

CONTRIBUTIONS FROM THE CUSHMAN  
LABORATORY FOR FORAMINIFERAL RESEARCH

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156. NEW SPECIES OF FORAMINIFERA FROM THE  
LOWER OLIGOCENE OF MISSISSIPPI

By JOSEPH A. CUSHMAN

Through the kindness of Messrs. A. R. Mornhinveg and J. B. Garrett, who have been concentrating work on the Lower Oligocene, Vicksburg, of Mississippi, material of the various species of foraminifera of that formation has been placed in this laboratory. Among this excellent series are the following species which are apparently new. They show, as has been noted before, a very close relationship to the fauna of the Indo-Pacific, particularly to that of the Miocene of Australia.

*TRILOCULINA MISSISSIPPIENSIS* Cushman, n. sp. (Pl. 4, figs. 1 a-c)

Test elongate, slender, fusiform, broadly rounded in end view, both ends of the chambers extending well beyond the previous ones; chambers fairly distinct, very elongate, semicircular in transverse section, periphery broadly rounded; sutures rather indistinct; wall ornamented with numerous, 10-12, longitudinal costae running the entire length of the chamber, with fine rectangular pits in the grooves between the costae, of uniform size and regular position; aperture small, nearly circular, with a slight, rounded lip. Length 0.60-0.65 mm.; breadth 0.15 mm.; thickness 0.12 mm.

Holotype (Cushman Coll. No. 21942) from Lower Oligocene, Byram marl, 4 ft. above ledge under expansion bridge on Pearl River, Byram, Mississippi.

This is a small, slender species, but highly ornamented, and should prove a good index fossil.

*MASSILINA GLABRICOSTATA* Cushman, n. sp. (Pl. 4, figs. 2 a-c)

Test only slightly longer than broad, much compressed, periphery rounded; chambers fairly distinct, the last two mak-

ing up most of the surface, those in the early portion quinqueloculine, later in one plane, not extending out beyond the limits of the previous one; sutures rather indistinct; wall of the early portion with distinct, rounded, longitudinal costae, which in the adult chambers are confined to the area just below the aperture, the remainder of the chamber wall smooth; aperture elliptical, with a distinct lip. Length 0.45-0.50 mm.; breadth 0.35-0.40 mm.; thickness 0.12-0.14 mm.

Holotype (Cushman Coll. No. 21943) from Lower Oligocene, Byram marl, 6 ft. above ledge under expansion bridge on Pearl River, Byram, Mississippi.

The peculiar ornamentation should easily distinguish this species.

*FLINTIA LATICONCAVA* Cushman, n. sp. (Pl. 4, figs. 3 a, b)

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

Holotype (Cushman Coll. No. 21944) from 6 ft. above ledge under expansion bridge on Pearl River, Byram, Mississippi.

In its later stages this species has characters that place it in the genus *Flintia*.

*PYRGO OLIGOCENICA* Cushman, n. sp. (Pl. 4, figs. 5 a, b)

Test small, slightly longer than broad, breadth and thickness about equal, periphery very broadly rounded; chambers distinct, much inflated, the last two making up the entire exterior; suture distinct, depressed; wall ornamented with numerous longitudinal costae covering the whole chamber wall except at the base and just below the lip at the apertural end; aperture broadly elliptical, with a distinct, rounded lip and a flattened, somewhat bifid tooth. Length 0.45 mm.; breadth 0.35 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 21945) from Lower Oligocene, 16 ft. above limestone ledge at bottom of hill on road ascending from Waltersville, Mississippi, to National Cemetery.

*CORNUSPIRA BYRAMENSIS* Cushman, n. sp. (Pl. 4, figs. 4 a, b)

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

Holotype (Cushman Coll. No. 21946) from Lower Oligocene, Byram marl, 4 ft. above ledge under expansion bridge on Pearl River, Byram, Mississippi.

*PLANISPIRINA MORNHINVEGI* Cushman, n. sp. (Pl. 4, figs. 6 a, b)

Test planispiral, the adult whorl composed of about four nearly involute chambers, much compressed, periphery subacute; chambers distinct, slightly inflated in the middle, compressed toward the periphery, and also toward the umbilicus; sutures slightly depressed, somewhat sigmoid; wall ornamented with numerous rounded or slightly polygonal depressions covering the entire surface, and rather evenly spaced; aperture narrowly elliptical in the middle of the apertural face. Diameter 0.35 mm.; thickness 0.07 mm.

Holotype (Cushman Coll. No. 21947) from Lower Oligocene, Byram marl, 4 ft. above ledge under expansion bridge on Pearl River, Byram, Mississippi.

This is a striking species which seems to be planispiral throughout, and has a very definite ornamentation.

*SPIROLINA ARRECTA* Cushman, n. sp. (Pl. 4, fig. 7)

Test in the early stages planispiral, involute, about six chambers making up the whorl, later portion abruptly uncoiled and rectilinear, rounded in end view; chambers distinct, the early coiled ones of uniform shape, increasing only slightly in size as added; sutures distinct, strongly limbate, earlier ones very slightly curved, not depressed; wall distinctly striate; aperture in the adult irregularly rounded, terminal. Length 0.35-0.45 mm.; diameter of coiled portion 0.20 mm., of uncoiled portion 0.12-0.15 mm.

Holotype (Cushman Coll. No. 21948) from Lower Oligocene, Byram marl, on ledge at water's edge under expansion bridge on Pearl River at Byram, Mississippi.

This species is peculiar in the very abrupt change from a close coiling series to a very upright, rectilinear series.

