

CONTRIBUTIONS FROM THE CUSHMAN
LABORATORY FOR FORAMINIFERAL RESEARCH

NO. 195. ADDITIONAL NEW SPECIES OF AMERICAN
CRETACEOUS FORAMINIFERA

By JOSEPH A. CUSHMAN*

The following new forms from the American Cretaceous are here published so that they may be available for the many workers on our American Cretaceous foraminifera pending the publication of the large work now nearly completed on the Cretaceous foraminifera of the Gulf Coastal Plain of the United States and adjacent regions.

The figures are from drawings and retouched photographs.

ROBULUS NAVARROENSIS (Plummer), var. **EXTRUATUS** Cushman, n. var. (Pl. 5, fig. 1)

Variety differing from the typical in the sutures which instead of fusing into the smooth umbo are much raised, forming thickened ridges, especially at the inner ends, and the whole test tending slightly to uncoil.

Holotype of variety (Cushman Coll. No. 24542) from the Corsicana marl of the Navarro group, Mexia highway at forks of Wortham road, 2.8 mi. ESE. of Cooleedge, Limestone Co., Texas.

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.

* Published by permission of the Director of the United States Geological Survey.

ROBULUS SPISSO-COSTATUS Cushman, n. sp. (Pl. 5, fig. 2)

Test much compressed, close 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, 9-12 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 1.00-1.65 mm.; thickness 0.45-0.55 mm.

Holotype (Cushman Coll. No. 24544) from the Corsicana marl of the Navarro group, Mexia highway at forks of Wortham road, 2.8 miles ESE. of Coolee, Limestone Co., Texas.

This species is a characteristic one of the upper part of the Navarro above the Nacatoch sand. It occurs in the Corsicana marl, Kemp clay and Arkadelphia marl, and also in the Prairie Bluff chalk. It differs from *R. navarroensis* (Plummer) in not having a thin, flange-like keel, and in the peculiarly raised sutures becoming thick and rounded at the inner end.

ROBULUS PSEUDO-SECANS Cushman, n. sp. (Pl. 5, fig. 3)

Test strongly umbonate thence thinning 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 1.00-1.40 mm.; thickness 0.65-0.80 mm.

Holotype (Cushman Coll. No. 24550) from Selma chalk, Jim Wilkin's property, 300 yards N. of Union Church, Hardin Co., Tenn.

This 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. So far as seen, our species is found only in the Selma and upper part of Taylor marl samples close to the Taylor-Navarro contact.

MARGINULINA INCONSTANTIA Cushman, n. sp. (Pl. 5, figs. 4-9)

Test compressed, in the microscopic form almost completely close 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 0.70-1.00 mm.

Holotype (Cushman Coll. No. 24553) from basal part of Taylor marl just above Austin contact, E. side of Buckner Boulevard, 2 ft. below pavement, 0.1 mile N. of intersection with U. S. Highway No. 80, near Buckner Orphans Home, E. of Dallas, Dallas Co., Texas.

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.

MARGINULINA JUNCEA Cushman, n. sp. (Pl. 5, fig. 10)

Test very elongate, slender, earliest portion coiled, becoming quickly uncoiled and rectilinear, slightly curved; chambers distinct, earliest coiled ones not inflated, later ones 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.

Holotype (Cushman Coll. No. 24556) from Taylor marl, road ditch, N-facing slope of Bullhide Creek valley, 5½ miles E. by S. of Lorena, McLennon Co., Texas.

This species differs from *Marginulina texana* Cushman in the more slender 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 MUNDA Cushman, n. sp. (Pl. 5, figs. 11, 12)

Test elongate, slender, much compressed, periphery subacute, early portion close coiled, slightly evolute, adult uncoiled, slightly curved; chambers very distinct and sharply outlined, increasing slowly in size, earliest ones triangular in side view, later ones 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 0.25-0.30 mm.

Holotype (Cushman Coll. No. 24559) from Taylor marl, 0.3 mi. by road SE. of Gastonia, Texas. It also occurs in the Taylor, E. of Crandall and 2.7 mi. by road NW. of Gastonia.

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.

MARGINULINA CURVATURA Cushman, n. sp. (Pl. 5, figs. 13, 14)

Test elongate, slightly if at all compressed, early portion coiled, later chambers uncoiled in a slightly curved line which gradually becomes straight; chambers distinct, becoming gradually more inflated toward the apertural end, considerably overlapping, 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 0.25-0.30 mm.

Holotype (Cushman Coll. No. 24581) from the Navarro, Corsicana marl, 17 ft. above base of bluff on Onion Creek, 2¼ mi. W. of Old Garfield, Travis Co., Texas. It also occurs in the Corsicana marl of other localities, and in the Arkadelphia marl of Arkansas.

M. curvatura differs from *M. texana* Cushman in the greater proportion of curved early chambers, more curved later portion, and lack of a ridge-like pinching in of the dorsal margin in the early stages.

MARGINULINA SILIQUA Cushman, n. sp. (Pl. 5, figs. 15, 16)

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 form-

ing 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 0.50-0.60 mm.; breadth 0.20 mm.

Holotype (Cushman Coll. No. 24585) from near the base of the Kemp clay of the Navarro group, branch of Mustang Creek, 1 mi. WSW. of Noack, 900 ft. downstream from road, 0.2 mi. SW. of Christ Evangelical Lutheran Church, Williamson Co., Texas. It also occurs in the Arkadelphia marl and in the Corsicana marl.

M. siliqua differs from *M. cretacea* Cushman in the fewer and more distinct chambers, ventral margin not concave, and a tendency to contract rather than expand toward the apertural end.

MARGINULINA JARVISI Cushman, n. sp. (Pl. 5, figs. 17, 18)

Cristellaria grata CUSHMAN (not REUSS), Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 598, pl. 19, figs. 1 a, b.

Lenticulina grata CUSHMAN and JARVIS (not REUSS), Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 96, pl. 14, fig. 3.

Marginulina grata CUSHMAN and JARVIS (not REUSS), Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 25, pl. 7, fig. 7; pl. 8, fig. 3.

Marginulina schloenbachi CUSHMAN and JARVIS (not REUSS), l. c., 1932, p. 26, pl. 8, fig. 5.

Test compressed, elongate, earliest portion coiled, later uncoiling, periphery rounded; ventral margin slightly concave, dorsal margin convex; chambers distinct, rather few, the earliest 4-6 coiled, remainder uncoiled, not inflated; sutures distinct, slightly limbate, not raised, somewhat curved; wall smooth; aperture at the peripheral angle, radiate. Length 1.00-1.40 mm.; breadth 0.30-0.40 mm.; thickness 0.20-0.25 mm.

