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CONTRIBUTIONS

FROM THE

CUSHMAN LABORATORY

FOR

FORAMINIFERAL RESEARCH

VOLUME 3, PART 2
JUNE 1927

SHARON, MASSACHUSETTS, U. S. A.

CONTENTS

These contributions will be issued quarterly. They will contain short papers with plates, describing new forms and other interesting notes on the general research work on the foraminifera being done on the group by the workers in this laboratory. New literature as it comes to hand will be briefly reviewed.

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CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

40. PENNSYLVANIAN FORAMINIFERA FROM MICHIGAN

By JOSEPH A. CUSHMAN and JAMES A. WATERS

The material on which this short paper is based was collected by the junior author from the Saginaw formation of the Middle Pennsylvanian near Grand Ledge, Eaton Co., Michigan. Two lots of material were collected just across the line in Clinton County, one from Carbonaceous shale above the 20 inch coal bed which occurs at this locality and the other from the *Lingula* bed below the same coal bed. A very striking difference in the foraminiferal faunas of these two beds is at once noted no genus or species occurring in one occurring in the other. All the foraminifera are small, some of them very small indeed. In the upper bed there are great numbers of *Glomospira pusilla* (Geinitz) with a few *Ammobaculites*. In the lower bed the most common species is *Ammodiscus annularis* (H. B. Brady) with fewer numbers of the other species noted. The preservation of the specimens is good and numerous ostracods occurring in the same material have the calcareous shells well preserved.

Several of the species cannot be distinguished from those already described from the Carboniferous of Europe and a few appear to be undescribed. All are simple forms belonging to the primitive arenaceous group of the foraminifera.

GLOMOSPIRA PUSILLA (Geinitz)

Plate 22, figures 1 *a*, *b*

Serpula pusilla GEINITZ, Verstein. deutsch, Zechstein., pt. 1, 1848, p. 6, pl. 3, figs. 4–6.—JONES, in King, Pal. Soc., 1850, p. 57, pl. 6, figs. 7–9; pl. 18, figs. 13 *a–d*.

Trochammina pusilla JONES, PARKER and KIRKBY, Ann. Mag. Nat. Hist. ser. 4, vol. 4, 1869, p. 390, pl. 13, figs. 4–6, 15.—H. B. BRADY, Pal. Soc., vol. 30, 1876, p. 78, pl. 3, figs. 4, 5.

There are very abundant specimens of this species, irregular in form as the earlier figures quoted show more plainly than do those of Brady. The one here figured is one of the more regular ones. The test is arenaceous irregularly winding but usually the test is broader than thick. The Michigan specimens measured from 0.25–0.40 mm. in diameter.

AMMOBACULITES COMPRESSA Cushman and Waters, new species

Plate 22, figures 2 *a*, *b*

Test with the early portion close coiled and much compressed, of two or three coils, four to six chambers in each coil, the later portion uncoiled, consisting of a few chambers in a rectilinear series, also compressed; wall arenaceous, fairly thick; aperture elliptical, terminal. Length, up to 0.60 mm.

Holotype (Cushman Coll. 6594) from carbonaceous shale of Saginaw formation, Middle Pennsylvanian, above the 20 inch coal bed near Grand Ledge, Clinton Co., Michigan.

Some of the specimens show a larger proportion of uncoiled chambers.

AMMODISCUS ANNULARIS (H. B. Brady)

Plate 22, figures 3 *a*, *b*

Trochammina annularis H. B. BRADY, Pal. Soc., vol. 30, 1876, p. 76, pl. 3, figs. 9, 10.

Test minute, planispiral or somewhat irregular, consisting of a proloculum and elongate tubular second chamber of even diameter, nearly circular in section; wall coarsely arenaceous for the size of the test; aperture formed by the open end of the tube, nearly circular. Maximum diameter, 0.17 mm.

Brady described and figured the later coils of this species. The inner portion is easily broken away although in the material from the *Lingula* bed below the coal bed it is common and most of the specimens are complete. Many specimens were measured

and the maximum seems to be exactly the same as that given by Brady for his English specimens. There is very little irregularity in the shape of the Michigan specimens, nearly all of them being regularly planispiral.

PSAMMOPHIS INVERSUS Schellwein

Plate 22, figure 4

Psammophis inversus SCHELLWEIN, Palaeontographica, vol. 44, 1897, pl. 23, fig. 10.

The specimen figured seems to be very close to or identical with Schellwein's species. It is less regular than his figure and in this respect is more nearly like figures given by Rhumbler and referred to *Tolypammina vagans* (H. B. Brady). These appear to belong to *Psammophis,* the characters of which are an arenaceous attached test, the early coils of which are planispiral and the later ones winding back and forth at one side as shown in our figure. The specimen figured is a small one and is attached to a fragment of shale.

TURRITELLELLA SPIRANS Cushman and Waters, new species

Plate 22, figures 5, 6

Test arenaceous, consisting of a proloculum and long tubular second chamber coiled in an elongate spiral, the tubular chamber circular in section, early portion with the sides nearly parallel, later portion more fusiform; wall arenaceous; apertural end somewhat projecting forward and slightly contracted at the rounded aperture. Maximum length, 0.37 mm.; breadth, 0.15 mm.

Holotype (Cushman Coll. No. 6599) from *Lingula* bed below 20 inch coal bed near Grand Ledge, Clinton Co., Michigan.

This brings this genus back to the Palaeozoic which is really not surprising as several of the genera of the Ammodiscidae, *Ammodiscus, Psammophis, Tolypammina, Ammolagena, Glomospira, Hemidiscus* and *Lituotuba* have been found in the Carboniferous, leaving only *Ammodiscoides* and *Psammonyx* not occurring there. These two genera are known only from the Recent oceans.

HYPERAMMINA BULBOSA Cushman and Waters, new species

Plate 22, figures 7 *a, b*

Test with a fairly large proloculum broader than the tubular second chamber, flattened at one side, convex on the other, the

tubular chamber nearly circular in transverse section; wall arenaceous; aperture formed by the open end of the tube. Length variable, diameter of the tubular chamber 0.10 mm.

Holotype (Cushman Coll. No. 6601) from *Lingula* bed, below the 20 inch coal bed near Grand Ledge, Clinton Co., Michigan.

The peculiar shape of the proloculum seems to be a constant and unusual character. The tubular chamber has a somewhat sinuous border with regular enlargements and contractions of small amount but noticeable. These do not represent chamber divisions.

ENDOTHYRA BOWMANNI (Phillips)

Plate 22, figures 8 *a*, *b*

Endothyra bowmanni PHILLIPS, Rept. Proc. Geol. Poly. Soc. West Riding Yorkshire, 1844-45 (1846), p. 277, pl. 7, fig. 1.—H. B. BRADY, Pal. Soc., vol. 30, 1876, p. 92, pl. 5, figs. 1–4.

Specimens of rather small size but in general with the characters of this species occur in some numbers in the *Lingula* bed below the 20 inch coal bed.

TROCHAMMINA RUDIS Cushman and Waters, new species

Plate 22, figures 9 *a–c*

Test trochoid, of several whorls, chambers fairly distinct, increasing rapidly in size as added, in the adult three or sometimes four making up the whorl, dorsal side somewhat convex, ventral side slightly convex with deep depressions between the chambers; sutures fairly distinct; wall rather coarsely arenaceous with a distinct reddish cement; aperture on the ventral side. Diameter, 0.30–0.35 mm.

Holotype (Cushman Coll. No. 6603) from *Lingula* bed, below the 20 inch coal bed near Grand Ledge, Clinton Co., Michigan.

This species is somewhat variable in form but in general has three chambers in a whorl in the adult. The coarsely arenaceous wall and very reddish cement are constant in all the specimens.

Besides the species already noted, there is a single specimen appearing to be a very small *Fusulinella* but no other specimens to check this were obtained. An examination of larger lots of material will undoubtedly give a larger fauna. While some of these species also occur in the Pennsylvanian of the South Western United States, the Michigan specimens are all very small and agree more closely with European material.