## FRONDICULARIA GARRETTI Cushman, n. sp. (Pl. 4, figs. 8 a-c)

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

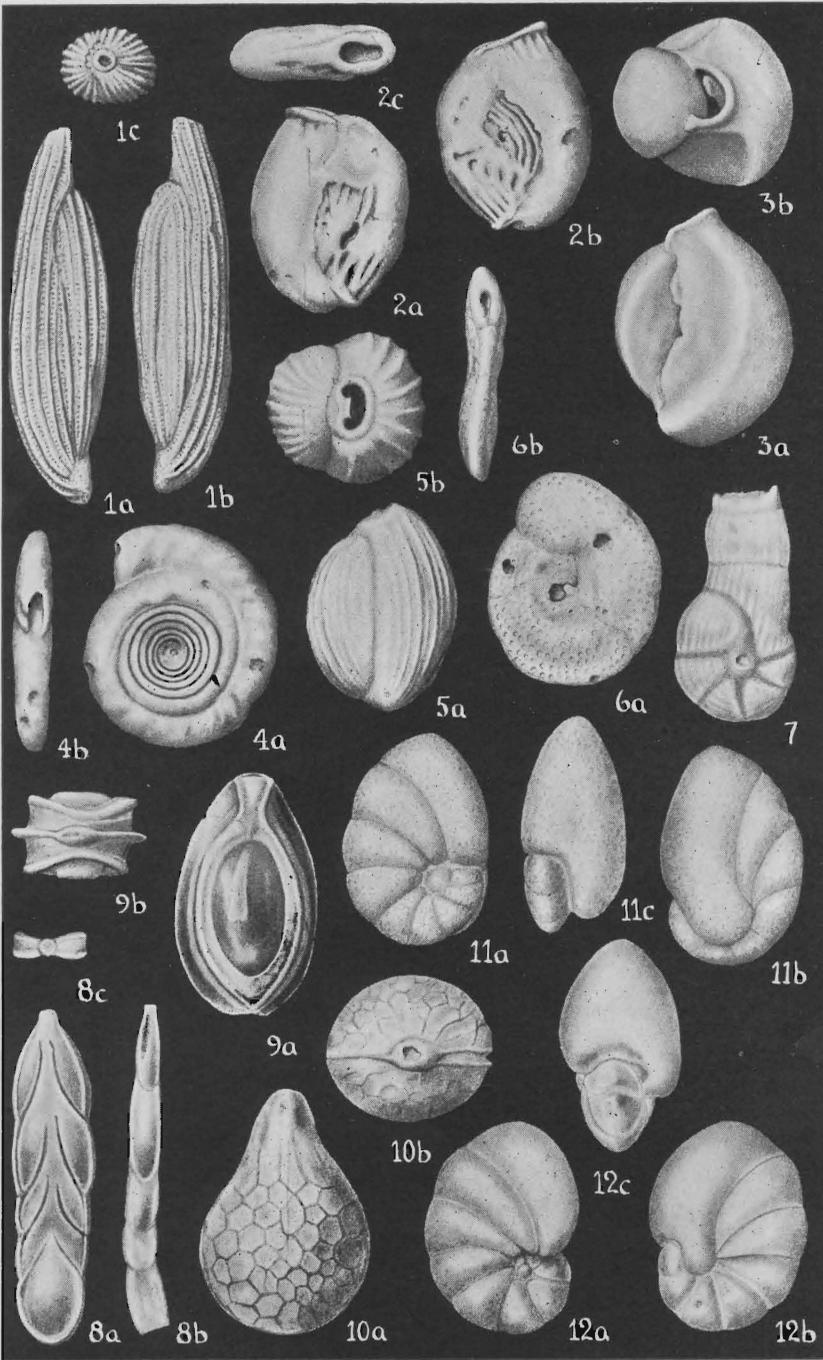
Holotype (Cushman Coll. No. 21949) from Lower Oligocene, Byram marl, 6 ft. above ledge under expansion bridge on Pearl River, Byram, Mississippi.

This species resembles one described by Heron-Allen and Earland from the Miocene of Australia, and is another of the many closely related species from these two areas.

## EXPLANATION OF PLATE 4

- FIGS. 1 a-c. *Triloculina mississippiensis* Cushman, n. sp.  $\times 80$ . a, b, opposite sides; c, apertural view.
- FIGS. 2 a-c. *Massilina glabricostata* Cushman, n. sp.  $\times 60$ . a, b, opposite sides; c, apertural view.
- FIGS. 3 a, b. *Flintia laticoncava* Cushman, n. sp.  $\times 60$ . a, side view; b, apertural view.
- FIGS. 4 a, b. *Cornuspira byramensis* Cushman, n. sp.  $\times 60$ . a, side view; b, peripheral view.
- FIGS. 5 a, b. *Pyrgo oligocenica* Cushman, n. sp.  $\times 60$ . a, side view; b, apertural view.
- FIGS. 6 a, b. *Planispirina mornhinvegi* Cushman, n. sp.  $\times 80$ . a, side view; b, peripheral view.
- FIG. 7. *Spirolina arrecta* Cushman, n. sp.  $\times 80$ .
- FIGS. 8 a-c. *Frondicularia garretti* Cushman, n. sp.  $\times 80$ . a, front view; b, side view; c, apertural view.
- FIGS. 9 a, b. *Entosolenia crumenata* Cushman, n. sp.  $\times 90$ . a, front view; b, apertural view.
- FIGS. 10 a, b. *Entosolenia byramensis* Cushman, n. sp.  $\times 90$ . a, front view; b, apertural view.
- FIGS. 11 a-c. *Nonionella crassipunctata* Cushman, n. sp.  $\times 100$ . a, dorsal view; b, ventral view; c, peripheral view.
- FIGS. 12 a-c. *Nonionella pauciloba* Cushman, n. sp.  $\times 100$ . a, dorsal view; b, ventral view; c, peripheral view.

Figures drawn by Margaret S. Moore.



## ENTOSOLENIA CRUMENATA Cushman, n. sp. (Pl. 4, figs. 9 a, b)

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

Holotype (Cushman Coll. No. 21950) from Lower Oligocene, 3 ft. above limestone ledge at bottom of hill on road ascending from Waltersville, Mississippi, to National Cemetery.

This is close to some of the forms that have been assigned to "*Lagena orbignyana*."

## ENTOSOLENIA BYRAMENSIS Cushman, n. sp. (Pl. 4, figs. 10 a, b)

Test somewhat longer than broad, slightly compressed, the apertural end much extended; wall covered with an irregularly hexagonal network of raised ribs which extend up into longitudinal costae toward the aperture, and at the sides fuse into a single or double carina; aperture rounded at the end of a stout neck. Length 0.40 mm.; breadth 0.25 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 21951) from Lower Oligocene, Byram marl, 6 ft. above ledge under expansion bridge on Pearl River, Byram, Mississippi.

This somewhat resembles the forms usually assigned to "*Lagena hexagona*," but the difference in compression, extension of costae at the apertural end, and the median keels will separate it.

## NONIONELLA CRASSIPUNCTATA Cushman, n. sp. (Pl. 4, figs. 11 a-c)

Test somewhat longer than broad, periphery rounded, dorsal side with the chambers somewhat evolute, ventral side involute, very unequal in peripheral view; chambers indistinct, about nine in the last-formed whorl, increasing in length in the adult, ventrally with a large lobular extension covering the umbilical region, and continuing nearly to the periphery; wall very coarsely perforate, smooth; aperture elongate, narrow at the periphery, and continuing over to the ventral side. Length 0.30 mm.; breadth 0.18 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 21952) from Lower Oligocene, under high bridge at Haynes Bluff, Mississippi, at top of first fall upstream.

This species is very coarsely perforate. It has shorter chambers than *Nonionella jacksonensis* Cushman, and is very different in shape from *N. tatumi* Howe, described from the Lower Oligocene of Mississippi.

**NONIONELLA PAUCILOBA** Cushman, n. sp. (Pl. 4, figs. 12 a-c)

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

Holotype (Cushman Coll. No. 21953) from Lower Oligocene, just above limestone ledge, 5½ ft. above water level, 30 ft. north of base of power tower, eastern bank of Mississippi River, south of Vicksburg, Mississippi.

This is a very distinctive species from the preceding with its very small, ventral lobe, pointed chambers, and very finely perforate wall.

**BOLIVINA MORNHINVEGI** Cushman, n. sp. (Pl. 5, figs. 1 a, b)

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

Holotype (Cushman Coll. No. 21954) from Lower Oligocene, 24 ft. above limestone ledge, bottom of hill on road ascending from Waltersville, Mississippi, to National Cemetery.

This species may be distinguished from others of the Lower Oligocene by the strongly limbate sutures and very coarsely perforate wall.