Holotype (Cushman Coll. No. 15351) from Upper Cretaceous, pit at Lizard Springs, near Guayaguayare, Trinidad, B. W. I.

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.

VAGINULINA TAYLORANA Cushman, n. sp. (Pl. 5, fig. 19)

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 ones showing a slight tendency toward coiling; sutures distinct, limbate, the median portion of each thickened, forming an elongate, elliptical, bead-like process; wall smooth except for the thickened sutures; aperture radiate, at the dorsal angle, only slightly projecting. Length up to 3 mm.; breadth 0.70 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 24572) from upper part of Taylor marl, 5 mi. SE. of Taylor, Williamson Co., Texas.

This species seems to be confined to the upper part of the Taylor marl. In some respects it 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 siltcula* Plummer in the swollen central areas above the sutures, but is very different in its other characters.

PALMULA SIMPLEX Cushman, n. sp. (Pl. 6, fig. 1)

Test elongate, much compressed, greatest thickness at the umbo, formed by the proloculum, thence thinning 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 close 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 0.30-0.35 mm.

Holotype (Cushman Coll. No. 24578) from Pecan Gap chalk member of the Taylor marl on secondary road to Otto at crossing of "Big Creek," 3.2 mi. SW. of Mart, McLennon Co., Texas. 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.

P. simplex differs from *P. rugosa* in the nearly parallel sides and very smooth surface ornamented with very numerous, very fine, longitudinal striae.

PALMULA PILULATA Cushman, n. sp. (Pl. 6, fig. 2)

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 ones of rather uniform shape, increasing very gradually in size, adult ones chevron-shaped, extending backward at the sides but not including much of the early coiled ones; sutures limbate, very slightly raised, each of the earlier ones 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.

Holotype (Cushman Coll. No. 24575) from the Bonham marl, U. S. Highway 271, 4.5 mi. N. of Paris, 0.7 mi. S. of Hinckley, Lamar Co., Texas.

This 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* (Nilson) in the much greater coiled stage, the somewhat raised sutures, and beaded ornamentation.

DENTALINA INVOLVENS Cushman, n. sp. (Pl. 6, fig. 3)

Test small, elongate, slender, of nearly uniform diameter throughout, slightly curved, initial end with a distinct spine; chambers few, distinct, except the earliest ones, later ones slightly inflated, somewhat overlapping; early sutures indistinct, later ones slightly depressed; wall ornamented by longitudinal costae, those of the early portion coarse and strongly twisted, later ones 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.

Holotype (Cushman Coll. No. 24587) from Austin chalk, on road at N. edge of Whitewright, north-facing slope of branch valley, Grayson Co., Texas.

This is a peculiarly ornamented species, and holds its characters very closely. It differs from *D. alternans* (Jones) in the smaller, more slender test, fewer costae, and the peculiarly twisted character of the ornamentation.

DENTALINA BASITORTA Cushman, n. sp. (Pl. 6, figs. 4, 5)

Test elongate, slender, somewhat curved, initial end with a basal spine, early portion with the chambers somewhat twisted,

later uniserial; chambers distinct, the earliest ones elongate, twisted about the elongate axis or even appearing somewhat irregularly biserial, not inflated, later ones strongly inflated, less overlapping; sutures distinct, earlier ones very strongly oblique, not depressed, later ones gradually less oblique and progressively more depressed; wall smooth; aperture terminal, radiate. Length up to 1.00 mm.; diameter 0.18 mm.

Holotype (Cushman Coll. No. 24589) from near the top of the Selma chalk, Alpina road, 2 mi. S. of Graham, Union Co., Miss. It also occurs at several localities in the upper part of the Taylor marl.

Dentalina basitorta differs from *D. legumen* (Reuss) in the early stages which in our species are very peculiarly twisted and the sutures very oblique. This peculiar early character is held in all the specimens to a greater or lesser degree, and should make this species easily recognizable and a good index fossil for this part of the Taylor marl.

DENTALINA BASIPLANATA Cushman, n. sp. (Pl. 6, figs. 6-8)

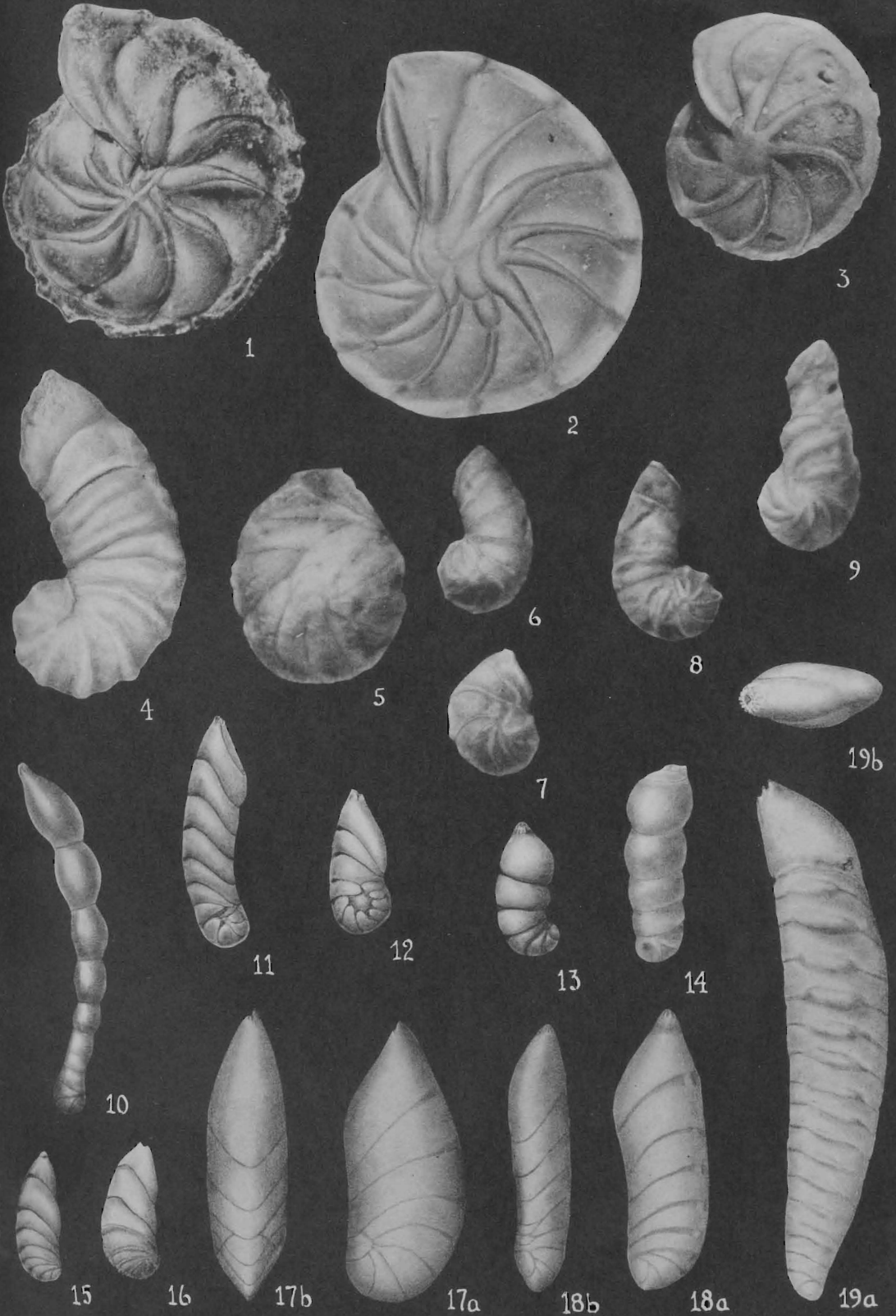
Dentalina annulata CUSHMAN (not REUSS), Bull. 41, Tenn. Geol. Surv., 1931, p. 28, pl. 3, fig. 3.

