor marl, Lamar County, Tex. (202) × 150.

38. *Lingulina pygmaea* Reuss (p. 77). Wolfe City sand member of the Taylor marl, Navarro County, Tex. (188). × 45.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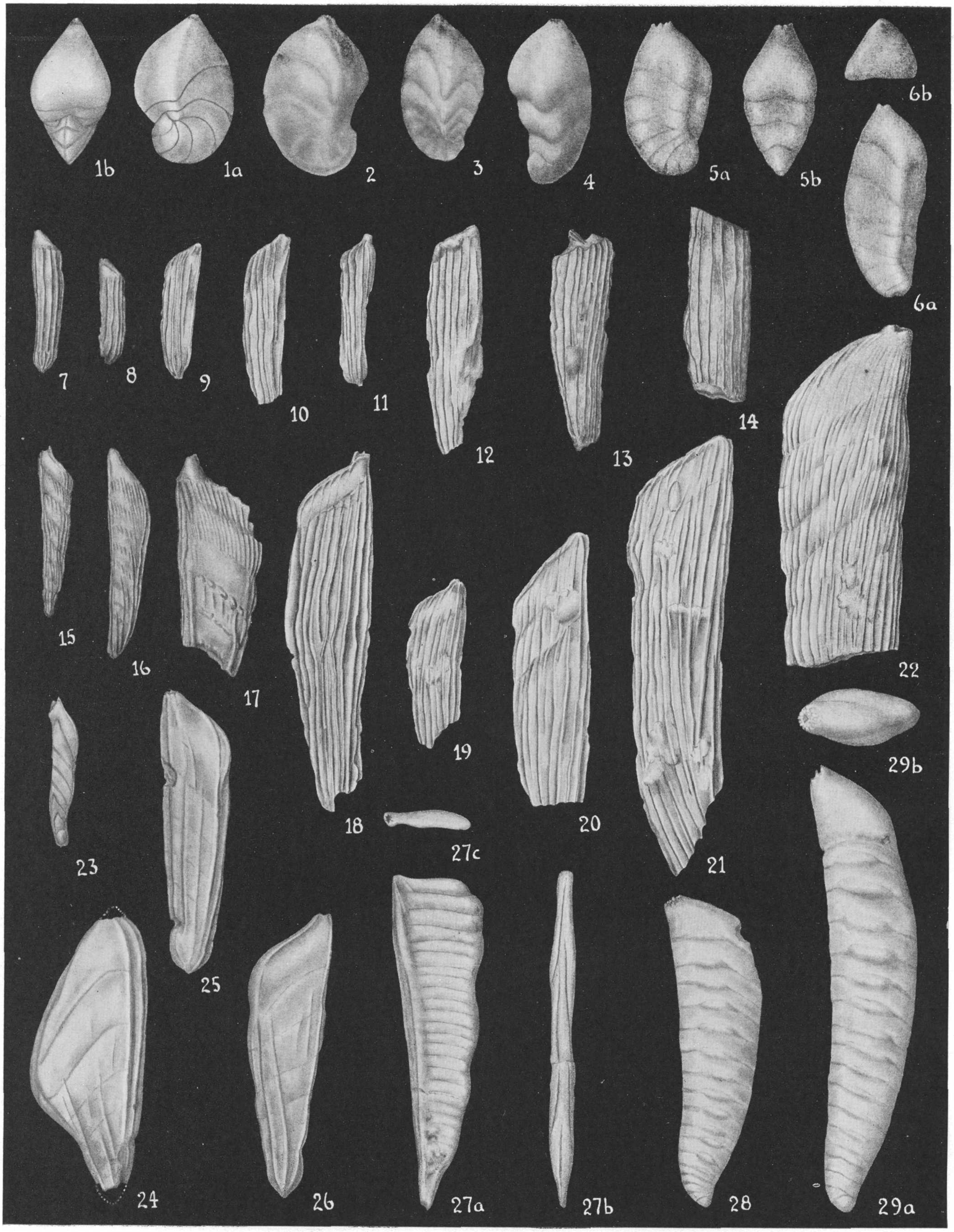
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PLATE 28

FIGURES 1–3. *Saracenaria triangularis* (D'Orbigny) Cushman and Church (p. 58).
1. Lower part of Taylor marl, Fannin County, Tex. (203). *a*, Side view; *b*, apertural view. × 55.
2, 3. Gober tongue of Austin chalk, Fannin County, Tex. (280). × 38.

4–6. *Saracenaria saratogana* Howe and Wallace (p. 58).
4. Corsicana marl, Bexar County, Tex. (46). × 38.
5, 6. Saratoga chalk, Howard County, Ark. (79). 5, *a*, side view; 5, *b*, apertural view; 6*a*, side view; 6*b*, nd view. × 23.

7–22. *Vaginulina texana* Cushman (p. 77).
7, 8, 18. Gober tongue of Austin chalk, Lamar County, Tex. (282). 7, 8, × 18. 18, × 23.
9, 10. Brownstown marl, Sevier County, Ark. (347). × 23.
11–14. Gober tongue of Austin chalk, Lamar County, Tex. (288). 11, 12, × 23. 13, 14, × 18.
15–17. Brownstown marl, Sevier County, Ark. (348). × 18.
19–22. Austin chalk, Hill County, Tex. (314). × 23.

23. *Vaginulina recta* Reuss (p. 78). Gober tongue of Austin chalk, Lamar County, Tex. (282). × 15.

24. *Vaginulina subcomarginata* Morrow (p. 78). Niobrara chalk, Ellis County, Kans. Redrawn from holotype. × 60.

25. *Vaginulina knighti* Morrow (p. 78). Niobrara chalk, Ellis County, Kans. Redrawn from holotype. × 60.

26. *Vaginulina rectilateralis* Morrow (p. 78). Niobrara chalk, Ellis County, Kans. Redrawn from holotype. × 60.

27. *Vaginulina niobrarensis* Morrow (p. 78). Niobrara chalk, Ellis County, Kans. Redrawn from holotype; *a*, side view; *b*, apertural view. × 12.

28, 29. *Vaginulina taylorana* Cushman (p. 81). Upper part of Taylor marl, Williamson County, Tex. (142). *a*, Side view; *b*, apertural view. × 25.

PLATE 29

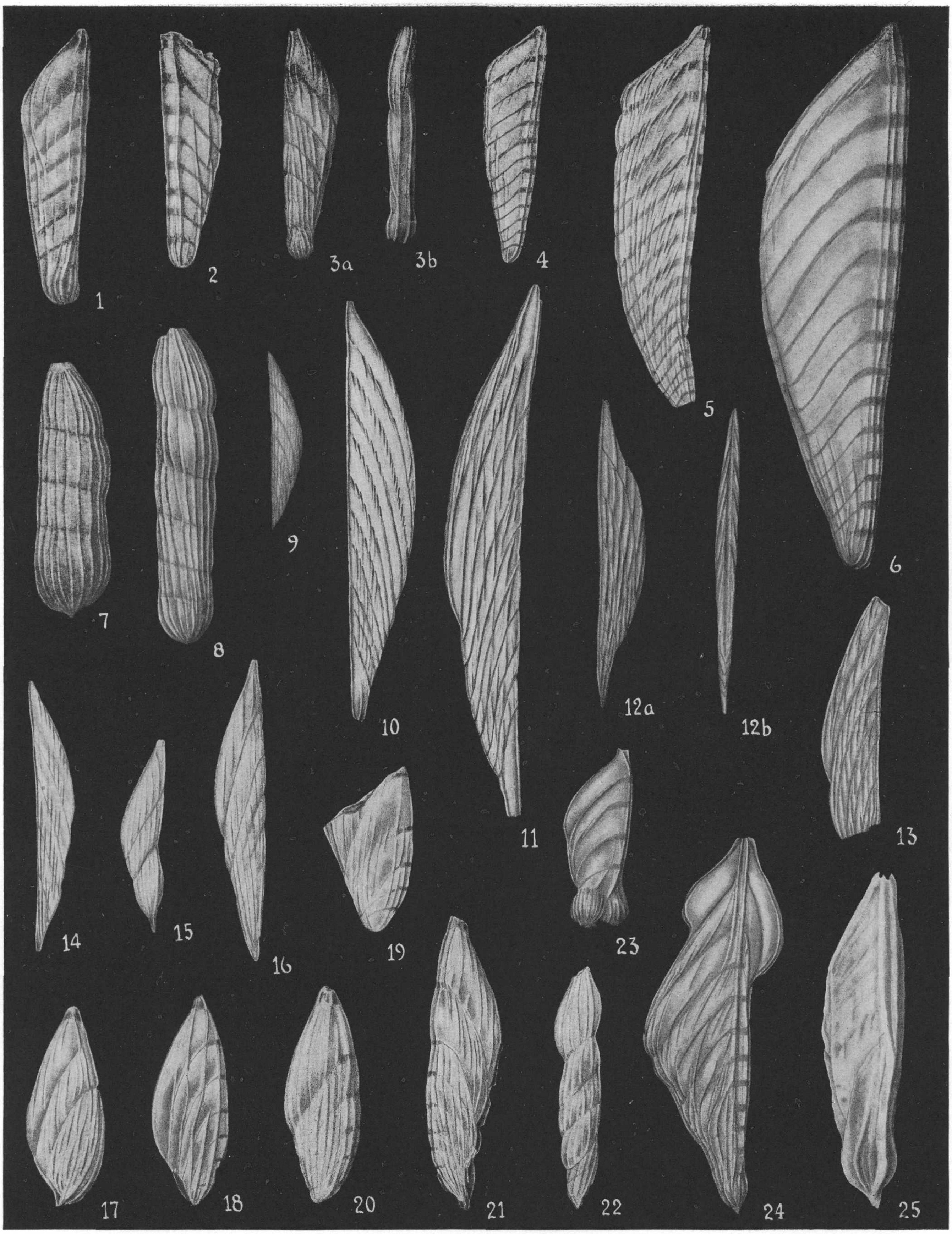
FIGURES 1–6. *Vaginulina wadei* Kelley (p. 79).
1. Ripley formation, McNairy County, Tenn. (97). Holotype redrawn. × 38.
2. Lower part of Taylor marl, Collin County, Tex. (207). × 38.
3. Ripley formation, Henderson County, Tenn. (96). *a*, Side view; *b*, peripheral view. × 38.
4, 5. Wolfe City sand member of Taylor marl, Hunt County, Tex. (186). × 23.
6. Selma chalk (upper part), McNairy County, Tenn. (98). × 33.

7, 8. *Vaginulina selmaensis* Cushman (p. 79). Ripley formation, McNairy County, Tenn. (94). 7, Holotype. 8, Paratype. × 75.

9–16. *Vaginulina multicostata* Cushman (p. 79).
9. Prairie Bluff chalk, Wilcox County, Ala. (100). Holotype. × 20.
10. Corsicana marl, Travis County, Tex. (35). × 30.
11. Corsicana marl, Navarro County, Tex. (27). × 38.
12, 15, 16. Ripley formation, Henderson County, Tenn. (96). *a*, Side view; *b*, peripheral view. 12, × 38. 15, 16, × 55.
13. Saratoga chalk, Howard County, Ark. (79). × 25.
14. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). × 25

17–22. *Vaginulina navarroana* Cushman (p. 80).
17, 18, 21. Corsicana marl, Navarro County, Tex. (27). 17, Holotype. 18, 21, Paratypes. × 55.
19, 20. Nacatoch sand, White County, Ark. (76). × 68.
22. Corsicana marl, Limestone County, Tex. (30). × 55.

23–25. *Vaginulina simondsi* Carsey (p. 80).
23, 24. Corsicana marl, Navarro County, Tex. (27). 23, Specimen starting with two prolocula, then fused. 24, Specimen with frondicularian final chamber. × 25.
25. Corsicana marl, Bexar County, Tex. (46). × 38.



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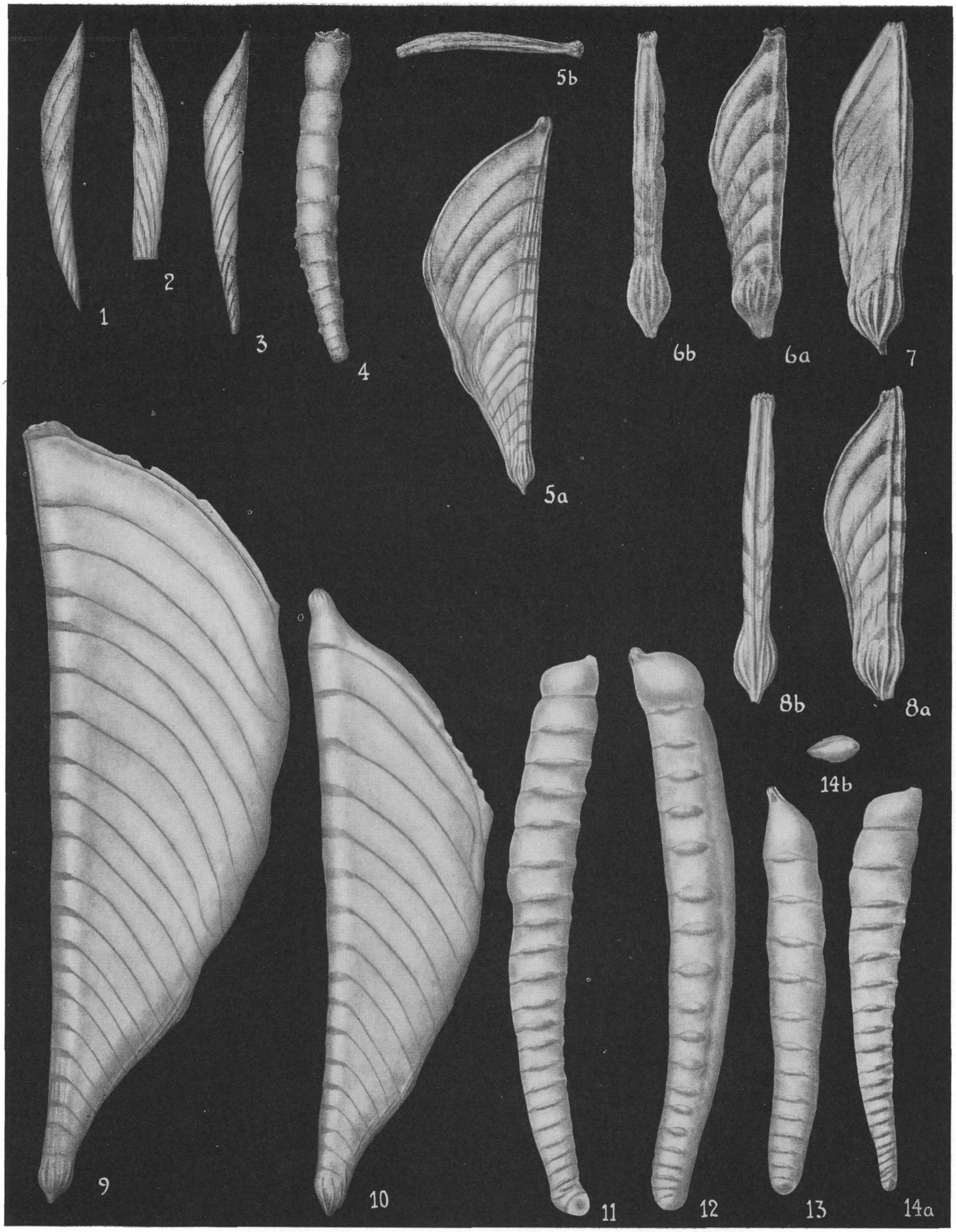

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PLATE 30

FIGURES 1–3. *Vaginulina suturalis* Cushman (p. 81). Nacatoch sand, Clark County, Ark. (74). × 27.

4. *Vaginulina subgracilis* Cushman (p. 81). Ripley formation, Henderson County, Tenn. (96). Holotype. × 45.

5–10. *Vaginulina webbervillensis* Carsey (p. 81).

5, 10. Corsicana marl, Limestone County, Tex. (30). *a*, Side view; *b*, end view. 5, × 20. 10, × 25.

6–8. Prairie Bluff chalk, Chickasaw County, Miss. (87). *a*, Side view; *b*, peripheral view. × 28.

9. Corsicana marl, Navarro County, Tex. (27). × 25.

11–14. *Vaginulina cretacea* Plummer (p. 80).

11–13. Corsicana marl, Limestone County, Tex. (30). × 25.

14. Corsicana marl, Navarro County, Tex. (26). *a*, Side view; *b*, end view. × 25.

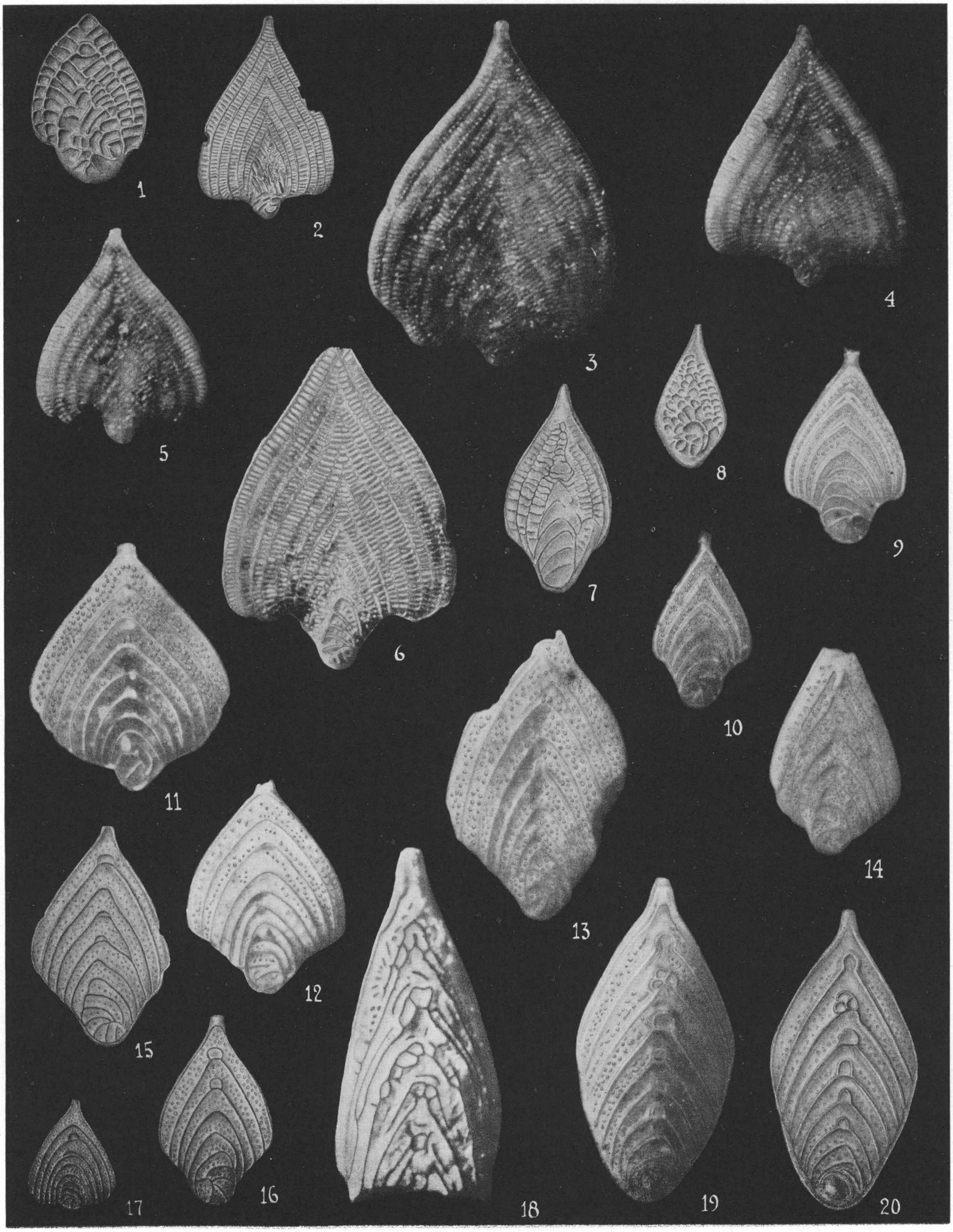
PLATE 31

FIGURES 1–6. *Palmula reticulata* (Reuss) Cushman (p. 84).
1–5. Corsicana marl, Limestone County, Tex. (30). 1, Early stages, × 55. 2, × 20. 3–5, × 33.
6. Corsicana marl, Navarro County, Tex. (27). × 33.

7, 8. *Palmula semireticulata* (Cushman and Jarvis) Cushman (p. 85). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 55.

9–17. *Palmula rugosa* (D'Orbigny) Cushman (p. 83).
9, 10. Neylandville marl, Red River County, Tex. (50). × 38.
11, 12, 17. Upper part of Taylor marl, Limestone County, Tex. (135). 11, 12, × 38. 17, × 20.
13, 14. "Craie blanche," Bougival, France. Topotypes. × 33.
15. Saratoga chalk, Howard County, Ark. (79). × 42.
16. Upper part of Taylor marl, Collin County, Tex. (118). × 38.

18–20. *Palmula jarvisi* (Cushman) Cushman (p. 85). Cretaceous, Trinidad. × 38.



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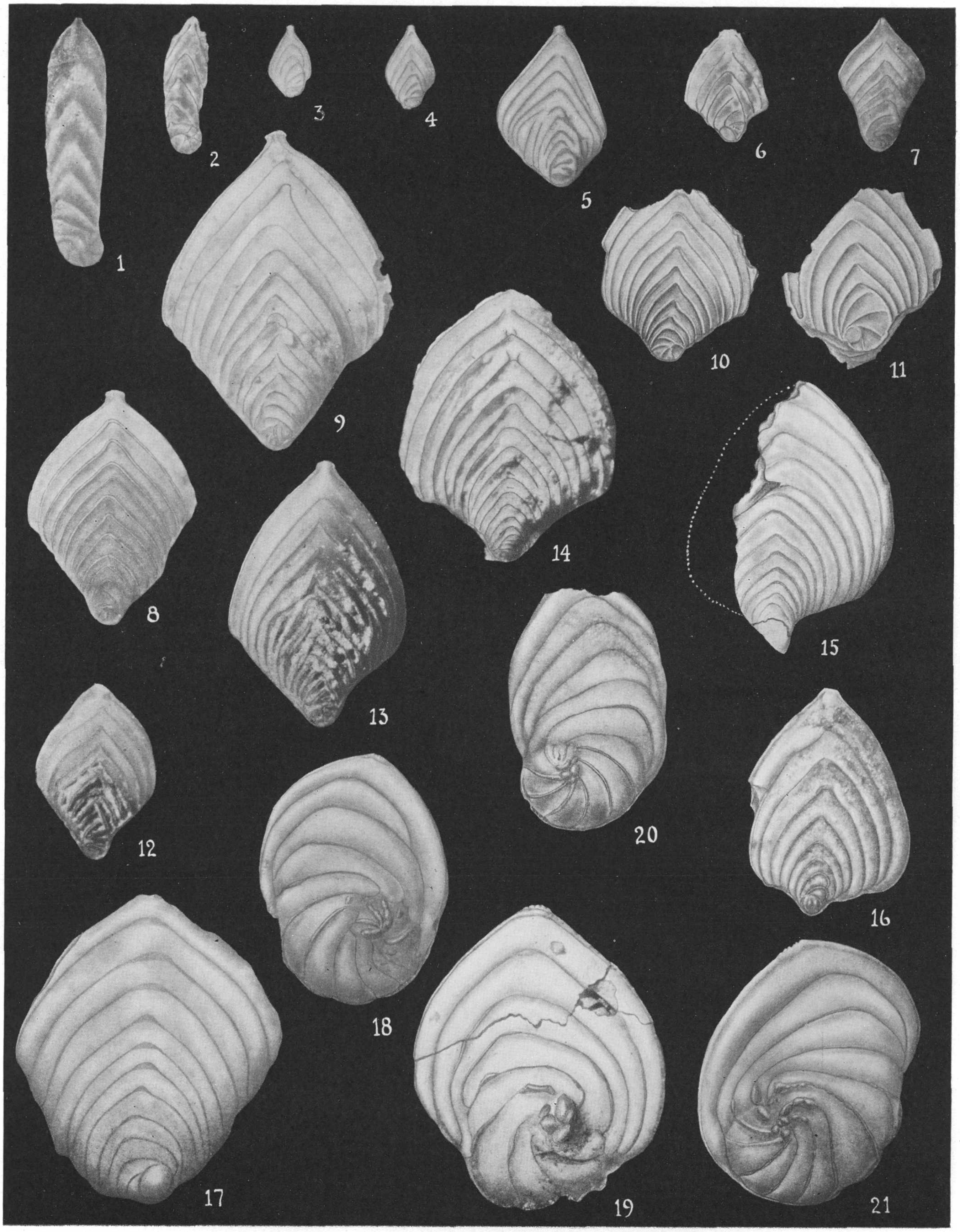

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PLATE 32

FIGURES 1, 2. *Palmula primitiva* Cushman (p. 84).
1. Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). Holotype. × 30.
2. Upper part of Taylor marl, Kaufman County, Tex. (131). × 30.

3–14. *Palmula suturalis* (Cushman) Loetterle (p. 82).
3–5. Austin chalk, Hill County, Tex. (313). × 23.
6–9. Upper part of Taylor marl, Limestone County, Tex. (135). × 25.
10. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). × 20.
11. White chalk, Antigua, British West Indies. × 45.
12, 13. Upper part of Taylor marl from well samples, Texas. × 23.
14. Gober tongue of Austin chalk, Lamar County, Tex. (288). × 23.

15, 16. *Palmula cushmani* (Morrow) Cushman (p. 82).
15. Niobrara chalk, Ellis County, Kans. Holotype, redrawn. × 23.
16. Lower part of Austin chalk, Collin County, Tex. (337). × 25.

17. *Palmula elliptica*? (Nilsson) Brotzen (p. 85). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 15.

18–21. *Palmula pilulata* Cushman (p. 84). Bonham marl, Lamar County, Tex. (327). 19, Holotype. 18, 20, 21, Paratypes. × 18.

PLATE 33

FIGURES 1–4. *Frondicularia lanceola* Reuss (p. 85).

1. Lower part of Taylor marl, Collin County, Tex. (209). × 33.
2, 4. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). × 33.
3. Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). × 33.

5–8. *Frondicularia lanceola* Reuss var. *bidentata* Cushman (p. 85).