41. NEW AND INTERESTING FORAMINIFERA FROM MEXICO AND TEXAS

By JOSEPH A. CUSHMAN

The study of Upper Eocene material from Mexico in the Alazan Clay and of the Upper Cretaceous of Mexico and Texas has brought to light a number of interesting species a few of which are noted here. Descriptions of these follow:

VULVULINA SPINOSA Cushman, new species

Plate 23, figure 1

Test comparatively large, compressed, the periphery acute and with a spinose process at the basal peripheral angle of each chamber; early portion biserial, later chambers uniserial; sutures depressed, especially those of the later portion; wall finely arenaceous with a large proportion of gray cement and the whole neatly and smoothly finished; aperture in the early portion a low transverse slit, in the adult terminal, elliptical. Length 1.30 mm.; breadth nearly 1 mm.; thickness 0.40 mm.

Holotype (Cushman Coll. No. 901) from Alazan Clay, Rio Buena Vista, just south of crossing of Alazan to Moyutla Road, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

This species which is peculiar in the angular projections also apparently occurs in Trinidad and probably in Ecuador. It is quite distinct from *Vulvulina advena* Cushman from the Eocene of the Gulf Coastal Plain.

FRONDICULARIA TENUISSIMA Hantken

Plate 22, figure 11

Frondicularia tenuissima HANTKEN, A. magy. kir. földt. int. evkönyve, vol. 4, 1875 (1876), p. 36, pl. 13, fig. 11; Mitth. Jahrb. ungar. geol. Anstalt, vol. 4, 1875 (1881), p. 43, pl. 13, fig. 11.

Test very much compressed, generally elliptical in face view; tapering at the ends, the periphery rounded, initial end often with a spinose process; chambers numerous, very elongate, early ones in a loose coil, later ones extending to the base at either side; sutures distinct, curved, slightly depressed; wall smooth, very finely perforate; aperture terminal, radiate. Length up to 2 mm.

This species described by Hantken from the *Clavulina-szaboi* beds of Hungary occurs in considerable numbers in the Alazan Clay from Rio Buena Vista, 0.5 km. S. 25° E. from Tumbadero Hacienda House, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

PLECTOFRONDICULARIA TRILINEATA Cushman, new species
Plate 23, figure 2

Test much compressed, elongate, slightly tapering, very slightly keeled, median portion of the test thickest, with three elongate slightly raised sharp costae continuous over the length of the test; chambers numerous, earliest ones biserial, later ones uniserial and extending backward on either side; sutures distinct, slightly curved, oblique, not depressed; wall smooth except for the three costae and finely perforate; aperture terminal, elliptical, not radiate. Length 0.85 mm.; breadth 0.25 mm.; thickness 0.10 mm.

Holotype (U. S. Nat. Mus. No. 369299) from Alazan Clay, Rio Buena Vista, 9.8 kms. in a straight line upstream from Tumbadero, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

PLECTOFRONDICULARIA VAUGHANI Cushman, new species
Plate 23, figure 3

Test much compressed, broadly elliptical in front view, initial end broadly rounded; chambers distinct, early ones coiled about the proloculum, then biserial and in the adult extending back on either side; sutures distinct, only slightly depressed, with a slight depression in the curve on opposite sides in succeeding chambers; wall smooth, finely perforate; aperture terminal, elliptical. Length up to 0.60 mm.; breadth 0.40 mm.

Holotype (U. S. Nat. Mus. No. 369300) from Alazan Clay, Rio Buena Vista, 9.8 kms. in a straight line upstream from Tumbadero, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

This species is peculiar in the retention of the alternating character of the chambers as shown by the apertures pointing first to one side then the other in succeeding chambers and the incurved portion of the wall even after the alar projections are developed. The species occurs at a number of localities in the Alazan Clay.

PLECTOFRONDICULARIA ALAZANENSIS Cushman, new species

Plate 22, figure 12

Test much compressed, elongate, tapering, with a broad thin clear peripheral keel, early chambers biserial, later ones uniserial, slightly inflated, sutures slightly depressed, very slightly oblique; wall thin, ornamented with several sharp narrow longitudinal costae, finely perforate; aperture elliptical, terminal. Length up to 1 mm.; breadth 0.40 mm.

Holotype (U. S. Nat. Mus. No. 369301) from Alazan Clay, Rio Tuxpan, crossing of road from Palo Blanco to La Noria and along Rio Pantepec about 200 meters above its mouth, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

This is the most highly ornamented of the Alazan species, the costae often standing well above the surface of the test.

PULVINULINELLA INTERRUPTA Cushman, new species

Plate 22, figures 10 *a–c*

Test trochoid, unequally biconvex, the dorsal side nearly flat, periphery with a thin keel ending in a distinct projection at the peripheral margin of the base of each chamber; chambers distinct especially those of the last coil, about seven making up the adult coil, slightly inflated on the ventral side; sutures slightly limbate and flush on the dorsal side, oblique, on the ventral side gently curved, depressed; wall smooth, finely perforate; aperture elongate at a high angle to the periphery on the ventral side. Diameter 0.50 mm.; thickness 0.20 mm.

Holotype (U. S. Nat. Mus. No. 369302) from type locality of the Alazan Clay, Rio Buena Vista, just south of crossing of Alazan to Moyutla Road, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

This species is related to *Pulvinulinella culter* (Parker and Jones) but differs in the smaller number of chambers and the peculiar peripheral margin.

PLANULINA MEXICANA Cushman, new species

Plate 23, figures 5 *a, b*

Test very much compressed, complanate, the periphery broadly rounded, not keeled, sides flattened; chambers numerous, 10-12 in the final whorl, narrow, curved; sutures limbate but not raised, distinct, curved; wall coarsely perforate otherwise smooth; aperture peripheral, narrow, at the base of the narrow peripheral face of the chamber. Diameter 1.30 mm.

Holotype (U. S. Nat. Mus. No. 369303) from Alazan Clay, Rio Buena Vista, 0.5 km. S. 25° E. from Tumbadero Hacienda House, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

This is one of the largest and finest species in the Alazan Clays.

GLOBOROTALIA SPINULOSA Cushman, new species

Plate 23, figures 4 *a–c*

Test biconvex, the dorsal side somewhat less so than the ventral, periphery with a spinose keel; chambers distinct, 4 or 5 in the final whorl, somewhat inflated on the ventral side, sutures very slightly if at all depressed on the dorsal side, slightly depressed on the ventral, nearly radial; wall at the periphery with short spines becoming more prominent in older specimens, the dorsal side with the early chambers roughly granular, later ones smooth and finely perforate, ventral side smooth; aperture large, on the ventral side. Diameter up to 0.40 mm.

Holotype (U. S. Nat. Mus. No. 369304) from Alazan Clay, Rio Tuxpan, crossing of road from Palo Blanco to La Noria and along Rio Pantepec about 200 meters above its mouth, Vera Cruz, Mexico, collected by Dr. T. Wayland Vaughan.

In older specimens than that figured the middle of the periphery of each chamber becomes more projecting and the spinose projections somewhat larger and flatter.

SPIROPLECTOIDES ROSULA (Ehrenberg)

Plate 23, figures 6, 7

Spiroplecta rosula EHRENBERG, Mikrogeologie, 1854, pl. 32, pt. 2, fig. 36.
Spiroplectoides rosula CUSHMAN, Contrib. Cushman Lab. Foram. Res., vol. 3, pt. 1, 1927, p. 62, pl. 13, figs. 9 *a*, *b*.

Test with a close coiled young, planispiral, later chambers in a biserial, parallel sided, flattened test, the chambers numerous and oblique; wall smooth, polished.

Figured specimen (Cushman Coll. 6699) Upper Cretaceous, Pecan Gap Chalk, roadside ditch along pike, 1.8 mi. N. E. of Rockwall, Texas. Collected by Mrs. Helen Jeanne Plummer.

This species was found by Ehrenberg in material from the Cretaceous of America. Figure 6 is a copy of his original figure which was from a specimen mounted in balsam. The species is found in the Upper Cretaceous of the United States and Mexico, and a very similar species is now living in the waters of the Philippine region.

PSEUDOUVIGERINA PLUMMERAE Cushman, new species

Plate 23, figures 8 *a*, *b*

Test small, earliest chambers in the microspheric form planispiral, later ones biserial and those of the adult triserial; chambers distinct slightly inflated, the periphery truncate and the margins crenulate; sutures slightly depressed, distinct; wall smooth, finely perforate; aperture circular, terminal, without a tooth. Length 0.35 mm.; breadth 0.10 mm.

Holotype (Cushman Coll. 6700) from Upper Cretaceous, Pecan Gap Chalk, roadside ditch along pike, 1.8 mi. N. E. of Rockwall, Texas, collected by Mrs. Helen Jeanne Plummer.