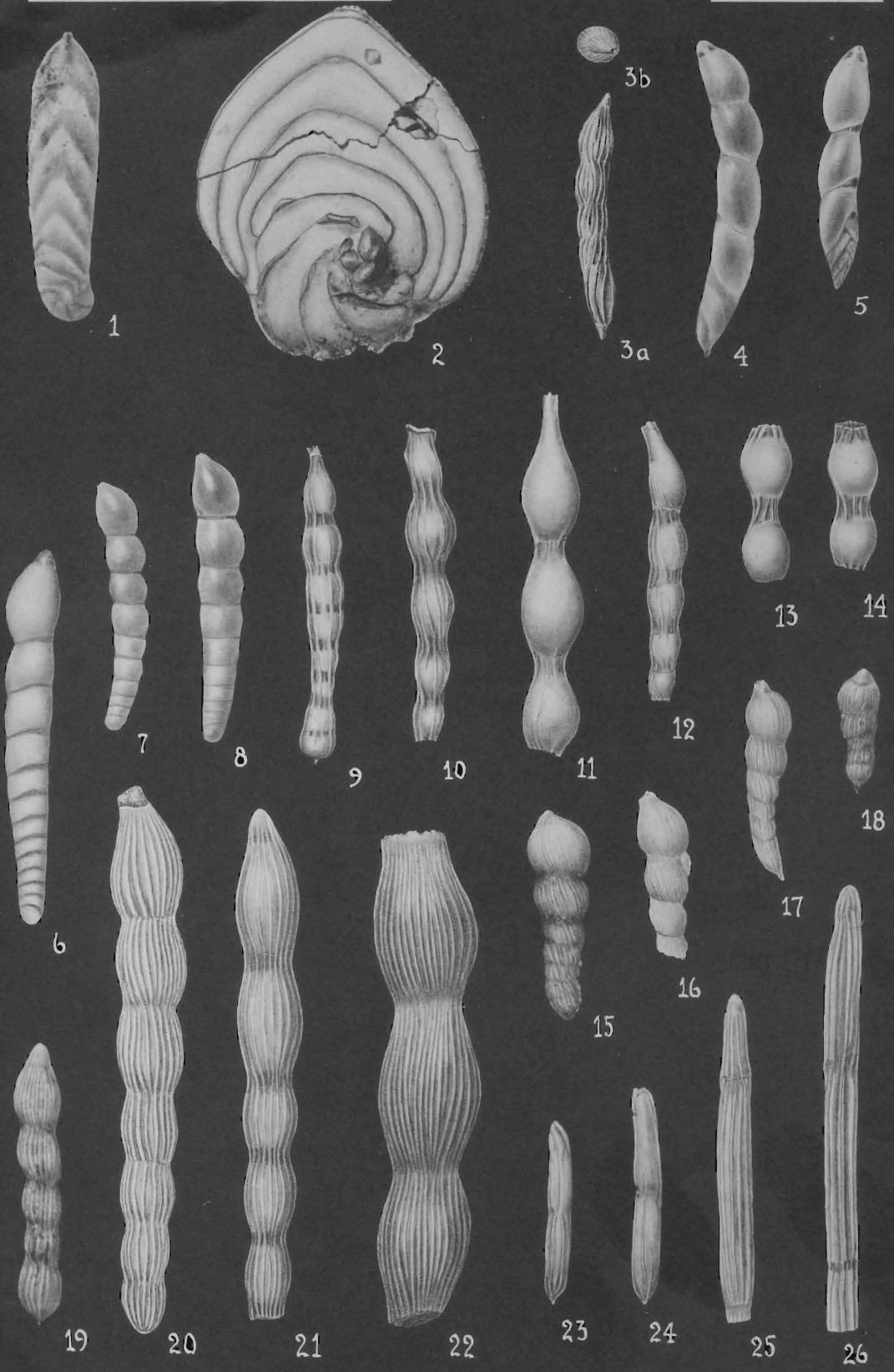
Test very elongate, slightly tapering, usually slightly curved, early portion showing oblique costae indicating coiling, especially in the microspheric form and often slightly compressed; chambers distinct, earlier ones not inflated, later becoming increasingly

EXPLANATION OF PLATE 5

FIGS.

1. *Robulus navarroensis* (Plummer), var. *extruatus* Cushman, n. var. $\times 37\frac{1}{2}$. Holotype.
2. *R. spisso-costatus* Cushman, n. sp. $\times 37\frac{1}{2}$. Holotype.
3. *R. pseudo-secans* Cushman, n. sp. $\times 37\frac{1}{2}$. Holotype.
- 4-9. *Marginulina inconstantia* Cushman, n. sp. 4, Holotype. $\times 55$. 5-9, Paratypes. $\times 26$. 5, 7, Microspheric. 4, 6, 8, 9, Megalospheric.
10. *M. juncea* Cushman, n. sp. $\times 37\frac{1}{2}$. Holotype.
- 11, 12. *M. munda* Cushman, n. sp. $\times 37\frac{1}{2}$. 11, Holotype. 12, Paratype.
- 13, 14. *M. curvatura* Cushman, n. sp. $\times 37\frac{1}{2}$. 14, Holotype. 13, Paratype.
- 15, 16. *M. siliqua* Cushman, n. sp. $\times 37\frac{1}{2}$. 15, Holotype. 16, Paratype.
- 17, 18. *M. jarvisi* Cushman, n. sp. $\times 55$. 18, Holotype. 17, Paratype. 17 a, 18 a, side views; 17 b, 18 b, peripheral views.
19. *Vaginulina taylorana* Cushman, n. sp. $\times 25$. a, side view; b, apertural view. Holotype.





inflated as added, earlier ones much more strongly overlapping; sutures distinct, somewhat limbate, earlier ones flush with the surface, oblique, later ones 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 0.20-0.25 mm.