*BOLIVINA GARRETTI* Cushman, n. sp. (Pl. 5, figs. 2 a, b)

Test about  $1\frac{1}{2}$  times as long as broad, slightly compressed, periphery broadly rounded, tapering throughout, the greatest breadth formed by the last pair of chambers; chambers comparatively few, inflated, all relatively high; sutures distinct, early ones limbate and raised, later ones depressed, early ones oblique, later ones becoming nearly at right angles to the elongate axis; wall smooth except for the raised sutures; aperture elliptical, contracted at the margin of the chamber and with a raised lobe at either side at the base. Length 0.30 mm.; breadth 0.20 mm.; thickness 0.13 mm.

Holotype (Cushman Coll. No. 21955) from Lower Oligocene, 24 ft. above limestone ledge, bottom of hill on road ascending from Waltersville, Mississippi, to National Cemetery.

This has several characters such as the raised sutures, few and high chambers with the peculiarly shaped aperture, which should easily distinguish it.

*ANGULOGERINA VICKSBURGENSIS* Cushman, n. sp. (Pl. 5, figs. 3, 4)

Test elongate,  $2\frac{1}{2}$ -3 times as long as broad, triangular in end view, sides somewhat convex, the angles rounded, early portion rapidly enlarging, adult portion with the sides nearly parallel; chambers numerous, distinct, generally triserial, slightly inflated, increasing in height in the adult; sutures distinct, slightly depressed; wall smooth, finely but distinctly perforate; aperture circular, terminal, with a distinct, cylindrical neck and prominent lip. Length 0.35-0.40 mm.; diameter 0.12-0.15 mm.

Holotype (Cushman Coll. No. 21956) from Lower Oligocene, Byram marl, on ledge at water's edge under expansion bridge on Pearl River at Byram, Mississippi.

This species is rather widely distributed in the Byram marl. It somewhat resembles the form described by Heron-Allen and Earland as "*Uvigerina canariensis*, var. *australis*" from the Miocene of Australia (Journ. Roy. Micr. Soc., 1924, pl. 11, figs. 67-70).

*ANGULOGERINA RUGOPLICATA* Cushman, n. sp. (Pl. 5, figs. 5 a, b)

Test about twice as long as broad, generally triangular in end view, the sides slightly concave, and the angles in the adult truncate, somewhat fusiform in side view, greatest diameter at about the middle; chambers distinct, strongly concave at the base, irregular, increasing in height toward the apertural end;

sutures strongly depressed; wall distinctly perforate, with slight traces of longitudinal striae; aperture circular, terminal, with a very short, cylindrical neck and a very slight, rounded lip. Length 0.30 mm.; diameter 0.15 mm.

Holotype (Cushman Coll. No. 21958) from Lower Oligocene, 41 ft. above limestone ledge, bottom of hill on road ascending from Waltersville, Mississippi, to National Cemetery.

This is a very strongly rugose species, and easily distinguished from the other Lower Oligocene species of the genus.

*SPIRILLINA VICKSBURGENSIS* Cushman, n. sp. (Pl. 5, figs. 6 a-c)

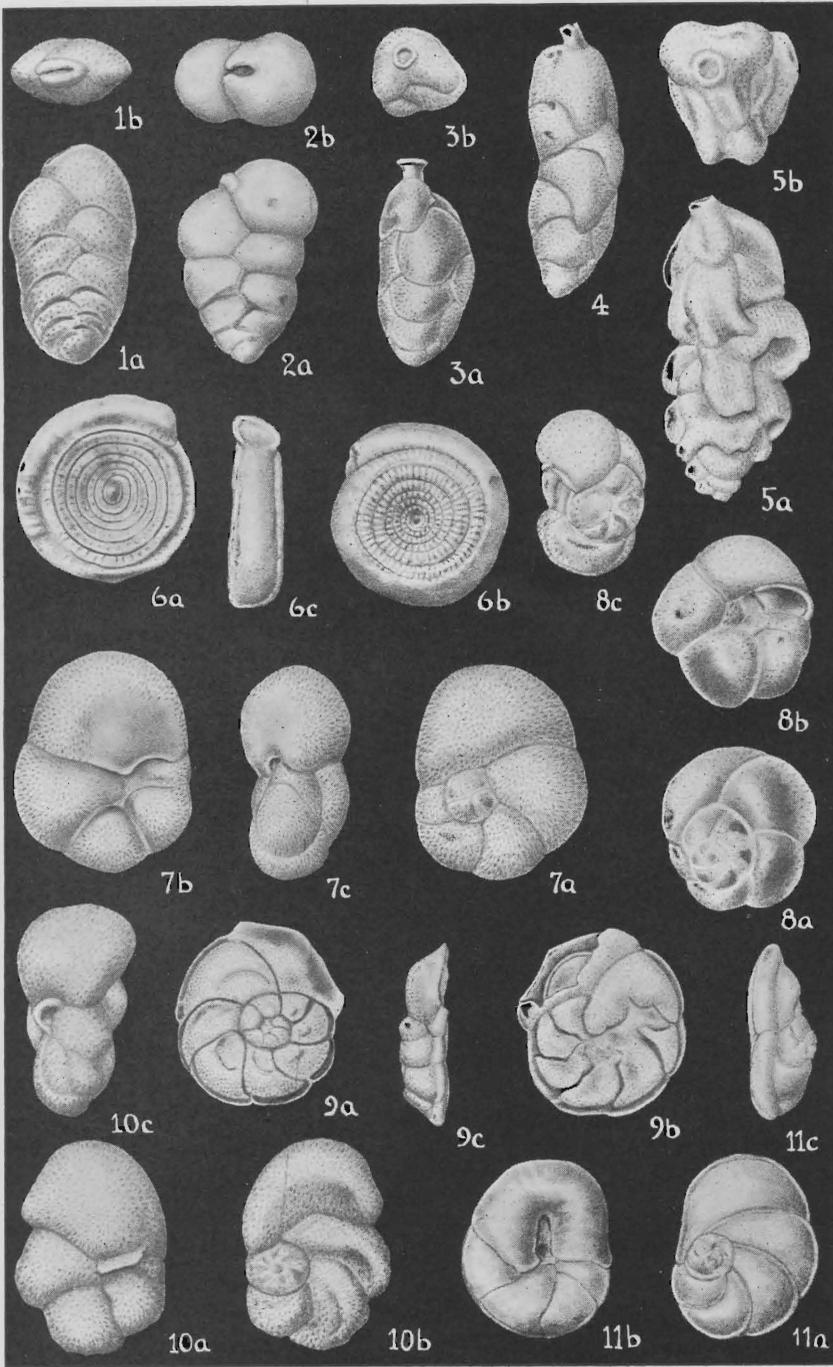
Test planispiral, evolute, biconvex, periphery obliquely truncate, the dorsal side somewhat broader than the ventral; suture distinct, slightly depressed on the ventral side; wall on the dorsal side with a single row of coarse pits, on the ventral side transversely and regularly plicate; aperture formed by the open end of the tubular chamber. Diameter 0.25 mm.; thickness 0.07 mm.

Holotype (Cushman Coll. No. 21959) from Lower Oligocene, Byram marl, 4 ft. above ledge at water's edge under expansion bridge on Pearl River, Byram, Mississippi.