This species is a small one, but has distinctive characters from *P. cristata* (Marsson) which it most nearly resembles. The crenulated edges of the raised periphery are peculiar.

BOLIVINITA PLANATA Cushman, new species

Plate 23, figures 9 *a*, *b*

Test compressed, tapering, edges truncate, concave, broad faces flattened; chambers distinct; sutures limbate but not raised; wall smooth and unornamented; aperture at the peripheral margin of the last formed chamber. Length 0.50 mm.; breadth 0.25 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. 6701) from Upper Cretaceous, Pecan Gap Chalk, roadside ditch along pike, 1.8 mi. N. E. of Rockwall, Texas, collected by Mrs. Helen Jeanne Plummer.

This is to be distinguished from the much narrower *B. eleyi* Cushman which also occurs in the Upper Cretaceous.

GLOBOTRUNCANA CALCARATA Cushman, new species

Plate 23, figures 10 *a*, *b*

Test trochoid, umbilicate, dorsal and ventral sides nearly parallel, the sides angled, obliquely truncate; chambers 4 or 5 in the final whorl, each with a stout peripheral spine, the early ones roughened with spinose projections as are the spines; sutures distinct, on the dorsal side oblique and marked by a bead-like ornamentation, ventrally radial, slightly depressed; aperture opening onto the umbilical region. Diameter with spines 0.40 mm.

Holotype (U. S. Nat. Mus. No. 73419) from Upper Cretaceous, Pecan Gap Chalk, cut in G. C. and S. F. R. R., at N. edge of Farmerville, Texas, collected by Dr. L. W. Stephenson.

This is related to *Globotruncana arca* (Cushman) but is dis-

tinct in the large, well developed peripheral spines. The species also occurs in the Mendez Shales of the Tampico Embayment, Mexico.

GLOBOTRUNCANA CANALICULATA (Reuss)

Plate 23, figures 11 *a–c*

Rosalina canaliculata REUSS, Denkschr. Akad. Wiss. Wien, vol. 7, pt. 1, 1854, p. 70, pl. 26, fig. 4.

Globigerina canaliculata EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, pt. 1, 1899, p. 172, pl. 21, figs. 15–17, 24–26.

Test small, the dorsal and ventral faces parallel or even slightly concave, periphery broad and squarely truncate or concave; chambers few, usually 5 in the final whorl, the periphery roughened with short blunt spines, remainder of the surface smooth or slightly spinose in the young, aperture ventral, opening into the umbilical region which is open. Diameter 0.25–0.30 mm.; thickness 0.05–0.08 mm.

Figured specimen from Upper Cretaceous, Pecan Gap Chalk, cut in G. C. and S. F. R. R., at N. edge of Farmerville, Texas, collected by Dr. L. W. Stephenson.

This species is also common in the Mendez Shales of the Tampico Embayment, Mexico.

It is apparently well distributed in the Upper Cretaceous of Europe. Reuss' original figure is less highly ornamented and has more chambers. Our American material is also variable, the particular form here figured being much more nearly like that figured by Egger.

EXPLANATION OF PLATE 22

FIGS. 1 *a, b.* *Glomospira pusilla* (Geinitz). X 75. *a*, side view; *b*, peripheral view.

FIGS. 2 *a, b.* *Ammobaculites compressa* Cushman and Waters, new species. X 50. *a*, side view; *b*, apertural view.

FIGS. 3 *a, b.* *Ammodiscus annularis* (H. B. Brady). X 75. *a*, side view; *b*, peripheral view.

FIG. 4. *Psammophis inversus* Schellwein. X 75.

FIGS. 5, 6. *Turritellella spirans* Cushman and Waters, new species. X 100. *a*, side views; *b*, apertural views.

FIGS. 7 *a, b.* *Hyperammina bulbosa* Cushman and Waters, new species. X 75. *a*, front view; *b*, side view.

FIGS. 8 *a, b.* *Endothyra bowmanni* (Phillips). X 75, *a*, side view; *b*, apertural view.

FIGS. 9 *a–c.* *Trochammina rudis* Cushman and Waters, new species. X 75. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 10 *a–c.* *Pulvinulinella interrupta* Cushman, new species. X 50. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIG. 11. *Frondicularia tenuissima* Hantken. X 50.

FIGS. 12 *a, b.* *Plectofrondicularia alazanensis* Cushman, new species. X 50. *a*, front view; *b*, end view.

EXPLANATION OF PLATE 23

FIG. 1. *Vulvulina spinosa* Cushman, new species. X 35.

FIG. 2. *Plectofrondicularia trilineata* Cushman, new species. X 50.

FIG. 3. *Plectofrondicularia vaughani* Cushman, new species. X 60.

FIGS. 4 *a–c.* *Globorotalia spinulosa* Cushman, new species. X 80. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 5 *a, b.* *Planulina mexicana* Cushman, new species. X 35. *a, b*, views from opposite sides.

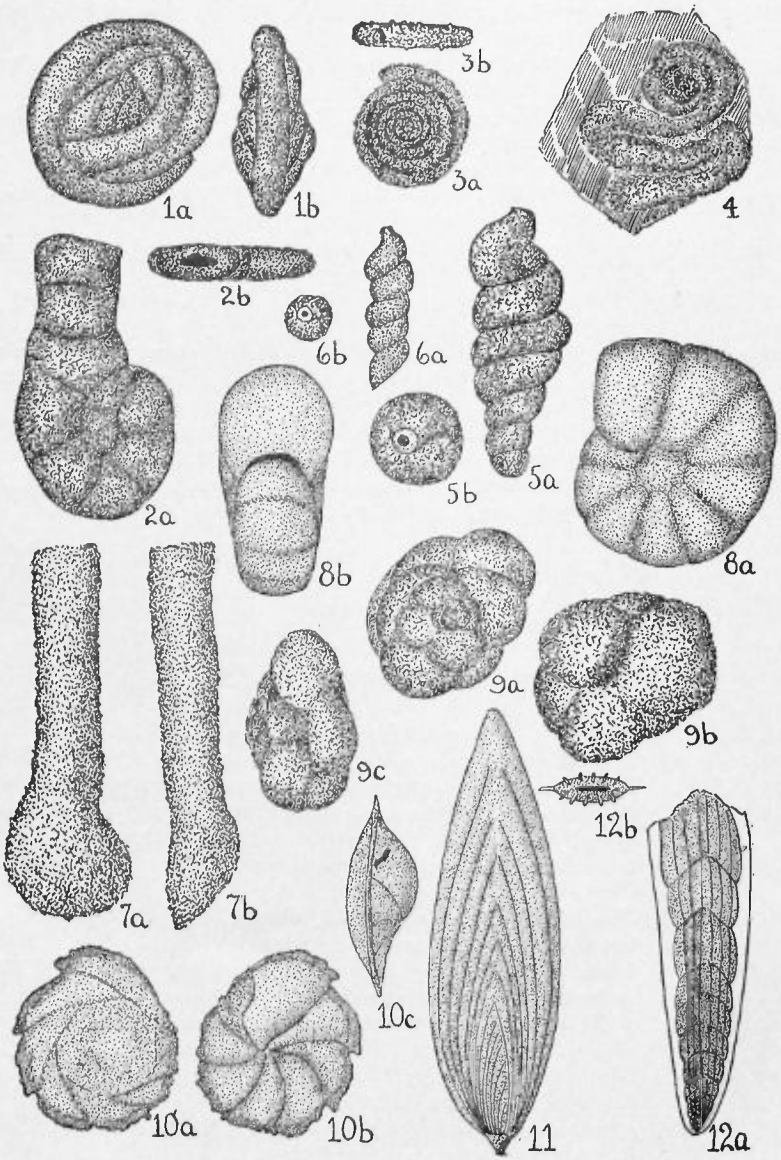
FIGS. 6, 7. *Spiroplectoides rosula* (Ehrenberg). X 80. 6, (After Ehrenberg); 7, Texas specimen.

FIGS. 8 *a, b.* *Pseudouvigerina plummerae* Cushman, new species. X 100. *a*, front view; *b*, apertural view.

FIGS. 9 *a, b.* *Bolivinita planata* Cushman, new species. X 80. *a*, front view; *b*, side view.

FIGS. 10 *a, b.* *Globotruncana calcarata* Cushman, new species. X 80. *a*, dorsal view; *b*, ventral view.