Holotype (Cushman Coll. No. 24591) from Corsicana marl, clay pit, 2 mi. S. of Corsicana Court House, Navarro Co., Texas.

This species is often very abundant in the Corsicana marl, Kemp clay and Arkadelphia marl. Specimens occur less commonly in the upper part of the Selma chalk, and there are scattering specimens from the Neylandville marl and a very few localities in the uppermost part of the Taylor marl. There are specimens in the Upper Cretaceous of Mexico that 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. megapolitana* Reuss also belong here.

DENTALINA SOLVATA Cushman, n. sp. (Pl. 6, figs. 9-14)

Test elongate, slender, slightly curved, initial end with a short spine; chambers distinct, early ones slightly overlapping, gradu-

EXPLANATION OF PLATE 6

FIGS.

1. *Palmula simplex* Cushman, n. sp. $\times 30$. Holotype.
2. *P. pilulata* Cushman, n. sp. $\times 18$. Holotype.
3. *Dentalina involvens* Cushman, n. sp. $\times 37\frac{1}{2}$. Holotype. a, front view; b, apertural view.
- 4, 5. *D. basitorta* Cushman, n. sp. $\times 55$. 4, Holotype. 5, Paratype.
- 6-8. *D. basiplanata* Cushman, n. sp. 6, Holotype. $\times 37\frac{1}{2}$. 7, 8, Paratypes. $\times 22\frac{1}{2}$.
- 9-14. *D. solvata* Cushman, n. sp. $\times 37\frac{1}{2}$. 9, Holotype. 10-14, Paratypes.
- 15-18. *D. pertinens* Cushman, n. sp. $\times 37\frac{1}{2}$. 15, Holotype. 16-18, Paratypes.
- 19, 20. *D. delicatula* Cushman, n. sp. 20, Holotype. $\times 55$. 19, Paratype. $\times 30$.
- 21, 22. *D. angusticostata* Cushman, n. sp. $\times 55$. 21, Holotype. 22, Paratype.
- 23-26. *Nodosaria gracilitatis* Cushman, n. sp. $\times 30$. 26, Holotype. 23-25, Paratypes. 23, 24, showing early stages. 25, 26, apertural portions.

ally 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, stolon-like portions; sutures distinct, strongly limbate, more and more depressed as growth proceeds; wall in the early portion with longitudinal costae, 8-10 in number, 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 0.20-0.22 mm.

Holotype (Cushman Coll. No. 24594) from Selma chalk, gully near public road, 3½ mi. NW. of Booneville, Miss.

The species occurs at a number of localities in the upper part of the Taylor marl, and in the lower part of the Navarro as well as scattered specimens elsewhere.

The later chambers become much separated from each other, and the connecting stolons are easily broken so that perfect specimens are very rare.

DENTALINA PERTINENS Cushman, n. sp. (Pl. 6, figs. 15-18)

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.

Holotype (Cushman Coll. No. 24595) from upper part of Taylor marl, on road to Corsicana, 2.6 mi. E. of Barry, Navarro Co., Texas.

This species differs from *D. multicosata* 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.

DENTALINA DELICATULA Cushman, n. sp. (Pl. 6, figs. 19, 20)

Test elongate, slender, gently curved, initial end with a distinct spine, very slightly tapering; chambers distinct, earlier ones 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 ones somewhat depressed; wall ornamented with numerous, 15-20, rather high, plate-like, 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.

Holotype (Cushman Coll. No. 24599) from Corsicana marl, 35 feet above base of bluff on Onion Creek, 2½ mi. W. of Old Garfield, Travis Co., Texas.

In some respects this species resembles *D. alternata* (Jones), but it is a more delicate, thinner-walled form, with a larger number of costae. It seems to be characteristic of the Corsicana marl.

DENTALINA ANGUSTICOSTATA Cushman, n. sp. (Pl. 6, figs. 21, 22)

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 continuing across the sutures and 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.

Holotype (Cushman Coll. No. 24561) from Corsicana marl of the Navarro group, Mexia highway at forks of Wortham road, 2.8 mi. ESE. of Coolegge, Limestone Co., Texas.

This species differs from *D. multicostata* d'Orbigny in the more slender test, more fusiform chambers, and very abundant and narrow costae.

NODOSARIA GRACILITATIS Cushman, n. sp. (Pl. 6, figs. 23-26)

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 6-12 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.

Holotype (Cushman Coll. No. 24564) from near base of upper part of Taylor marl, road cut, E. bank, near crest of hill, 14.4 mi. S. of Paris, 0.9 mi. N. of Lake City, Delta Co., Texas.

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, non-depressed sutures, the ornamentation covering the entire test, and the very elongate proloculum.

NODOSARIA CORSICANANA Cushman, n. sp. (Pl. 7, figs. 1-4)

Test elongate, slightly if at all tapering, initial end pointed with a distinct spine; chambers few, usually 2-5, 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, 10-14, longitudinal costae, only slightly raised and narrow, slightly twisted, not interrupted at the sutures; aperture radiate, terminal. Length up to 3.00 mm.; diameter 0.25-0.35 mm.

Holotype (Cushman Coll. No. 24568) from Corsicana marl, road ditch, 3.5 mi. NW. of Union Seminary School, 4.3 mi. SSE. of Corbet, Navarro Co., Texas.

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.

CHRYSALOGONIUM EXIMIUM Cushman, n. sp. (Pl. 7, figs. 5-8)

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 fine longitudinal costae, 18-24 in number, in the adult sometimes 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.

Holotype (Cushman Coll. No. 24570) from Pecan Gap chalk, member of Taylor marl, on secondary road to Otto at crossing of "Big Creek," 3.2 mi. SW. of Mart, McLennon Co., Texas.

This species differs from *C. texanum* Cushman particularly in the ornamentation of the wall and the somewhat more slender and slightly less inflated chambers.

LINGULINA TAYLORANA Cushman, n. sp. (Pl. 7, fig. 9)

Test minute, compressed, tapering, peripheral margins of each chamber keeled near the base, 2-3 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 0.20-0.30 mm.; breadth 0.12-0.14 mm.

Holotype (Cushman Coll. No. 24580) from lower part of Taylor marl, ditch E. of Commerce-Paris highway, 8.4 mi. S. of Paris, Lamar Co., Texas.

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 the thin flanges at the basal angles of the chambers.