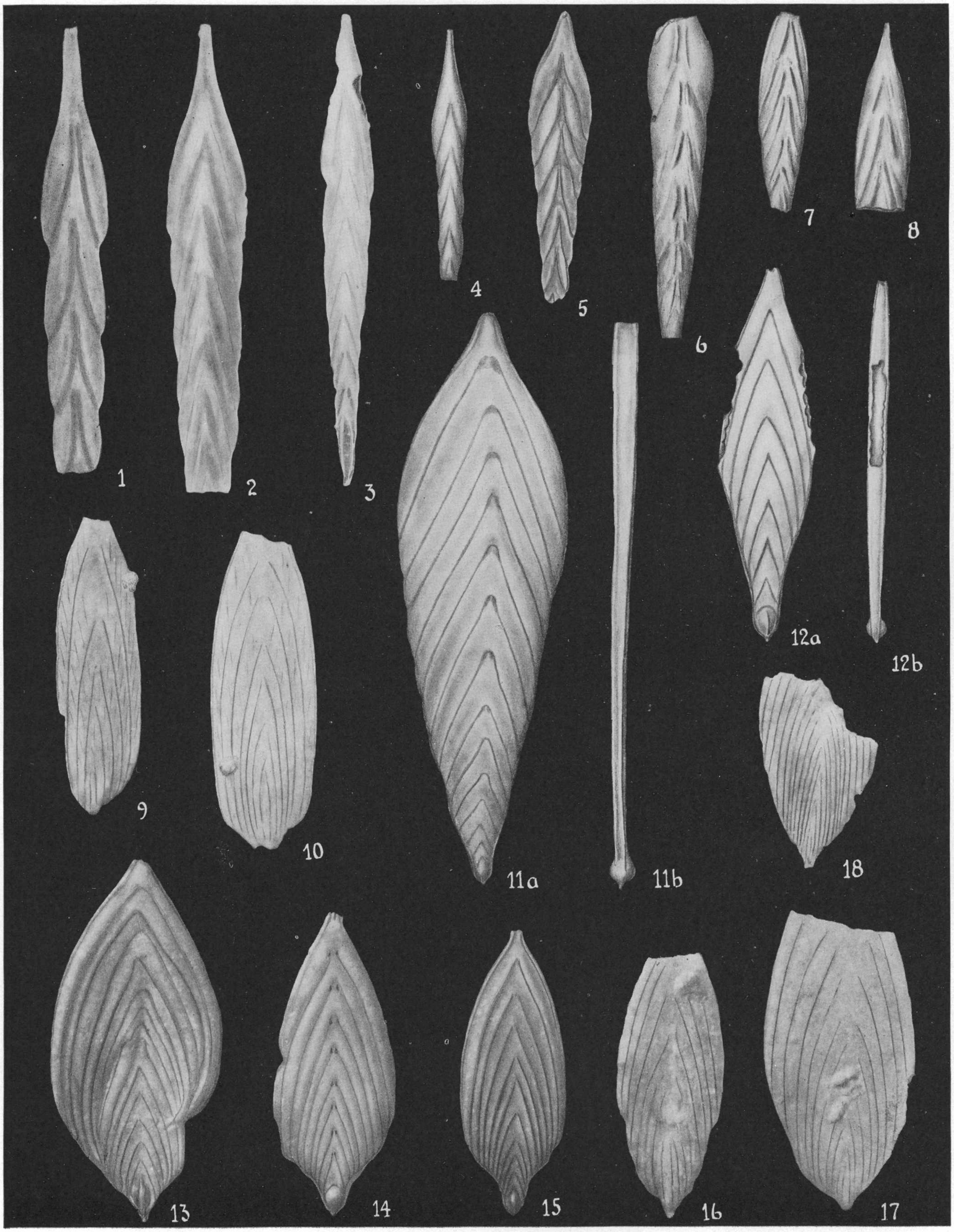
5. Austin chalk, Dallas County, Tex. (311). × 20.
6–8. Gober tongue of Austin chalk, Lamar County, Tex. (211). × 20.

9–10. *Frondicularia austinana* Cushman (p. 86).

9. Gober tongue of Austin chalk, Lamar County, Tex. (282). × 30.
10. Austin chalk, Bell County, Tex. (316). × 30.

11–18. *Frondicularia inversa* Reuss (p. 86).

11, 12. Ripley formation, Henderson County, Tenn. (96). *a*, Front view; *b*, peripheral view. 11, × 38; 12, × 30.
13–15. Arkadelphia marl, Clark County, Ark. (74). × 23.
16, 18. Austin chalk, Bell County, Tex. (316). × 23.
17. Austin chalk, Bell County, Tex. (315). × 23.



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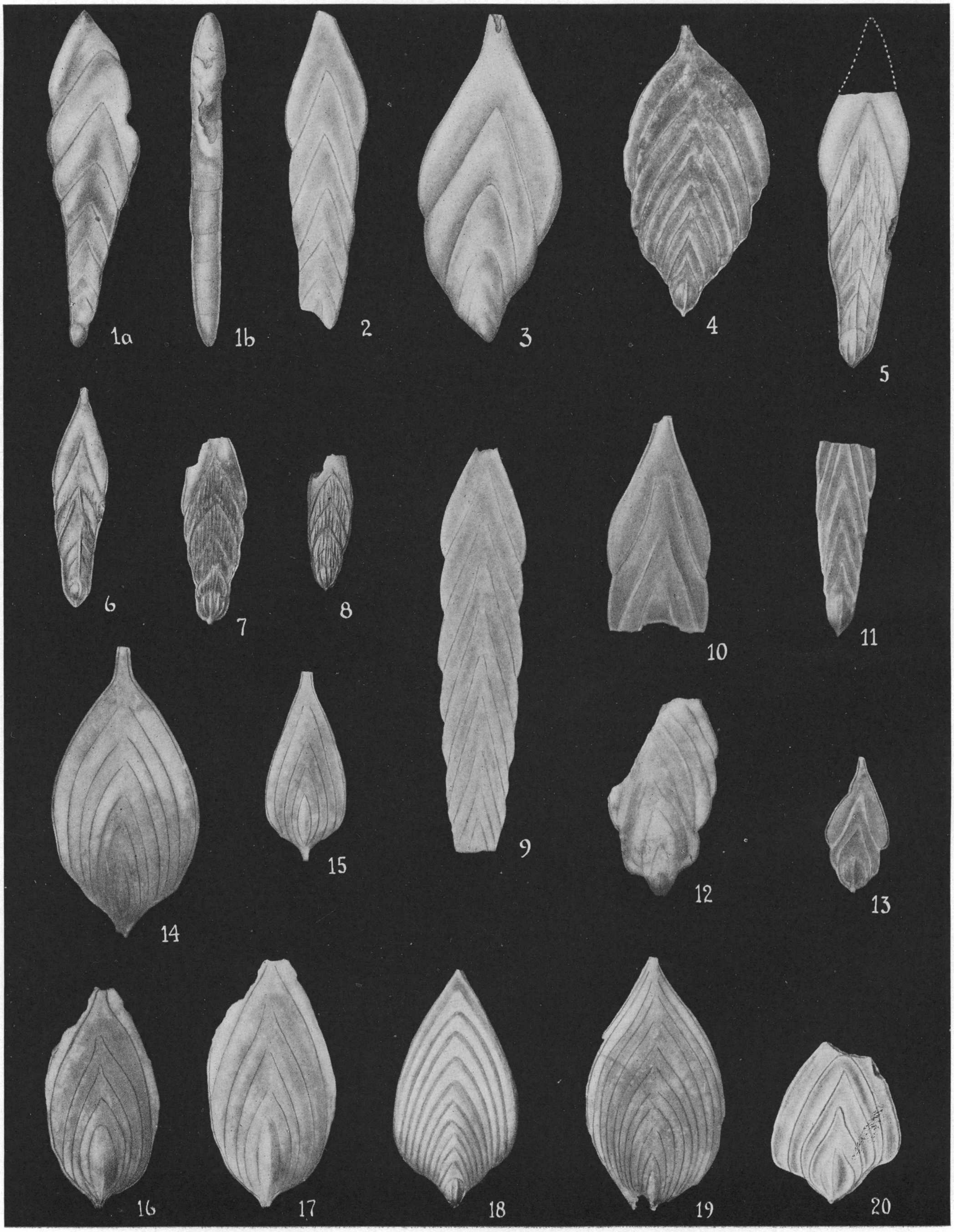

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PLATE 34

FIGURES 1, 2. *Frondicularia dunbari* Morrow (p. 86). Basal Niobrara chalk, Ellis County, Kans. Redrawn from types. 1, Holotype. 2, Paratype. × 58.

3, 4. *Frondicularia extensa* Morrow (p. 86).
3. Basal Niobrara chalk, Ellis County, Kans. Holotype redrawn. × 58.
4. Brownstown marl, Lamar County, Tex. (321). × 27.

5–8. *Frondicularia aclis* Morrow (p. 87).
5. Basal Niobrara chalk, Ellis County, Kans. Redrawn from holotype. × 58.
6. Austin chalk, Dallas County, Tex. (310). × 27.
7, 8. Brownstown marl, Sevier County, Ark. (348). × 27.

9–13. *Frondicularia undulosa* Cushman (p. 87).
9–11. Austin chalk, Dallas County, Tex. (311). × 30.
12. Gober tongue of Austin chalk, Lamar County, Tex. (288). × 30.
13. Austin chalk, 6½ miles east by north of Allen, Collin County, Tex. × 30.

14–17. *Frondicularia mucronata* Reuss (p. 87).
14, 16, 17. Upper part of Taylor marl, Limestone County, Tex. (136). × 30.
15. Gober tongue of Austin chalk, Lamar County, Tex. (282). × 30.

18–20. *Frondicularia goldfussi* Reuss (p. 87).
18. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). × 16.
19. Upper part of Taylor marl, Limestone County, Tex. (135). × 27.
20. Annona chalk at type locality, Texas (188a). × 33.

PLATE 35

FIGURES 1, 2. *Frondicularia goldfussi* Reuss (p. 87). Upper part of Taylor marl, Bexar County, Tex. (158). × 23.

3–7. *Frondicularia cordata* Roemer (p. 88).

3. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (179). × 23.
4, 5. Taylor marl, well samples, Bastrop County, Tex. × 23.
6. Annona chalk, Red River County, Tex. (198). × 23.
7. Austin chalk, Bell County, Tex. (316). × 23.

8–10. *Frondicularia linearis* Franke (p. 88).

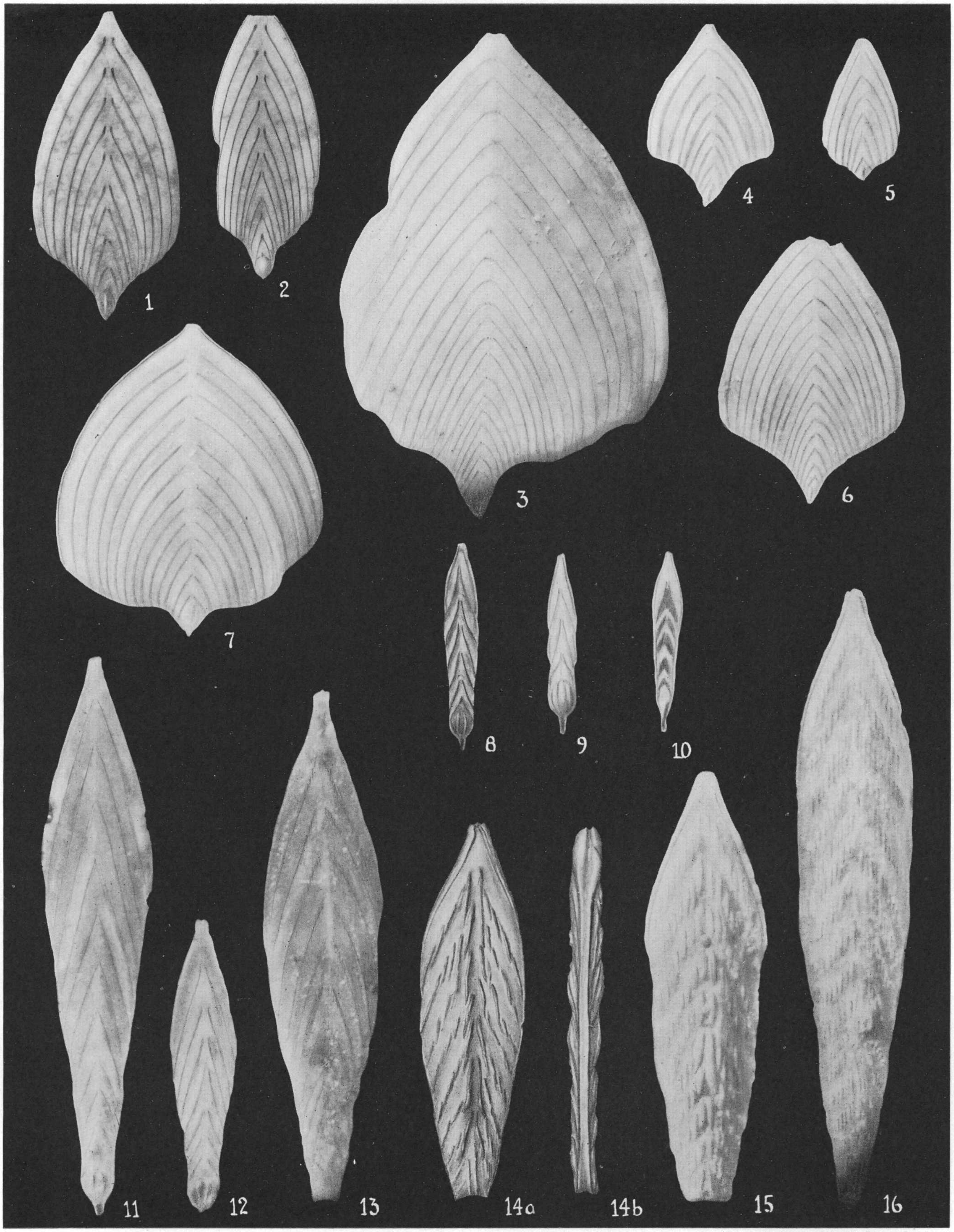
8, 10. Annona chalk. Red River County, Tex. (193). × 30.
9. Lower part of Taylor marl, 6.1 miles east of McKinney, Collin County, Tex. (210). × 30.

11–13. *Frondicularia intermittens* Reuss (p. 88).

11. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (179). × 30.
12, 13. Upper part of Taylor marl, Bexar County, Tex. (158). × 30.

14–16. *Frondicularia frankei* Cushman (p. 89).

14. Ripley formation, McNairy County, Tenn. (95). *a*, Front view; *b*, peripheral view. × 33.
15, 16. Lower part of Taylor marl, Bell County, Tex. (245). × 23.



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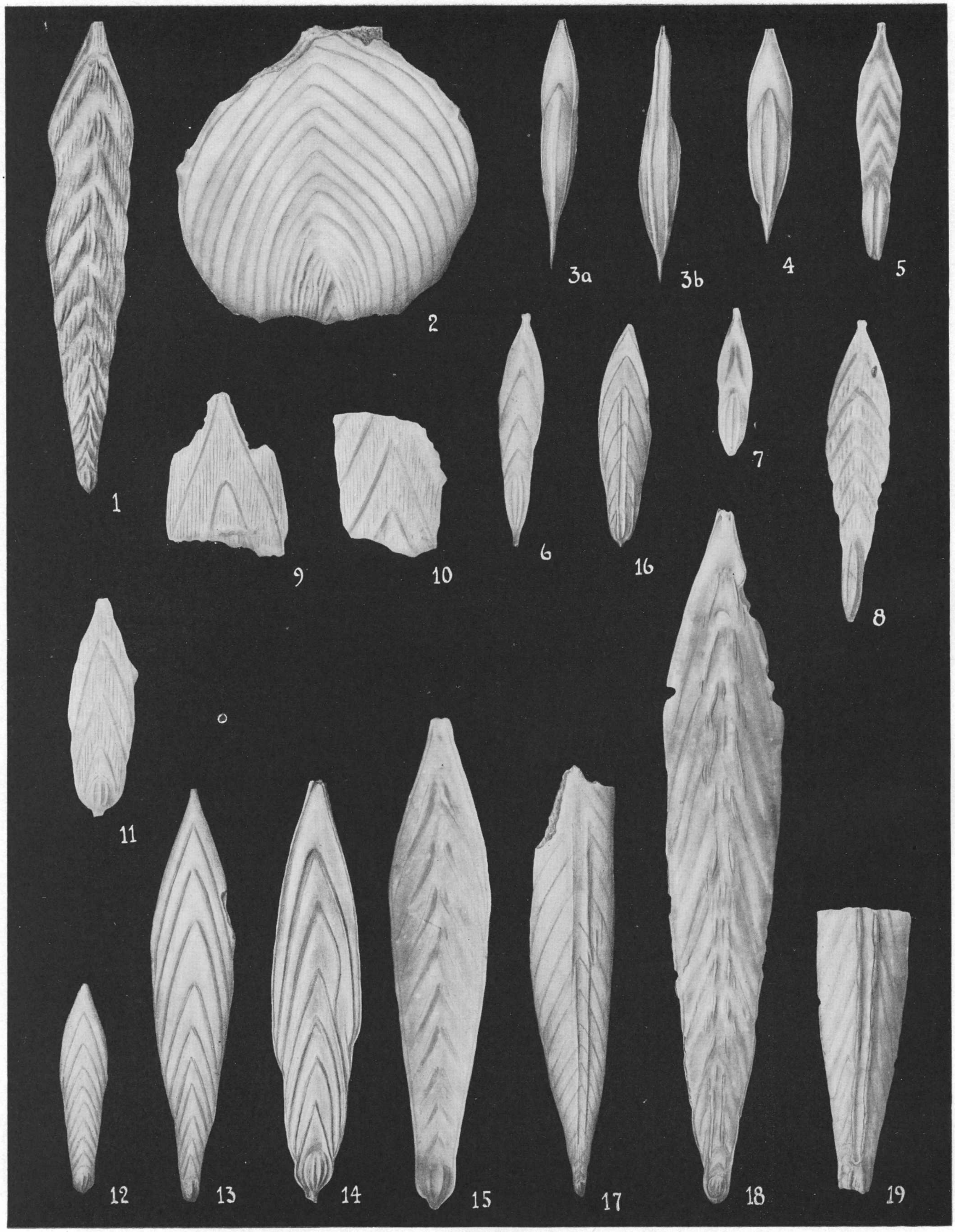

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PLATE 36

FIGURE 1. *Frondicularia frankei* Cushman (p. 89). Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). × 15.

2. *Frondicularia microdisca* Reuss (p. 90). Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). × 20.

3–7. *Frondicularia cuspidata* Cushman (p. 89).
3, 4. Ripley formation, McNairy County, Tenn. (94). 3, Holotype. *a*, Front view; *b*, peripheral view. × 75.
5. Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). × 38.
6, 7. Upper part of Taylor marl, Red River County, Tex. (106). × 30.

8. *Frondicularia cuspidata* Cushman var. *costifera* Cushman (p. 89). Upper part of Taylor marl, Lamar County, Tex. (110). Holotype. × 30.

9–11. *Frondicularia linguiformis* Marsson (p. 89).
9, 10. Annona chalk, Red River County, Tex. (196). × 23.
11. Annona chalk, Red River County, Tex. (197). × 23.

12–15. *Frondicularia verneuiliana* D'Orbigny (p. 90).
12, 13. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). × 20.
14. Corsicana marl, Limestone County, Tex. (30). × 38.
15. Selma chalk (upper part), Prentiss County, Miss. (91). × 30.

16–19. *Frondicularia verneuiliana* D'Orbigny var. *fossata* Cushman (p. 90).
16, 17. Gober tongue of Austin chalk, Lamar County, Tex. (288). × 18.
18, 19. Upper part of Taylor marl, Limestone County, Tex. (136). × 27.

PLATE 37

FIGURES 1–4. *Frondicularia striatula* Reuss (p. 90).

1, 2. Upper part of Taylor marl, Lamar County, Tex. (110). Young specimens. × 30.

3. Upper part of Taylor marl, Red River County, Tex. (108). × 23.

4. Gober tongue of Austin chalk, Lamar County, Tex. (282). × 23.

5. *Frondicularia glabrans* Cushman (p. 91). Ripley formation, Henderson County, Tenn. (96). Holotype, *a*, front view; *b*, peripheral view. × 38.

6, 7. *Frondicularia watersi* Cushman (p. 91).

6. Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). Holotype. × 30.

7. Upper part of Taylor marl, Bexar County, Tex. (152). × 30.

8–20. *Frondicularia archiaciana* D'Orbigny (p. 91).

8, 14, 16, 17. Pecan Gap chalk member of Taylor marl, Falls County, Tex. (178). 8, × 16; 14, × 20; 16, 17, × 28.

9, 10. Corsicana marl, Limestone County, Tex. (30). × 25.

11. Ripley formation, McNairy County, Tenn. (94). *a*. Front view; *b*, peripheral view. × 38.

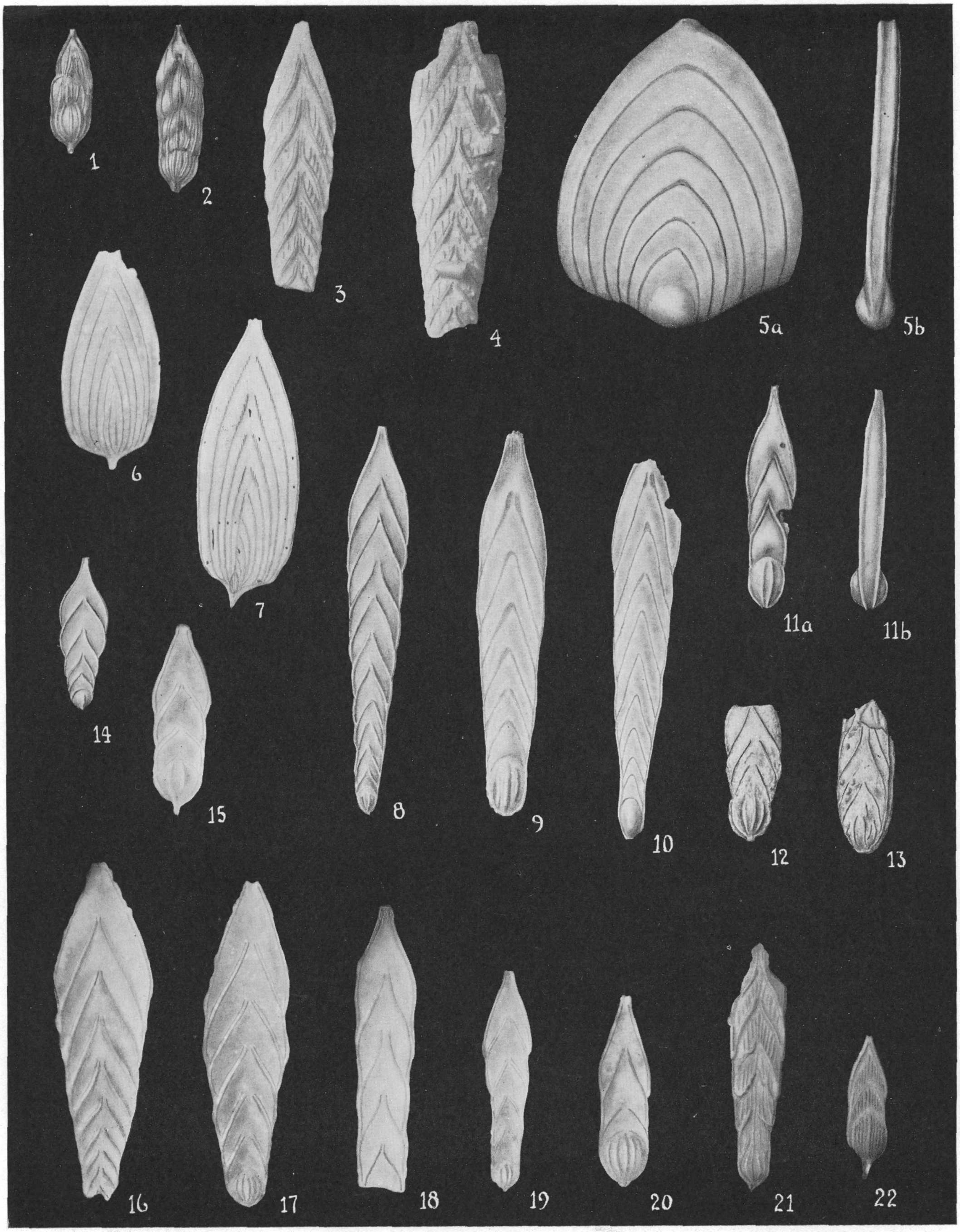
12, 13. Marlbrook marl, Little River County, Ark. (254). × 20.

15. Annona chalk, Red River County, Tex. (198). × 38.

18, 20. Upper part of Taylor marl, Collin County, Tex. (118). 18, × 38; 20, × 30.

19. Lower part of Taylor marl, Travis County, Tex. (250). × 38.

21, 22. *Frondicularia arkadelphiana* Cushman (p. 91). Arkadelphia marl? 5½ miles northeast of Hope, Hempstead County Ark. 21, Holotype. 22, Paratype. × 30.



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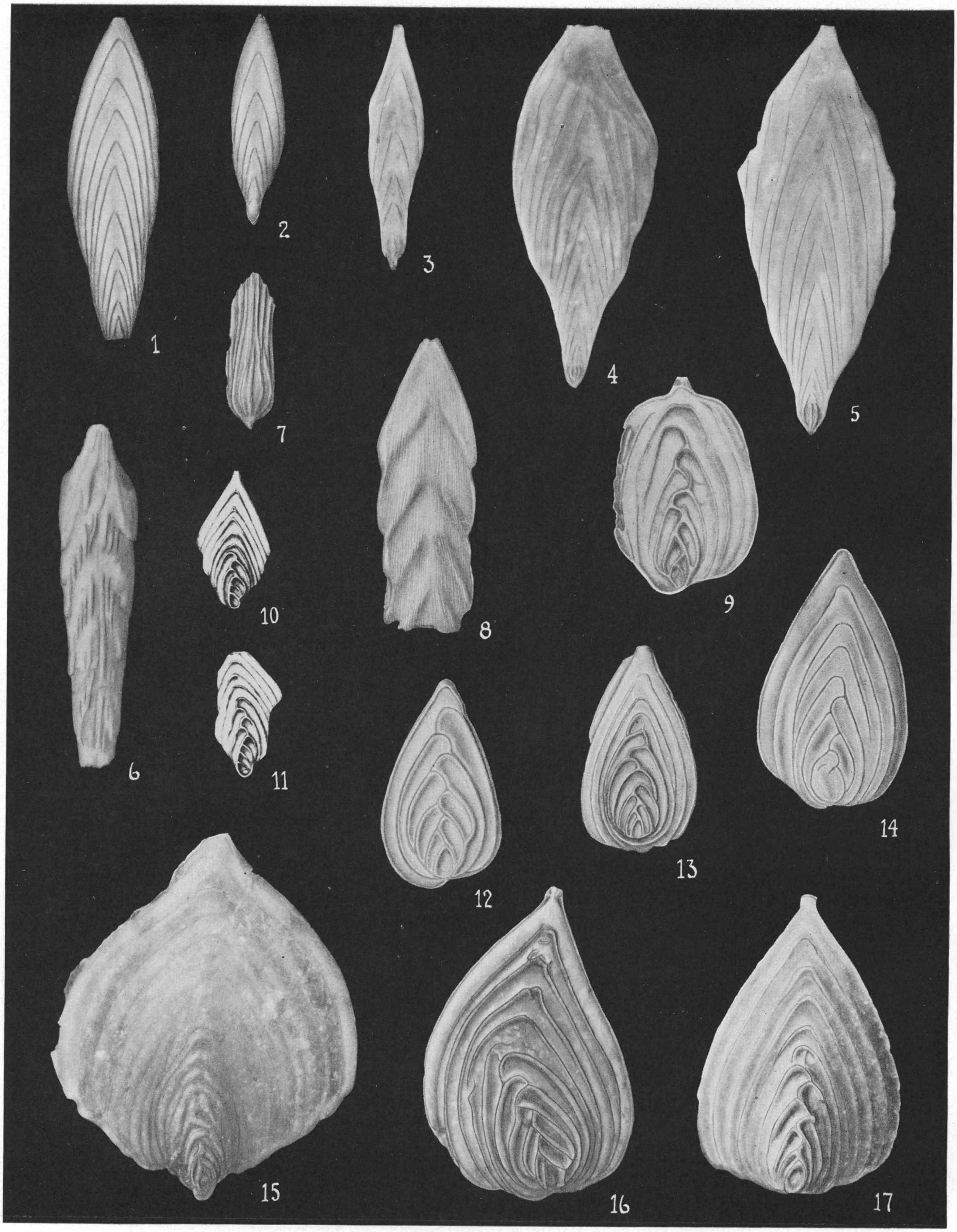


LAGENIDAE.