FIGS. 11 *a–c.* *Globotruncana canaliculata* (Reuss). X 80. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.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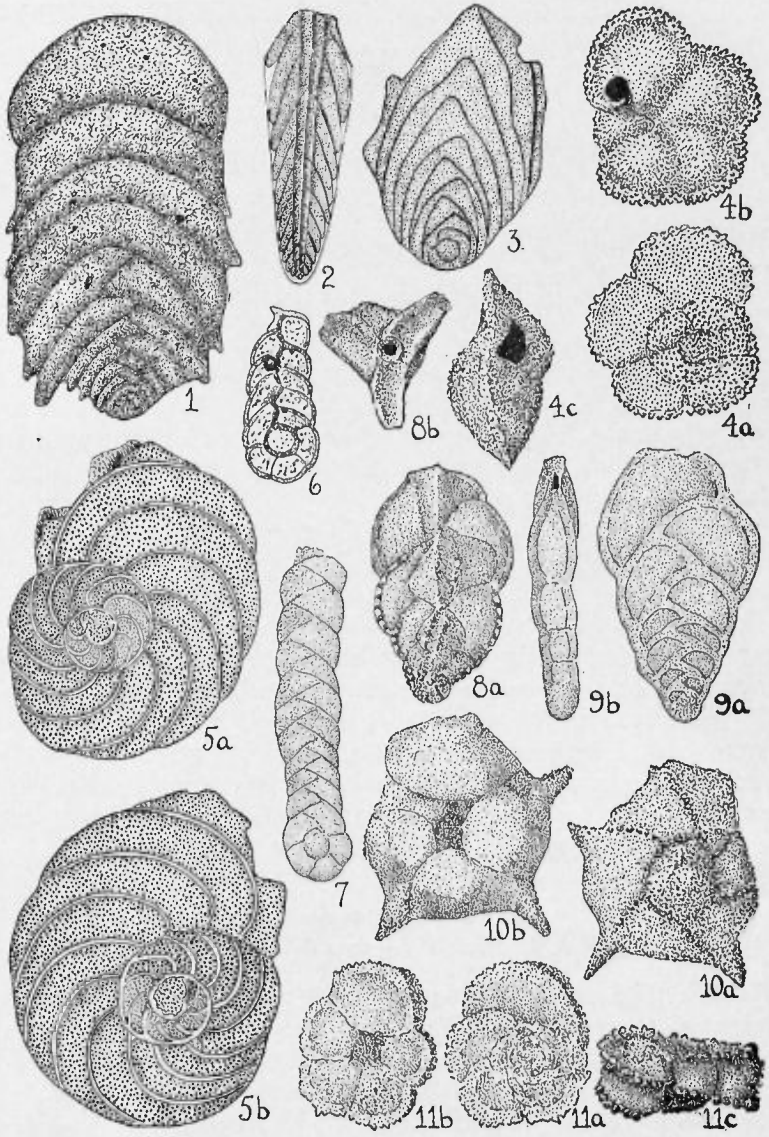
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42. A SPECIES OF SIPHONINELLA IN THE TERTIARY OF AMERICA

By JOSEPH A. CUSHMAN and HENRY V. HOWE

The only hitherto known species of *Siphoninella* is *S. soluta* (H. B. Brady) described from a *Challenger* dredging in 390 fathoms off Culebra Island, West Indies. Brady records this as very rare. It is well known that the present foraminiferal fauna of the West Indian region is closely related to that of the Tertiary of the Gulf Coastal Plain of the United States and Mexico especially to the Oligocene and Upper Eocene. There are many living species which are undoubtedly direct derivatives of closely related Tertiary species.

The finding of a species of *Siphoninella* in the Claiborne of Louisiana, especially in considerable numbers when the only other record for the genus is the rare living West Indian species is interesting. It raises the problem of where the genus has been living during the long interval between these two occurrences. As the single record for the living species is 390 fathoms, it is quite probable that the depth at which it lives is enough to account for this absence in most of the fossil series of the Gulf Coastal Plain, and its occurrence in Louisiana where deposition was naturally in deeper water during the embayment of Claiborne time. The species may be described as follows:

SIPHONINELLA CLAIBORNENSIS Cushman and Howe, new species
Plate 24, figures 8–10

Test in the early portion trochoid, unequally biconvex, the ventral side more convex than the dorsal, in later growth uncoiled in the last two chambers; periphery of the earlier portion strongly carinate, the carina divided into tooth-like portions, usually coalescing and typically with an angle in each process, later chambers slightly rounded and without the keel; sutures somewhat limbate, flush on the dorsal side, very slightly depressed on the ventral; wall very coarsely perforate, especially on the dorsal side; apertural end with a distinct lip, a slightly

constricted neck and narrow elongate aperture.

Length, 0.35 mm.; breadth, 0.25 mm.; thickness, 0.10 mm.

Holotype (Cushman Coll. No. 6711) from Louisiana Oil Refining Co., Tremont No. 1, Township 30, Range 10, 2E, at a depth of 736–740 feet. Paratypes are in the collections of the Louisiana State University and the United States National Museum.

Siphoninella claibornensis differs from *S. soluta* in the periphery which in the fossil species is broad and composed of peculiar tooth-like portions and in the shape and number of the chambers, fewer and more elongate in the fossil species as well as in the surface which is smooth in the fossil species and in the recent one with tubercles, especially along the sutures.

43. SOME NOTES ON THE EARLY FORAMINIFERAL GENERA ERECTED BEFORE 1808

By JOSEPH A. CUSHMAN

It has been puzzling for many of the workers on the foraminifera to know what species should be assigned to some of the early genera. The only hope to understand some of the type species and therefore the genera based on them is a careful study of the type species in European collections. Others are more clearly defined and figured, and the study of material from the exact type locality may be made use of until the actual types have been studied. Nothing however can take the place of actual type specimens which must finally settle all questions as to what the author may have meant by his specific name and therefore of the genus based upon the species. The writer hopes to make a study of many of the older genotypes in European collections this year.

In 1792, Brugiere (Ency. Method., "Vers", vol. 1, 1792, p. 395) described the genus *Camerina* with three new species, *C. laevigata, C. nummularia,* and *C. striata.* Of these the first, *Camerina laevigata* Brugiere may be selected as the type. As Lamarck in 1801 used the same species as the type of his genus *Nummulites,* there can be no question but that *Nummulites* is a synonym of *Camerina* Brugiere. Therefore *Camerina* Brugiere, 1792 with its genotype *C. laevigata* Brugiere will stand.

In 1784, Walker and Boys (Testacea minuta rariora, etc.), used the name *Lagena* in a subgeneric sense, but as their work is not binomial, it is ruled out of consideration by the International Rules of Nomenclature. However, in 1798, Walker and Jacob (A Description and Arrangement of Minute and Rare Shells, in Adam's Essays on the Microscope, 2nd Edition) used *Lagena,* and their *Serpula (Lagena) sulcata,* pl. 14, fig. 5, must be taken as the genotype. This will give as *Lagena,* tests which are single chambered, with a more or less tapering neck, a rounded aperture, wall calcareous and very finely perforate and typically the chamber rounded in transverse section.

In 1801 (Syst. Anim.) and 1804, 1806, and 1807 (Annales du Museum) Lamarck erected numerous genera for foraminifera. During this period however, Montagu in 1803 (Testacea Brit-

tanica) used the name *Vermiculum*. I believe no definite species has been selected as the genotype. Of the figured specimens, Plate 14, figure 1, is an obscure form, the generic position of which is very doubtful. Figure 2 is *Vermiculum squamosum* Montagu, a species of British waters. Figure 3 is *V. perlucidum* Montagu, a species well known in the same region. Figure 9 is *V. oblongum* Montagu, the exact character of which is very difficult to determine, a proof of which is the fact that it has been assigned to various genera by later authors. Of the figures, that on plate 14, figure 3, of *Vermiculum perlucidum* Montagu is undoubtedly the most definite, and that species may be taken as the genotype. This would make *Vermiculum* a synonym of *Lagena* Walker and Jacob, and eliminate it from further consideration.

Of the genera erected by Lamarck in 1801, *Nummulites* with the type *Nummulites laevigata* (Brugiere) becomes a direct synonym of *Camerina* Brugiere, 1792 as already noted.