RAMULINA NAVARROANA Cushman, n. sp. (Pl. 7, figs. 10, 11)

Test consisting of a central, more or less globular body from which radiate comparatively large, stout tubular projections which are little if at all tapering; wall of the central portion smooth, the arms sometimes hispid or finely spinose.

Holotype (Cushman Coll. No. 24600) from Corsicana marl, Mexia road, 2.75 mi. E. of Coolegge on east-facing slope of Elm Creek Valley, Limestone Co., Texas.

This species differs from *R. laevis* Rupert Jones in the more globular central body, more definite radiating projections with the finely spinose or hispid surface of the projections.

The distribution seems to be confined to the Corsicana marl of the Navarro group.

RAMULINA ARKADELPHIANA Cushman, n. sp. (Pl. 7, figs. 12-14)

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.

Holotype (Cushman Coll. No. 24602) from Arkadelphia marl, near base, 7 mi. N. by W. of Hope, Hempstead Co., Arkansas.

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.

RAMULINA ORNATA Cushman, n. sp. (Pl. 7, fig. 15)

Ramulina sp(?) (part) CUSHMAN and JARVIS, Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 41, pl. 12, fig. 11 (not fig. 10).

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.

Holotype (Cushman Coll. No. 15400) from Upper Cretaceous, pit at Lizard Spring, near Guayaguayare, Southeastern Trinidad, B. W. I. 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, n. sp. (Pl. 7, fig. 16)

Ramulina sp(?) CUSHMAN, Bull. 41, Tenn. Geol. Survey, 1931, p. 42, pl. 7, fig. 1.

In the upper part of the Taylor marl in the Pecan Gap chalk member, and in the Selma and Annona chinks there 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.

Holotype (Cushman Coll. No. 15208) from Selma chalk, 1½ mi. W. of Sardis, on Sardis-Henderson road, Henderson Co., Tenn.

This species differs from *R. laevis* Rupert Jones in the more globular central chamber, finer tubular projections, and hispid surface.

NONIONELLA ANSATA Cushman, n. sp. (Pl. 7, fig. 17)

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, little if at all depressed, 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.

Holotype (Cushman Coll. No. 24606) from Prairie Bluff chalk, on U. S. Highway 80, 2.4 mi. ESE. of So. Ry. underpass at Livingston, Sumter Co., 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.

RECTOGUMBELINA MINUTA Cushman, n. sp. (Pl. 7, fig. 18)

Test minute, elongate, about 2-2½ 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 ones increasing rapidly in size as added, uniserial ones in the adult somewhat overlapping, subglobular; sutures distinct, slightly depressed, early ones 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 0.30-0.35 mm.; diameter 0.15 mm.

Holotype (Cushman Coll. No. 24609) from near the base of the upper part of the Taylor marl, road cut, E. bank, near crest of hill, 14.4 mi. S. of Paris, 0.9 mi. N. of Lake City, Delta Co., Texas.

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.

LOXOSTOMA MINUTISSIMUM Cushman, n. sp. (Pl. 7, fig. 19)

Test minute, elongate, about three times as long as broad, somewhat compressed, periphery slightly lobulate, rounded in end view; chambers distinct, early ones much broader than high, but in the adult much higher than broad, later ones inflated; sutures distinct, slightly depressed, earlier ones strongly oblique, later ones strongly curved; wall smooth; aperture in the adult terminal, oval, with a distinct lip. Length 0.25-0.30 mm.; breadth 0.10-0.12 mm.; thickness 0.07-0.08 mm.

Holotype (Cushman Coll. No. 24608) from near the base of the upper part of the Taylor marl, road cut, E. bank, near crest of hill, 14.4 mi. S. of Paris, 0.9 mi. N. of Lake City, Delta Co., Texas.

This species differs from *L. plaitum* (Carsey) in the smaller

size, fewer chambers and rapid rate of relative height of the adult chambers.

It is very abundant at the type locality, but on account of its small size may be easily overlooked.

NODOSARELLA TEXANA Cushman, n. sp. (Pl. 8, fig. 1)

Test very slender, elongate, distinctly curved, very slightly tapering; chambers distinct, slightly overlapping, increasing rather regularly in length as added, last ones in the adult 3-4 times as long as broad, very slightly inflated; sutures very slightly depressed in the later portion; wall smooth; aperture sub-terminal, with an arched, hood-like portion over the opening. Length 1.50-1.75 mm.; breadth 0.15 mm.

Holotype (Cushman Coll. No. 24498) from the upper part of the Austin chalk, Farmersville road, 5 mi. E. of McKinney, Collin Co., Texas.

The species occurs in our material only at localities in the upper part of the Austin. It differs from *N. gracillima* Cushman in the distinctly curved test, and the chambers are much longer in the adult.