EXPLANATION OF PLATE 5

- FIGS. 1 *a, b.* *Bolivina mornhinvegi* Cushman, n. sp.  $\times 100$ . *a*, front view; *b*, apertural view.
- FIGS. 2 *a, b.* *Bolivina garretti* Cushman, n. sp.  $\times 90$ . *a*, front view; *b*, apertural view.
- FIGS. 3, 4. *Angulogerina vicksburgensis* Cushman, n. sp.  $\times 100$ . Fig. 3, Paratype. *a*, front view; *b*, apertural view. Fig. 4, Holotype.
- FIGS. 5 *a, b.* *Angulogerina rugoplicata* Cushman, n. sp.  $\times 100$ . *a*, front view; *b*, apertural view.
- FIGS. 6 *a-c.* *Spirillina vicksburgensis* Cushman, n. sp.  $\times 100$ . *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- FIGS. 7 *a-c.* *Valvulineria paucilocula* Cushman, n. sp.  $\times 80$ . *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- FIGS. 8 *a-c.* *Discorbis subglobosa* Cushman, n. sp.  $\times 100$ . *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- FIGS. 9 *a-c.* *Discorbis arcuato-costata* Cushman, n. sp.  $\times 80$ . *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- FIGS. 10 *a-c.* *Valvulineria sculpturata* Cushman, n. sp.  $\times 100$ . *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- FIGS. 11 *a-c.* *Heronallenia vicksburgensis* Cushman, n. sp.  $\times 100$ . *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

Figures drawn by Margaret S. Moore.



This species most closely resembles the form I have described as *Spirillina limbata* H. B. Brady, var. *bipunctata* Cushman (Prof. Paper 129, U. S. Geol. Survey, 1922, pl. 32, figs. 3-5), but the ornamentation of the two, while generally similar, seems to be distinctive.

VALVULINERIA PAUCILOCULA Cushman, n. sp. (Pl. 5, figs. 7 a-c)

Test rounded, somewhat compressed, periphery broadly rounded, dorsal side slightly convex, ventral side slightly concave in the center; chambers distinct, five in the adult whorl, of rather uniform shape, increasing regularly in size as added, on the ventral side the last-formed chamber making up nearly one-half the surface; sutures distinct, slightly depressed, gently curved; wall thin, coarsely and distinctly perforate except a clear area above the aperture on the ventral side; aperture an elongate, arched opening on the ventral side with a flattened, somewhat angular projecting lip above it. Length 0.35-0.40 mm.; breadth 0.30 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 21960) from Lower Oligocene, Byram marl, 8 ft. above ledge at water's edge, under expansion bridge on Pearl River, Byram, Mississippi.

This species reminds one somewhat of *Baggina* by the clear area above the aperture. It resembles some of the Recent species of the Indo-Pacific.

VALVULINERIA SCULPTURATA Cushman, n. sp. (Pl. 5, figs. 10 a-c)

Test trochoid, somewhat longer than broad, dorsally flattened or somewhat concave, ventrally convex except slightly depressed in the umbilical region, periphery lobulate, rounded in edge view; chambers distinct in the adult whorl, 4 or 5 in number, increasing somewhat in length as added, on the ventral side strongly convex, on the dorsal side with the outer half convex, the inner half strongly excavated; sutures distinct, depressed, strongly curved dorsally, less so ventrally; wall very coarsely perforate; aperture on the ventral side, nearly umbilical, with a rather thick, projecting lip above the aperture itself. Length 0.30 mm.; breadth 0.20 mm.; thickness 0.15-0.18 mm.

Holotype (Cushman Coll. No. 21961) from Lower Oligocene, 36 feet above limestone ledge, bottom of hill on road ascending from Waltersville, Mississippi, to National Cemetery.

This is a very unusual form for this genus, and should make a good index fossil for this formation.

*DISCORBIS SUBGLOBOSA* Cushman, n. sp. (Pl. 5, figs. 8 a-c)

Test subglobose, dorsal side slightly flattened, ventrally convex but somewhat depressed or concave at the umbilicus, periphery very broadly rounded; chambers strongly inflated, 4 or 5 in the adult whorl, of rather uniform shape, increasing rather regularly in size as added; sutures distinct, depressed; wall coarsely and distinctly perforate, smooth; aperture semi-circular, ventral, opening on the umbilicus, with a slight lip. Diameter 0.25 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 21962) from Lower Oligocene, Byram marl, 8 ft. above limestone ledge at water's edge, under expansion bridge on Pearl River, Byram, Mississippi.

*DISCORBIS ARCUATO-COSTATA* Cushman, n. sp. (Pl. 5, figs. 9 a-c)

Test plano-convex, ventral side flattened, dorsal side slightly convex, periphery acute, slightly keeled; chambers distinct, on the dorsal side increasing gradually in size, shape rather uniform, on the ventral side in the adult with the later chambers having distinct lobes on the inner margin; sutures very distinct, limbate, strongly but evenly curved on the dorsal side, sigmoid on the ventral side; wall distinctly perforate, on the dorsal side with a raised protuberance on the inner end of the earlier chambers, elongating in the adult to form an arcuate, raised rib on the proximal portion of each chamber; aperture a low, elongate opening on the ventral side. Diameter 0.30-0.35 mm.; thickness 0.08-0.10 mm.

Holotype (Cushman Coll. No. 21963) from Lower Oligocene, 16 ft. above limestone ledge, bottom of hill on road ascending from Waltersville, Mississippi, to National Cemetery.

The ornamentation of the dorsal side of the test is distinctive.

*HERONALLENIA VICKSBURGENSIS* Cushman, n. sp. (Pl. 5, figs. 11 a-c)

Test plano-convex, dorsal side gently convex, ventral side flattened, slightly umbilicate, periphery with a rounded border; chambers distinct, five in the adult whorl, increasing rather rapidly in breadth as added, height increasing only slightly; sutures distinct, limbate and raised on the dorsal side, gently curved, ventrally nearly radial, very slightly depressed, slightly sigmoid; wall smooth except for the carina and raised sutures on the dorsal side; aperture elongate, radial, opening at the umbilicus. Length 0.25 mm.; breadth 0.20 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 21964) from Lower Oligocene

from firm sandy clay bed between sandy lime ledges 35 ft. above water level, 30 ft. N. of base of power tower, E. bank of Mississippi River, S. of Vicksburg, Mississippi.

This is another of the forms that connect this fauna with that of the Miocene of Australia.

## 157. NEW TERTIARY TEXTULARIIDAE

By CECIL G. LALICKER

Additional new species of the family Textulariidae are here placed on record. Some of them have been referred to established species by other authors, but comparisons with topotype specimens from several parts of the world show they are distinct, and should therefore have new specific names. A large number of Tertiary species in the Cushman Collection, apparently new, are represented by so few specimens that it seems advisable not to record them at this time.

I am indebted to Dr. Joseph A. Cushman for having made his extensive collections of topotype material and laboratory facilities available, to Mrs. Helen Jeanne Plummer, of Austin, Texas, for specimens and samples from Texas localities, as well as her invaluable notes on the occurrence and characteristics of certain species, and to Mr. Bradford C. Adams, of Los Angeles, California, for having submitted a large collection from the Tertiary of California.