Orbitolites Lamarck, 1801, with its genotype *O. complanata* Lamarck is well known from the Paris Basin Eocene, but as has been shown by later authors must have a more restricted use than has often been made of it. It has the openings between chamberlets of the adjacent preceding and succeeding annuli but no direct communication between chamberlets of the same annulus.

Siderolites Lamarck, 1801 is also monotypic, the genotype being *S. calcitrapoides* Lamarck from the chalk of Maestricht, Holland. This is a well known species described in detail by many later authors.

Rotalites Lamarck, 1801 had for its type *R. tuberculosa* Lamarck, from Grignon. No figures are given by Lamarck who does refer to some very inadequate figures of Guettard. The description does not give a recognizable conception of what this species may have been. It is not referred to by Lamarck or by later authors, so that it may be identified. The genus *Rotalites* therefore unless the type specimen of *R. tuberculosa* may later be found in Paris and studied, will have to be discarded as unrecognizable.

Oveolites Lamarck, 1801 has been shown to be really a calcareous alga and not a foraminifer so needs no further consideration here.

Of the genera erected in 1804, *Discorbis* is the first (p. 182). This is a monotypic genus, the genotype being *Discorbis vesicularis* Lamarck (Pl. 24, figs. 1 *a–c*). The type is from Grignon.

It is plano-convex, trochoid, the coils all visible from the dorsal side, only the chambers of the last-formed coil visible from the ventral side, the umbilical region excavated, and the chambers often extending in a narrowed projection across this depressed central area or building up alar projections, the wall calcareous, coarsely perforate, especially on the ventral side and the aperture a long narrow slit at the base of the chamber extending to the umbilical area, often with a slight lip and often hidden by the basal projection of the chamber. A very similar species often referred to this same specific name is now living in the Australian region, and the genus is well distributed at the present day as well as going well back in the fossil series. d'Orbigny applied the name *Rosalina* to some of the species of *Discorbis* and many of them are to be found under *Discorbina* in the literature.

Lamarck did not find the aperture in *Discorbis vesicularis*. This is not strange as the covering of the aperture by the alar projections makes it very easily filled with matrix. Many of the younger specimens from Grignon are identical in form and number of chambers with Lamarck's figures. In the adult the number of chambers increases. This is one of the largest, most conspicuous and best characterized species of Grignon.

The genus *Rotalia* Lamarck, 1804 (P. 183), should have chosen as its genotype the first species given by him, *Rotalia trochidiformis* Lamarck (pl. 24, figs. 5–7). This is a very definite species from the Eocene of Grignon. It is planoconvex, dorsal side convex, ventral side flattened, trochoid, ventral side with a solid plug in the umbilical position, the sutures radial and excavated, the sides of the chambers beaded and the whole ventral side usually ornamented with raised papillae, dorsal side smooth, the aperture ventral, along the margin of the last-formed chamber. This is the form to which the name *Rotalia* has usually been applied, and to which d'Orbigny applied other names at different times.

The description of this species especially of the characters of the ventral side is excellent. Plate 24, figs. 7 *a*, *b* show a young specimen with the lobing of the ventral side; figs. 6 and 5 later stages where the thickening has continued, resulting in the highly ornate ventral side seen in the adult of this species.

Lenticulites Lamarck, 1804, has three species, *L. planulata*, *L. variolaria* and *L. rotulata* Lamarck. The first two of these are not figured, but the last, *L. rotulata* Lamarck is figured by Lamarck in 1806, Ann. Mus., pl. 62, fig. 11. *Lenticulites rotulata* Lamarck should be taken as the genotype, and is the form usually

referred to as *Cristellaria rotulata* by later authors. This may mean that the generic name *Lenticulites* should be used instead of *Cristellaria* and many of the names given by Montfort. The test is planispiral, involute, biconvex, distinctly umbonate. A study of the type specimen of this species which is in Defrance's collection will give much light on the problem of the generic name to be used for *Cristellaria.*

Lituola Lamarck, 1804, has two species *L. nautiloidea* and *L. difformis* Lamarck of which *L. nautiloidea* Lamarck should be designated as the genotype. It is a test close coiled and involute in the young, uncoiling in the adult, and having several openings in the terminal apertural face. From the description given by Lamarck, the wall may be inferred to be arenaceous and the interior labyrinthic. This agrees well with the restricted use now being made of *Lituola.*

Spirolina Lamarck, 1804 has two species *S. depressa* and *S. cylindracea* Lamarck (plate 24, fig. 4). The latter being the best known and most common may be chosen as the genotype. The early chambers are planispiral and the later ones in a rectilinear uncoiled series; wall calcareous, imperforate; aperture rounded, terminal. The type of *S. cylindracea* came from Grignon. The genus is represented in the fossil series at least from the Eocene and is widely distributed today in warm, shallow waters.

Miliola Lamarck, 1804, had five species assigned to it by Lamarck as follows: *M. ringens, M. cor-anguinum, M. trigonula, M. planulata,* and *M. saxorum.* The first is now *Biloculina ringens* (Lamarck). *M. trigonula* has been designated as the genotype of d'Orbigny's *Triloculina.*

For *Quinqueloculina, Q. seminulum* (Linné) has already been designated as the type. Of the three original species of Lamarck left, *Miliola saxorum* is the most abundant and best known. As figured by later authors (Terquem, Mém. Soc. géol. France, ser. 3, vol. 2, 1882, pl. 19 (27), figs. 22 *a, b*) the aperture is shown to be cribrate. A study of material from the Eocene of the Paris Basin also shows this character although the plate over the aperture is easily broken and often in poorly preserved specimens not seen. *Miliola saxorum* Lamarck should stand as the genotype of the genus *Miliola* representing those species distinct from *Quinqueloculina* by the cribrate aperture.

Renulina Lamarck, 1804, is a monotypic genus, the genotype being *R. opercularia* Lamarck, fairly common in the Eocene of the Paris Basin at Grignon and elsewhere.

The various species were figured by Lamarck in the Annales du Museum in 1807. The original type specimens when studied will undoubtedly give further light on some of the more obscure species, but the Grignon material while it has more than one faunule can be definitely determined by *Renulina opercularia* and other unmistakable species.

Thus there seem to be well established before the appearance of Montfort's wretchedly illustrated work in 1808 the following definite genera: *Camerina* Brugiere, 1792; *Lagena* Walker and Jacob, 1798; *Orbitolites* Lamarck, 1801; *Siderolites* Lamarck, 1801; *Discorbis* Lamarck, 1804; *Rotalia* Lamarck, 1804; *Lituola* Lamarck, 1804; *Spirolina* Lamarck, 1804; *Miliola* Lamarck, 1804, and *Renulina* Lamarck, 1804. *Lenticulites* Lamarck, 1804, is perhaps less clearly defined than the others, but the type specimen when studied will make clear the now obscure points.

Some of the more important of these species are figured on the accompanying plate that American workers may see to what forms these generic names should be applied.

EXPLANATION OF PLATE 24

FIGS. 1 *a–c.* *Discorbis vesicularis* Lamarck. Adult specimen from the type locality, Grignon, France. *a*, ventral view; *b*, dorsal view; *c*, peripheral view. X 30.