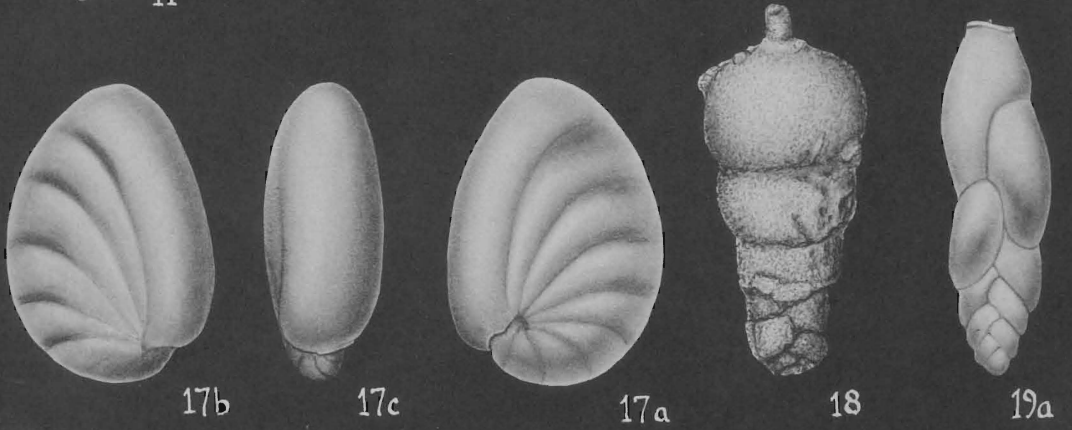
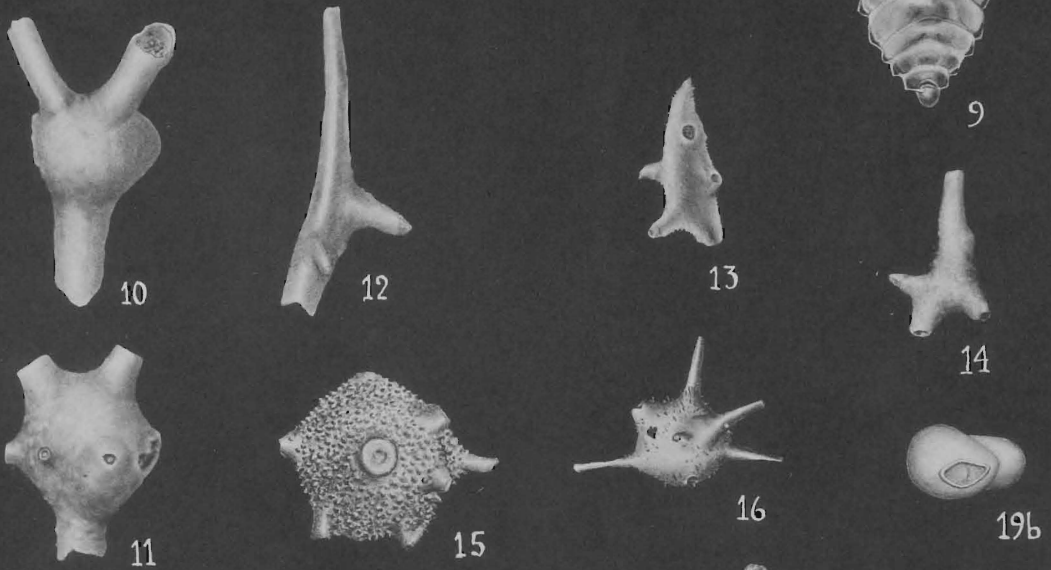
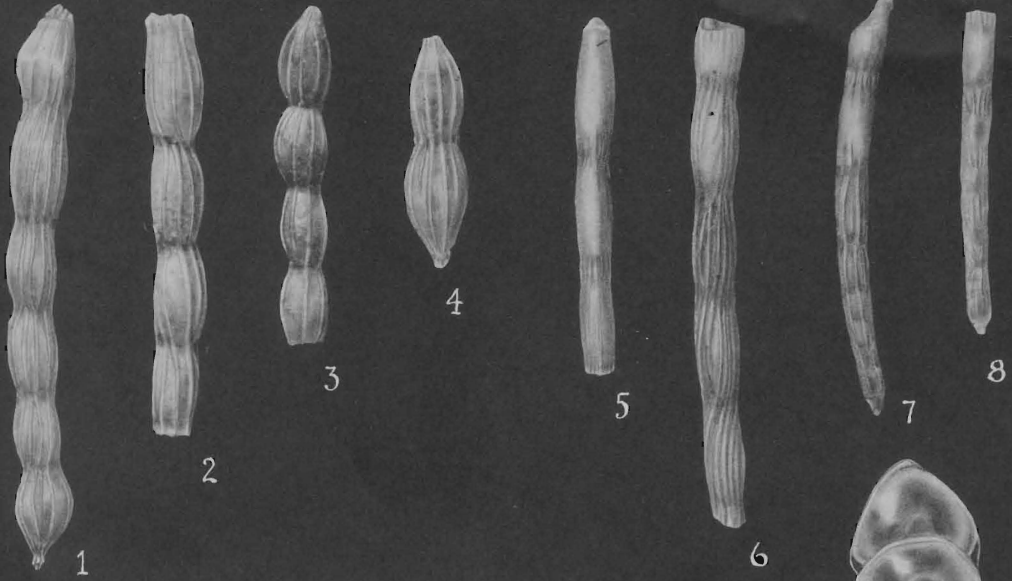
NODOSARELLA PRIMITIVA Cushman, n. sp. (Pl. 8, fig. 2)

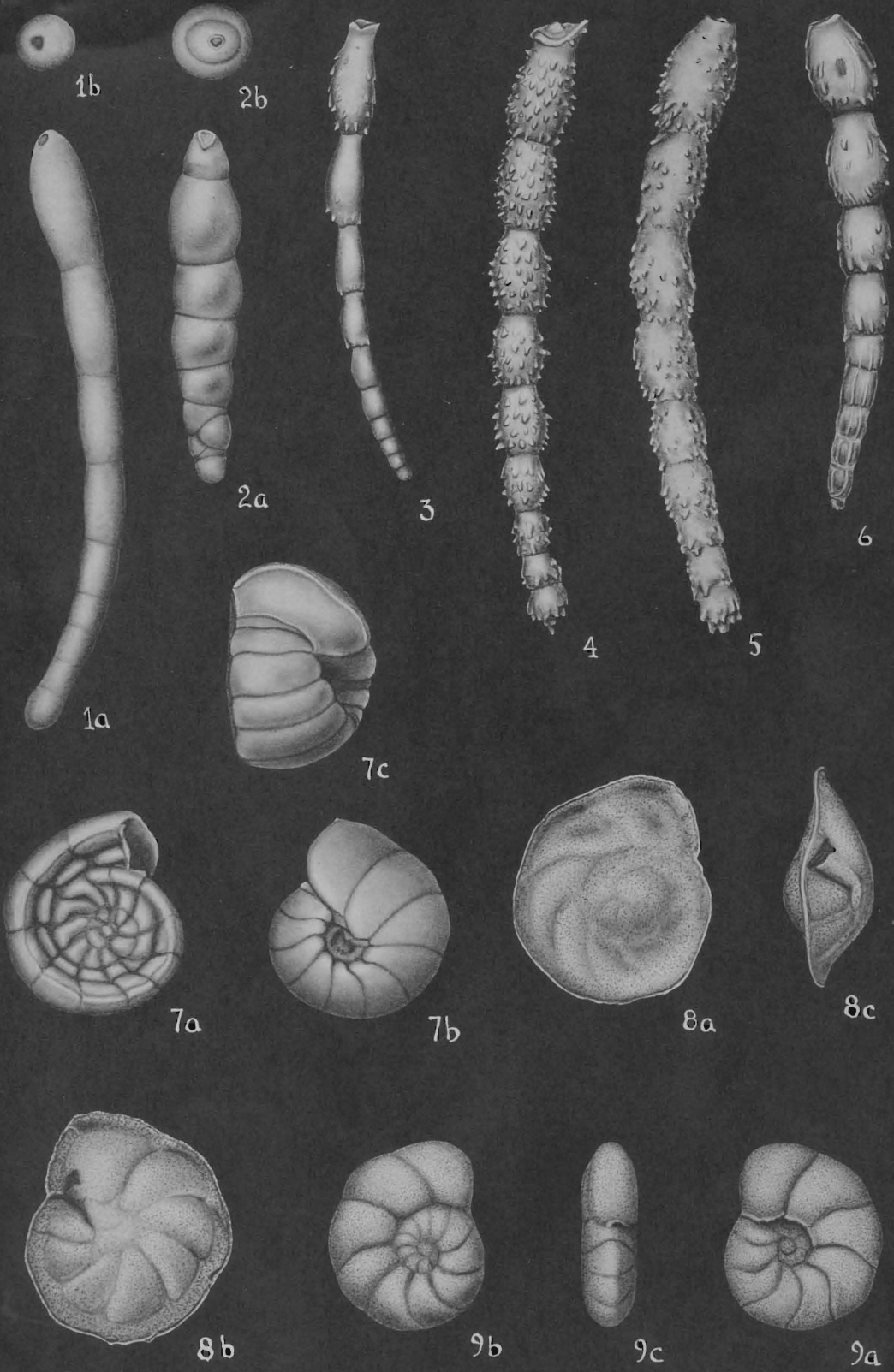
Test elongate, slightly tapering, earliest portion biserial, later uniserial; chambers distinct, inflated, increasing gradually in size