PLATE 38

FIGURES 1–5. *Frondicularia clarki* Bagg (p. 92).
1, 2, 3, 5. Corsicana marl, Limestone County, Tex. (30). 1, 2, × 20. 3, 5, × 30.
4. Corsicana marl, Navarro County, Tex. (26). × 30.
6. *Frondicularia dimidia* Bagg (p. 92). Neylandville marl, Hunt County, Tex. (55). × 30.
7. *Frondicularia jarvisi* Cushman (p. 92). (After Cushman and Jarvis.) Cretaceous, Trinidad. × 38.
8. *Frondicularia* sp. (p. 92). (After Cushman and Jarvis) Cretaceous, Trinidad. × 38.
9. *Kyphopyxa cushmani* Albritton and Phleger (p. 93). (After Albritton and Phleger.) Lower part of Taylor marl, Ellis County, Tex. (230). Holotype. × 33.
10, 11. *Kyphopyxa undulata* Loetterle (p. 93). (After Loetterle.) Fort Hays limestone, 4.7 miles east and 0.5 mile north of St. James, Nebr. × 25.
12–17. *Kyphopyxa christneri* (Carsey) Cushman (p. 92).
12–14. Annona chalk at type locality, Texas (188a). × 27.
15. Austin chalk, Hill County, Tex. (313). × 23.
16. Upper part of Taylor marl, Limestone County, Tex. (136). × 30.
17. Gober tongue of Austin chalk, Fannin County, Tex. (278). × 30.

PLATE 39

FIGURES 1–12. *Kyphopyxa christneri* (Carsey) Cushman (p. 92).
1, 2. Brownstown marl, Red River County, Tex. (319). × 30.
3. Gober tongue of Austin chalk, Lamar County, Tex. (284). × 30.
4, 5. Upper part of Austin chalk, Public road 6.5 miles east by north of Allen, Collin County, Tex. (295a). × 30.
6, 7. Austin chalk, Dallas County, Tex. (306). × 30.
8, 9. Selma chalk (lower part), Lee County, Miss. (350). × 30.
10, 11. Lower part of Taylor marl, Travis County, Tex. (249). × 30.
12. (After Cushman and Hedberg.) Colon shale, Venezuela. × 45.

13. *Lagena hispida* Reuss (p. 93). Ripley formation, Henderson County, Tenn. (96). × 75.

14, 15. *Lagena acuticosta* Reuss (p. 94).
14. Annona chalk at type locality, Texas (188a). × 120.
15. Saratoga chalk, Howard County, Ark. (79). × 75.

16. *Lagena hexagona* (Williamson) Siddall (p. 95). Ripley formation, McNairy County, Tenn. (95). × 75.

17. *Lagena plumigera* H. B. Brady (p. 95). Selma chalk (upper part), McNairy County, Tenn. (98). × 120.

18–21. *Lagena sulcata* (Walker and Jacob) Parker and Jones var. *semiinterrupta* W. Berry (p. 94).
18–20. Ripley formation, Henderson County, Tenn. (96). *a*, Front views; *b*, apertural views. 18, 19, × 110. 20, × 48.
21. Ripley formation, McNairy County, Tenn. (97). Holotype of variety, redrawn. × 75.

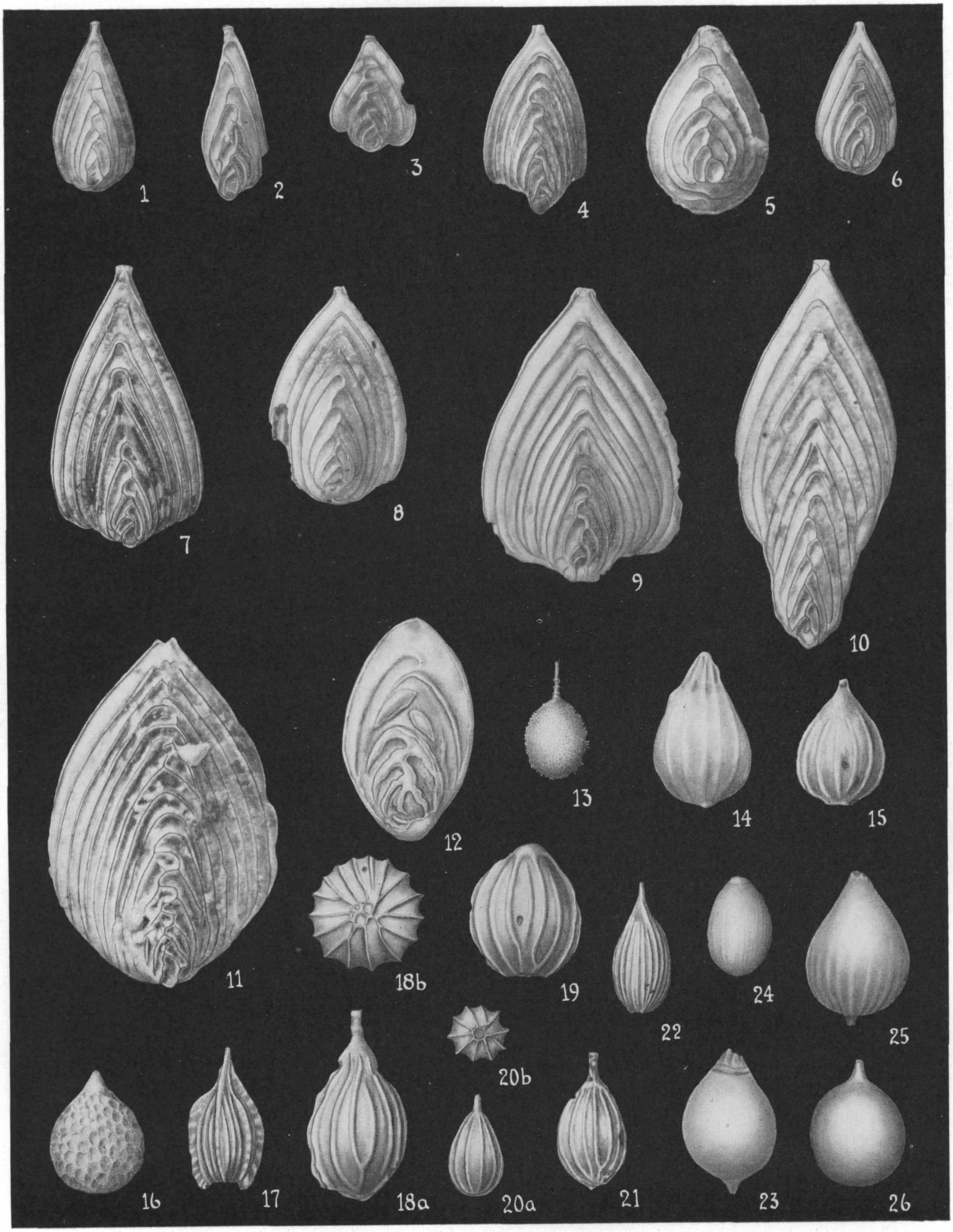
22. *Lagena substriata* Williamson (p. 95). Ripley formation, McNairy County, Tenn. (94). × 68.

23. *Lagena apiculata* Reuss (p. 94). Upper part of Taylor marl, Hunt County, Tex. (115). × 90.

24. *Lagena lineata* (Williamson) Reuss (p. 95). Ripley formation, McNairy County, Tenn. (94). × 120.

25. *Lagena semilineata* J. Wright (p. 95). Upper part of Taylor marl, Red River County, Tex. (105). × 68.

26. *Lagena* cf. *L. globosa* Montagu (p. 95). Lower part of Taylor marl, Williamson County, Tex. (246). × 68.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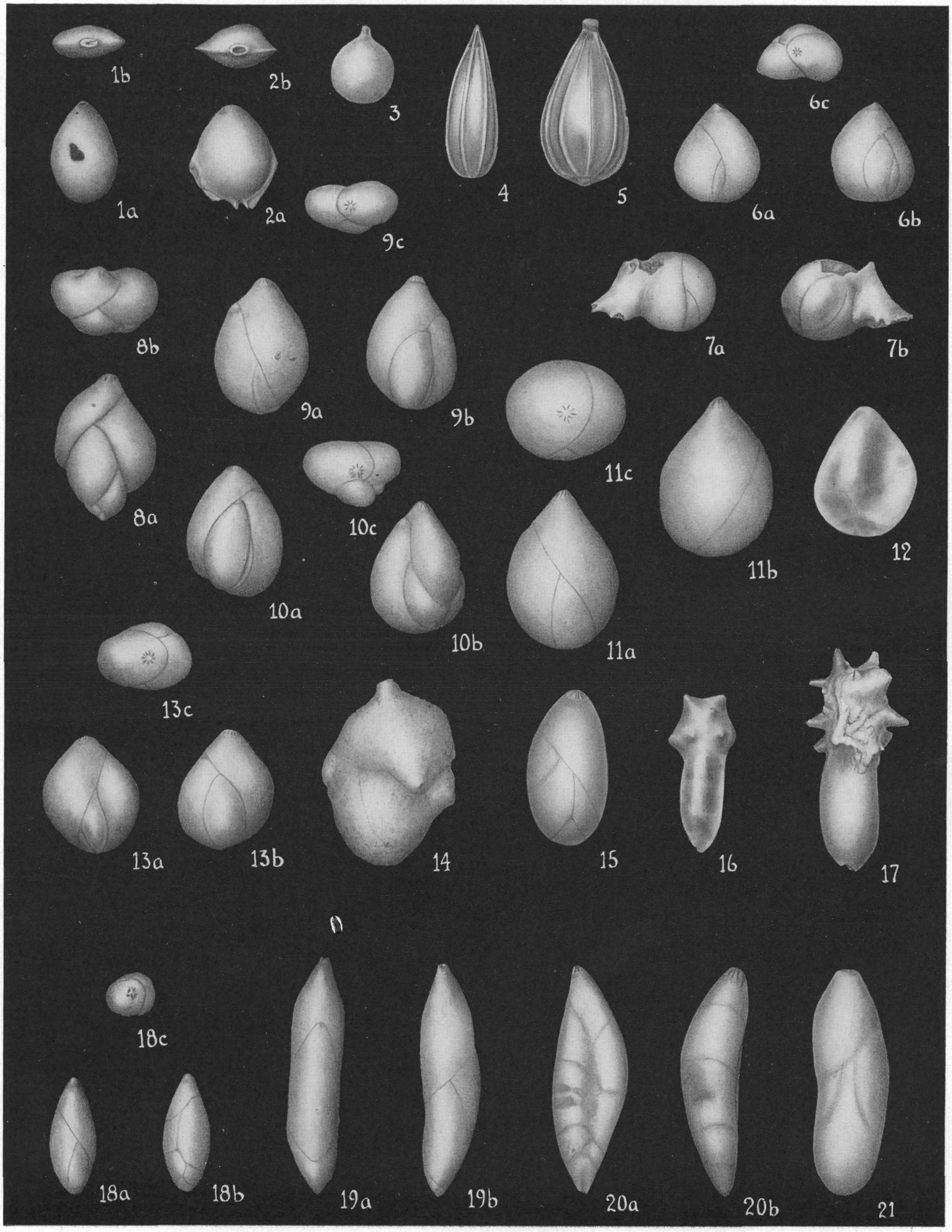
LAGENIDAE.



LAGENIDAE, POLYMORPHINIDAE.

PLATE 40

FIGURE 1. *Lagena laevigata* Reuss (p. 95). Selma chalk (upper part), McNairy County, Tenn. (98). *a*, Front view; *b*, apertural view. × 120.

2. *Lagena alveolata* H. B. Brady (p. 95). Selma chalk (upper part), McNairy County, Tenn. (98). *a*, Front view; *b*, apertural view. × 120.

3. *Lagena vulgaris* Williamson (p. 95). Saratoga chalk, Howard County, Ark. (79). × 42.

4, 5. *Lagena amphora* Reuss var. *paucicosta* Franke (p. 94).
- 4. Lower part of Taylor marl, Lamar County, Tex. (202). × 90.
- 5. Upper part of Taylor marl, Williamson County, Tex. (140). × 90.

6, 7. *Guttulina trigonula* (Reuss) Cushman and Ozawa (p. 95). Ripley formation, McNairy County, Tenn. (94). *a*, *b*, Opposite sides; *c*, apertural view. × 75.

8–10. *Guttulina adhaerens* (Olszewski) Cushman and Ozawa (p. 96).
- 8. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 42.
- 9, 10. Ripley formation, McNairy County, Tenn. (94). *a*, *b*, Opposite sides; *c*, apertural view. × 75.

11, 12. *Globulina lacrima* Reuss (p. 96).
- 11. Selma chalk (middle part), Hardin County, Tenn. (255). *a*, *b*, Opposite sides; *c*, apertural view. × 90.
- 12. Annona chalk at type locality, Texas (188a). × 55.

13. *Globulina lacrima* Reuss var. *subsphaerica* (Berthelin) Cushman and Ozawa (p. 96). Ripley formation, McNairy County, Tenn. (94). *a*, *b*, Opposite sides; *c*, apertural view. × 120.

14. *Globulina lacrima* Reuss var. *horrida* Reuss (p. 97). Annona chalk at type locality, Texas (188a). × 45.

15–17. *Globulina prisca* Reuss (p. 97).
- 15. Selma chalk (upper part). Union County, Miss. (92). Normal form. × 60.
- 16. Annona chalk at type locality, Texas (188a). Fistulose form. × 48.
- 17. Prairie Bluff chalk, Sumter County, Ala. (101). Fistulose form. × 60.

18, 19. *Pyrulina cylindroides* (Roemer) Cushman and Ozawa (p. 97).
- 18. Ripley formation, McNairy County, Tenn. (94). *a*, *b*, Opposite sides; *c*, apertural view. × 75.
- 19. Ripley formation, Henderson County, Tenn. (96). *a*, *b*, Opposite sides. × 75.

20. *Pyrulina velascoensis* (Cushman) Cushman and Ozawa (p. 97). Velasco shale, Mexico. Holotype, *a*, front view; *b*, side view. × 60.

21. *Pseudopolymorphina digitata* (D'Orbigny) Cushman and Ozawa (p. 98). Cretaceous greensand of Navarro age, Georges Bank, Atlantic Ocean. × 38.

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PLATE 41

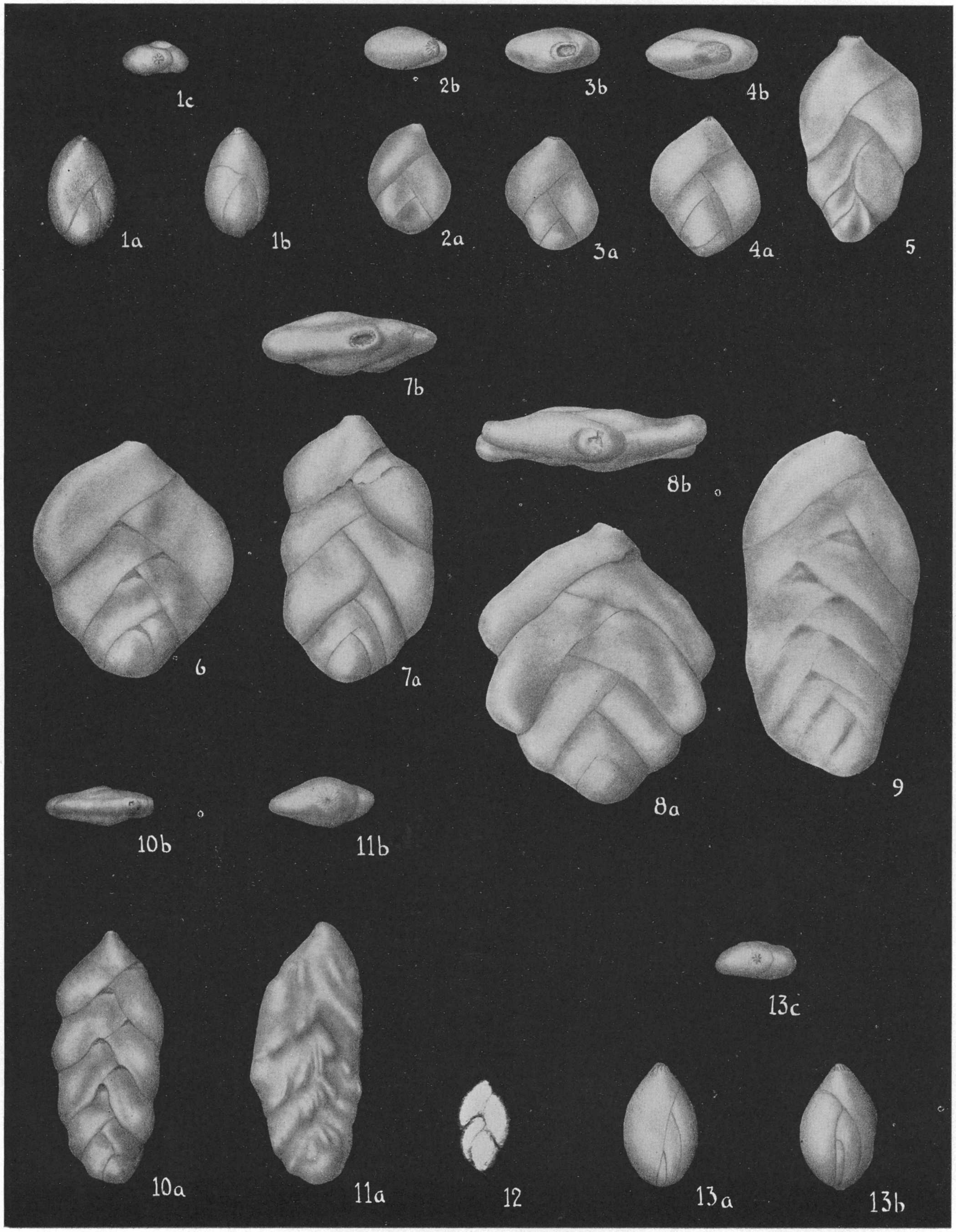
FIGURE 1. *Pseudopolymorphina incerta* (Egger) Cushman and Ozawa (p. 97). Ripley formation, McNairy County, Tenn. (94) *a*, *b*, Opposite sides; *c*, apertural view. × 75.

2–10. *Pseudopolymorphina cuyleri* Plummer (p. 98). Corsicana marl, Limestone County, Tex. (30). Series showing various stages in development and variations in shape in the adult; *a*, front view; *b*, apertural view. 2–9, × 25. 10, × 15.

11. *Pseudopolymorphina ozawana* Cushman and Jarvis (p. 98). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, front view; *b*, apertural view. × 23.

12. *Pseudopolymorphina mendezensis* (White) Cushman and Ozawa (p. 98). (After White.) Velasco shale, Mexico. × 30.

13. *Sigmomorphina semitecta* (Reuss) Cushman and Ozawa var. *terquemiana* (Fornasini) Cushman and Ozawa (p. 98). Ripley formation, McNairy County, Tenn. (94). *a*, *b*, Opposite sides; *c*, apertural view. × 75.



POLYMORPHINIDAE.

POLYMORPHINIDAE.

PLATE 42

FIGURES 1–4. *Bullopora laevis* (Sollas) Wickenden (p. 98).

1. Corsicana marl, Limestone County, Tex. (30). Attached to *Vaginulina webbervillensis* Carsey. × 30.
2. Upper part of Taylor marl, Bexar County, Tex. (161). × 30.
3. Upper part of Taylor marl, Bexar County, Tex. (158). × 30.
4. Brownstown marl, Lamar County, Tex. (321). × 23.

5–7. *Bullopora tuberculata* (Sollas) Cushman (p. 99).

5. Upper part of Taylor marl, Travis County, Tex. (147). Showing complete development. × 23.
6. Upper part of Taylor marl, Bexar County, Tex. (162). × 30.
7. Upper part of Taylor marl, Bexar County, Tex. (159). × 30.

PLATE 43

FIGURES 1, 2. *Ramulina navarroana* Cushman (p. 99). Corsicana marl, Limestone County, Tex. (31). 1, Holotype. 2, Paratype. × 30.

3–8. *Ramulina arkadelphiana* Cushman (p. 99). Arkadelphia marl, Hempstead County, Ark. (70). 3, Holotype. 4–8, Paratypes. × 30.

9. *Ramulina ornata* Cushman (p. 99). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype. × 30.

10. *Ramulina globo-tubulosa* Cushman (p. 100). Ripley formation, Henderson County, Tenn. (96). Holotype. × 75

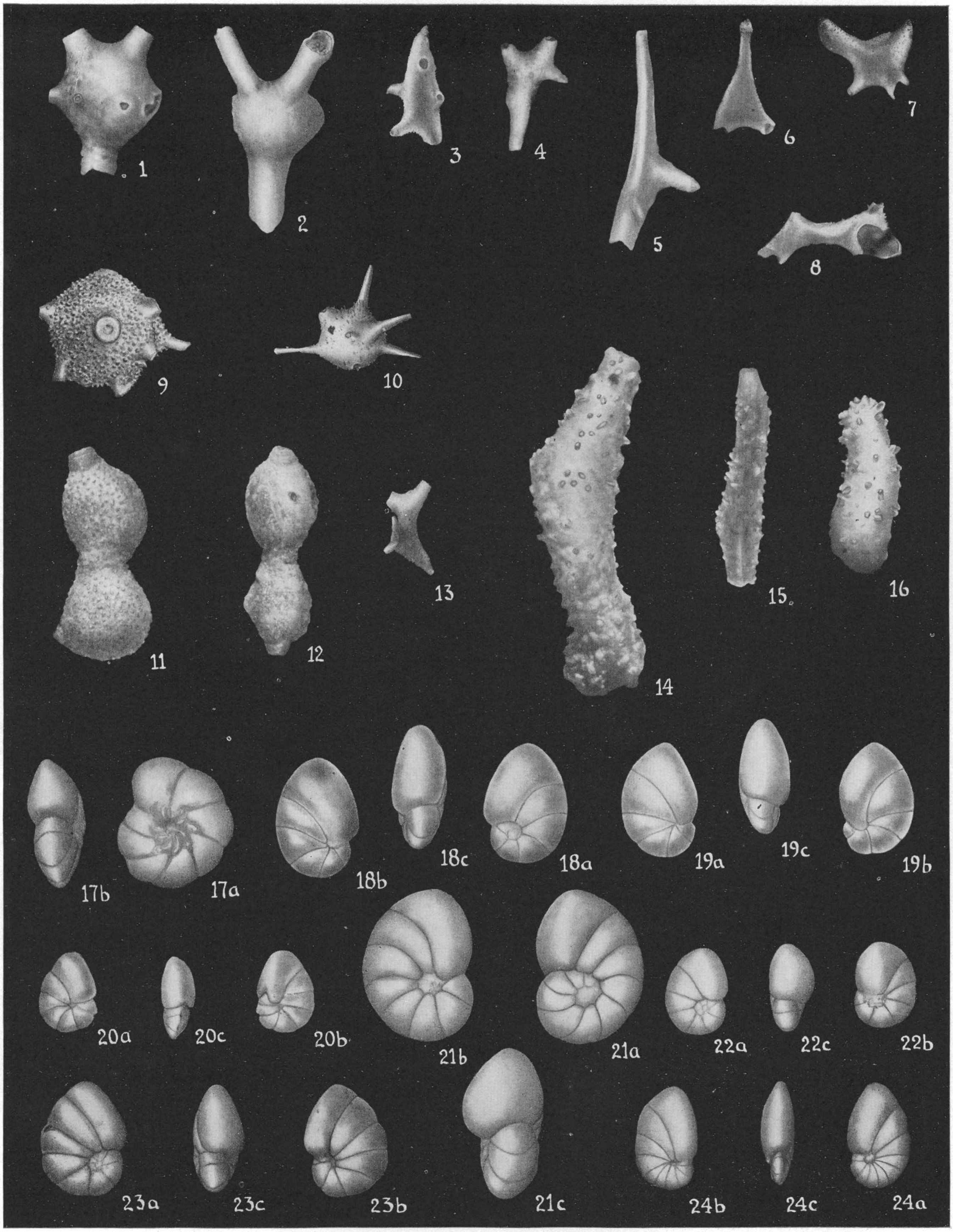
11–16. *Ramulina aculeata* (D'Orbigny) Wright (p. 100).
- 11, 12. Mendez shale, Mexico. × 38.
- 13–16. Pecan Gap chalk member of Taylor marl, McLennan County, Tex. (177). × 30.

17. *Nonion jarvisi* Thalmann (p. 100). Cretaceous, Trinidad. (After Cushman and Jarvis.) Holotype; *a*, side view: *b*. peripheral view. × 38.

18–20. *Nonionella austinana* Cushman (p. 100). *a*, *b*, Opposite sides; *c*, peripheral view.
- 18. Austin chalk, Collin County, Tex. (292). Holotype. × 90.
- 19. Taylor marl, Travis County, Tex. (145). × 90.
- 20. Austin chalk, Grayson County, Tex. (335). × 90.

21–23. *Nonionella robusta* Plummer (p. 100). Corsicana marl, Navarro County, Tex. (26). *a*, *b*, Opposite sides; *c*, peripheral view. × 90.

24. *Nonionella cretacea* Cushman (p. 101). Selma chalk (upper part), McNairy County, Tenn. (98). *a*, *b*, Opposite sides; *c*, peripheral view. × 90.