### *SPIROPLECTAMMINA ADAMSI* Lalicker, n. sp. (Pl. 6, figs. 1, 2)

Test small, rather broad, compressed, subrhomboidal in apertural view, thickest in central portion, periphery sharp; early chambers planispiral, later biserial, low and broad, usually collapsed, especially near peripheral margin; sutures distinct, usually somewhat limbate because of collapsed chambers, depressed in perfect specimens, typically straight and oblique, but curved downward near peripheral margin in some forms; wall finely arenaceous, composed almost entirely of calcareous cement with very fine mineral grains evenly distributed throughout the wall, smoothly finished; aperture a low, rather broad opening at the

inner margin of the last-formed chamber, in a distinct reëntrant. Length of holotype 0.50 mm.; greatest width 0.40 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 21940) from the Martinez formation about 6,300 feet S. 26.5° W. of the railroad depot, town of Santa Susana, Ventura Co., California, where it is rather common. Collected by Loring Snedden.

This species has also been found in brown shale, 2,110 and 2,225 feet above the Kew\* Cretaceous Contact, in strata mapped by him as Martinez, Poison Oak Canyon, Simi Valley, 3 miles N. 46° E. of the town of Santa Susana, Ventura Co., California.

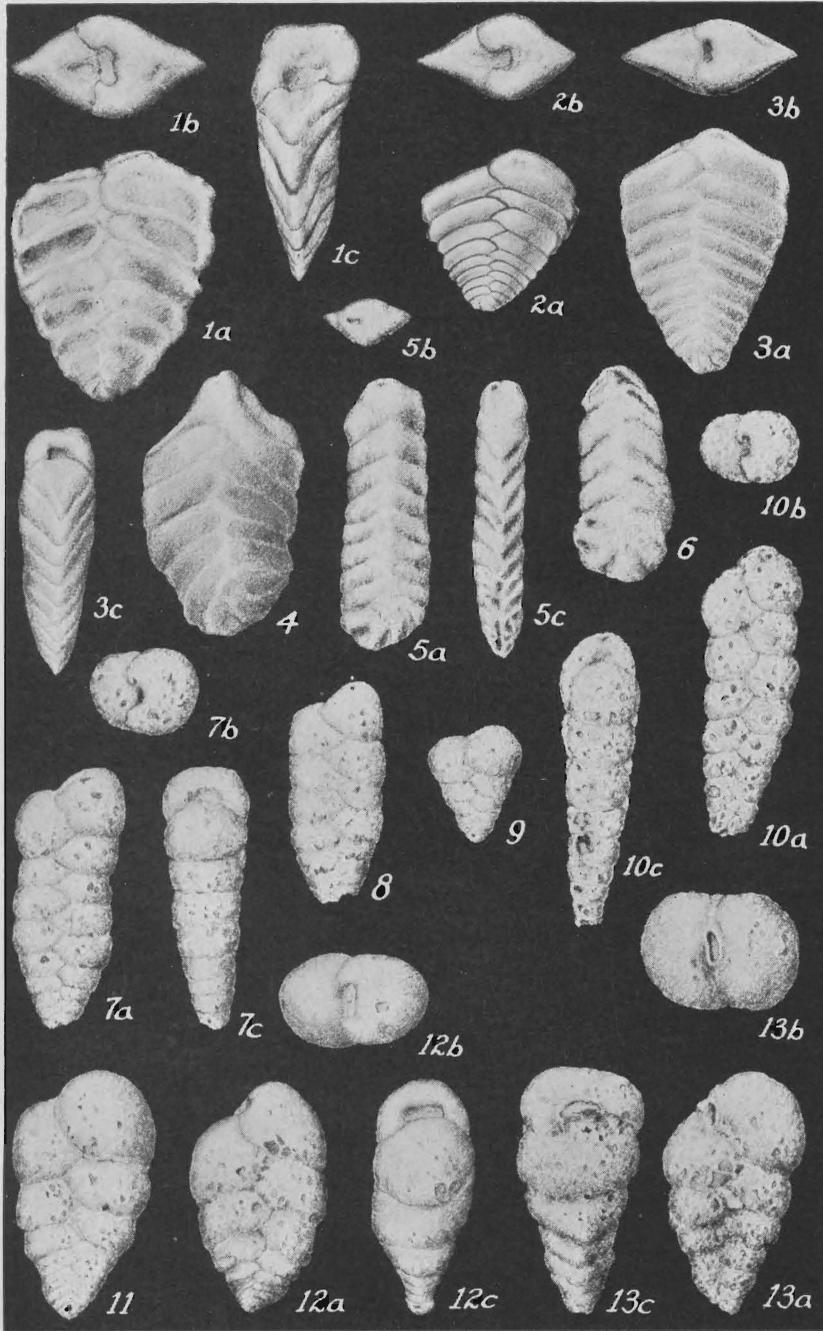
This species is characterized by a thick axial portion and a depressed area on each side of it. Paratypes have been deposited in the Paleontological Collection of the Texas Co., Los Angeles, California.

\* Kew, W. S. W., Geology and Oil Resources of a part of Los Angeles and Ventura Counties, California: U. S. Geol. Surv., Bull. 753, 1924.

#### EXPLANATION OF PLATE 6

- FIGS. 1, 2. *Spiroplectammia adamsi* Lalicker, n. sp. × 60. Fig. 1, Holotype. *a*, front view; *b*, apertural view; *c*, side view. Fig. 2, Paratype. *a*, front view; *b*, apertural view. Eocene, California.
- FIGS. 3, 4. *S. nuttalli* Lalicker, n. sp. × 60. Fig. 3, Holotype. *a*, front view; *b*, apertural view; *c*, side view. Fig. 4, Paratype, front view showing projecting axial portion at apertural end. Eocene, Venezuela.
- FIGS. 5, 6. *S. mexiaensis* Lalicker, n. sp. × 60. Fig. 5, Holotype. *a*, front view; *b*, apertural view; *c*, side view. Fig. 6, Paratype, front view. Eocene, Texas.
- FIGS. 7-9. *Textularia midwayana* Lalicker, n. sp. × 45. Fig. 7, Holotype. *a*, front view; *b*, apertural view; *c*, side view. Figs. 8, 9, Paratypes, front views. Eocene, Texas.
- FIG. 10. *T. plummeræ* Lalicker, n. sp. × 45. Holotype. *a*, front view; *b*, apertural view; *c*, side view. Eocene, Texas.
- FIGS. 11, 12. *T. ovulata* Lalicker, n. sp. × 45. Fig. 11, Paratype, front view. Fig. 12, Holotype. *a*, front view; *b*, apertural view; *c*, side view. Miocene, France.
- FIG. 13. *T. lajollaensis* Lalicker, n. sp. × 45. Holotype. *a*, front view; *b*, apertural view; *c*, side view. Eocene, California.

Figures drawn by Margaret S. Moore.



**SPIROPLECTAMMINA MEXIAENSIS** Lalicker, n. sp. (Pl. 6, figs. 5, 6)

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

Holotype (Cushman Coll. No. 21924) from the Mexia clay member, Wills Point formation of the Midway group, about 35 feet above the top of the Tehuacana limestone, from a steep bank along the eastern side of a tributary flowing due north into Tehuacana Creek, about 2 miles in a direct line north and slightly west of the center of the town of Mexia, about one-quarter of a mile west of the railroad, Limestone Co., Texas. Collected by Mrs. Helen Jeanne Plummer.

This is an unusual species in that the planispiral portion is usually slightly larger than the biserial portion. It is rather a common species in the Wills Point formation, but rarely abundant. It is superficially similar to *Spiroplectammina parallela* Cushman from the Pliocene of Fiji, but differs in having the ridge-like axial portion, a smaller planispiral portion in relation to the biserial portion, and commonly depressed chambers.