EXPLANATION OF PLATE 7

FIGS.

- 1-4. *Nodosaria corsicanana* Cushman, n. sp. $\times 22\frac{1}{2}$. 1, Holotype. 2-4, Paratypes.
- 5-8. *Chrysalogonium eximium* Cushman, n. sp. $\times 30$. 5, Holotype. 6-8, Paratypes.
9. *Lingulina taylorana* Cushman, n. sp. $\times 150$. Holotype.
- 10, 11. *Ramulina navarroana* Cushman, n. sp. $\times 30$. 11, Holotype. 10, Paratype.
- 12-14. *R. arkadelphiana* Cushman, n. sp. $\times 30$. 13, Holotype. 12, 14, Paratypes.
15. *R. ornata* Cushman, n. sp. $\times 30$. Holotype.
16. *R. globo-tubulosa* Cushman, n. sp. $\times 70$. Holotype.
17. *Nonionella ansata* Cushman, n. sp. $\times 110$. Holotype. a, dorsal view; b, ventral view; c, peripheral view.
18. *Rectogümbelina minuta* Cushman, n. sp. $\times 150$. Holotype.
19. *Lozostoma minutissimum* Cushman, n. sp. $\times 150$. Holotype. a, front view; b, apertural view.





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 0.55-0.70 mm.; breadth 0.15 mm.

Holotype (Cushman Coll. No. 24368) from upper part of Taylor marl, branch of Kickapoo Creek, 1,200 ft. S. of public road, 1.8 mi. NW. of Annona, Red River Co., Texas.

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 shales of the Tampico Embayment region of Mexico, but most of the Mexican specimens are slightly larger than the Texas ones. One of the Mexican specimens was figured as "*Ellipsosiphogenerina* sp (?)" (Cushman, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 591, pl. 20, fig. 12).

N. primitiva differs from *N. gracillima* Cushman in the shorter test, slightly more tumid and fewer chambers, and more tendency to have biserial chambers in the earlier portion.

ELLIPSONODOSARIA STEPHENSONI Cushman, var. SPECIOSA Cushman, n. var.
(Pl. 8, fig. 3)

Variety differing from the typical 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.

EXPLANATION OF PLATE 8

FIGS.

1. *Nodosarella texana* Cushman, n. sp. $\times 55$. Holotype. a, side view; b, apertural view.
2. *N. primitiva* Cushman, n. sp. $\times 90$. Holotype. a, front view; b, apertural view.
3. *Ellipsonodosaria stephensoni* Cushman, var. *speciosa* Cushman, n. var. $\times 55$. Holotype.
- 4, 5. *E. alexanderi* Cushman, var. *impensia* Cushman, n. var. 4, Holotype. $\times 45$. 5, Paratype. $\times 37\frac{1}{2}$.
6. *E. minuta* Cushman, n. sp. $\times 150$. Holotype.
7. *Gyroidina arkadelphia* Cushman, n. sp. $\times 70$. Holotype. a, dorsal view; b, ventral view; c, peripheral view.
8. *Pulvinulinella texana* Cushman, n. sp. $\times 90$. Holotype. a, dorsal view; b, ventral view; c, peripheral view.
9. *Planulina nacatochensis* Cushman, n. sp. $\times 70$. Holotype. a, dorsal view; b, ventral view; c, peripheral view.

Holotype of variety (Cushman Coll. No. 24610) from Arkadelphia marl, 6 mi. N. by W. of Hope, Hempstead Co., Arkansas. This variety is more common in the upper range of the species.

ELLIPSONODOSARIA ALEXANDERI Cushman, var. IMPENSIA Cushman, n. var.
(Pl. 8, figs. 4, 5)

Variety differing from the typical in the greater amount of spinosity, the early chambers in the microspheric form having numerous spines and the adult chambers more fusiform, while those in the typical are usually somewhat pyriform, the number of spines on the adult chambers much more numerous and usually less backwardly pointing than in the typical. The variety is also considerably larger than the typical form.

Holotype (Cushman Coll. No. 23254) from the Navarro group, Corsicana marl, Mexia road, 2.75 mi. E. of Cooledege, Limestone Co., Texas.

The variety replaces the typical form in the upper part of the Navarro, being abundant in the Corsicana marl and somewhat less so in the Kemp clay, occurring in the Arkadelphia marl and in the Prairie Bluff chalk.

The relation may not be a varietal one, and the two forms may be found to be distinct species.

ELLIPSONODOSARIA MINUTA Cushman, n. sp. (Pl. 8, fig. 6)

Test small, slender, slightly curved, gradually tapering initial end with a distinct spine; chambers distinct, later ones somewhat inflated, very slightly overlapping, increasing very gradually in length in the adult, becoming somewhat inflated, somewhat pyriform; sutures distinct, strongly limbate, later ones strongly depressed; wall of the early chambers smooth or slightly costate longitudinally, later becoming progressively spinose on the lower half of the chamber, later in the adult entirely covered with short spines but not costate. Length up to 0.75 mm.; diameter 0.07-0.08 mm.

Holotype (Cushman Coll. No. 24611) from lower portion of the Taylor marl, Bear Creek, 0.8 mi. S. by E. of Lavon, Collin Co., Texas.

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.

GYROIDINA ARKADELPHIANA Cushman, n. sp. (Pl. 8, fig. 7)

Test plano-convex, 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 0.30-0.40 mm.; diameter 0.40-0.50 mm.

Holotype (Cushman Coll. No. 24612) from Arkadelphia marl, 4.5 mi. E. of Washington, in creek $\frac{1}{2}$ mi. N. of Reed's Store, Arkansas.