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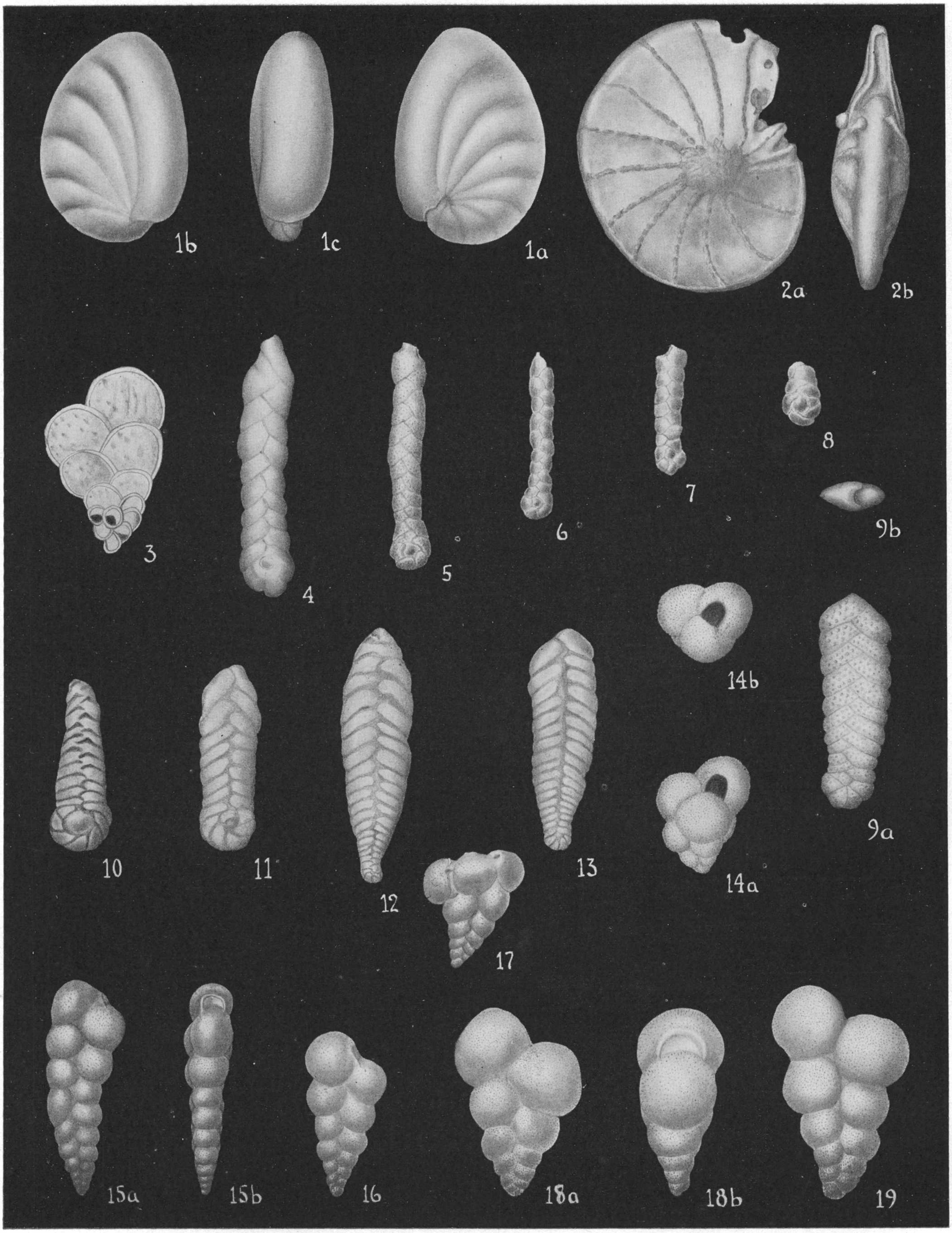


NONIONIDAE, CAMERINIDAE, HETEROHELICIDAE.

PLATE 44

FIGURE 1. *Nonionella ansata* Cushman (p. 101). Prairie Bluff chalk, Sumter County, Ala. (101). Holotype, *a*, *b*, opposite sides; *c*, peripheral view. × 110.

2. *Operculina catenula* Cushman and Jarvis (p. 101). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, side view; *b*, peripheral view. × 25.

3. *Heterohelix americana* (Ehrenberg) Cushman (p. 101). (After Ehrenberg.)

4–8. *Bolivinopsis rosula* (Ehrenberg) Macfadyen (p. 101).
   4. Selma chalk (upper part), McNairy County, Tenn. (98). × 110.
   5. Selma chalk (middle part), Prentiss County, Miss. (260). × 58.
   6–8. Lower part of Taylor marl, Lamar County, Tex. (202). × 68.

9. *Bolivinopsis papillata* (Cushman) Cushman (p. 102). Ripley formation, McNairy County, Tenn. (94). Holotype, *a*, front view; *b*, apertural view. × 115.

10–13. *Bolivinopsis? clotho* (Grzybowski) Cushman (p. 103). After Cushman and Jarvis.) Cretaceous, Trinidad. × 45.

14. *Gümbelitria cretacea* Cushman (p. 103). Kemp clay, Guadalupe County, Tex. (18). Holotype, *a*, front view; *b*, apertural view. × 115.

15–17. *Gümbelina moremani* Cushman (p. 103). Eagle Ford shale, Hill County, Tex. (367). 15, Holotype, *a*, front view; *b*, side view. 16, 17, Paratypes. × 90.

18, 19. *Gümbelina reussi* Cushman (p. 104). Austin chalk, Grayson County, Tex. (334). 18, Holotype, *a*, front view; *b*, side view. 19, Paratype. × 90.

PLATE 45

FIGURES 1–3. *Gümbelina plummerae* Loetterle (p. 104). Lower part of Taylor marl, Delta County, Tex. (206). *a*, Front view; *b*, side view. × 115.

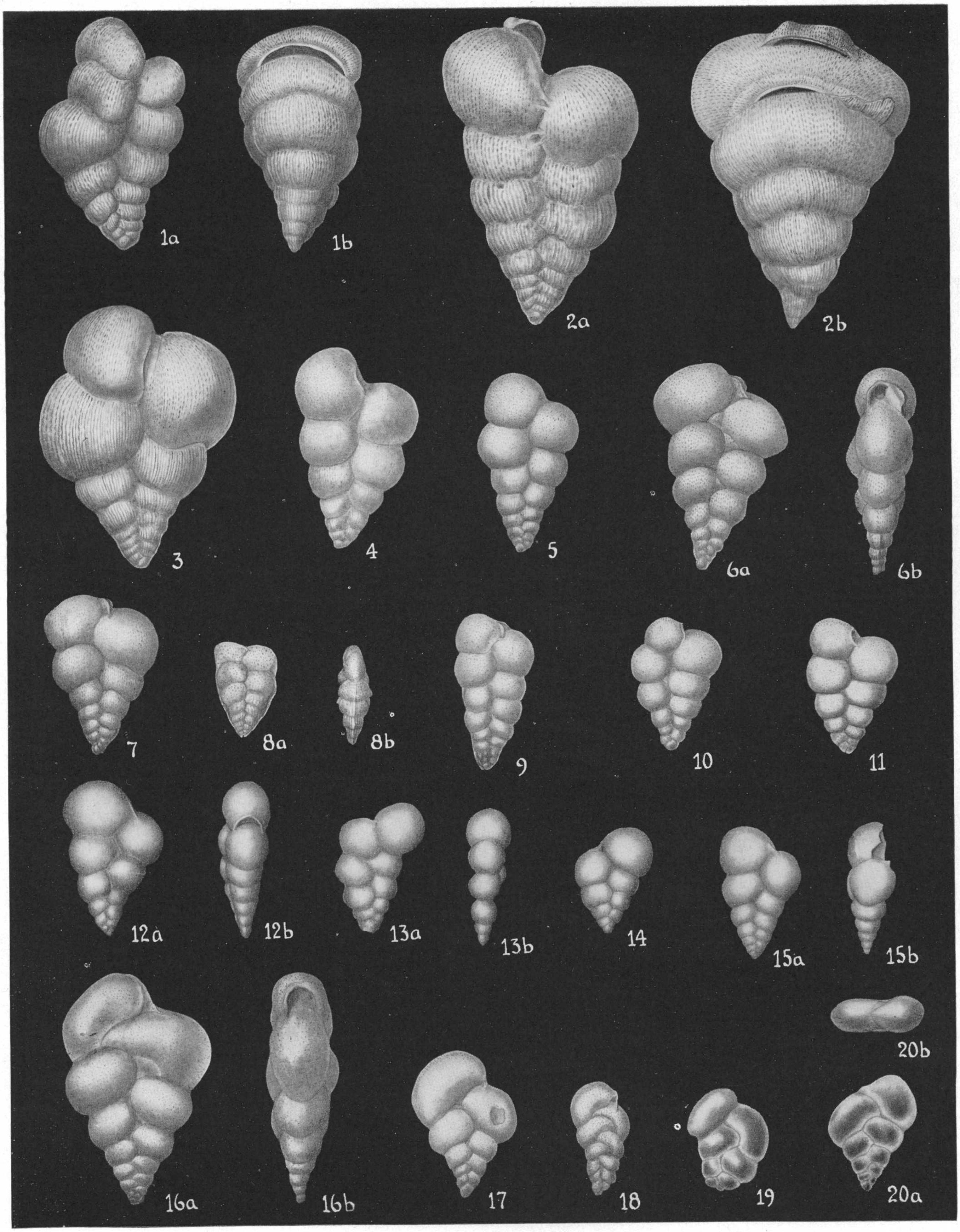
4, 5. *Gümbelina striata* (Ehrenberg) Egger (p. 104).
- 4. Lower part of Taylor marl, McLennan County, Tex. (238). × 90.
- 5. Brownstown marl, Red River County, Tex (318). × 90.

6, 7. *Gümbelina planata* Cushman (p. 105). Upper part of Taylor marl, Red River County, Tex. (108). 6, Holotype. *a*, Front view; *b*, side view. × 90.

8. *Gümbelina carinata* Cushman (p. 105). Lower part of Taylor marl, Lamar County, Tex. (201). Holotype, *a*, front view; *b*, side view. × 90.

9–15. *Gümbelina globulosa* (Ehrenberg) Egger (p. 105).
- 9. Prairie Bluff chalk, Chickasaw County, Miss. (86). × 90.
- 10, 11. Wolfe City sand member of Taylor marl, Hunt County, Tex. (186). × 90.
- 12. Ripley formation, Henderson County, Tenn. (96). *a*, Front view; *b*, side view. × 115.
- 13. Ripley formation, McNairy County, Tenn. (94). *a*, Front view; *b*, side view. × 120.
- 14. Selma chalk (upper part), McNairy County, Tenn. (98). × 120.
- 15. White chalk, Antigua, British West Indies. *a*, Front view; *b*, side view. × 68.

16–20. *Gümbelina pseudotessera* Cushman (p. 106).
- 16. Upper part of Taylor marl, Kaufman County, Tex. (129). Holotype, *a*, front view; *b*, side view. × 115.
- 17, 18. Bonham marl, Lamar County, Tex. (327). × 115.
- 19, 20. Annona chalk at type locality, Texas (188a). *a*, Front view; *b*, apertural view. × 68.



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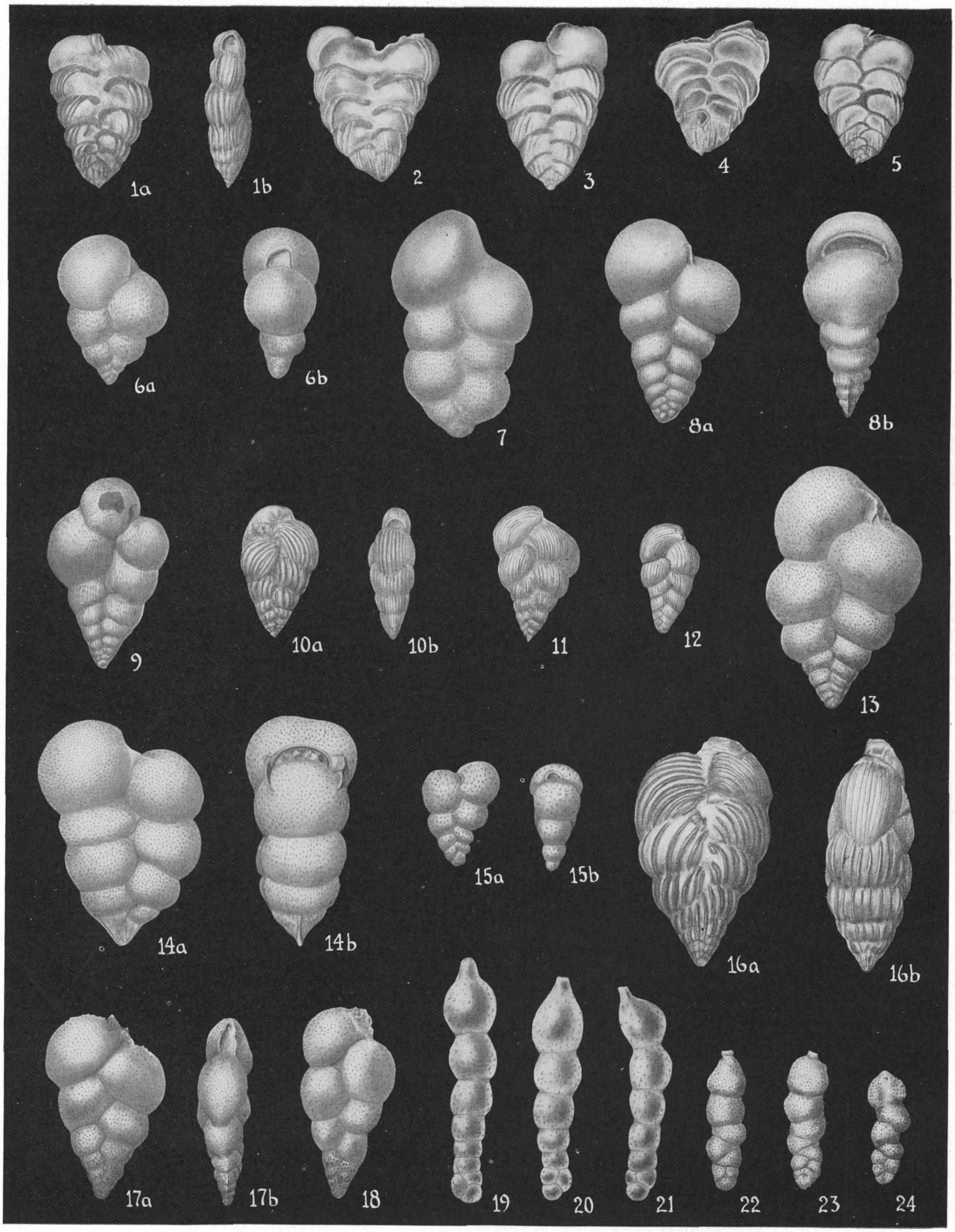


HETEROHELICIDAE.

PLATE 46

FIGURES 1–5. *Gümbelina semicostata* Cushman (p. 107). Lower part of Taylor marl, Delta County, Tex. (206). 1, Holotype, *a*, front view; *b*, side view. 2–5, Paratypes. × 90.

6, 7. *Gümbelina ultimatumida* White (p. 107). × 90. Velasco shale near Velasco, Mexico. *a*, Front view; *b*, side view. × 90.

8, 9. *Gümbelina globocarinata* Cushman (p. 107). Upper part of Taylor marl, Lamar County, Tex. (110). 8, Holotype, *a*, front view; *b*, side view. 9, Paratype. × 90.

10–12. *Gümbelina costulata* Cushman (p. 108). Upper part of Taylor marl, Red River County, Tex. (107). 10, Holotype, *a*, front view; *b*, side view. 11, 12, Paratypes. × 90.

13, 14. *Gümbelina punctulata* Cushman (p. 108). Upper part of Taylor marl, Red River County, Tex. (108). 14, Holotype, *a*, front view; *b*, side view. 13, Paratype. × 90.

15. *Gümbelina spinifera* Cushman (p. 108). Ripley formation, McNairy County, Tenn. (94). Holotype, *a*, front view. *b*, side view. × 90.

16. *Gümbelina excolata* Cushman (p. 108). Corsicana marl. Limestone County, Tex. (31). *a*, Front view; *b*, side view × 90.

17, 18. *Gümbelina glabrans* Cushman (p. 109). Kemp clay, Williamson County, Tex. (12). 17, Holotype, *a*, front view; *b*, side view. 18, Paratype. × 90.

19–21. *Rectogümbelina texana* Cushman (p. 109). Austin chalk, Grayson County, Tex. (323). 19, Holotype. 20, 21, Paratypes. × 150.

22–24. *Rectogümbelina hispidula* Cushman (p. 109). Austin chalk, Dallas County, Tex. (325.) 22, Holotype. 23, 24, Paratypes. × 90.

PLATE 47

FIGURE 1. *Rectogümbelina minuta* Cushman (p. 109). Lower part of Taylor marl, Delta County, Tex. (206). Holotype. × 150.

2, 3. *Rectogümbelina cretacea* Cushman (p. 110). Arkadelphia marl 5½ miles northeast of Hope, Hempstead County, Ark. 2, Holotype. 3, Paratype. × 135.

4–7. *Pseudotextularia varians* Rzehak (p. 110). Mendez shale, Mexico. 4*a*, 5*a*, Front views; 4*b*, 5*b*, apertural views. 7*a*, Front view; 7*b*, side view. × 58.

8. *Pseudotextularia varians* Rzehak var. *textulariformis* White (p. 110). (After White.) Mendez shale, 2.2 miles east of Guerrero, Mexico. *a*, Front view; *b*, apertural view. × 30.

9. *Pseudotextularia varians* Rzehak var. *mendezensis* White (p. 110). (After White.) Mendez shale, 2.2 miles east of Guerrero, Mexico. *a*, Front view; *b*, apertural view. × 30.

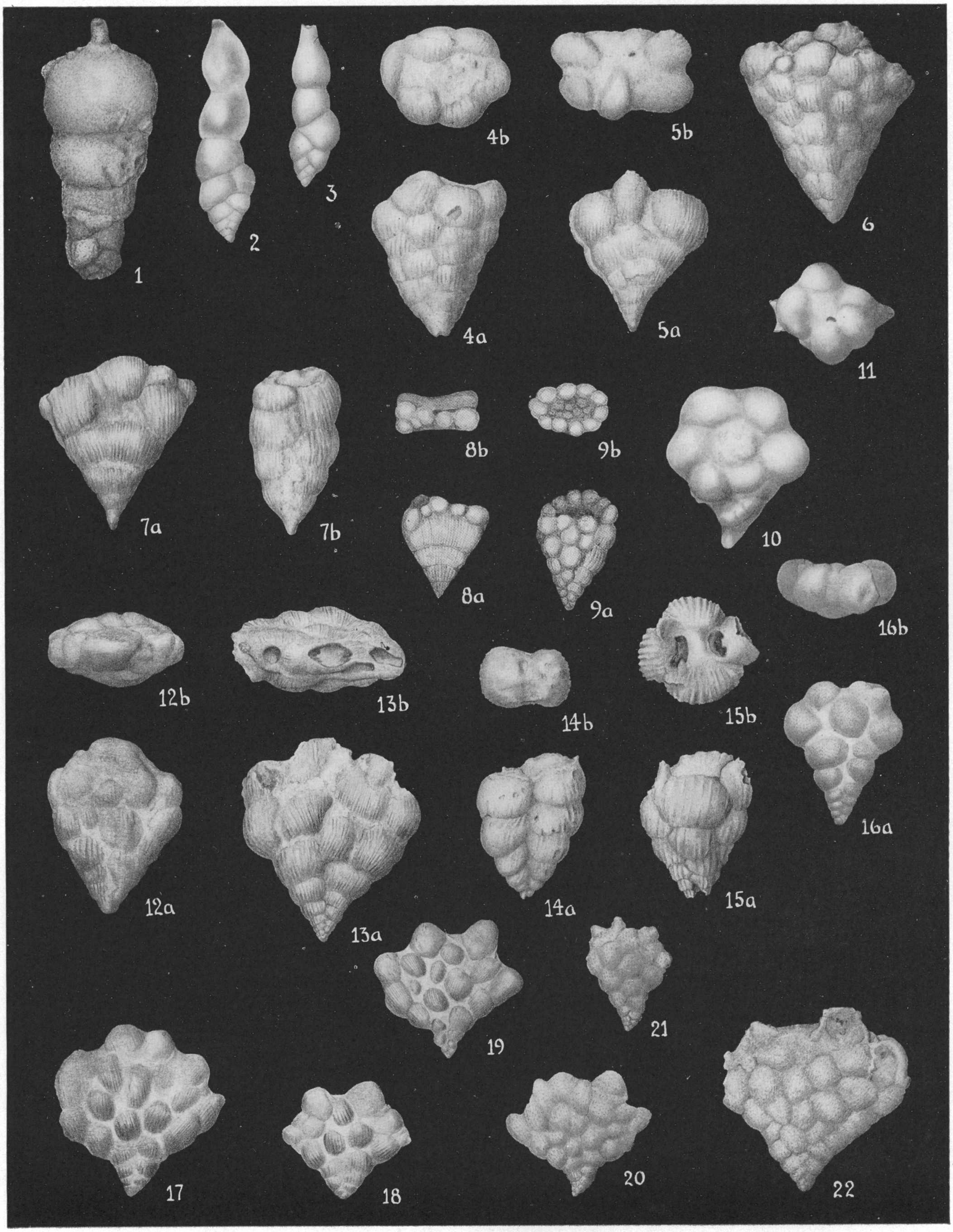
10, 11. *Planoglobulina taylorana* Cushman (p. 110). Lower part of Taylor marl, Dallas County, Tex. (224). 10, Holotype. 11, Paratype. × 90.

12–15. *Planoglobulina acervulinoides* (Egger) Cushman (p. 111).
12. Mendez shale, Mexico. *a*, Front view; *b*, apertural view. × 58.
13–15. Prairie Bluff chalk, Wilcox County, Ala. (99). *a*, Front view; *b*, apertural view. × 75.

16. *Ventilabrella austinana* Cushman (p. 111). Gober tongue of Austin chalk, Fannin County, Tex. (277). Holotype, *a*, Front view; *b*, side view. × 58.

17–19. *Ventilabrella eggeri* Cushman (p. 111).
17, 18. Lower part of Taylor marl, Travis County, Tex. (247). × 45.
19. Lower part of Taylor marl, McLennan County, Tex. (242). × 38.

20–22. *Ventilabrella eggeri* Cushman var. *glabrata* Cushman (p. 111). Lower part of Taylor marl, Ellis County, Tex. (231). 22, Holotype. 20, 21, Paratypes. × 58.



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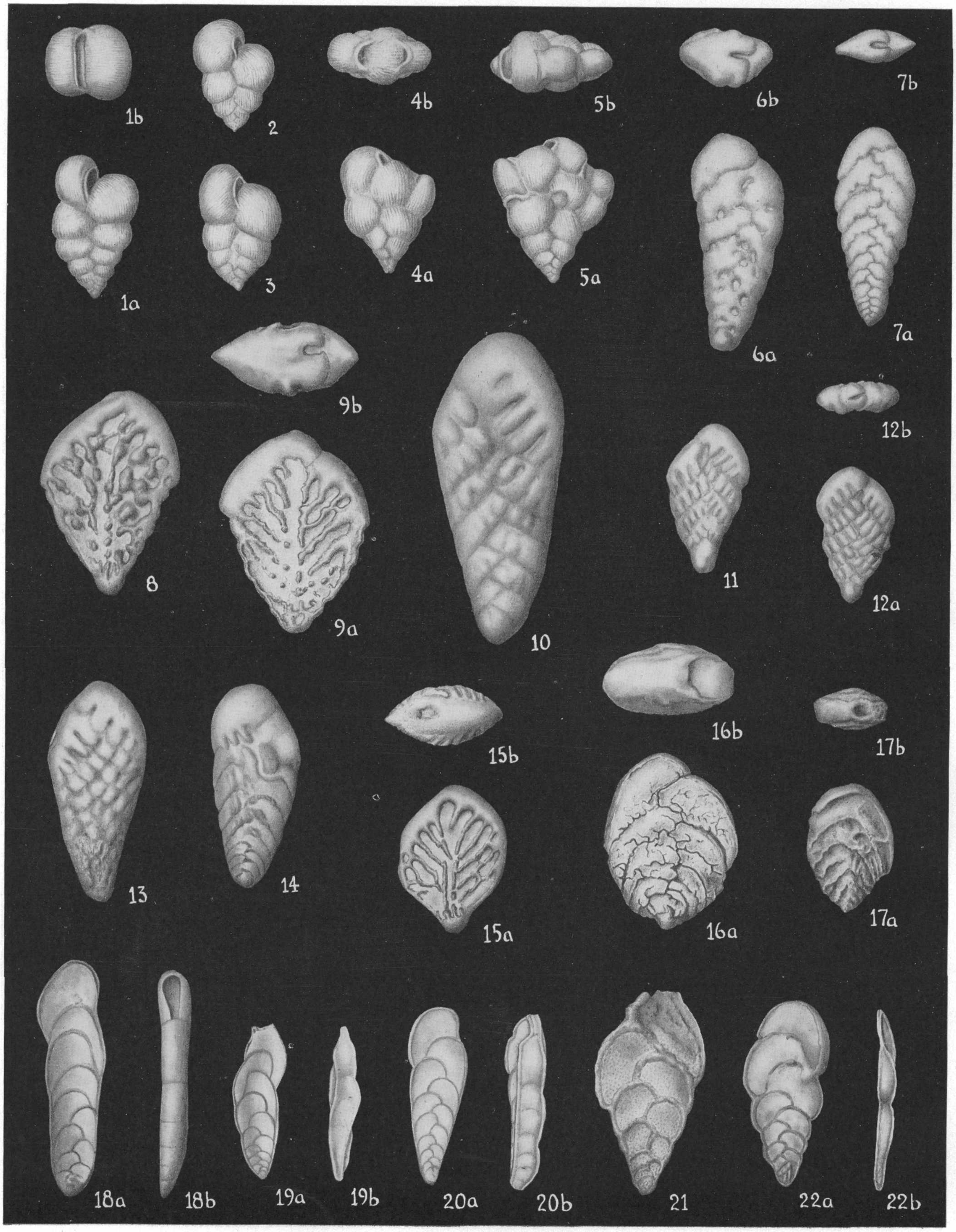

HETEROHELICIDAE.

PLATE 48

FIGURES 1–5. *Ventilabrella carseyae* Plummer (p. 112). Arkadelphia marl, Hempstead County, Ark. (70). *a*, Front view; *b*, apertural view. × 58.

6. *Bolivinoides austinana* Cushman (p. 112). Austin chalk, Bell County, Tex. (316). Holotype, *a*, Front view; *b*, apertural view. × 120.

7. *Bolivinoides texana* Cushman (p. 112). Lower part of Taylor marl, Collin County, Tex. (211). Holotype, *a*, Front view; *b*, apertural view. × 100.

8, 9. *Bolivinoides decorata* (Jones) Cushman (p. 113). Annona chalk, Bowie County, Tex. (189). *a*, Front view; *b*, apertural view. × 90.