**SPIROPLECTAMMINA NUTTALLI** Lalicker, n. sp. (Pl. 6, figs. 3, 4)

*Textularia* aff. *pala* NUTTALL (not CZJZEK), Journ. Pal., vol. 9, No. 2, 1935, p. 123, pl. 14, fig. 4.

Test broad, tapering, compressed, subrhomboidal in apertural view, periphery sharp, apertural end slightly projecting in the central portion, especially in the megalospheric form; early chambers planispiral, the coil in the megalospheric form being much larger than in the microspheric, later biserial, very low, broad, increasing gradually in height as added; sutures distinct, slightly depressed except along axial line where they are somewhat limbate in some specimens, straight, oblique, forming an

angle of  $25^\circ$  with the horizontal; wall finely arenaceous with a very large proportion of calcareous cement, smoothly finished; aperture a small, nearly circular opening at the inner margin of the last-formed chamber, in a distinct reëntrant. Length of holotype 0.54 mm.; greatest width 0.35 mm.; thickness 0.17 mm.

Holotype (Cushman Coll. No. 21926) from the Mene Grande series of Upper Eocene age, near Arnold Hill, Sucre district, southeast of Lake Maracaibo, Venezuela.

Dr. Nuttall referred this species with uncertainty to *Textularia* ent species with a large suite of specimens of *T. pala* from the Miocene of the Vienna Basin shows they are very distinct. *T. pala* has curved sutures which tend to flatten out as the peripheral margin is reached, and it does not have planispiral chambers at the initial end.

**TEXTULARIA BADENENSIS** Lalicker, n. sp. (Pl. 7, fig. 1)

*Textularia partschii* CZJZEK (not REUSS), Haidinger's Naturw., Abh. 2, 1848, p. 148, pl. 13, figs. 22-24.

Test large, conical, tapering, slightly compressed in early portion, subcircular in top view, periphery broadly rounded; chambers numerous, inflated, rapidly increasing in height as added; sutures distinct, depressed, except in early portion, nearly straight, somewhat oblique; wall rather coarsely arenaceous with a large proportion of cement, smoothly finished in early portion, but otherwise rough; aperture a broad, rather high arched opening at the inner margin of the last-formed chamber, and in a distinct reëntrant. Length of holotype 1.20 mm.; greatest width 0.76 mm.; thickness 0.56 mm.

Holotype (Cushman Coll. No. 21929) from the Miocene of Baden, Vienna Basin, Austria. Collected by Frances L. Parker.

The present species has also been found in the Miocene of Steinabrunn, Vienna Basin; Valea Semini, Kostej, Banat, Hungary; and in the Aquitanian superieur, Moulin du Minoy, Salles, France.

**TEXTULARIA BARTONANA** Lalicker, n. sp. (Pl. 7, fig. 6)

Test rather large, thick, tapering, somewhat compressed, periphery sharp, spinose, apertural chambers strongly curved; chambers numerous, rather indistinct in early portion, wider than high, and increasing gradually in height as added, peripheral margin of each chamber marked by a short, conical spine, giving the test a serrate appearance in front view, only slightly

inflated; sutures indistinct in early portion, depressed in later portion, slightly curved, somewhat oblique; wall finely arenaceous with a large proportion of calcareous cement, not smooth; aperture a very broad, low opening at the inner margin of the last-formed chamber. Length of holotype 0.94 mm.; greatest width 0.68 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 21937) from the Upper Eocene, Bartonian, of Val di Lonte, Italy, where it is common.

This species is characterized by the thick, tapering test and the short conical spines on the peripheral ends of the chambers. It is somewhat similar to *Spiroplectammina dentata* (Alth) from the Cretaceous of Lemberg, Galicia, but differs in being thicker, in having a broader aperture, and in lacking the planispiral initial chambers.

**TEXTULARIA DOLLFUSSI** Lalicker, n. sp. (Pl. 7, figs. 8, 9)

Test large, thick, tapering, periphery broadly rounded, ovate in top view, apertural chambers rounded in front view; chambers numerous, wider than high, and increasing gradually in height as added, not inflated; sutures distinct, slightly depressed, straight, horizontal; wall rather coarsely arenaceous, composed of large and small sand grains with a large proportion of cement; aperture a very broad, rather low opening at the inner margin of the last-formed chamber, with a slight lip above. Length of holotype 1.14 mm.; greatest width 0.76 mm.; greatest thickness 0.58 mm.

Holotype (Cushman Coll. No. 21938) from the Miocene, Burdigalien inferieur, Moulin de l'Eglise, Saucats, France, where it is very common. Collected by Dr. G. Dollfuss. It has also been found in the Burdigalien moyen, Leognan, France.

This species is similar to *Textularia marginata* d'Orbigny from Madagascar, but a comparison shows they are distinct.

**TEXTULARIA HALKYARDI** Lalicker, n. sp. (Pl. 7, fig. 5)

*Textularia agglutinans* HALKYARD (not D'ORBIGNY), Mem. Proc. Manchester Lit. and Philos. Soc., vol. 62, 1917-1918 (1919), p. 31.

Test very small, elongate, tapering, somewhat compressed, broadly oval in top view, periphery rounded; chambers numerous, low, broad, gradually increasing in height as added, commonly depressed, except apertural chambers, which are inflated; sutures distinct, not depressed, straight and horizontal; wall finely arenaceous with a large proportion of cement, but not

smoothly finished; aperture a small, low arched opening at the inner margin of the last-formed chamber. Length of holotype 0.38 mm.; greatest width 0.22 mm.; thickness 0.14 mm.

Holotype (Cushman Coll. No. 21928) from Upper Eocene, Blue marl, on sea cliff, Biarritz, France, where it is frequent. Collected by Mr. Reynolds.

Halkyard referred this species to *Textularia agglutinans* d'Orbigny, but a comparison of specimens of *T. agglutinans* from the West Indies and from the Pliocene of Italy shows that they are very different. *T. halkyardi* Lalicker, n. sp., differs from *T. agglutinans* in being much smaller, much more compressed, and in having more and lower chambers.