This differs from *G. subangulata* (Plummer) in the radial sutures, large umbilicus, and peculiar ornamentation of the dorsal side.

PULVINULINELLA TEXANA Cushman, n. sp. (Pl. 8, fig. 8)

Test small, trochoid, biconvex, ventral side slightly more convex than dorsal, periphery with a definite, sharp, thin, flange-like 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 0.35-0.45 mm.; thickness 0.12-0.15 mm.

Holotype (Cushman Coll. No. 24614) from near the base of the upper part of the Taylor marl, branch of Kickapoo Creek, 1,200 ft. S. of public road, 1.8 mi. NW. of Annona, Red River Co., Texas.

This species differs from *P. alata* (Marsson) in having a larger number of chambers in the adult whorl, more nearly biconvex, and the aperture more rounded.

PLANULINA NACATOCHEMENSIS Cushman, n. sp. (Pl. 8, fig. 9)

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 0.40-0.50 mm.; thickness 0.10-0.12 mm.

Holotype (Cushman Coll. No. 24613) from Nacatoch sand, Cyrus Heller's marl bed, Beebe, White Co., Arkansas.

This species differs from *P. taylorensis* (Carsey) in the smaller size, rounded periphery, more evolute form and lack of a central umbo.

RECENT LITERATURE ON THE FORAMINIFERA

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

- Thalman, Hans E.** Synecological Studies in Foraminifera.—*Proc. Geol. Soc. Amer.* for 1935 (June, 1936), p. 364.
Foraminifera.—*Fortschritte der Paläontologie*, Bd. 1, 1937, pp. 66-82.
- Chapman, Frederick and Walter James Parr.** Foraminifera.—*Australasian Antarctic Expedition*, ser. C, vol. 1, pt. 2, 1937, pp. 1-190, pls. VII-X.—342 species and varieties noted, 30 new.
- Lillie, A. and W. J. Schroeder.** Le Nummulitique du vallon des Chambres (Nappe de Morcles, Alpes de Samoëns, Haute-Savoie).—*Compte rendu Soc. Phys. Hist. Nat. Genève*, 1937, pp. 124-127.—Mentions foraminifera.
- Huzimotu, Haruyosi.** Some Fusulinids from Kawanobori-Mura, Kyusyu, Japan.—*Jap. Journ. Geol. Geogr.*, vol. XIV, 1937, pp. 117-125, pls. VII, VIII.—7 species, 3 new.
- Collet, Léon W.** Nouveaux profils de la Vallée de l'Arve, entre le Col de Chatillon et Passy, et de la Tour Saillère.—*Eclogae geologicae Helvetiae*, vol. 30, No. 2, 1937, pp. 293-300, 2 pls.—Mentions foraminifera.
- Deb, S.** Sur la découverte de micro-organismes dans le Plaisancien des Alpes-Maritimes.—*Comptes rendus, Soc. géol. France*, No. 12, 1937, pp. 184, 185.—Lists numerous species.
- Chapman, Fredk. and Walter J. Parr.** On the Discovery of Fusulinid Foraminifera in the Upper Palaeozoic of North-West Australia; With a Note on a New Bivalve.—*Victorian Naturalist*, vol. 53, March, 1937, pp. 175-179, pl. XVI.
- Macfadyen, W. A.** Report on the Foraminifera (in Baden-Powell, D. F. W. On the Holocene Marine Fauna from the Implementiferous Deposits of Island Magee, County Antrim).—*Journ. Animal Ecology*, vol. 6, No. 1, May, 1937, pp. 87-91.—Lists.
- Huzimotu, H.** The Nappe Theory with Reference to the North-Eastern Part of the Kwanto-Mountainland.—*Sci. Repts. Tokyo Bunrika Daigaku*, Sect. C, vol. 1, July 10, 1937, pp. 215-244, pls. 30-32, 2 text figs., map.—Foraminifera mentioned, 1 figured.
- Parr, Walter J. and Arthur C. Collins.** Notes on Australian and New Zealand Foraminifera. No. 3, Some Species of the Family Polymorphinidae.—*Proc. Roy. Soc. Victoria*, vol. 50, (n. ser.), pt. 1, Dec. 29, 1937, pp. 190-211, pls. XII-XV, 7 text figs.—35 species and varieties, 10 new.
- Myers, Earl H.** The Present State of our Knowledge Concerning the Life Cycle of the Foraminifera.—*Proc. Nat. Acad. Sci.*, vol. 24, No. 1, Jan., 1938, pp. 10-17, text figs. A-C.

- Cushman, J. A. and L. W. LeRoy. A Microfauna from the Vaqueros Formation, Lower Miocene, Simi Valley, Ventura County, California.—*Journ. Pal.*, vol. 12, No. 2, March, 1938, pp. 117-126, pl. 22, text figs. 1, 2.—21 species and varieties noted, 4 new.
- Vaughan, Thomas Wayland and W. Storrs Cole. *Triplalepidina veracruziana*, a New Genus and Species of Orbitoidal Foraminifera from the Eocene of Mexico.—*L. c.*, pp. 167-169, pl. 27.
- Lalicker, C. G. and P. J. Bermudez. Some Foraminifera of the Family Textulariidae from the Eocene of Cuba.—*L. c.*, pp. 170-172, pl. 28 (pt.).—3 new species.
- Thalmann, Hans E. Bibliography and Index to New Genera, Species, and Varieties of Foraminifera for the Year 1935.—*L. c.*, pp. 177-208.
- Bermúdez, Pedro J. Foraminíferos pequeños de las margas eocénicas de Guanajay, Provincia del Río, Cuba, 2nd. Part.—*Mem. Soc. Cubana Hist. Nat.*, vol. 12, No. 1, March, 1938, pp. 1-26.—Many species noted, none new.
- Natland, M. L. New Species of Foraminifera from off the West Coast of North America and from the Later Tertiary of the Los Angeles Basin.—*Bull. Scripps Inst. Oceanography, Tech. Ser.*, vol. 4, No. 5, 1938, pp. 137-164, pls. 3-7.—36 species and varieties figured and described, 33 new.
- Umbgrove, J. H. F. A Second Species of *Biplanispira* from the Eocene of Borneo.—*Leidsche Geol. Med.*, vol. 10, pt. 1, 1938, pp. 82-89, 17 text figs.—*Biplanispira absurda*, n. sp.
- Rhumbler, L. Foraminiferen aus dem Meeressand von Helgoland, gesammelt von A. REMANE (Kiel).—*Kieler Meeresforschungen*, vol. 2, 1938, pp. 157-222, text figs. 1-64.—20 species and varieties described and figured, 12 new, and new genera, *Causia*, *Spirillinoidea*, *Remaneica*, and *Earlmyersia*.

J. A. C.