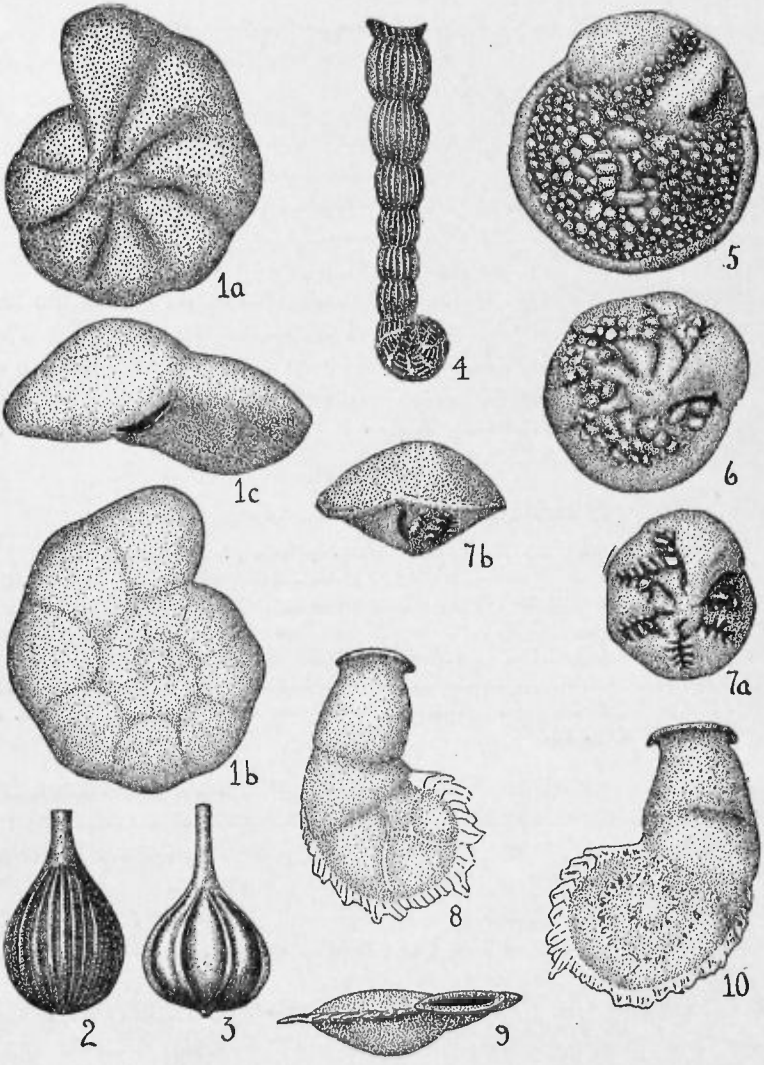
FIG. 2. *Lagena sulcata* Walker and Jacob. After type figure from Walker and Jacob.

FIG. 3. *Lagena perlucida* (Montagu). *(Vermiculum perlucidum)* after type figure of Montagu.

FIG. 4. *Spirolina cylindracea* Lamarck. Specimen from Grignon, France.

FIGS. 5–7. *Rotalia trochidiformis* Lamarck, from the type locality, Grignon, France. X 30. Fig. 5, ventral view of adult showing the characteristic thickenings. Fig. 6, a less mature individual from the ventral side. Fig. 7, a younger specimen showing the start of the ornamentation, *a*, ventral; *b*, peripheral view.

FIGS. 8–10. *Siphoninella claibornensis* Cushman and Howe, n. sp. X 100. Fig. 8, ventral view. Fig. 9, apertural view. Fig. 10, dorsal view.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44. NOTES ON THE GENUS PLEUROSTOMELLA

By JOSEPH A. CUSHMAN and REGINALD W. HARRIS

The necessity of reviewing the entire literature relating to the genus while working up a collection of recent and fossil species belonging to *Pleurostomella* has made it seem wise to publish brief notes and outline figures for the benefit of other workers. Figures of all but four of the described species are included on Plate 25. Some of these do not belong in the genus as will be indicated in the notes. But a single species was found to be new and this had already been noted by Schubert but no name was given by him. Except for the stippled figures, those on Plate 25 are outlines of the type figures. The species are grouped by geologic periods. Only the original reference is given and no attempt is made to give a complete synonymy.

GENUS PLEUROSTOMELLA Reuss, 1860

Nodosaria (part) REUSS, Verst. Böhm. Kried., pt. 1, 1845, p. 28.
Dentalina (part) REUSS, Haidinger's Nat. Abhandl., vol. 4, 1850, p. 24.
Pleurostomella REUSS (type, *P. subnodosa* REUSS), Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 203.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 410.—CHAPMAN, The Foraminifera, 1902, p. 174.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 49; Bull. 104, pt. 3, 1922, p. 49; Contrib. Cushman Lab. Foram. Res., vol. 3, pt. 1, 1927, p. 72.

Test usually elongate, biserial; chambers usually distinct, inflated, the sutures distinct, occasionally somewhat limbate; aperture an arched opening, partially closed by two broad teeth at either side at the base with a narrow slit between.

From the available records, the genus probably arose in the Cretaceous and continues to the present oceans, usually in fairly deep water.

It belongs in the Family Ellipsoidinidae of A. Silvestri, the members of which have a lateral aperture and the interior typically with a tubular structure connecting the chambers. It is thus closely related to the Buliminidae from which the Ellipsoidinidae undoubtedly developed in Cretaceous time. Species of which specimens were studied are indicated by an asterisk.

SPECIES WITH TYPES FROM THE PRESENT OCEANS

**Pleurostomella acuminata* CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 50, pl. 19, fig. 6.

Types from Caribbean Sea, *Albatross* H 79 in 821 fathoms (Pl. 25, fig. 1).

Pleurostomella contorta MILLETT, Journ. Roy. Micr. Soc., 1900, p. 280, pl. 2, figs. 11, 12.

Types from Malay Archipelago (Pl. 25, fig. 3).

**Pleurostomella spinosa* CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 51, text figs. 3 *a*, *b*.

Types from *Albatross* D 4970, in 500 fathoms off Japan (Pl. 25, fig. 2).

This species may possibly belong to *Bulimina* as is suggested by its spinose surface. The general structure resembles *Pleurostomella*.

SPECIES WITH TYPES FROM PLEISTOCENE

Pleurostomella sapperi SCHUBERT, Abhandl. Geol. Reichs., vol. 20, pt. 4, 1911, p. 56, text figs. 3 *a*, *b*.

Type from *Globigerina* earth of Fetsoa, Bismark Archipelago (Pl. 25, fig. 4).

This is one of the very few ornamented species.

**Pleurostomella* sp. nov. SCHUBERT, Abhandl. Geol. Reichs., vol. 20, pt. 4, 1911, p. 57, text figs. 4 *a*, *b*.=*P. schuberti* CUSHMAN and HARRIS, n. sp. See below.

Schubert's specimens are from the Bismarck Archipelago (Pl. 25, fig. 5).

SPECIES WITH TYPES FROM THE PLIOCENE

**Pleurostomella alternans* SCHWAGER, *Novara*-Exped., Geol. Theil., pt. 2, 1866, p. 239, pl. 6, fig. 79, 80.

Types from Kar Nicobar (Pl. 25, figs. 7, 8).

This species has been widely recorded. We have specimens which seem to be identical with this species from the Pliocene of the Sepik River, New Guinea. In the Eocene of Mexico and Trinidad specimens occur which very closely resemble this species and one of these is figured (Pl. 25, fig. 28).

Pluerostomella brevis SCHWAGER, *Novara*-Exped., Geol. Theil., pt. 2, 1866, p. 239, pl. 6, fig. 81.

Types from Kar Nicobar (Pl. 25, fig. 6).

SPECIES WITH TYPES FROM THE MIOCENE

Pleurostomella alternans SCHWAGER, var. *telostoma* SCHUBERT, Sitz. deutsch. naturwiss.-med. Ver. Böhmen "Lotos", vol. 20, 1900, p. 224, pl. 5, figs. 5 *a, b.*

Types from Karwin, Austria (Pl. 25, fig. 9).

This and related forms represent a stage seen in a number of species of the genus where in the adult a small partially developed chamber ends the development. In such forms there is a tendency for the aperture to become terminal.

Pleurostomella alternans SCHWAGER, var. *parvifinita* SCHUBERT, Sitz. deutsch, naturwis.-med. Ver. Böhmen "Lotos", vol. 20, 1900, p. 224, pl. 5, figs. 6 *a–c.*

Types from Karwin, Austria (Pl. 25, fig. 10).

Pleurostomella alternans SCHWAGER, var. *moravica* SCHUBERT, Sitz. deutsch. Naturwiss.-med. Ver. Böhmen "Lotos", vol. 20, 1900, p. 157, pl. 2, fig. 5.

Types from Ptin, Austria (Pl. 25, fig. 11).

This is another of the varieties with a subterminal aperture.

Pleurostomella alternans SCHWAGER, var. *hians* SCHUBERT, Jahrb. Geol. Reichsanst, vol. 52, 1903, p. 297.

Types from Karwin, Austria (Pl. 25, fig. 12).

Pleurostomella pleurostomella (A. SILVESTRI). *Ellipsopleurostomella pleurostomella* A. SILVESTRI, Accad. Real. Sci. Torino, 1903-04, p. 7, text figs. 4, 5.

Types from the Piedmont, Italy (Pl. 25, fig. 13).

This differs from *Pleurostomella subnodosa* in the amount of enveloping of the chambers and in the broader aperture.