10–14. *Bolivinoides decorata* (Jones) Cushman var. *delicatula* Cushman (p. 113).
- 10. Cretaceous, Hacienda el Limon, Vera Cruz, Mexico. × 75.
- 11. Pecan Gap chalk member of Taylor marl, Lamar County, Tex. (165). × 58.
- 12. Saratoga chalk, Howard County, Ark. (79). *a*, Front view; *b*, apertural view. × 38.
- 13. Cretaceous, Trinidad. × 75.
- 14. Taylor marl, south of Austin on Greedmor-Delvalle road, Texas. × 100.

15. *Bolivinoides rhomboidea* (Cushman) Cushman (p. 113). Mendez shale, 5 kilometers southeast of Guerrero on Tamuin River, San Luis Potosi, Mexico. Holotype, *a*, Front view; *b*, apertural view. × 55.

16. *Bolivinoides velascoensis* (Cushman) Cushman (p. 114). Velasco shale, Hacienda el Limon, Vera Cruz, Mexico. Holotype, *a*, Front view; *b*, apertural view. × 55.

17. *Bolivinoides trinitatensis* Cushman and Jarvis (p. 114). (After Cushman and Jarvis). Cretaceous, Trinidad. Holotype, *a*, Front view; *b*, apertural view. × 50.

18–20. *Bolivinita eleyi* Cushman (p. 114).
- 18. Brownstown marl, Clark County, Ark. (349). *a*, Front view; *b*, side view. × 90.
- 19. Annona chalk at type locality, Texas (188a). *a*, Front view; *b*, side view. × 55.
- 20. White chalk, Antigua, British West Indies. *a*, Front view; *b*, side view. × 68.

21, 22. *Bolivinita planata* Cushman (p. 114).
- 21. Pecan Gap chalk member of Taylor marl, Rockwall County, Tex. (176). Holotype. × 55.
- 22. Pecan Gap chalk member of Taylor marl, Lamar County, Tex. (165). *a*, Front view; *b*, side view. × 55

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PLATE 49

FIGURES 1, 2. *Bolivinita selmensis* Cushman (p. 114). Ripley formation, McNairy County, Tenn. (94). 1, Holotype, *a*, front view; *b*, apertural view. 2, Paratype. × 150.

3. *Bolivinita costifera* Cushman (p. 115). Arkadelphia marl(?), 5½ miles northeast of Hope, Hempstead County, Ark. Holotype, *a*, front view; *b*, apertural view. × 150.

4, 5. *Eouvigerina americana* Cushman (p. 115).
   4. Lower part of Taylor marl, Dallas County, Tex. (226). Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 150.
   5. Ripley formation, McNairy County, Tenn. (94). *a*, Front view; *b*, side view. × 120.

6. *Eouvigerina gracilis* Cushman (p. 115). Lower part of Taylor marl, Dallas County, Tex. (226). Holotype, *a*, front view; *b*, side view; *c*, apertural view. × 150.

7, 8. *Eouvigerina hispida* Cushman (p. 115). Selma chalk (upper part), McNairy County, Tenn. (98). 7, Holotype. 8, Paratype. × 150.

9. *Eouvigerina austinana* Cushman (p. 116). Austin chalk, Collin County, Tex. (294). Holotype, *a*, front view; *b*, apertural view. × 150.

10, 11. *Eouvigerina plummerae* Cushman (p. 116). Austin chalk, Collin County, Tex. (324). 10, Holotype. 11, Paratype. × 100.

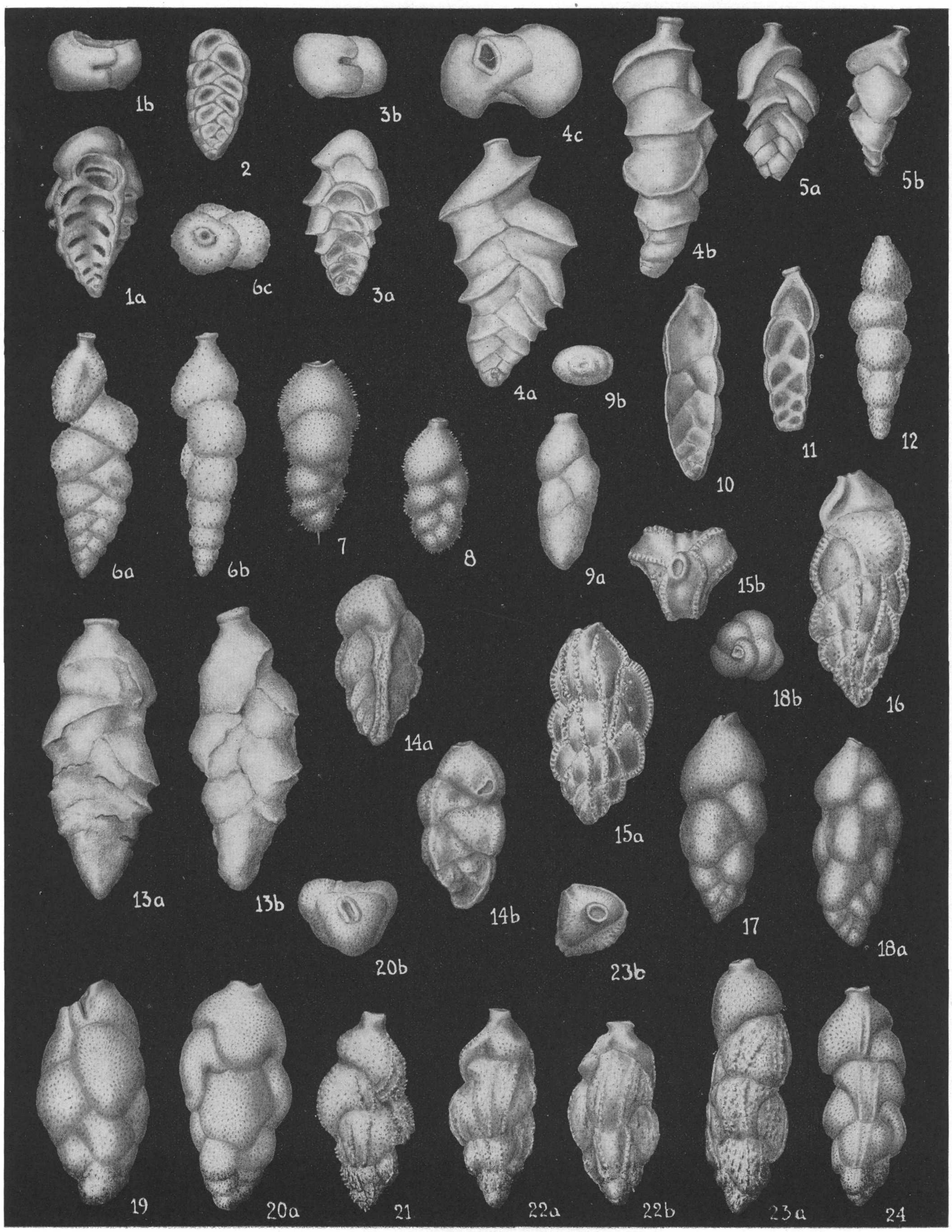
12. *Eouvigerina geneae* Morrow (p. 116). Fort Hays limestone, Ellis County, Kans. Holotype, redrawn. × 120.

13. *Eouvigerina aculeata* Cushman (p. 116). Austin chalk, 6.5 miles east by north of Allen, Collin County, Tex. (295a). *a*, Front view; *b*, side view. × 150.

14–16. *Pseudouvigerina plummerae* Cushman (p. 116).
   14. Selma chalk (upper part), McNairy County, Tenn. (98). *a*, Front view; *b*, side view. × 120.
   15, 16. Neylandville marl, Red River County, Tex. (50). *a*, Front view; *b*, apertural view. × 150.

17–20. *Pseudouvigerina cretacea* Cushman (p. 117). Ripley formation, McNairy County, Tenn. (94). 18, Holotype. 17, 19, 20, Paratypes. *a*, Front view; *b*, apertural view. × 120.

21–24. *Pseudouvigerina seligi* (Cushman) Cushman and Todd (p. 117).
   21. Arkadelphia marl, Hempstead County, Ark. (72). × 150.
   22. Corsicana marl, Travis County, Tex. (40). *a*, Front view; *b*, side view. × 150.
   23, 24. Corsicana marl, Navarro County, Tex. (27). *a*, Front view; *b*, apertural view. × 150.



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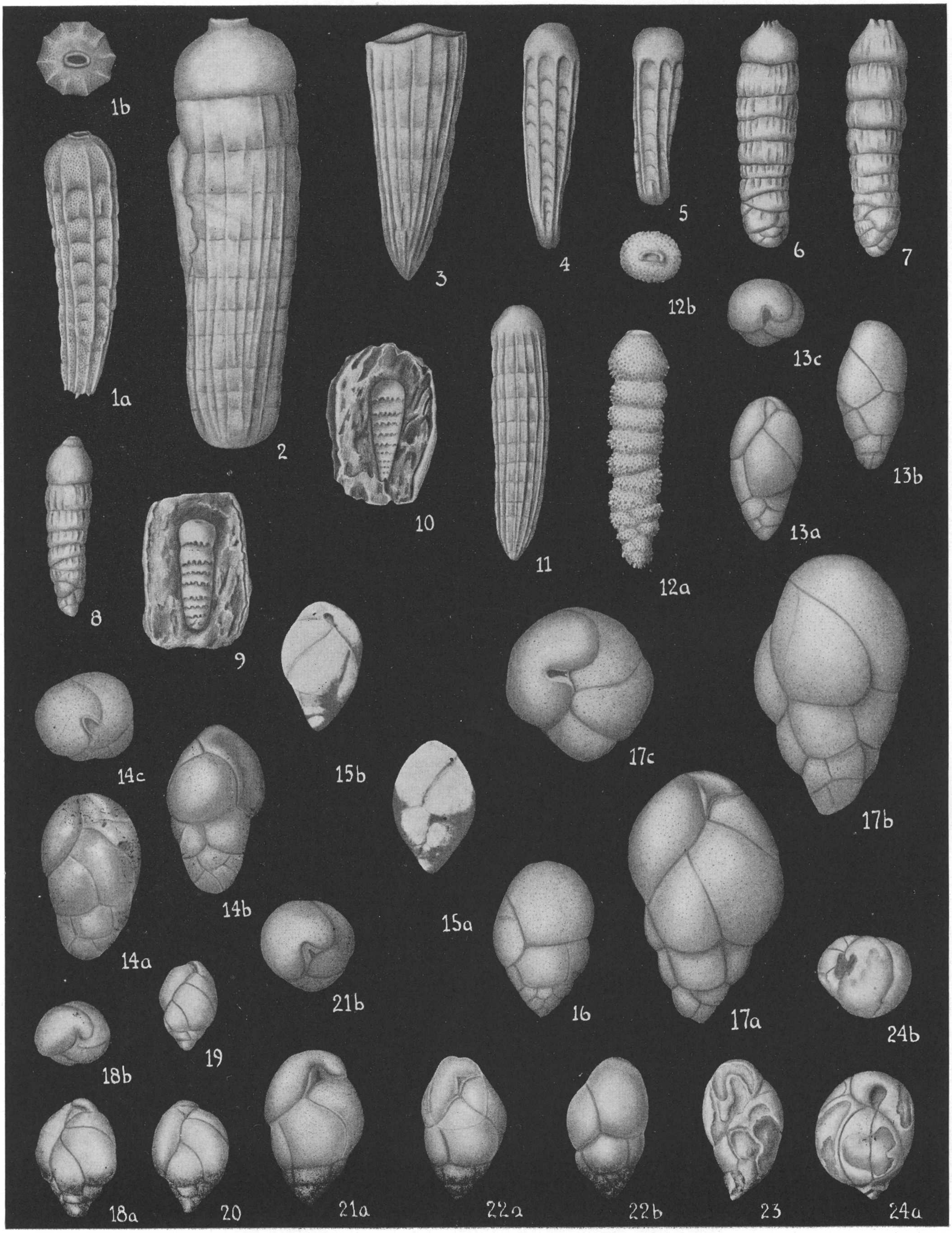


HETEROHELICIDAE, BULIMINIDAE.

PLATE 50

FIGURE 1. *Siphogenerinoides plummeri* (Cushman) Cushman (p.117). Kemp clay, 6½ miles north of Cameron, Milam County, Tex. (10). Holotype, *a*, front view; *b*, apertural view. × 75.

2, 3. *Siphogenerinoides cretacea* Cushman (p. 118). Colon shale, Quebrada Honda, Venezuela. 2, Holotype, megalospheric. 3, Paratype, microspheric. × 38.

4, 5. *Siphogenerinoides bramlettei* Cushman (p. 118). Colon shale, Quebrada Honda, Venezuela. 4, Holotype. 5, Paratype. × 38.

6–8. *Siphogenerinoides parva* Cushman (p. 118). Colon shale, Quebrada Honda, Venezuela. 6, Holotype. 7, 8, Paratypes. × 38.

9–11. *Siphogenerinoides ewaldi* (Karsten) Cushman (p. 118). (After Karsten.) Cretaceous, Colombia. Wax cast from mold. 9, 10, × 18; 11, × 38.

12. *Siphogenerinoides brevispinosa* Cushman (p. 119). Arkadelphia marl(?) 5½ miles northeast of Hope, Hempstead County, Ark. Holotype, *a*, front view; *b*, apertural view. × 105.

13. *Buliminella fabilis* Cushman and Parker (p 119.). Lower part of Taylor marl, Hill County, Tex. (237). Holotype, *a*, front view; *b*, rear view; *c*, apertural view. × 95.

14. *Buliminella vitrea* Cushman and Parker (p. 119). Selma chalk (middle part), Lee County, Miss. (265). Holotype, *a*, front view; *b*, rear view; *c*, apertural view. × 80.

15. *Buliminella cushmani* Sandidge (p. 119). Kemp clay, Williamson County, Tex. (12). *a*, *b*, Opposite sides. × 68.

16, 21, 22. *Buliminella carseyae* Plummer var. *plana* Cushman and Parker (p. 120).
- 16, 21. Corsicana marl, Bexar County, Tex. (46). Holotype, 21*a*, front view; 21*b*, apertural view; 16, rear view. × 90.
- 22. Neylandville marl, Kaufman County, Tex. (59). × 90.

17–20. *Buliminella carseyae* Plummer (p. 119).
- 17. Taylor marl, southeast of Delvalle, Tex. *a*, Front view; *b*, rear view; *c*, apertural view. × 85.
- 18–20. Upper part of Taylor marl, Travis County, Tex. (147). *a*, Front view; *b*, apertural view. × 55.

23, 24. *Buliminella colonensis* Cushman and Hedberg (p. 120). (After Cushman and Hedberg.) Cretaceous, Venezuela. 24, Holotype, *a*, front view; *b*, apertural view. × 58.

PLATE 51

FIGURES 1–5. *Bulimina reussi* Morrow (p. 120).

1. Wolfe City sand member of Taylor marl, Collin County, Tex. (183). *a*, Front view; *b*, apertural view. × 75.
2. Austin chalk, Collin County, Tex. (292). × 75.
3, 4. White chalk, Antigua, British West Indies. *a*, Front view; *b*, apertural view. × 68.
5. Saratoga chalk, Howard County, Ark. (79). *a*, Front view; *b*, apertural view. × 75.

6. *Bulimina reussi* Morrow var. *navarroensis* Cushman and Parker (p. 121). Corsicana marl, Caldwell County, Tex. (44). Holotype, *a*, front view; *b*, apertural view. × 75.

7, 10, 13, 15, 16. *Bulimina aspera* Cushman and Parker (p. 121).

7. Kemp clay, Williamson County, Tex. (11). × 55.
10. Corsicana marl, Navarro County, Tex. (26) × 55.
13. Upper part of Taylor marl, Navarro County, Tex. (132). Megalospheric form, *a*, front view; *b*, apertural view. × 55.
15. Upper part of Taylor marl, Red River County, Tex. (107). *a*, Front view; *b*, apertural view. × 55.
16. Upper part of Taylor marl, Kaufman County, Tex. (125). × 55.

8, 9. *Bulimina kickapooensis* Cole var. *pingua* Cushman and Parker (p. 123). Corsicana marl, Limestone County, Tex. (30). *a*, Front view; *b*, apertural view. × 55.

11, 12, 14. *Bulimina kickapooensis* Cole (p. 123).

11, 12. Upper part of Taylor marl, Red River County, Tex. (106). 11, Microspheric form. 12, Megalospheric. *a*, Front view; *b*, apertural view. × 55.
14. Upper part of Taylor marl, Navarro County, Tex. (132). Microspheric form. *a*, Front view; *b*, apertural view. × 55.

17. *Bulimina trihedra* Cushman (p. 122). Velasco shale, Hacienda el Limon, Mexico. Holotype, *a*, front view; *b*, apertural view. × 60.

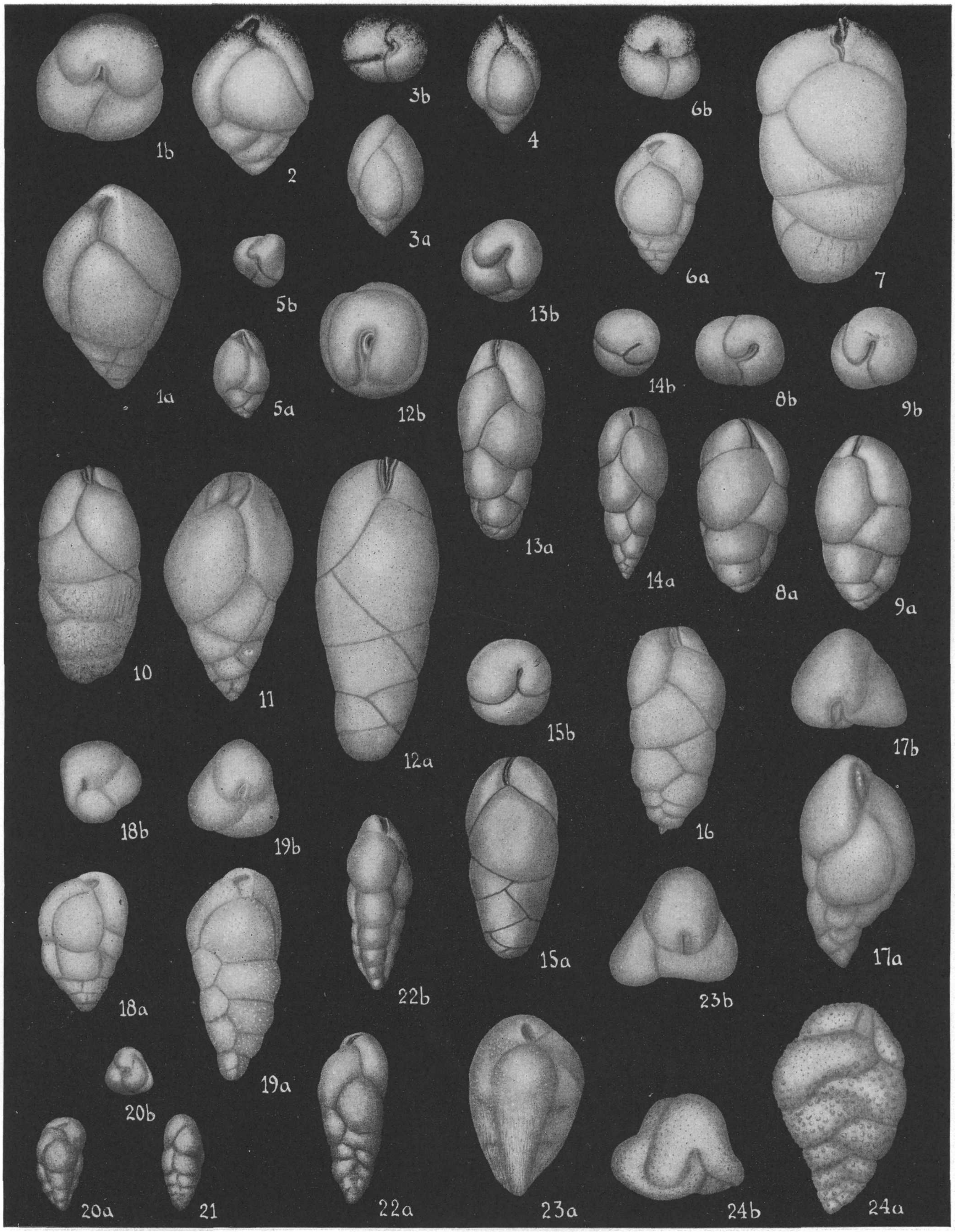
18. *Bulimina exigua* Cushman and Parker (p. 122). Brownstown marl, Red River County, Tex. (318). Holotype. *a*, front view; *b*, apertural view. × 90.

19–22. *Bulimina prolixa* Cushman and Parker (p. 122).

19, 22. Ripley formation, McNairy County, Tenn. (94). 19, Holotype, *a*, front view; *b*, apertural view 22*a*, Front view; *b*, side view. × 80.
20, 21. White chalk, Antigua, British West Indies. *a*, Front view; *b*, apertural view. × 68.

23. *Bulimina triangularis* Cushman and Parker (p. 122). Upper part of Taylor marl, Collin County, Tex. (122). Holotype, *a*, front view; *b*, apertural view. × 75.

24. *Bulimina rudita* Cushman and Parker (p. 122). Upper part of Taylor marl, Red River County, Tex. (108). Holotype, *a*, front view; *b*, apertural view. × 100.



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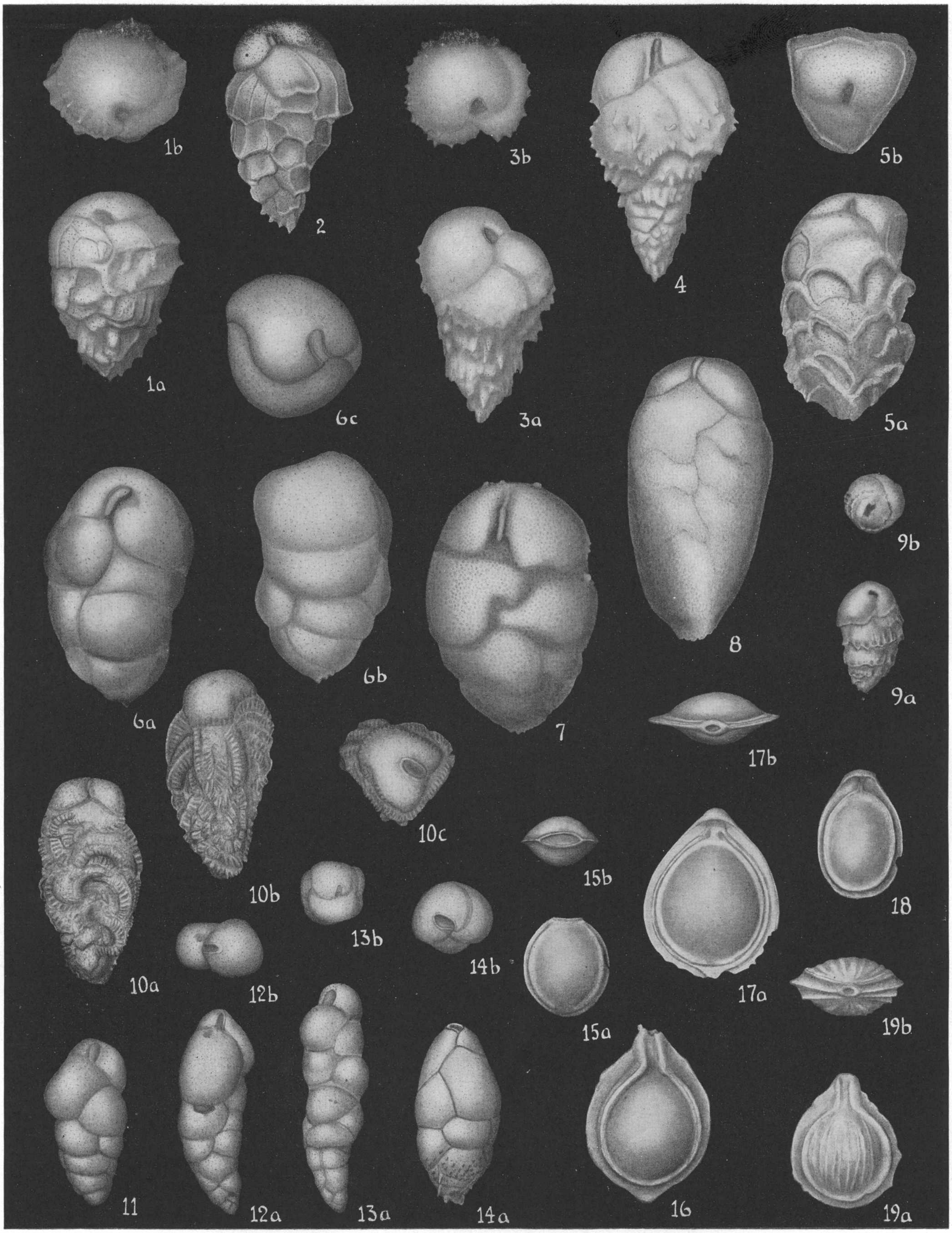


BULIMINIDAE.

PLATE 52

FIGURES 1, 2. *Bulimina taylorensis* Cushman and Parker (p. 123).
1. Upper part of Taylor marl, Red River County, Tex. (106). Holotype, *a*, front view; *b*, apertural view. × 75.
2. Upper part of Taylor marl, Bexar County, Tex. (152). × 100.

3, 4. *Bulimina arkadelphiana* Cushman and Parker (p. 124).
3. Arkadelphia marl, Hempstead County, Ark. (72). Holotype, *a*, front view; *b*, apertural view. × 65.
4. Arkadelphia marl, Hempstead County, Ark. (73). × 65.

5. *Bulimina limbata* White (p. 124). Cretaceous, Mexico. *a*, Front view; *b*, apertural view. × 55.

6. *Bulimina mendezensis* White (p. 124). Cretaceous, Mexico. *a*, Front view; *b*, rear view; *c*, apertural view. × 90.

7. *Bulimina incisa* Cushman (p. 124). Cretaceous, Mexico. Holotype. × 110.

8. *Bulimina velascoensis* (Cushman) White (p. 124). Cretaceous, Mexico. Holotype. × 90.

9. *Bulimina trinitatensis* Cushman and Jarvis, (p.124). (After Cushman and Jarvis.) Cretaceous, Trinidad. Holotype, *a*, front view; *b*, apertural view. × 75.

10. *Bulimina pectinata* Cushman and Parker (p. 123). Lower part of Taylor marl, Delta County, Tex. (206). Holotype, *a*, front view; *b*, rear view; *c*, apertural view. × 110.

11, 12. *Neobulimina canadensis* Cushman and Wickenden (p. 125).
11. Lower part of Taylor marl, Collin County, Tex. (212). × 95.
12. Lower part of Taylor marl, Ellis County, Tex. (235). *a*, Front view; *b*, apertural view. × 95.