TEXTULARIA LAJOLLAENSIS Lalicker, n. sp. (Pl. 6, fig. 13)

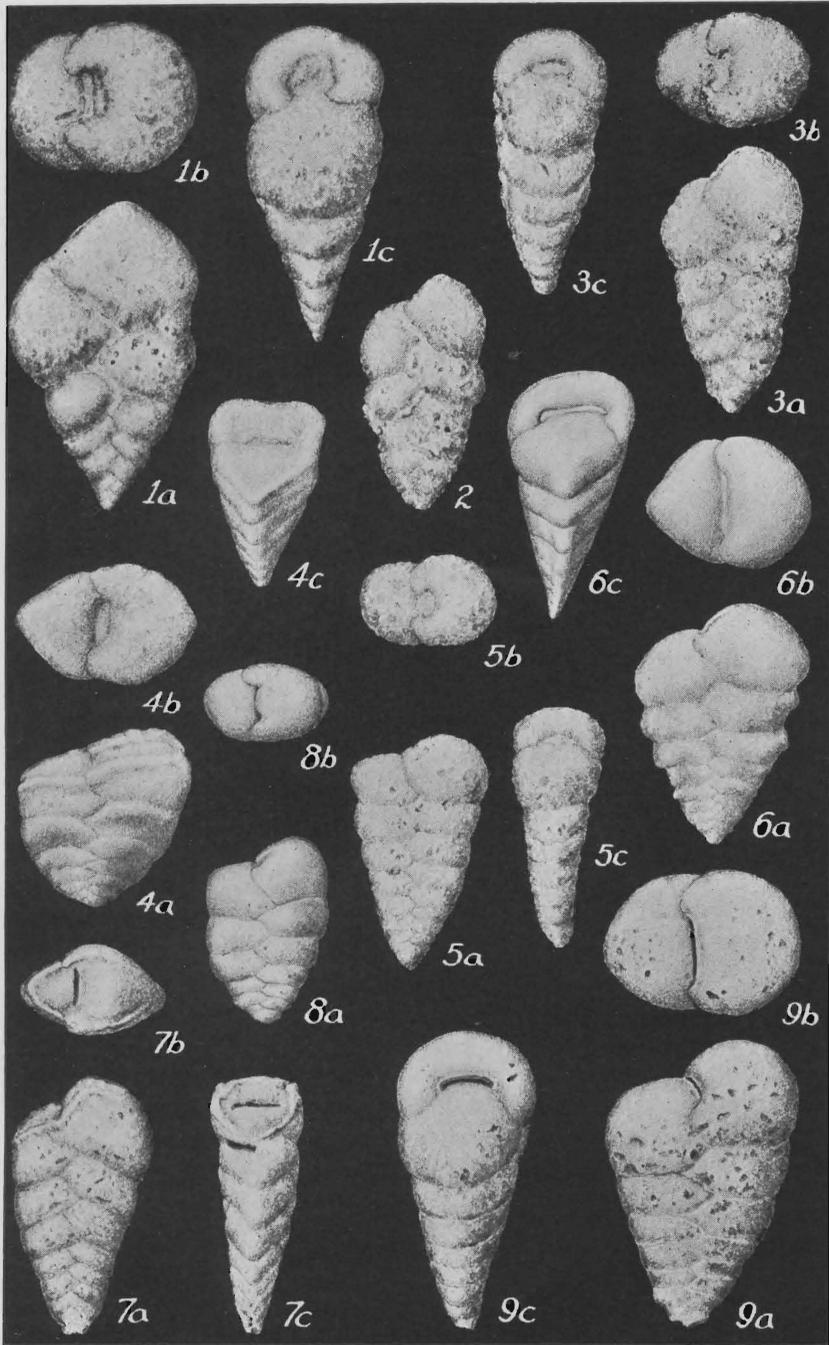
*Textularia labiata* REUSS, var., CUSHMAN and M. A. HANNA, Trans. San Diego Soc. Nat. Hist., vol. 5, 1927, p. 50, pl. 4, fig. 3.

Test elongate, conical, subovate in top view, periphery broadly rounded; chambers few, wider than high, and rapidly increasing in height as added, inflated, pinched, and arranged in a shingle-like pattern; sutures distinct, much depressed, nearly straight, oblique; wall coarsely arenaceous, composed of rather large sand grains with a small proportion of cement, rather smoothly finished; aperture a low, relatively broad opening situated just

#### EXPLANATION OF PLATE 7

- FIG. 1. *Textularia badenensis* Lalicker, n. sp. × 33. Holotype. *a*, front view; *b*, apertural view; *c*, side view. Miocene, Vienna Basin.
- FIGS. 2, 3. *T. lontensis* Lalicker, n. sp. × 33. Fig. 2, Paratype, front view. Fig. 3, Holotype. *a*, front view; *b*, apertural view; *c*, side view. Eocene, Italy.
- FIG. 4. *T. suttonensis* Lalicker, n. sp. × 60. Holotype. *a*, front view; *b*, apertural view; *c*, side view. Pliocene, England.
- FIG. 5. *T. halkyardi* Lalicker, n. sp. × 80. Holotype. *a*, front view; *b*, apertural view; *c*, side view. Eocene, France.
- FIG. 6. *T. bartonana* Lalicker, n. sp. × 33. Holotype. *a*, front view; *b*, apertural view; *c*, side view. Eocene, Italy.
- FIG. 7. *T. thanetana* Lalicker, n. sp. × 45. Holotype. *a*, front view; *b*, apertural view; *c*, side view. Eocene, England.
- FIGS. 8, 9. *T. dollfussi* Lalicker, n. sp. × 33. Fig. 8, Paratype. *a*, front view; *b*, apertural view. Fig. 9, Holotype. *a*, front view; *b*, apertural view; *c*, side view. Miocene, France.

Figures drawn by Margaret S. Moore.



above the inner margin of the last-formed chamber, with a distinct lip above and below. Length of holotype 0.68 mm.; greatest width 0.40 mm.; thickness 0.34 mm.

Holotype (Cushman Coll. No. 6127) from the Eocene of sea cliff, 90-240 feet below top, 1.85 miles north of the Scripps Institution of Oceanography, and 3.60 miles north of La Jolla, San Diego Co., California. Collected by Dr. M. A. Hanna.

This species is somewhat similar to *Textularia labiata* Reuss from the Pliocene of Antwerp, Belgium, but a comparison shows it is much longer, has higher chambers which are more inflated, and the aperture is above the margin of the chamber and has a distinct lip on both the upper and lower margins, whereas the aperture of *T. labiata* is at the margin of the chamber and only has a lip at the upper margin.

**TEXTULARIA LONTENSIS** Lalicker, n. sp. (Pl. 7, figs. 2, 3)

Test rather large, about twice as long as wide, tapering, subovate in top view, periphery broadly rounded; chambers indistinct in early portion, somewhat inflated in adult portion of test, wider than high; sutures depressed, straight, only slightly oblique; wall coarsely arenaceous, composed of fine and coarse sand grains and considerable cement; aperture a rather broad, low opening at the inner margin of the last-formed chamber, in a distinct reëntrant. Length of holotype 1.04 mm.; greatest width 0.56 mm.; thickness 0.46 mm.

Holotype (Cushman Coll. No. 21930) from the Upper Eocene, Bartonian of Val di Lonte, Italy, where it is frequent.

**TEXTULARIA MIDWAYANA** Lalicker, n. sp. (Pl. 6, figs. 7-9)

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

Holotype (Cushman Coll. No. 21932) from the uppermost Midway, 0.15 of a mile west of bridge on Kerens-Round Prairie Road.

3.8 miles by road south-southeast of the railroad station in Kerens, Navarro Co., Texas, where it is frequent. Collected by Mrs. Helen Jeanne Plummer.

This species is similar to *Textularia plummerae* Lalicker, n. sp., but differs in having a rapidly expanding early portion, nearly parallel sides in adult portion, in having lower chambers throughout, a more narrow aperture, and in being more smoothly finished.

TEXTULARIA OVULATA Lalicker, n. sp. (Pl. 6, figs. 11, 12)

*Textularia rugosa* D'ORBIGNY (not REUSS), Ann. Sci. Nat., vol. 7, 1826, p. 262 (*nomen nudum*).—FORNASINI, Riv. Ital. Pal., vol. 7, 1901, p. 105, pl. 3, fig. 3.