SPECIES WITH TYPES FROM THE EOCENE

**Pleurostomella alazanensis* CUSHMAN, Contrib. Cushman Lab. Foram. Res., vol. 1, pt. 1, 1925, p. 5, pl. 1, figs. 2 *a, b.*

Types from Alazan Clay, 2⅓ km. S. W. of Carrizo on Rio Tamuin, San Luis Potosi, Mexico. (Pl. 25, fig. 21).

Pleurostomella acuta HANTKEN, A magy. kir. földt. int. evkönyve, vol. 4, 1875 (1876), p. 37, pl. 13, fig. 18.

Types from *Clavulina*-Szaboi beds of Hungary (Pl. 25, fig. 14).

Pleurostomella eocaena GÜMBEL, Abhandl. kön. bay. Akad. Wiss., München, vol. 10, 1868, p. 630, pl. 1, figs. 53 *a, b.*

Types from Gotzreuther in the Bavarian Alps (Pl. 25, fig. 15).

This species is characterized by its small size and abnormally large final chamber, a character which seems suspiciously like

an individual abnormality. Hantken figures a specimen as *P. eocaena,* A. magy. kir. földt. int. evkönyve, vol. 4, 1875 (1876), pl. 13, fig. 17, which is a different thing and is close to the Trinidad and Mexican specimens referred to *P. alternans* SCHWAGER.

Pleurostomella rapa GÜMBEL, Abhandl. kön. bay. Akad. Wiss., München, vol. 10, 1868, p. 630, pl. 1, figs. 53 *a, b.*

Types from Gotzreuther, Bavarian Alps (Pl. 25, fig. 18).

Pleurostomella jacksonensis CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 168, pl. 7, figs. 9 *a–c.*

Types from Haynes Well No. 1, 3175–3270 feet, near Burkville, Newton Co., Texas (Pl. 25, fig. 17).

This is one of the few ornamented species of the genus.

Pleurostomella bellardi HANTKEN, Ertek. termesz. kör., vol. 13, 1883, p. 25, pl. 2, figs. 1 *a, b.*

Types from the Eocene of Hungary. This and the two following species are not figured on the plate.

Pleurostomella incrassata HANTKEN, Ertek. termesz. kör., vol. 13, 1883, p. 25, pl. 1, figs. 4 *a, b;* 7 *a, b.*

Types from the Eocene of Hungary.

Pleurostomella tenuis HANTKEN, Ertek. termesz. kör., vol. 13, 1883, p. 25, pl. 1, figs. 5 *a, b.*

Types from the Eocene of Hungary.

SPECIES WITH TYPES FROM THE CRETACEOUS

**Pleurostomella subnodosa* REUSS (Genotype), Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 204, pl. 8, figs. 2 *a, b.*

Types from Westphalia, Germany (Pl. 25, fig. 23).

We have had American specimens from Navarro formation, branch of Kickapoo Creek, 1200′ S. of Public Road, 1.8 miles N. W. of Annona, Red River Co., Texas, and from Pecan Gap Chalk, Greenville Road, 5.1 miles S. by W. of Wolfe City, Texas, collected by L. W. Stephenson.

Pleurostomella barroisi BERTHELIN, Mém. Soc. Geol. France, ser. 3, vol. 1, 1880, p. 30, pl. 1 (24), figs. 13 *a, b.*

Types from the Albien at Moncley, France (Pl. 25, fig. 24).

This seems more like a *Nodosarella* than a *Pleurostomella.*

Pleurostomella obtusa BERTHELIN, Mém. Soc. Geol. France, ser. 3, vol. 1, 1880, p. 29, pl. 1 (24), figs. 9 *a, b.*

Types from the Albien at Moncley, France (Pl. 25, fig. 22).

Pleurostomella reussi BERTHELIN, Mém. Soc. Geol. France, ser. 3, vol. 1, 1880, p. 25, pl. 1 (24), figs. 10–12.

Types from the Albien at Moncley, France (Pl. 25, fig. 25).

Pleurostomella fusiformis REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 205, pl. 8, fig. 1.

Types from Westphalia, Germany (Pl. 25, fig. 21[1]).

This species from the figure is not characteristically a *Pleurostomella*, the alternating character of the chambers being almost obsolete and taking on the characters of *Nodosarella*.

**Pleurostomella torta* CUSHMAN, Contrib. Cushman Lab. Foram. Res., vol. 2, 1926, p. 18, pl. 2, fig. 7.

Types from east of Pujal, San Luis Potosi, Mexico (Pl. 25, fig. 16).

**Pleurostomella clavata* CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 590, pl. 16, figs. 5 *a*, *b*.

Types from Velasco shale, near Velasco, Mexico (Pl. 25, fig. 19).

**Pleurostomella velascoensis* CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 590, pl. 16, figs. 4 *a*, *b*.

Types from Velasco shale, near Velasco, Mexico (Pl. 25, fig. 20).

Pleurostomella globulifera FRANKE, Verhandl. Nat. Hist. Ver., vol. 59, 1912 (1913), p. 265, pl. 6, fig. 3.

Types from near Ahlen, Germany. This is in reality an *Ellipsoglandulina*. It is not figured on our plate.

SPECIES WITH TYPES FROM THE JURASSIC

Pleurostomella jurassica HAEUSLER, Abhandl. Schweiz. Pal. Ges., vol. 17, 1890, p. 77, pl. 12, figs. 14–22.

Types from the Transversarius zone of Switzerland (Pl. 25, figs. 30–32).

These are arenaceous forms and do not belong with *Pleurostomella*. The aperture is not that of this genus.

SPECIES WITH TYPES FROM THE PERMO-CARBONIFEROUS

Pleurostomella antiqua CHAPMAN, Mem. Geol. Survey, New South Wales, vol. 14, 1905, p. 14, pl. 2, fig. 5.

Types from Wollong, New South Wales (Pl. 25, fig. 27).

There is little about the figure to suggest *Pleurostomella* and it may be questioned if it really belongs here.

The following species is new:

PLEUROSTOMELLA SCHUBERTI Cushman and Harris, n. sp.

Plate 25, figures 29 *a*, *b*

Pleurostomella n. sp., SCHUBERT, Abhandl. Geol. Reichs., vol. 20, pt. 4, 1911, p. 57, text figs. 4 *a*, *b*.

Test elongate, somewhat compressed, slightly tapering in side view, in front view narrow, the sides nearly parallel; chambers few, elongate, apertural end of the last-formed chamber extended and somewhat spatula-formed; sutures distinct, very slightly depressed, slightly limbate; wall smooth, finely perforate; aperture broadly elliptical, teeth not apparent.

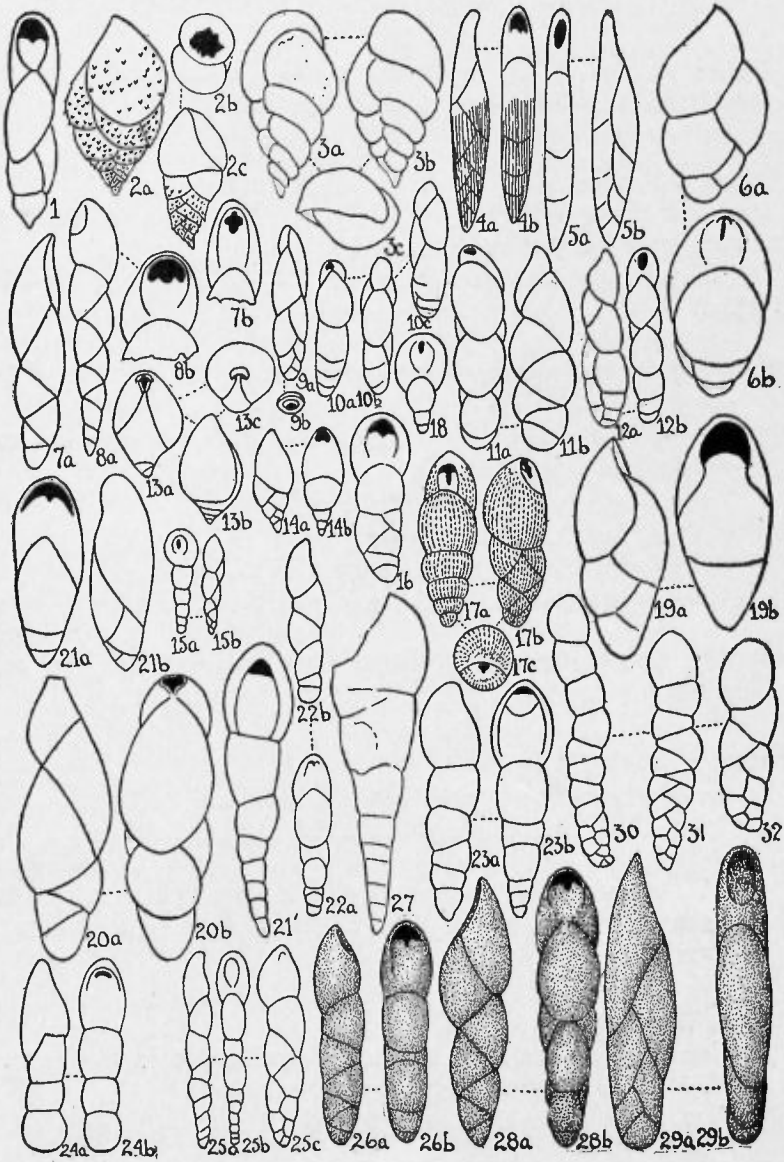
Length 0.65 mm.; breadth 0.13 mm.; thickness 0.10 mm.