13. *Neobulimina irregularis* Cushman and Parker (p. 125). Ector tongue of Austin chalk, Grayson County, Tex. (332). Holotype, *a*, front view; *b*, apertural view. × 60.

14. *Neobulimina spinosa* Cushman and Parker (p. 126). Ripley formation, Henderson County, Tenn. (96). Holotype, *a*, front view; *b*, apertural view. × 95.

15. *Entosolenia marginata* (Walker and Jacob) Williamson (p. 126). Ripley formation, McNairy County, Tenn. (94). *a*, Front view; *b*, apertural view. × 120.

16–18. *Entosolenia orbignyana* (Seguenza) Cushman (p. 126).
16. (After Cushman and Jarvis.) Cretaceous, Trinidad. × 42.
17, 18. Ripley formation, McNairy County, Tenn. (94). *a*, Front view; *b*, apertural view. × 105.

19. *Entosolenia orbignyana* (Seguenza) Cushman var. (p. 126). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 42.

PLATE 53

FIGURES 1–4. *Virgulina tegulata* Reuss (p. 126).
1, 3. Ripley formation, Henderson County, Tenn. (96). *a*, Front view; *b*, apertural view. 1, × 75; 2, × 68.
2. Selma chalk, Lee County, Miss. (264). × 75.
4. Austin chalk, Collin County, Tex. (324). *a*, Front view; *b*, apertural view. × 75.

5–7. *Virgulina navarroana* Cushman (p. 126). Corsicana marl, Navarro County, Tex. (26). 5, Holotype, *a*, front view; *b*, apertural view. 6, 7, Paratypes, *a*, front view; *b*, side view. × 120.

8–11. *Bolivina incrassata* Reuss (p. 127).
8, 9. Ripley formation, Henderson County, Tenn. (96). × 75.
10, 11. Mendez shale 5 kilometers southeast of Tamuin, San Luis Potosi, Mexico. × 45.

12, 13. *Bolivina decurrens* (Ehrenberg) Marsson (p. 127).
12. Upper Cretaceous, Venezuela. × 135.
13. Navarro group, east of Richland, Navarro County, Tex. × 150.

14–17. *Bolivina cretosa* Cushman (p. 128).
14. Selma chalk (upper part), Henderson County, Tenn. (98). Holotype. × 150.
15. Corsicana marl 5.4 miles west of Navarro Hotel, Corsicana, Navarro County, Tex. × 150.
16, 17. Upper part of Taylor marl, Williamson County, Tex. (144). *a*, Front view; *b*, apertural view. × 135.

18. *Bolivina watersi* Cushman (p. 128). Corsicana marl in well samples east of Richland, Navarro County, Tex. Holotype. × 150.

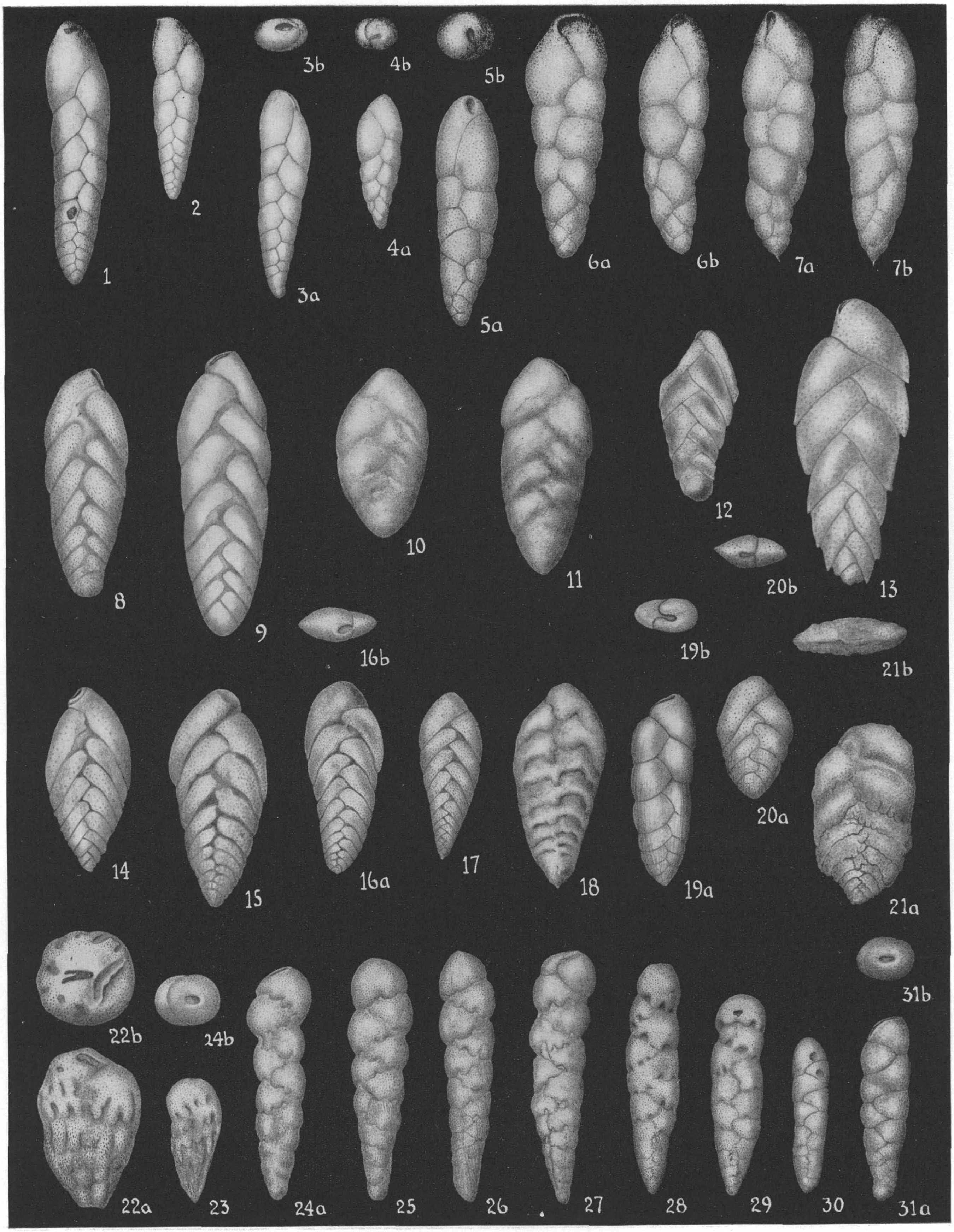
19. *Bolivina pondi* Cushman (p. 128). Ripley formation, McNairy County, Tenn. (94). Holotype, *a*, front view; *b*, apertural view. × 120.

20. *Bolivina selmaensis* Cushman (p. 128). Ripley formation, McNairy County, Tenn. (94). Holotype, *a*, front view; *b*, apertural view. × 150.

21. *Bolivina velascoensis* Cushman (p. 128). Velasco shale, Mexico. Holotype, *a*, front view; *b*, apertural view. × 75.

22, 23. *Bolivina explicata* Cushman and Hedberg (p. 129). (After Cushman and Hedberg.) Cretaceous, Venezuela. 22, Holotype, *a*, front view; *b*, apertural view. 23, Paratype. × 45.

24–31. *Loxostoma cushmani* Wickenden (p. 129).
24, 25. Boyne beds 1½ miles south-southwest of Treherne, Manitoba. Paratypes, *a*, front view; *b*, apertural view. × 68.
26. Selma chalk (lower part), Itawamba County, Miss. (351). × 68.
27. Gober tongue of Austin chalk, Lamar County, Tex. (288). × 68.
28–30. Lower part of Taylor marl, McLennan County, Tex. (240). × 55.
31. Lower part of Taylor marl, Ellis County, Tex. (231). *a*, Front view; *b*, apertural view. × 68.



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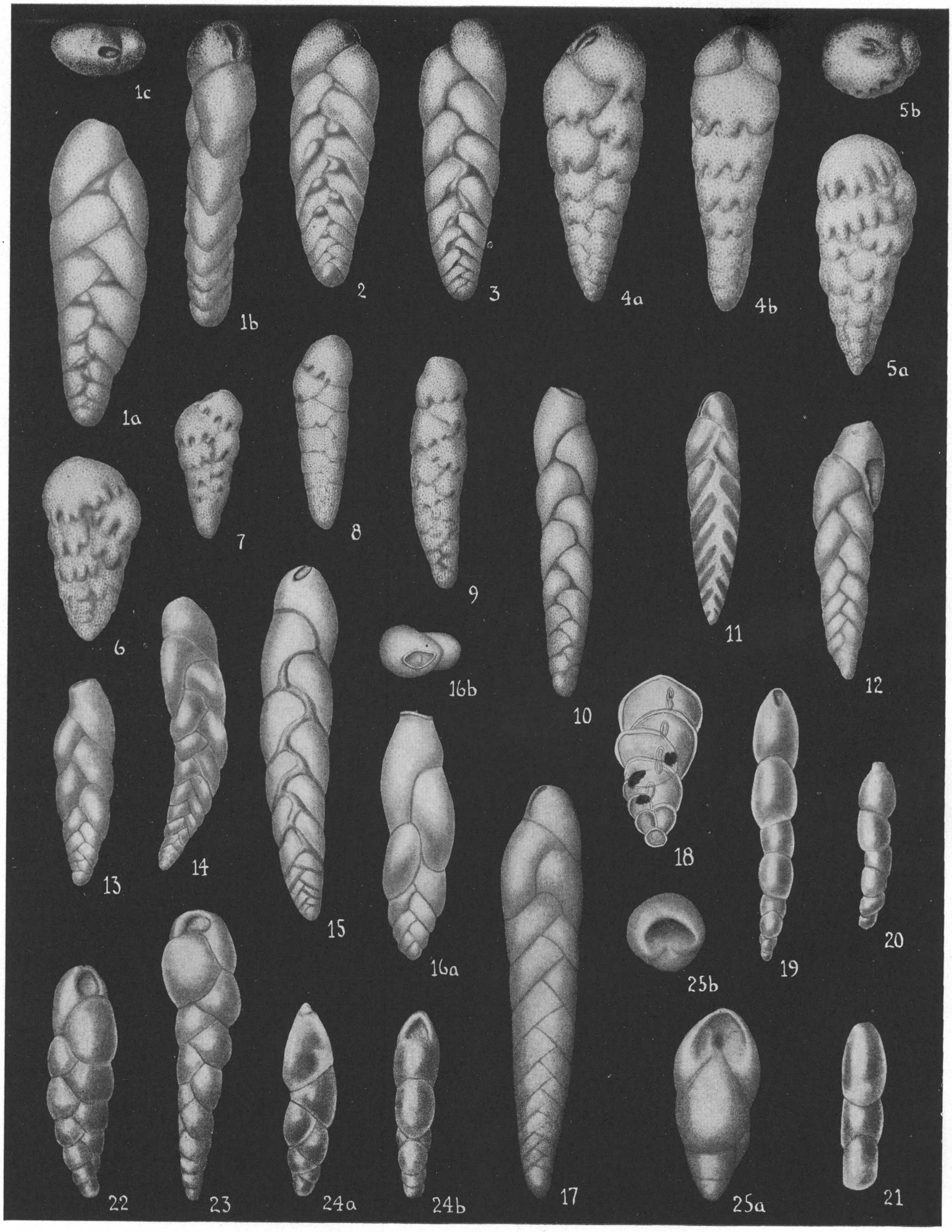


BULIMINIDAE, ELLIPSOIDINIDAE.

PLATE 54

FIGURES 1–3. *Loxostoma gemmum* (Cushman) Cushman (p. 129). Arkadelphia marl, Hempstead County, Ark. (70). 1, Holotype, *a*, front view; *b*, side view; *c*, apertural view, × 90. 2, 3, Paratypes, × 75.

4–9. *Loxostoma clavatum* (Cushman) Cushman (p 130.).
- 4. Lower part of Taylor marl, Dallas County, Tex. (226). Holotype, *a*, front view; *b*, side view. × 115.
- 5, 6. Lower part of Taylor marl, Ellis County, Tex. (231). *a*, Front view; *b*, apertural view. × 68.
- 7–9. Lower part of Taylor marl, Collin County, Tex. (212). × 55.

10–14. *Loxostoma plaitum* (Carsey) Cushman (p. 130).
- 10, 12–14. Corsicana marl, Travis County, Tex. (43). Topotypes. × 115.
- 11. Ripley formation, Henderson County, Tenn. (96). × 68.

15. *Loxostoma plaitum* (Carsey) Cushman var. *limbosum* Cushman (p. 131). Ripley formation, McNairy County, Tenn. (94). Holotype. × 75.

16. *Loxostoma minutissimum* Cushman. (p. 131). Lower part of Taylor marl, Delta County, Tex. (206). Holotype, *a*, front view; *b*, apertural view. × 150.

17. *Loxostoma limonense* (Cushman) Cushman (p. 131). Mendez shale near Guerrero, San Luis Potosi, Mexico. Holotype. × 60.

18. *Bifarina saxipara* (Ehrenberg) Parker and Jones (p. 131). (After Ehrenberg.)

19–21. *Pleurostomella austinana* Cushman (p. 131). Lower part of Austin chalk, Grayson County, Tex. (335). 19, Holotype. 20, 21, Paratypes. × 90.

22–23. *Pleurostomella watersi* Cushman (p. 132). Bonham marl, Grayson County, Tex. (328). 23, Holotype. 22, Paratype × 90.

24. *Pleurostomella nitida* Morrow (p. 132). Hartland shale member of Greenhorn limestone, Hodgeman County, Kans. Holotype, redrawn, *a*, front view; *b*, side view. × 90.

25. *Pleurostomella clavata* Cushman (p. 132). Cretaceous, Trinidad. *a*, Side view; *b*, apertural view. × 38.

PLATE 55

FIGURES 1–9. *Pleurostomella subnodosa* Reuss (p. 132).
1–7. Annona chalk, Bowie County, Tex. (189). *a*, Front view; *b*, side view. × 38.
8, 9. Annona chalk at type locality, Texas (188a). × 55.

10. *Pleurostomella subnodosa* Reuss var. *gigantia* White (p. 132). Mendez shale, Mexico. (After White.) *a*, Front view; *b*, side view. × 30.

11. *Pleurostomella torta* Cushman (p. 133). Mendez shale east of Pujal, San Luis Potosi, Mexico. Holotype, *a*, front view; *b*, side view. × 45.

12. *Pleurostomella velascoensis* Cushman (p. 133). Velasco shale near Velasco, Mexico. Holotype, *a*, front view; *b*, side view. × 58.

13, 14. *Ellipsopleurostomella curta* Cushman (p. 133). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front view; *b*, apertural view. × 42.

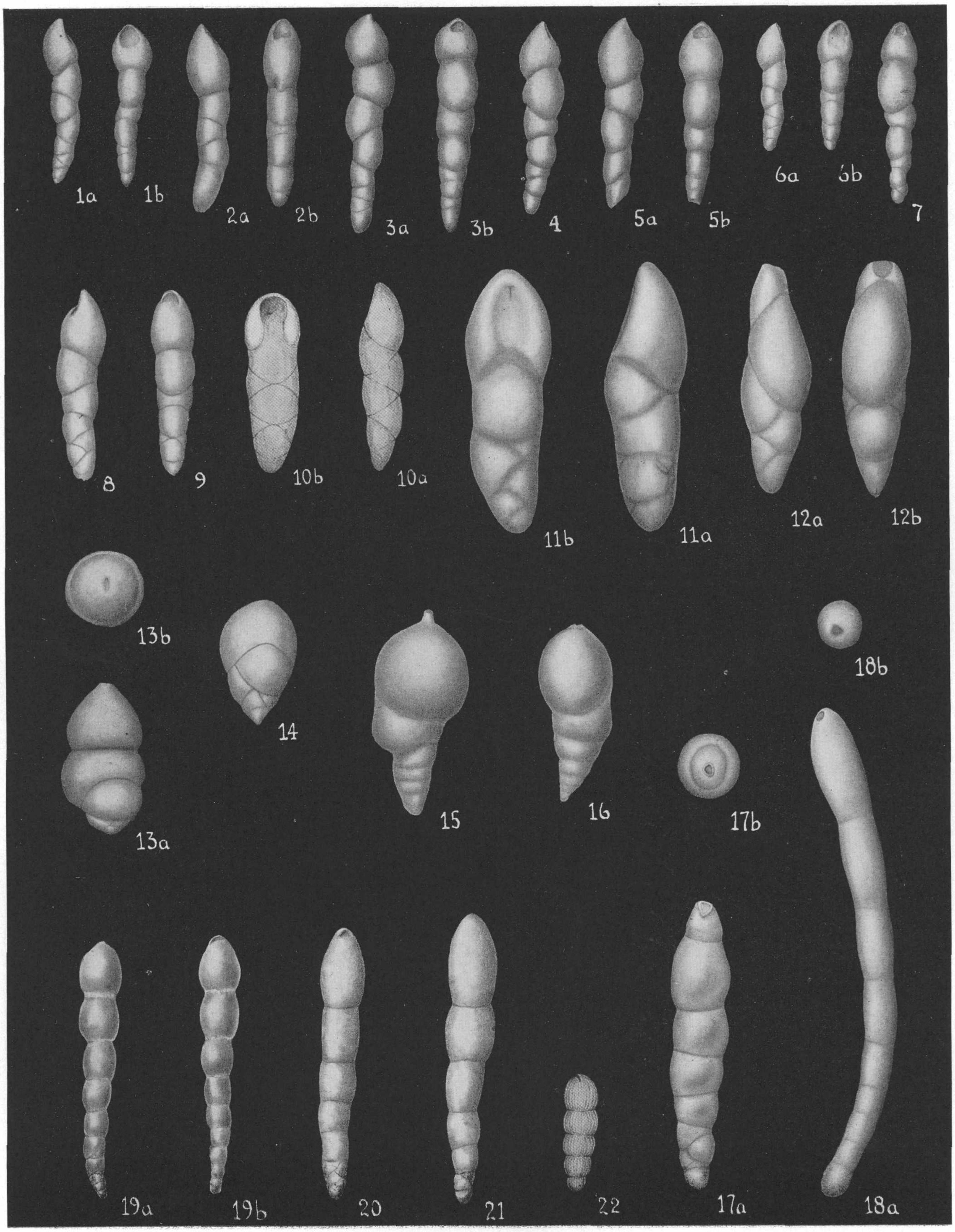
15, 16. *Nodosarella coalingensis* Cushman and Church (p. 133). Mendez shale south of Rancho Nuevo, San Luis Potosi, Mexico. × 55.

17. *Nodosarella primitiva* Cushman (p. 134). Upper part of Taylor marl, Red River County, Tex. (106). Holotype, *a*, front view; *b*, apertural view. × 80.

18. *Nodosarella texana* Cushman (p. 133). Lower part of Taylor marl, Collin County, Tex. (209). Holotype, *a*, front view; *b*, apertural view. × 58.

19–21. *Nodosarella gracillima* Cushman (p. 134).
19. Austin chalk 6½ miles east by north of Allen, Collin County, Tex. Holotype, *a*, front view; *b*, side view. × 58.
20, 21. Basal part of Niobrara chalk, Kansas. Redrawn from Morrow's material. × 58.

22. *Nodosarella striata* White (p. 134). (After White.) Velasco shale, Columbus Station on Tampico-Monterey Railroad, Mexico. × 30.



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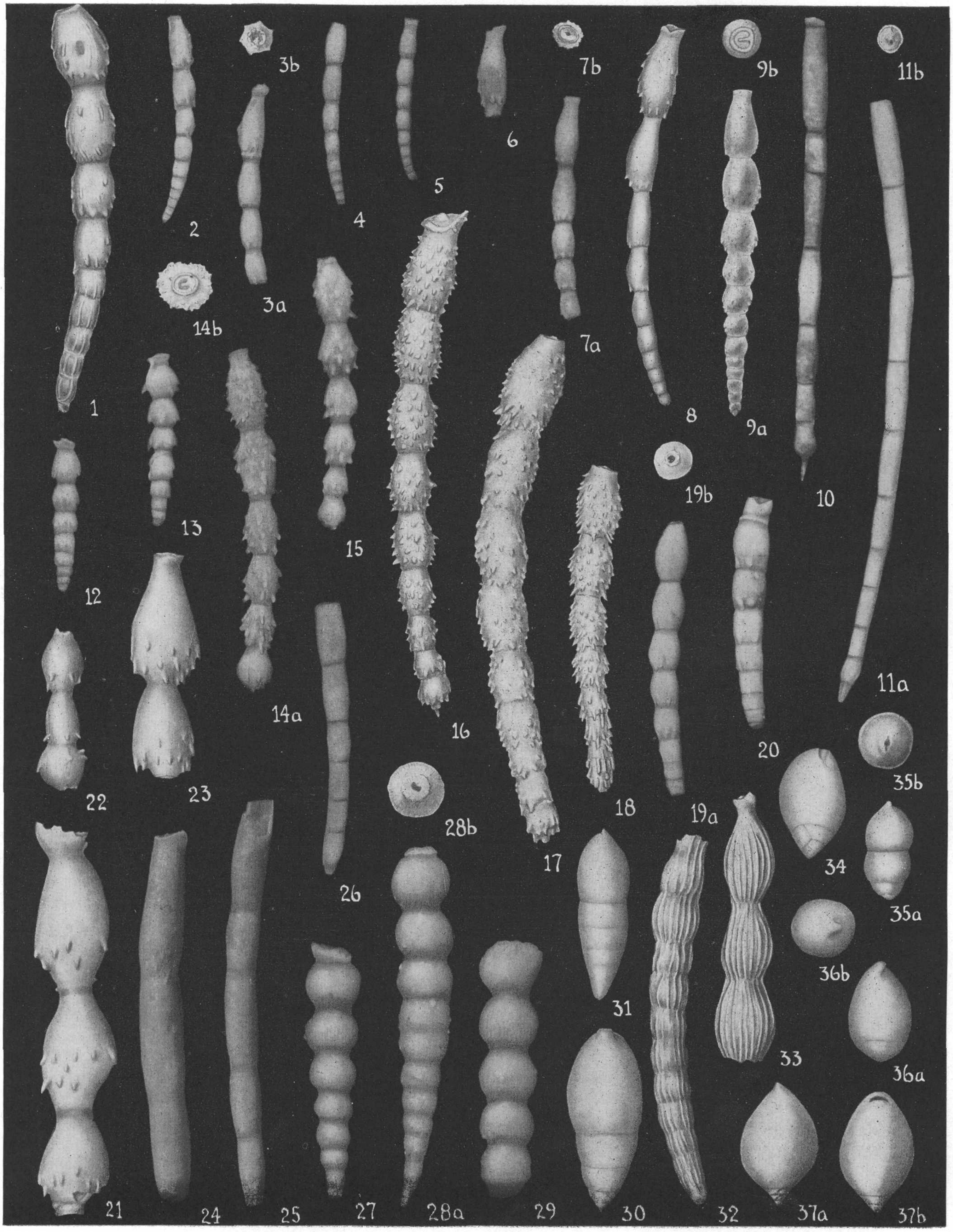


ELLIPSOIDINIDAE.

PLATE 56

FIGURE 1. *Ellipsonodosaria minuta* Cushman (p. 134). Lower part of Taylor marl, Collin County, Tex. (207). Holotype. × 150.

2–7. *Ellipsonodosaria stephensoni* Cushman (p. 134). Upper part of Taylor marl, Kaufman County, Tex. (125). 2, Holotype. 3–7, Paratypes. *a*, Front view; *b*, apertural view. × 38.

8. *Ellipsonodosaria stephensoni* Cushman var. *speciosa* Cushman (p. 135). Arkadelphia marl, Hempstead County, Ark. (72). Holotype. × 58.

9. *Ellipsonodosaria pseudoscripta* Cushman (p. 135). Upper part of Taylor marl, Limestone County, Tex. (136). Holotype, *a*, front view; *b*, apertural view. × 100.

10, 11. *Ellipsonodosaria exilis* Cushman (p. 135). Lower part of Taylor marl, Delta County, Tex. (206). 10, Holotype. 11, Paratype. *a*, Front view; *b*, apertural view. × 38.

12–15. *Ellipsonodosaria alexanderi* Cushman (p. 135). Lower part of Taylor marl, Delta County, Tex. (206). 14, Holotype, *a*, front view; *b*, apertural view. 12, 13, 15, Paratypes. × 33.

16–18. *Ellipsonodosaria alexanderi* Cushman var. *impensia* Cushman (p. 136). Corsicana marl, Limestone County, Tex. (30). 16, Holotype. 17, 18, Paratypes. × 38.

19, 20. *Ellipsonodosaria dentata-glabrata* Cushman (p. 136). Neylandville marl, Delta County, Tex. (52). 19, Holotype, *a*, front view; *b*, apertural view. 20, Paratype. × 38.

21–23. *Ellipsonodosaria horridens* Cushman (p. 136). Selma chalk (middle part), Hardin County, Tenn. (255). 21, Holotype. 22, 23, Paratypes. × 75.

24–26. *Ellipsonodosaria? granti* (Plummer) Cushman (p. 136). Corsicana marl, Navarro County, Tex. (26). × 38.

27–29. *Ellipsonodosaria? jarvisi* Cushman (p. 136). Cretaceous, Trinidad. 28, Holotype, *a*, front view; *b*, apertural view. 27, 29, Paratypes. × 45.

30, 31. *Ellipsonodosaria subnodosa* (Guppy) Nuttall (p. 137). (After Cushman and Jarvis.) Cretaceous, Trinidad. 30, × 38. 31, × 18.

32, 33. *Ellipsonodosaria* sp. (p. 137). Selma chalk (middle part), Hardin County, Tenn. (255). × 45.

34–36. *Ellipsoglandulina exponens* (H. B. Brady) Silvestri (p. 137). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Front views; *b*, apertural views. × 48.

37. *Ellipsoglandulina velascoensis* Cushman (p. 137). Velasco shale, Hacienda el Limon, Vera Cruz, Mexico. Holotype, *a*, front view; *b*, side view *c*. apertural view. × 45.

PLATE 57

FIGURE 1. *Patellina* sp. (p. 137). Ripley formation, McNairy County, Tenn. (94). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 120.

2. *Lamarckina ripleyensis* Cushman (p. 137). Ripley formation, McNairy County, Tenn. (94). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 90.