Test small, subovate in front and side views, periphery broadly rounded; chambers comparatively few, rapidly increasing in height as added, somewhat inflated; sutures distinct, slightly depressed, straight or slightly curved, oblique; wall coarsely arenaceous, composed of fine and coarse sand grains with considerable cement; aperture a rather highly arched opening at the inner margin of the last-formed chamber in a distinct reëntrant. Length of holotype 0.64 mm.; greatest width 0.39 mm.; thickness 0.27 mm.

Holotype (Cushman Coll. No. 21935) from the Miocene, Aquitanian superieur, Moulin du Minoy, Salles, France, where it is common. Collected by Dr. G. Dollfuss. It has also been found in considerable numbers in the Burdigalien moyen, Leognan, France, and in the Miocene of Kalksburg and Steinabrunn, Austria.

TEXTULARIA PLUMMERAE Lalicker, n. sp. (Pl. 6, fig. 10)

*Textularia cocaena* PLUMMER (not GÜMBEL), Univ. Texas Bull. No. 2644, 1926, p. 67, pl. 3, figs. 2 a, b.

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

Holotype (Cushman Coll. No. 21922) from the Mexia clay member, Wills Point formation, Midway group, about 35 feet above the Tehuacana limestone, from a steep bank along the east

side of a tributary flowing due north into Tehuacana Creek, about 2 miles in a direct line north and slightly west of the center of the town of Mexia, about one-quarter of a mile west of the railroad, Limestone Co., Texas. Collected by Mrs. Helen Jeanne Plummer.

This species was originally described as "*Textularia eocaena* (Gümbel)," but an examination of a number of Gümbel's species shows definitely it is a *Gaudryina*. It is a frequent species in the upper part of the Midway, but is not common at any horizon.

*TEXTULARIA SUTTONENSIS* Lalicker, n. sp. (Pl. 7, fig. 4)

*Textularia sulcata* JONES (not EHRENBERG), Crag Foram., Pal. Soc., 1895 (1897), p. 146, pl. 5, fig. 20.

Test short, width and length nearly equal, thick, periphery subacute, only slightly lobulate; chambers comparatively few, about twice as wide as high, the upper portion of each chamber thickened, protruding more than the lower portion of adjacent chamber; sutures distinct, somewhat depressed, gently curving in an anterior direction; wall finely arenaceous with a large proportion of cement, smoothly finished; aperture a very low, broad opening in a rather deep reëntrant at the inner margin of the last-formed chamber. Length of holotype 0.31 mm.; greatest width 0.31 mm.; thickness 0.21 mm.

Holotype (Cushman Coll. No. 21921) from the Lower Pliocene, Sutton, England.

*TEXTULARIA THANETANA* Lalicker, n. sp. (Pl. 7, fig. 7)

*Textularia sagittula* BURROWS and HOLLAND (not DEFRANCE), Proc. Geol. Assoc., vol. 15, 1897, p. 31, pl. 2, fig. 10.

Test elongate, tapering, about twice as long as broad, sub-rhomboidal in apertural view, periphery subacute; chambers numerous, about twice as wide as high, increasing gradually in height as added, slightly inflated; sutures distinct, depressed, straight, and oblique, forming an angle of 25°-30° with the horizontal; wall rather finely arenaceous with considerable cement, smoothly finished; aperture a broad, rather low opening at the base of the inner margin of the last-formed chamber. Length of holotype 0.72 mm.; greatest width 0.41 mm.; thickness 0.26 mm.

Holotype (Cushman Coll. No. 21923) from bed B of the Thanet beds, Lower Eocene, Pegwell Bay, England. Collected by Dr. J. A. Cushman.

The early portion of this species is rounded, and looks like a *Spiroplectamina*, but a detailed examination of several specimens shows it should be referred to *Textularia*.

## RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the foraminifera that have come to hand.

- Parr, Walter J.** Tertiary Foraminifera from Chalky Island, S. W. New Zealand.—*Trans. Roy. Soc. New Zealand*, vol. 64, 1934, pp. 140-146, pl. 20, 3 text figs.—There are 27 species and varieties listed, of which one, *Halkyardia bartrumi*, is new.
- Chen, S.** A New Species of Fusulinidae from the Meitien Limestone.—*Bull. Geol. Soc. China*, vol. XIII, No. 2, 1934, pp. 237-242, pl. 1.—A new genus, *Gallowaina*, with a new species, *G. meitienensis*, and a new variety, *evoluta*.
- Macfadyen, W. A. and E. J. André Kenny.** On the Correct Writing, in Form and Gender, of the Names of the Foraminifera.—*Journ. Roy. Micr. Soc.*, vol. LIV, 1934, pp. 177-181.—This should be consulted by all those publishing on the Foraminifera.
- Chen, S.** Fusulinidae of South China. Part I.—*Palaeontologia Sinica*, ser. B, vol. IV, fasc. 2, November, 1934, pp. 1-185, pls. I-XVI, 36 graphs.—One new genus, *Quasifusulina*, is erected, and 43 new species and varieties. The abundant illustrations are from microphotographs.
- Chapman, F., W. Howchin, and W. J. Parr.** A Revision of the Nomenclature of the Permian Foraminifera of New South Wales.—*Proc. Roy. Soc. Victoria*, vol. XLVII, (new series), pt. 1, Dec. 22, 1934, pp. 175-189, 5 text figs.—Discuss the relationships of several of the genera, revise the names of previously described species, and give two new names, *Lingulina davidi* and *Ammodiscus planoconvexus*.
- Tan, Sin Hok.** Über mikrosphäre Lepidocyclinen von Ngampel (Rembang, Mitteljava).—“*De Ingenieur in Nederlandsch Indië*,” IV. Mijnbouw en Geologie, “*De Mijningenieur*,” Jaarg. I, No. 12, December, 1934, pp. 203-211, pls. 1, 2, 4 text figs.  
Über *Lepidocyclina gigantea* K. Martin von Süd-Priangan (Westjava), Tegal (Mitteljava) und Benkoelen (Südsumatra).—*l. c.*, Jaarg. II, No. 1, January, 1935, pp. 1-8, pls. 1-3.  
Zwei neue mikrosphäre Lepidocyclinen von Java.—*l. c.*, Jaarg. II, No. 2, February, 1935, pp. 9-18, pls. (I)IV-(IV)VII.—*L. stratifera* and *L. omphalus*, n. spp. described and figured.  
All three papers are illustrated with excellent microphotographs.
- Macfadyen, W. A.** Jurassic Foraminifera.—From the Geology and Palaeontology of British Somaliland, Part II. The Mesozoic Palaeontology of British Somaliland, London, January, 1935, pp. 7-20, 1 pl.—24 species described, all but one figured, none new.
- Hadley, Wade H., Jr.** Seven New Species of Foraminifera from the Tertiary of the Gulf Coast.—*Bull. Amer. Pal.*, vol. 22, No. 74, Mar. 11, 1935, pp. 1-10, pl. 1.—Describes and figures the following new species: *Gaudryina koimeteoreola*, *Massilina goniopleura*, *Bitubulogenerina chichasawayica*, *Spiroloculina bidentata*, *Baggina xenoula*, *Pulvinulinella harrisi*, and *Bifarina tombigbeensis*.

J. A. C.