3, 4. *Valvulineria plummerae* Loetterle (p.137). (After Loetterle.) Fort Hays limestone, 4.7 miles east and 0.5 mile north from St. James,Nebr. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

5. *Valvulineria infrequens* Morrow (p. 138). Fort Hays limestone, Ellis County, Kans. Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

6, 7. *Valvulineria allomorphinoides* (Reuss) Cushman (p. 138).
6. Ripley formation, McNairy County, Tenn. (94). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 105.
7. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

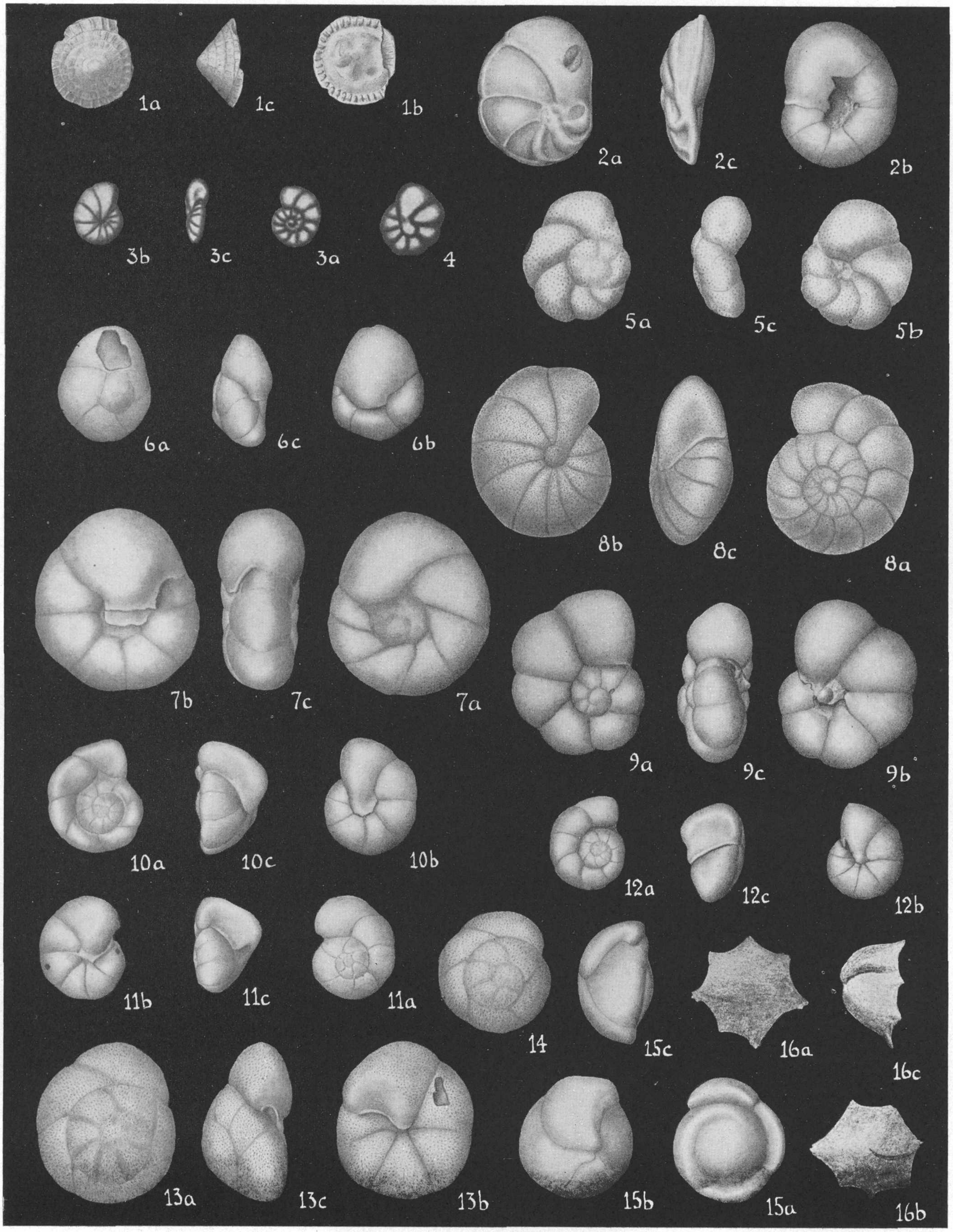
8. *Valvulineria cretacea* (Carsey) Cushman and Todd (p. 138). Corsicana marl, Navarro County, Tex. (26). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. ×100.

9–12. *Valvulineria* cf. *V. umbilicatula* (D'Orbigny) Cushman (p. 139). Ripley formation, Henderson County, Tenn. (96). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 9, × 90. 10–12, × 68.

13, 14. *Eponides haidingerii* (D'Orbigny) Cushman (p. 142). Ripley formation, McNairy County, Tenn. (127). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 90.

15. *Eponides simplex* (White) Cushman (p. 142). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view *c*, peripheral view. × 42.

16. *Eponides*? *spinea* (Cushman) Cushman (p. 142). Mendez shale, Mexico. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 75.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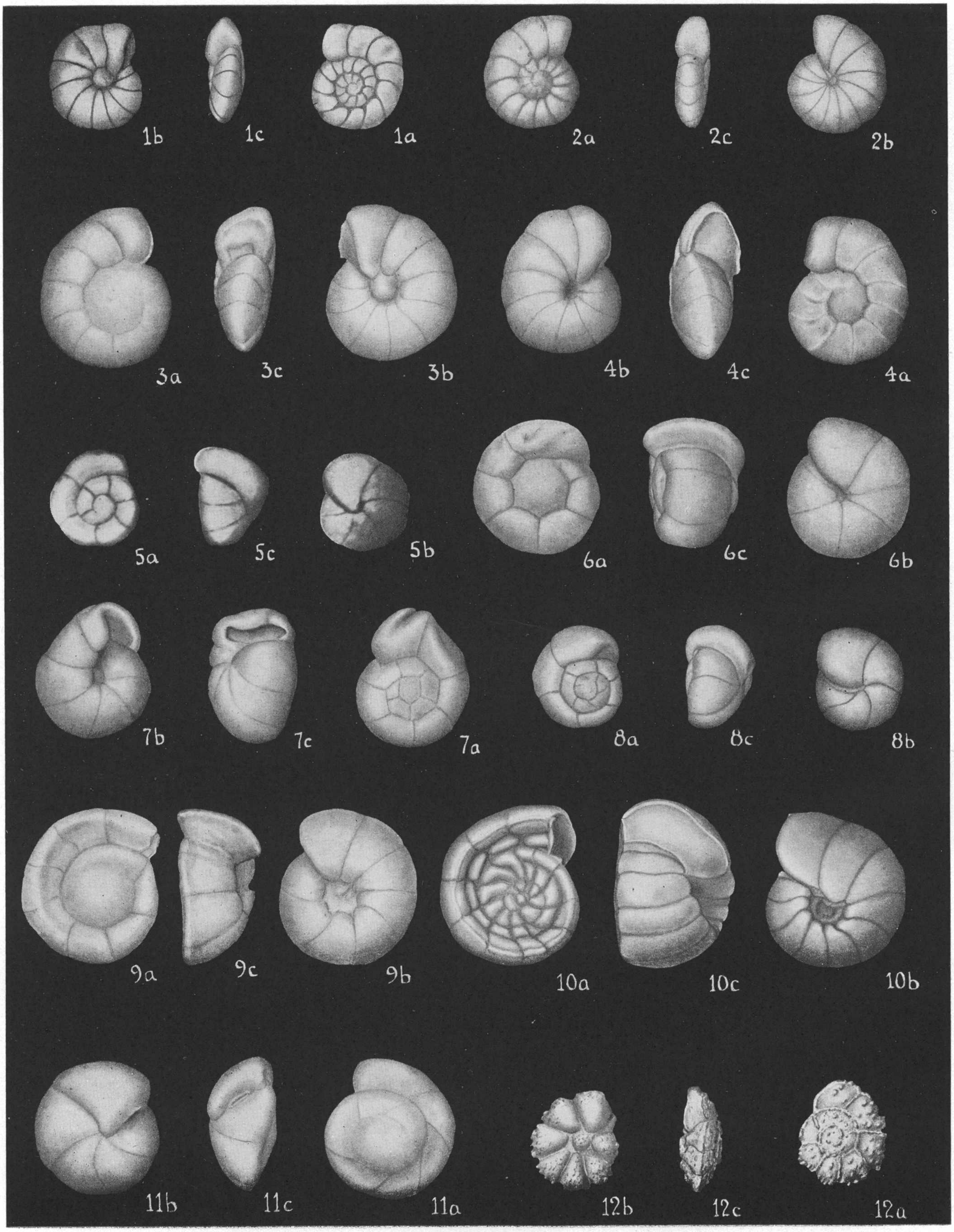
ROTALIIDAE.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ROTALIIDAE.

PLATE 58

FIGURES 1–4. *Gyroidina depressa* (Alth) Cushman and Church (p. 139).

1. Saratoga chalk, Howard County, Ark. (79). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 75.
2. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 55.
3, 4. Selma chalk (middle part), Hardin County, Tenn. (255). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

5. *Gyroidina nitida* (Reuss) Morrow (p. 140). (After Loetterle.) Fort Hays Limestone, 4.7 miles east and 0.5 mile north from St. James, Nebr. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 58.

6–8. *Gyroidina globosa* (Hagenow) Cushman (p. 140).

6. Saratoga chalk, Howard County, Ark. (79). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 68.
7, 8. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 7, × 58. 8, × 42.

9. *Gyroidina girardana* (Reuss) Cushman (p. 140). Saratoga chalk, Howard County, Ark. (79). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 42.

10. *Gyroidina arkadelphiana* Cushman (p. 141). Arkadelphia marl, Hempstead County, Ark. (73). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

11. *Gyroidina beisseli* White (p. 141). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 42.

12. *Rotalia fimbriatula* Cushman and Hedberg (p. 142). Cretaceous, Rio Lebrija about 1½ kilometers west of Chichira, Department of Santander, Colombia. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 58.

PLATE 59

FIGURES 1, 2. *Epistomina caracolla* (Roemer) Franke (p. 142). Ripley formation, McNairy County, Tenn. (97). 1, Holotype, redrawn. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. 1, × 55; 2, × 75.

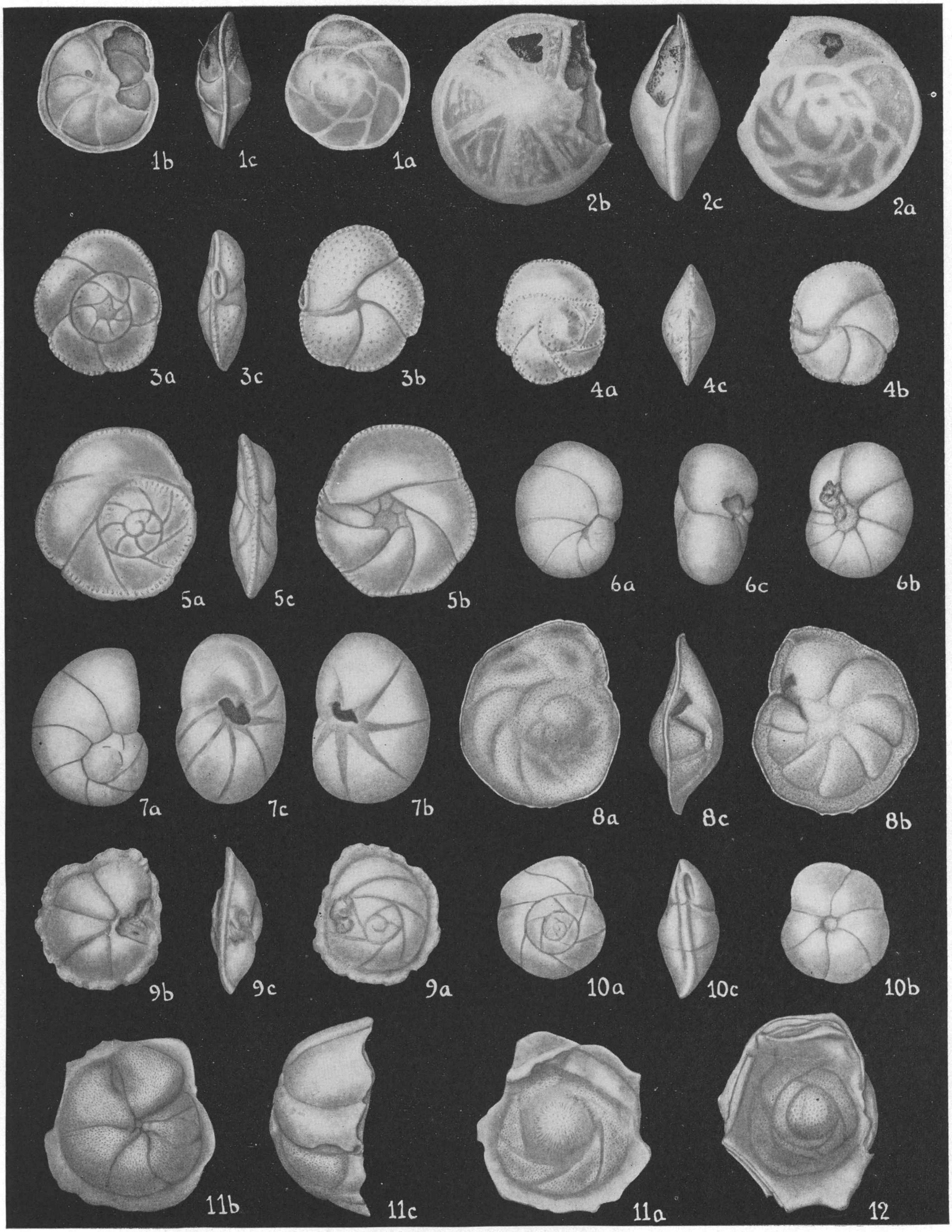
3–5. *Siphonina prima* Plummer (p. 142). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
3. Kemp clay, Hopkins County, Tex. (1). × 115.
4. Corsicana marl, Bexar County, Tex. (46). × 115.
5. Ripley formation, Pontotoc County, Miss. (90). × 115.

6, 7. *Ceratobulimina cretacea* Cushman and Harris (p. 143).
6. Ripley formation, McNairy County, Tenn. (97). × 68.
7. Navarro group, Mexia oil field, Mexia, Tex. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 60.

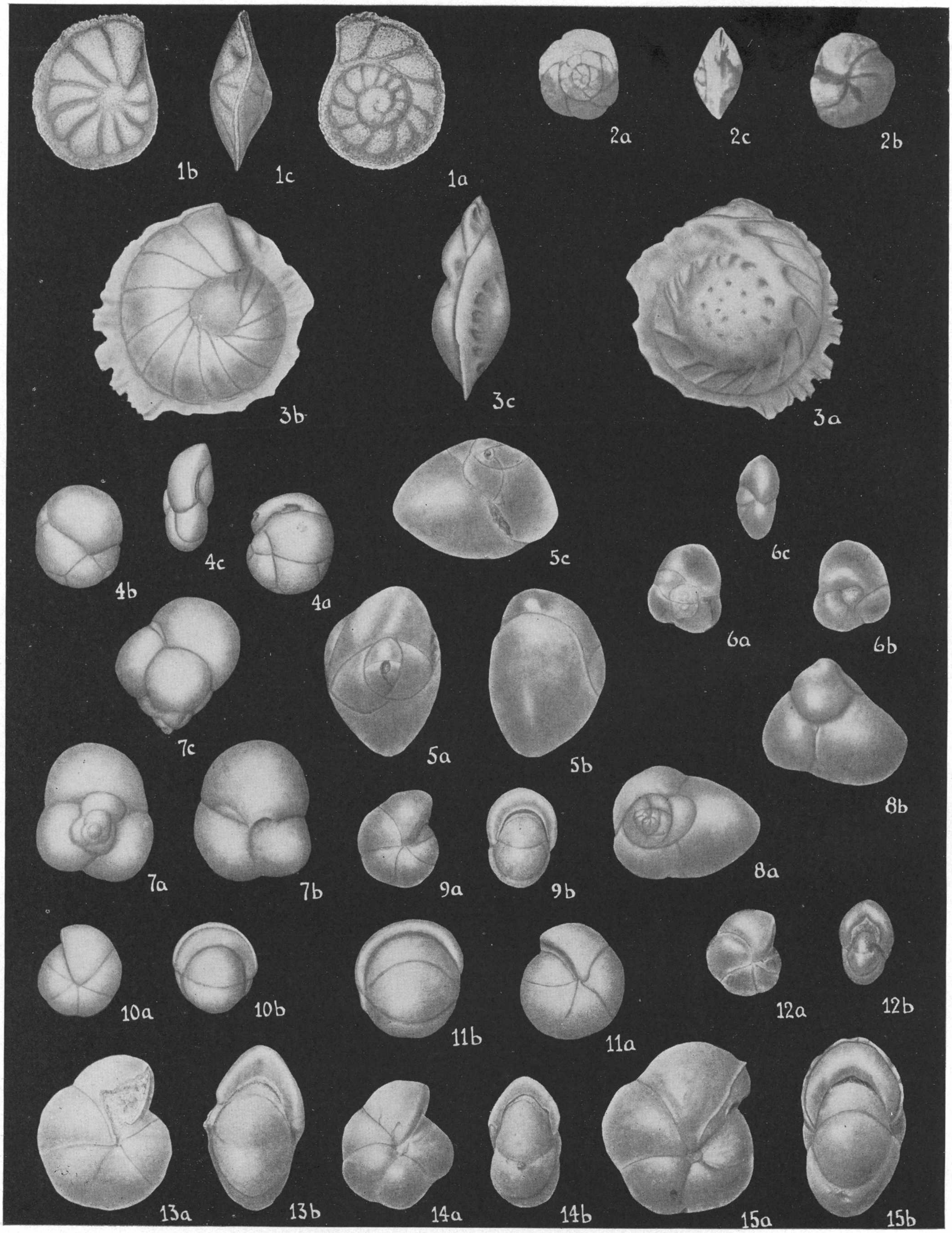
8, 9. *Pulvinulinella texana* Cushman (p. 143). *a* Dorsal view; *b*, ventral view; *c*, peripheral view.
8. Upper part of Taylor marl, Red River County, Tex. (106). Holotype. × 80.
9. Saratoga chalk, Howard County, Ark. (79). × 38.

10. *Pulvinulinella glabrata* Cushman (p. 144). Corsicana marl, Travis County, Tex. (34). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 115.

11, 12. *Pulvinulinella? florealis* (White) Cushman (p. 144). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.



ROTALIIDAE, CASSIDULINIDAE.



CASSIDULINIDAE, CHILOSTOMELLIDAE.

PLATE 60

FIGURE 1. *Pulvinulinella navarroana* Cushman (p.144). Kemp clay, Williamson County, Tex. (12). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 60.

2. *Pulvinulinella ripleyensis* Sandidge (p. 144). (After Sandidge.) Ripley formation, Lowndes County, Ala. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 100.

3. *Pulvinulinella velascoensis* (Cushman) Cushman and Jarvis (p. 145). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

4. *Cassidulina cretacea* Cushman (p. 145). Ripley formation, McNairy County, Tenn. (97). *a,b*, opposite sides; *c*, peripheral view. × 85.

5. *Allomorphina navarroana* Cushman (p. 145). Corsicana marl, Navarro County, Tex. (26). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 100.

6. *Allomorphina minuta* Cushman (p. 145). Gober tongue of Austin chalk, Fannin County, Tex. (278). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 100.

7. *Allomorphina trochoides* (Reuss) Cushman and Jarvis (p. 145). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 75.

8. *Allomorphina velascoensis* Cushman (p. 146). Velasco shale, Hacienda el Limon, Mexico. *a*, Dorsal view; *b* peripheral view. × 100.

9. *Pullenia cretacea* Cushman (p. 146). Ripley formation, Henderson County, Tenn. (96). Holotype, *a*, side view; *b*, apertural view. × 68.

10, 11. *Pullenia coryelli* White (p. 147).
   10. (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Side view; *b*, peripheral view. × 38.
   11. Saratoga chalk, Howard County, Ark. (79). *a*, Side view; *b*, peripheral view. × 65.

12. *Pullenia minuta* Cushman (p. 147). Corsicana marl, Navarro County, Tex. (26). Holotype, *a*, side view; *b*, peripheral view. × 90.

13, 14. *Pullenia americana* Cushman (p. 146). Upper part of Taylor marl, Williamson County, Tex. (142). Holotype, *a*, side view; *b*, apertural view. × 68.

15. *Pullenia jarvisi* Cushman (p. 147). Cretaceous, pit at Lizard Springs, near Guayaguayare, southeastern Trinidad. Holotype, *a*, side view; *b*, apertural view. × 68.

PLATE 61

FIGURES 1–3. *Hastigerinella moremani* Cushman (p. 147). Eagle Ford shale, Hill County, Tex. (369). 1, Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 2, 3, Paratypes. × 68.

4–7. *Hastigerinella alexanderi* Cushman (p. 148). Lower part of Austin chalk, Grayson County, Tex. (335). 4, Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 5–7, Paratypes. × 68.

8, 9. *Hastigerinella watersi* Cushman (p. 148). Lower part of Austin chalk, Grayson County, Tex. (335). 8, Holotype, *a*, *b*, opposite sides; *c*, peripheral view. 9, Paratype, young stage. × 68.

10. *Hastigerinella simplex* Morrow (p. 148). Hartland shale member of Greenhorn limestone, Hodgeman County, Kans. Holotype, redrawn, *a*, dorsal view; *b*, ventral view. × 90.

11, 12. *Schackoina multispinata* (Cushman and Wickenden) Cushman (p. 148). (After Cushman and Wickenden.) Cretaceous, Canada. × 115.

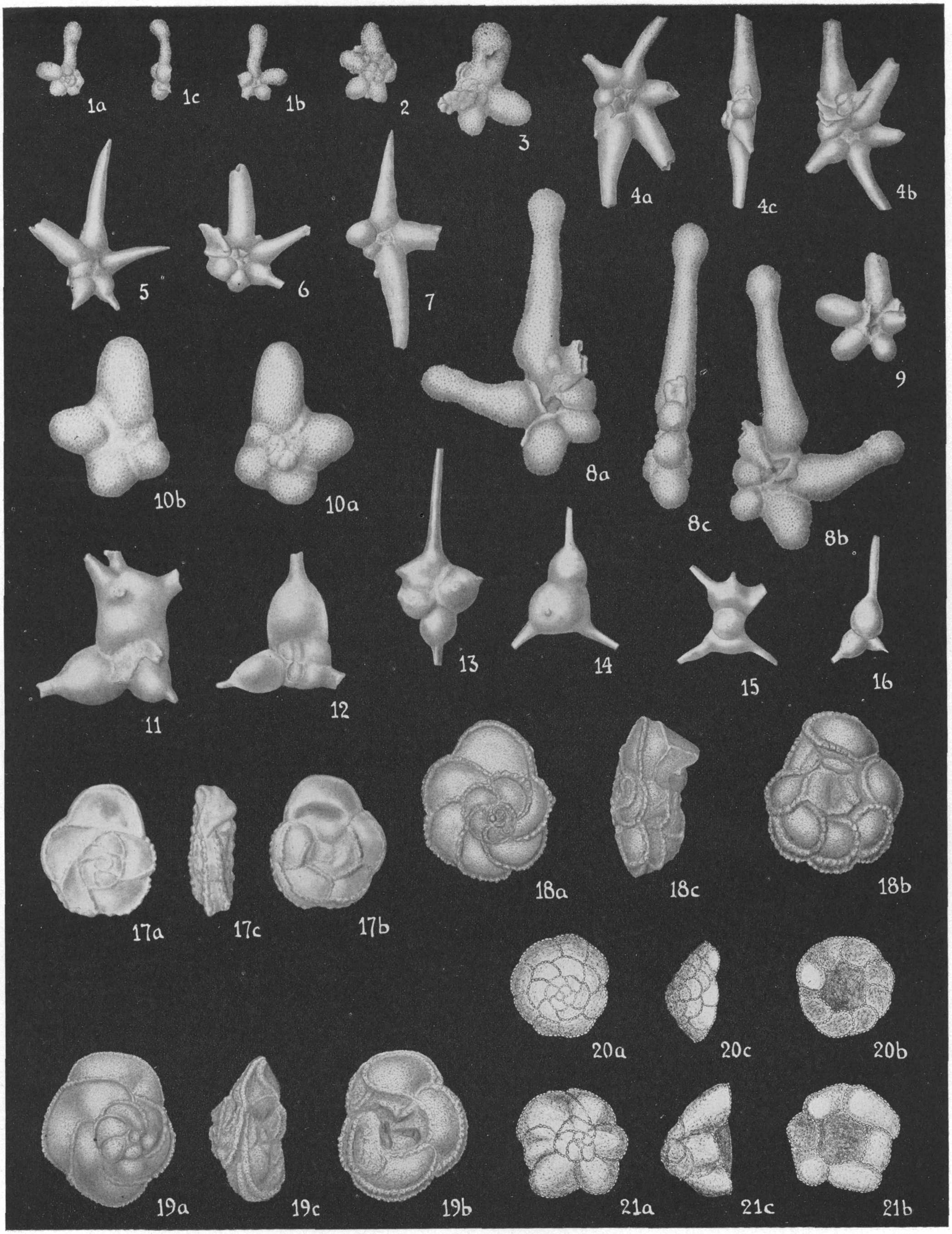
13–16. *Schackoina trituberculata* (Morrow) Loetterle (p. 148). (After Morrow.) Hartland shale member of Greenhorn limestone, Hodgeman County, Kans. × 58.

17, 18. *Globotruncana canaliculata* (Reuss) Cushman (p. 149). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
17. Annona chalk at type locality, Texas (188a). × 48.
18. Cretaceous, St. Johann, near Siegsdorf, Bavaria. × 55.

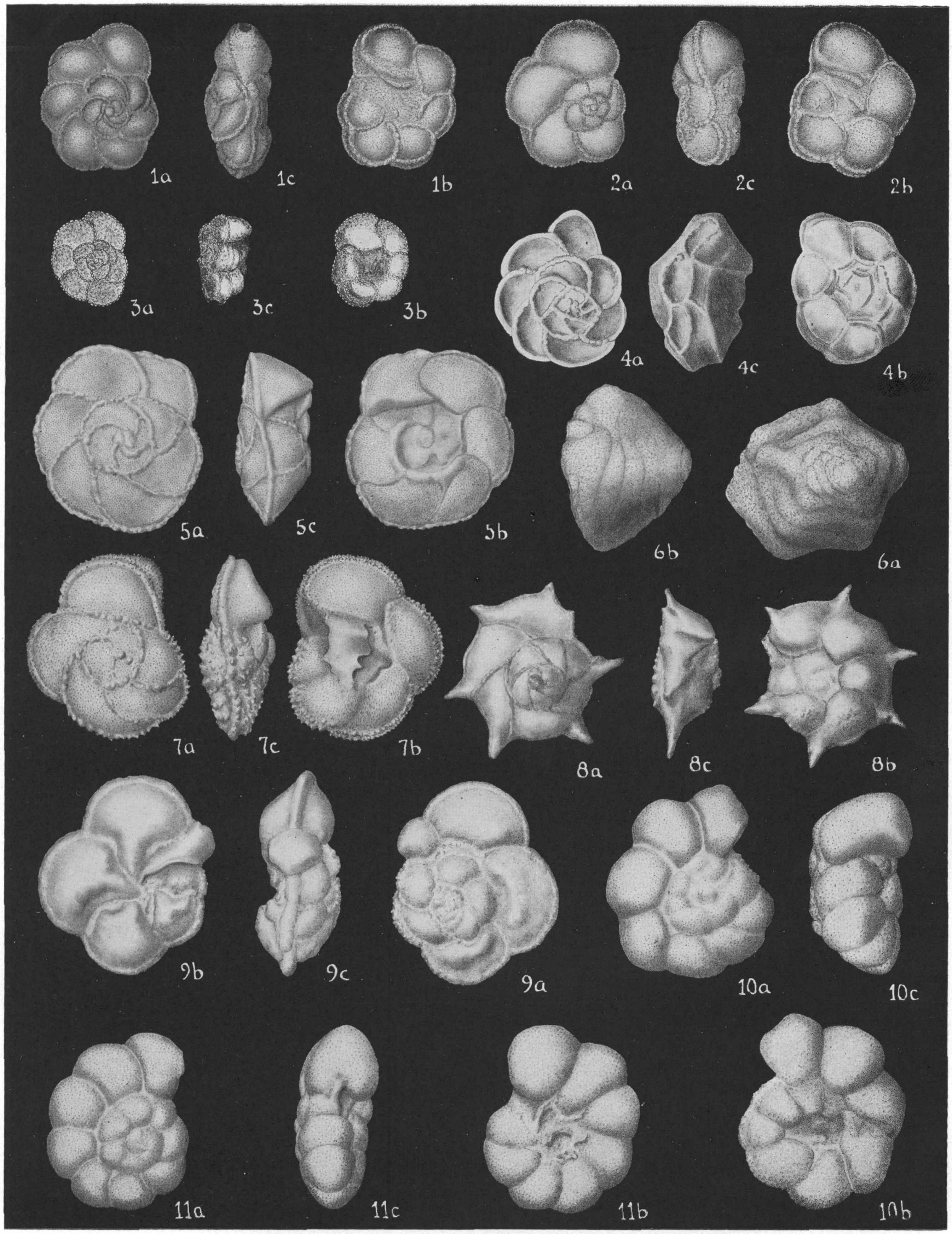
19. *Globotruncana fornicata* Plummer (p. 149). Upper part of Taylor marl, Bexar County, Tex. (161). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 45.

20. *Globotruncana conica* White (p. 151). (After White). Mendez shale 2.2 kilometers east of Guerrero, Mexico. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 30.

21. *Globotruncana conica* White var. *plicata* White (p. 151). (After White). Mendez shale 2.2 kilometers east of Guerrero, Mexico. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 30.



GLOBIGERINIDAE, HANTKENINIDAE, GLOBOROTALIIDAE.



GLOBOROTALIIDAE.

PLATE 62

FIGURES 1, 2. *Globotruncana marginata* (Reuss) Thalmann (p. 150). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
1. Plänermergel, Bohemia. Autotype. × 45.
2. Gober tongue of Austin chalk, Lamar County, Tex. (284). × 55.

3. *Globotruncana ventricosa* White (p. 150). (After White.) Cretaceous, Mexico. *a*, Dorsal view; *b*. ventral view; *c*, peripheral view. × 30.

4, 5. *Globotruncana arca* (Cushman) Cushman (p. 150). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
4. Mendez shale near Huiches, Hacienda el Limon, San Luis Potosi, Mexico. × 38.
5. Annona chalk at type locality, Texas (188a). × 48.

6. *Globotruncana arca* (Cushman) Cushman var. *contusa* (Cushman) Cushman (p. 150). Mendez shale near Coco, on railroad, Hacienda el Limon, San Luis Potosi, Mexico. Holotype, *a*, dorsal view; *b*, peripheral view. × 30.

7. *Globotruncana cretacea* Cushman (p. 151). Ripley formation, Henderson County, Tenn. (96). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 90.

8. *Globotruncana calcarata* Cushman (p. 151). Pecan Gap chalk member of Taylor marl, Collin County, Tex. (170). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 45.

9. *Globorotalia cushmani* Morrow (p. 152). Hartland shale member of Greenhorn formation, Hodgeman County, Kans. Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 55.

10, 11. *Globorotalia? multiloculata* Morrow (p. 153). Hartland shale member of Greenhorn limestone, Hodgeman County, Kans. 10, Holotype, redrawn, 11, Paratype. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 55.

PLATE 63

FIGURE 1. *Globorotalia umbilicata* Loetterle (p. 153). (After Loetterle.) Fort Hays limestone 4.7 miles east and ½ mile north from St. James, Nebr. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 58.

2, 3. *Globorotalia micheliniana* (D'Orbigny) Cushman (p. 153).

2. White chalk, Antigua, British West Indies. × 68.

3. Annona chalk at type locality, Texas (188a). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

4. *Globorotalia subconica* Morrow (p. 153). Fort Hays limestone, Ellis County, Kans. Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

5. *Globorotalia membranacea* (Ehrenberg) White (p. 152). Velasco shale 70 meters east of kilometer post 633, Tampico-San Luis Potosi Railroad, Mexico. *a*, Dorsal view; *b*, peripheral view. × 68.

6. *Globorotalia velascoensis* (Cushman) Cushman (p. 153). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

7. *Anomalina bentonensis* Morrow (p. 154). Hartland shale member of Greenhorn limestone, Hodgeman County, Kans. Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

8, 9. *Anomalina nelsoni* W. Berry (p. 154).

8. Ripley formation, McNairy County, Tenn. (97). Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 55.

9. Selma chalk (middle part), Hardin County, Tenn. (255). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 90.

10, 11. *Anomalina ammonoides* (Reuss) Chapman (p. 154). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

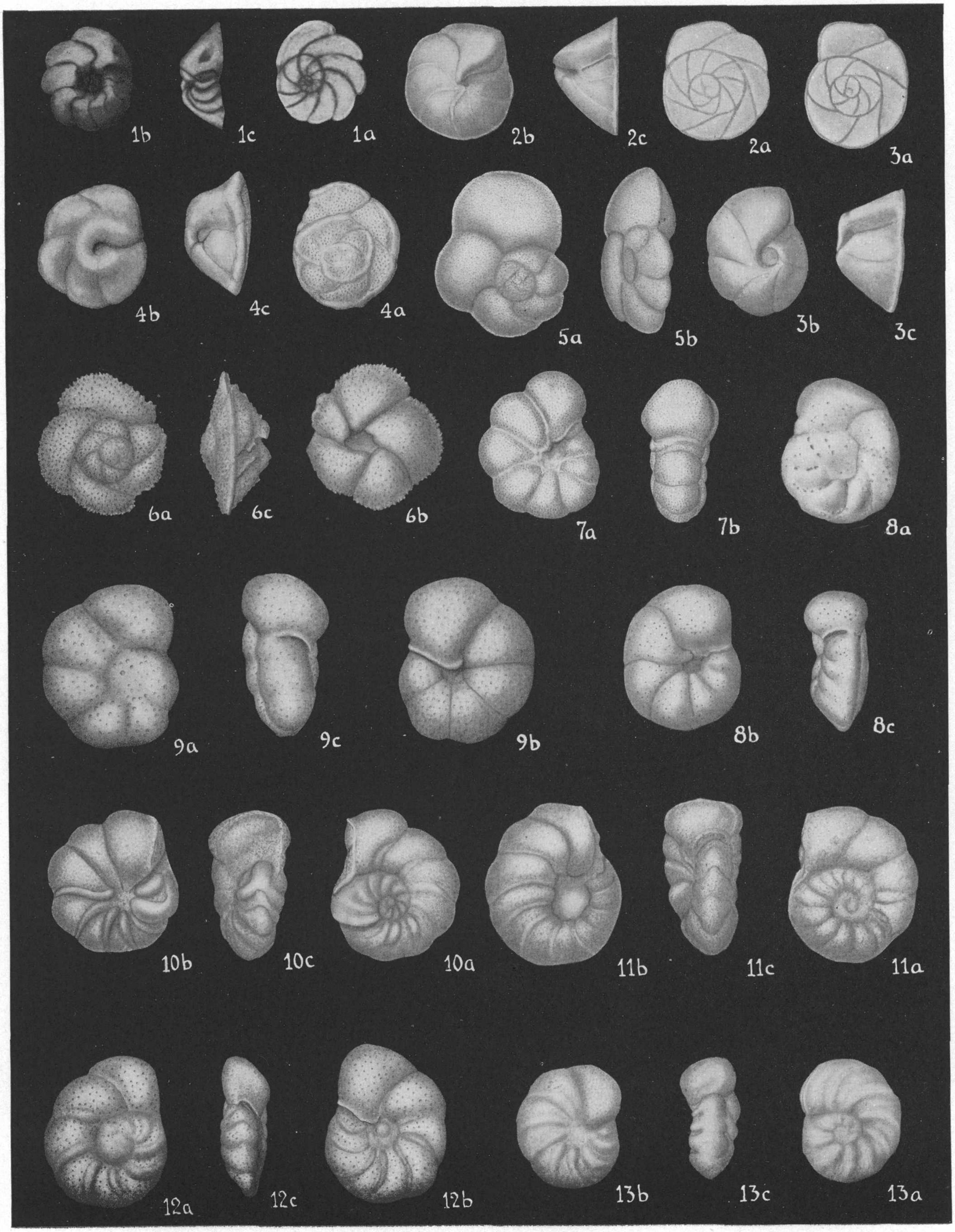
10. Plänermergel, Bohemia. Autotype, × 45.

11. Annona chalk, Red River County, Tex. (196). × 55.

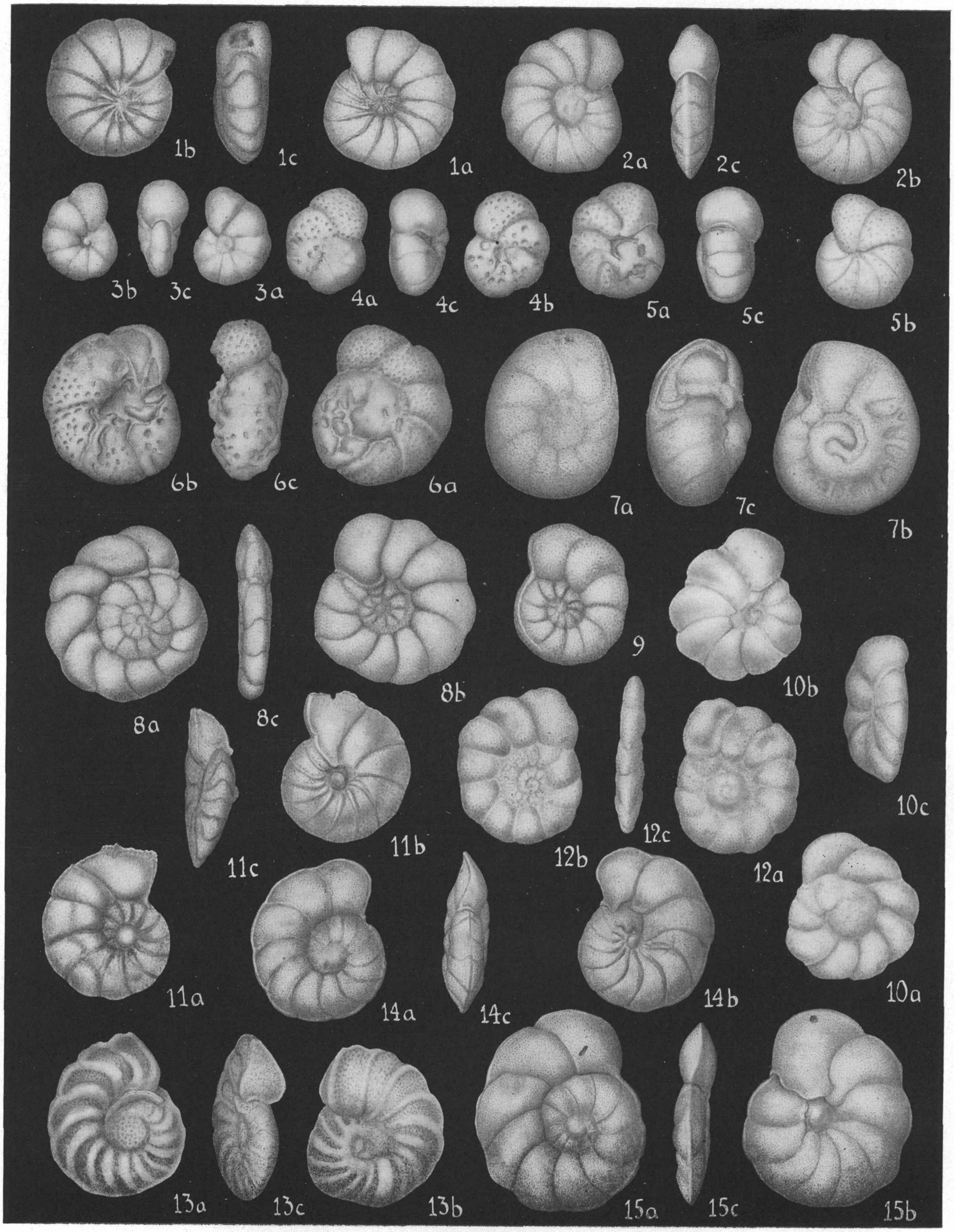
12, 13. *Anomalina clementiana* (D'Orbigny) Franke (p. 155). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.

12. Ripley formation, McNairy County, Tenn. (97). × 90.

13. White chalk, Antigua, British West Indies. × 45.



GLOBOROTALIIDAE, ANOMALINIDAE.



ANOMALINIDAE.

PLATE 64

FIGURE 1. *Anomalina pseudopapillosa* Carsey (p. 154). Corsicana marl, Navarro County, Tex. (26). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

2. *Anomalina henbesti* Plummer (p. 155). Ripley formation, Henderson County, Tenn. (96). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 60.

3. *Anomalina tennesseensis* W. Berry (p. 155). Ripley formation, McNairy County, Tenn. (97). Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, apertural view. × 55.

4–6. *Anomalina rubiginosa* Cushman (p. 156). (After Cushman and Jarvis.) Cretaceous, Trinidad. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

7. *Anomalina velascoensis* Cushman (p. 156). Velasco shale. Tamalte Arroyo, Hacienda el Limon, Mexico. Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 58.

8, 9. *Planulina eaglefordensis* (Moreman) Cushman (p. 156).
   8. Eagle Ford shale, Dallas County, Tex. (356). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 60.
   9. Eagle Ford shale, Dallas County, Tex. (363). × 60.

10. *Planulina austinana* Cushman (p. 156). Lower part of Austin chalk, Dallas County, Tex. (344). Holotype, *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 55.

11. *Planulina texana* Cushman (p. 157). Lower part of Taylor marl, Fannin County, Tex. (204). Holotype, *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 48.

12. *Planulina kansasensis* Morrow (p. 157) Fort Hays limestone, Elllis County, Kans. Holotype, redrawn, *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 55.

13. *Planulina spissocostata* Cushman (p. 157). Upper part of Taylor marl, Navarro County, Tex. (132). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 60.

14, 15. *Planulina taylorensis* (Carsey) Cushman (p. 158). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
   14. Saratoga chalk, Howard County, Ark. (79). × 30.
   15. Ripley formation, Henderson County, Tenn. (96). × 45.

PLATE 65

FIGURE 1. *Planulina correcta* (Carsey) Cushman (p. 158). Corsicana marl, Travis County, Tex. (39). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

2. *Planulina nacatochensis* Cushman (p. 158). Nacatoch sand, White County, Ark. (76). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 68.

3. *Planulina greenhornensis* (Morrow) Cushman (p. 159). Hartland shale member of Greenhorn limestone, Hodgeman County, Kans. Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 45.

4. *Cibicides stephensoni* Cushman (p. 159). Selma chalk of Pecan Gap age, Marengo County, Ala. (256). Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 55.

5–7. *Cibicides harperi* (Sandidge) Cushman (p. 159).
   5. (After Sandidge.) Ripley formation, Alabama River, Ala. *a*, Dorsal view; *b*, ventral view. × 58.
   6, 7. Kemp clay, Navarro County, Tex. (3). 6, Ventral view. 7, Dorsal view. × 38.

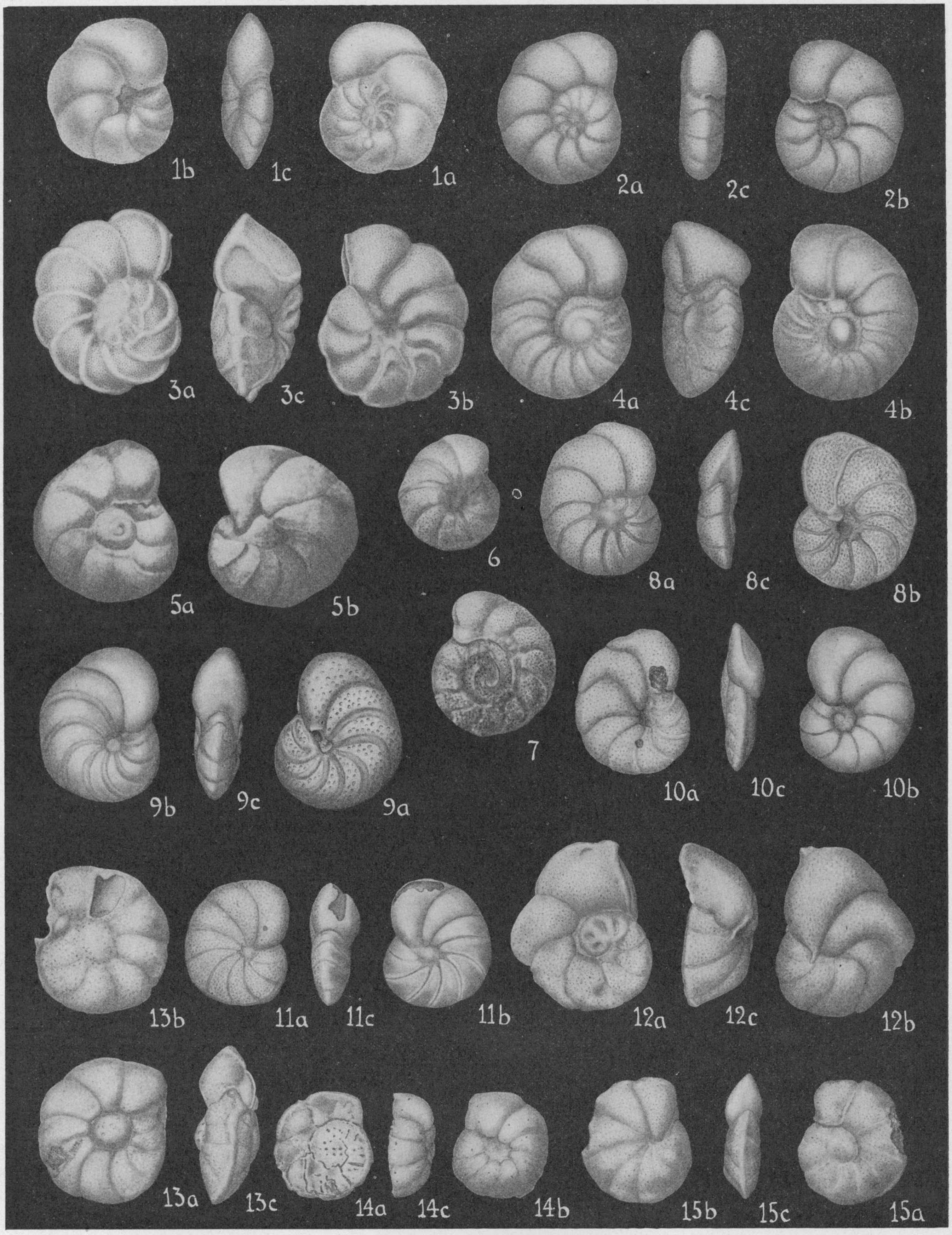
8–11. *Cibicides subcarinatus* Cushman and Deaderick (p. 159). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view.
   8. Ripley formation, McNairy County, Tenn. (97). Holotype, redrawn. × 55.
   9. Selma chalk (upper part), McNairy County, Tenn. (98). × 90.
   10. Ripley formation, McNairy County, Tenn. (97). Holotype of "*Anomalina wadei* W. Berry," redrawn. × 55.
   11. Ripley formation, McNairy County, Tenn. (97). Holotype of "*Truncatulina wadei* W. Berry," redrawn. × 55.

12. *Cibicides beaumontianus* (D'Orbigny) Brotzen (p. 160). Saratoga chalk, Howard County, Ark. (79). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 38.

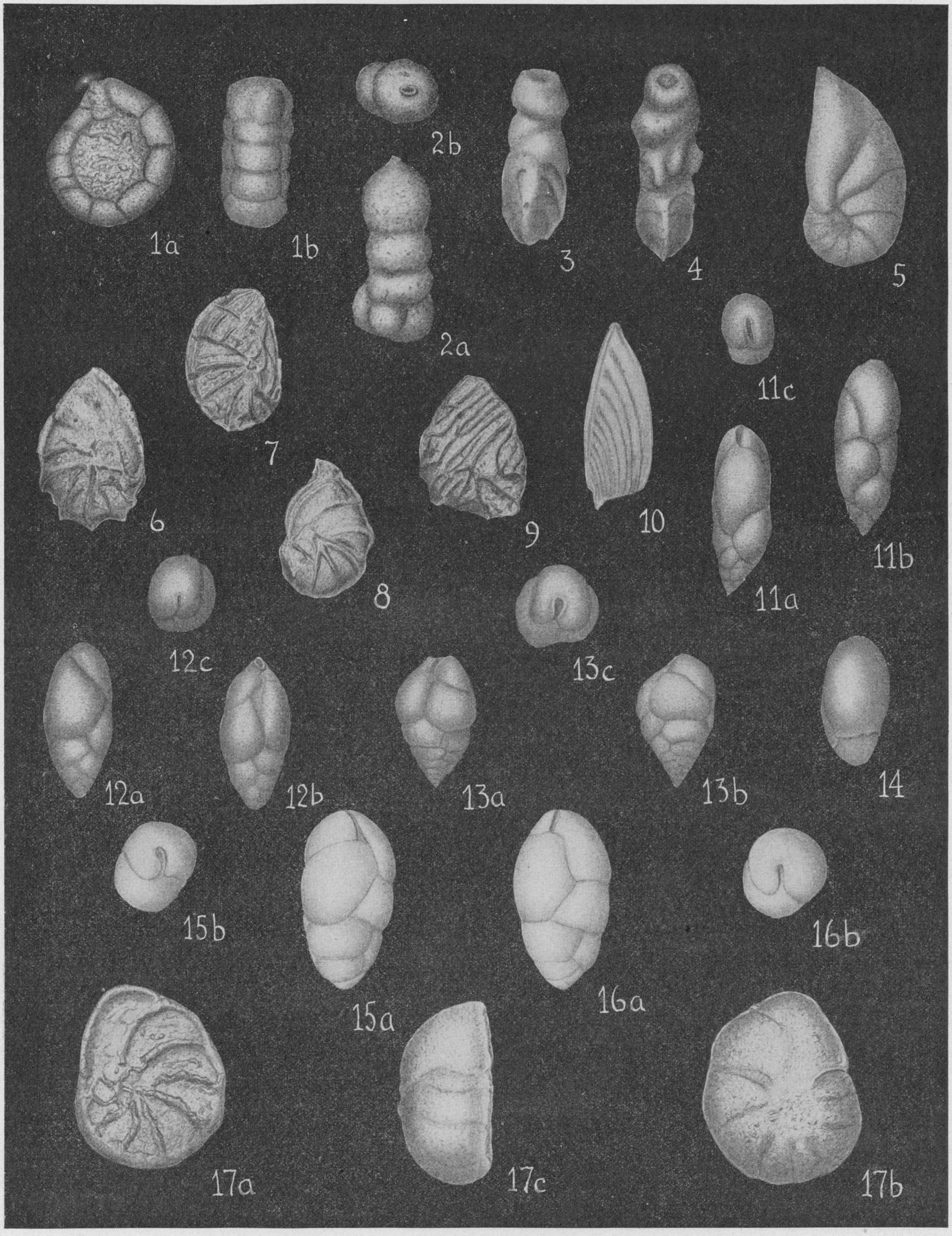
13. *Cibicides constrictus* (Hagenow) Cushman (p. 160). Saratoga chalk, Howard County, Ark. (79). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 30.

14. *Stensiöina americana* Cushman and Dorsey (p. 141). Saratoga chalk, Howard County, Ark. (79). *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. × 48.

15. *Cibicides coonensis* (W. Berry) Thalmann (p. 160). Ripley formation, McNairy County, Tenn. (97). Holotype, redrawn, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 68.



ANOMALINIDAE.



MISCELLANEOUS FORAMINIFERA.

PLATE 66

FIGURE 1. *Haplophragmoides flagleri* Cushman and Hedberg (p. 22). Colon shale, Quebrada Mito Juan, Colombia, Holotype, *a*, front view; *b*, apertural view. × 60.

2. *Ammobaculites lueckei* Cushman and Hedberg (p. 24). Colon shale, Quebrada Mito Juan, Colombia. Holotype, *a*, front view; *b*, apertural view. × 80.

3, 4. *Pseudogaudryinella colombiana* Cushman and Hedberg (p. 41). Colon shale, Quebrada Mito Juan, Colombia. 3, Holotype, × 40. 4, Paratype, × 28.

5. *Planularia* sp. (p. 58). Colon shale, Quebrada Mito Juan, Colombia. × 55.

6–9. *Planularia dissona* (Plummer) Cushman var. *santanderensis* Cushman and Hedberg (p. 57). Mito Juan formation, near kilometer post 33, west of Cucuta, Colombia, on road to Santiago. 7, Holotype. 6, 8, 9, Paratypes. × 35.

10. *Vaginulina barcoensis* Cushman and Hedberg (p. 82). Colon shale, Quebrada Mito Juan, Colombia. Holotype. × 50.

11. *Bulimina laddi* Cushman and Hedberg (p. 124). Colon shale, Quebrada Mito Juan, Colombia. Holotype, *a*, *b*, opposite sides; *c*, apertural view. × 60.

12. *Bulimina kickapooensis* Cole (p. 123). Colon shale, Quebrada Mito Juan, Colombia. *a*, *b*, Opposite sides; *c*, apertural view. × 55.

13. *Bulimina petroleana* Cushman and Hedberg (p. 125). Colon shale, Quebrada La Petrolea, Colombia. Holotype, *a*, *b*, opposite sides; *c*, apertural view. × 55.

14. *Chilostomella* cf. *C. ovoidea* Reuss (p. 146). Colon shale, Quebrada Mito Juan, Colombia. × 50.

15, 16. *Bulimina kickapooensis* Cole var. *pingua* Cushman and Parker (p. 123). Corsicana marl, on Mexia highway at forks of Wortham road 2.8 miles east-southeast of Cooledge, Limestone County, Tex. (30). 15, Holotype. 16, Paratype. *a*, Front view; *b*, apertural view. × 45.

17. *Stensiöina excolata* (Cushman) Cushman and Dorsey (p. 141). Mendez shale, on railroad near Coco, Hacienda el Limon, San Luis Potosi, Mexico. Holotype, *a*, dorsal view; *b*, ventral view; *c*, peripheral view. × 60.

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