Holotype (U. S. Nat. Mus. No. 20308) from *Albatross* D 5348, Palawan Passage, Philippines, 375 fathoms.

This is evidently the same as the species figured but not named by Schubert in the above reference with the closely related *P. sapperi* Schubert it is unique in the genus in the character of the very strong lateral compression.

EXPLANATION OF PLATE 25

FIG. 1. *Pleurostomella acuminata* Cushman. (After Cushman, 1922.)
FIG. 2. *Pleurostomella spinosa* Cushman. (After Cushman, 1911.)
FIG. 3. *Pleurostomella contorta* Millett. (After Millett, 1900.)
FIG. 4. *Pleurostomella sapperi* Schubert. (After Schubert, 1911.)
FIG. 5. *Pleurostomella* sp. nov. Schubert. (After Schubert, 1911.)
FIG. 6. *Pleurostomella brevis* Schwager. (After Schwager, 1866.)
FIGS. 7, 8. *Pleurostomella alternans* Schwager. (After Schwager, 1866.)
FIG. 9. *Pleurostomella alternans* Schwager, var. *telostoma* Schubert. (After Schubert, 1900.)
FIG. 10. *Pleurostomella alternans* Schwager, var. *parvifinita* Schubert. (After Schubert 1899.)
FIG. 11. *Pleurostomella alternans* Schwager, var. *moravica* Schubert. (After Schubert 1899.)
FIG. 12. *Pleurostomella alternans* Schwager, var. *hians* Schubert. (After Schubert, 1903.)
FIG. 13. *Pleurostomella pleurostomella* (A. Silvestri). (After A. Silvestri, 1904.)
FIG. 14. *Pleurostomella acuta* Hantken. (After Hantken, 1875.)
FIG. 15. *Pleurostomella eocaena* Gümbel. (After Gümbel, 1868.)
FIG. 16. *Pleurostomella torta* Cushman. (After Cushman, 1926.)
FIG. 17. *Pleurostomella jacksonensis* Cushman and Applin. (After Cushman and Applin, 1926.)
FIG. 18. *Pleurostomella rapa* Gümbel. (After Gümbel, 1868.)
FIG. 19. *Pleurostomella clavata* Cushman. (After Cushman, 1926.)
FIG. 20. *Pleurostomella velascoensis* Cushman. (After Cushman, 1926.)
FIG. 21. *Pleurostomella alazanensis* Cushman. (After Cushman, 1925.)
FIG. 21′. *Pleurostomella fusiformis* Reuss. (After Reuss, 1860.)
FIG. 22. *Pleurostomella obtusa* Berthelin. (After Berthelin, 1880.)
FIG. 23. *Pleurostomella subnodosa* Reuss. (After Reuss, 1860.)
FIG. 24. *Pleurostomella barroisi* Berthelin. (After Berthelin, 1880.)
FIG. 25. *Pleurostomella reussi* Berthelin. (After Berthelin, 1880.)
FIG. 26. *Pleurostomella subnodosa* Reuss. Texas specimen.
FIG. 27. *Pleurostomella antiqua* Chapman. (After Chapman.)
FIG. 28. *Pleurostomella alternans* Schwager. Specimen from Trinidad.
FIG. 29. *Pleurostomella schuberti* Cushman and Harris, n. sp. Philippine specimen.
FIGS. 30–32. *Pleurostomella jurassica* Haeusler. (After Haeusler.)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12b
13a
13b
13c
14a
14b
15a
15b
16
17a
17b
17c
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19a
19b
20a
20b
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21a
21b
22a
22b
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23b
24a
24b
25a
25b
25c
26a
26b
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28a
28b
29a
29b
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32

RECENT LITERATURE ON THE FORAMINIFERA

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

Chapman, Frederick and Walter James Parr.
Tertiary Foraminifera of Victoria, Australia. The Balcombian deposits of Port Phillip. Part II.
(Journ. Linn. Soc. Zool. London, vol. 36, 1926, pp. 373-399, 5 pls.)
Melbourne.

This is the second part of this paper, the first of which was published in 1907. This second part takes up 86 species and varieties of the Lagenidae of which one species and variety are described as new.

Matley, C. A. and A. Morley Davis.
Some Observations on the Geology of Viti Levu.
(Geol. Mag., vol. 64, 1927, pp. 65–75, 3 text figs.)
London.

Mention of several foraminiferal genera is made and something of their occurrence in the deposits given.

Cushman, Joseph A.
Foraminifera of the Genus Ehrenbergina and its Species.
(Proc. U. S. Nat. Mus., vol. 70, 1927, pp. 1–8, 2 pls.)
Washington.

A review of the species of this genus, figures after the originals and the distribution is given. One new species is described.

Nuttall, W. L. F.
The localities whence the Foraminifera figured in the report of H. M. S. "Challenger" by Brady were derived.
(Ann. Mag. Nat. Hist., ser. 9, vol. 19, 1927, pp. 209–241.)
London.

A very valuable work giving the localities of the figured specimens of Brady's work as well as the place of deposit of the type specimens.

Vaughan, T. Wayland.

Species of *Lepidocyclina* and *Carpenteria* from the Cayman Islands.

(Quart. Journ. Geol. Soc., vol. 82, Oct. 1926, pp. 388–400, 3 plates.)

London.

Notes are given on the preparation of sections for both field and laboratory use. Copious notes are given on several species and are illustrated by excellent photographs of sections. One new variety is described.

Vaughan, T. Wayland.

The Stratigraphic Horizon of the Beds Containing *Lepidocyclina chaperi* on Haut Chagres, Panama.

(Proc. Nat. Acad. Sci., vol. 12, No. 8, Aug. 1926, pp. 519–522.)

Washington.

Notes are given on the various species occuring at this locality and something of their distribution.

Vaughan, T. Wayland.

Foraminifera from the Upper Eocene Deposits of the Coast of Ecuador.

(Proc. Nat. Acad. Sci., vol. 12, No. 8, Aug. 1926, pp. 533–535.)

Washington.

Notes are given on several genera found in the collection from the locality given.

Silvestri, A.

Pseudonummuliti nel Terziario della Toscana.

(Atti Pont. Accad. Sci. Nuovi Lincei, Anno 79, 1926, pp. 155–159, text figs.)

Rome.

Figures of these bodies which externally resemble Nummulites are given and notes on their structure.

Silvestri, A.

Rinvernimento di "Dictyoconus" nell'Eocene delle Isole Ionie.

(Mem. Pont. Accad. Sci. Nuovi Lincei, vol. 9, 1926, pp. 1–8, 1 plate.)

Rome.

Figures of a number of the conical-shaped genera are given with notes on their structure and stratigraphic distribution.

Yabe, Hisakatsu and Shoshiro Hanzawa.
Globigerina Ooze from the Sea lying South of Okinawa-jima (the Riukiu Islands).
(Jap. Journ. Geol. Geog., vol. 4, 1925 (1926), pp. 47–54, 1 fig.)
Tokio.

This paper gives the results in tabular form of the examination of nine samples from the above region.

Hanzawa, Shoshiro.
Globigerina-marl and Other Foraminiferous Rocks underlying the Raised Coral Reef Formation of Okinawa-jima (The Riukiu Islands).
(Jap. Journ. Geol. Geog., vol. 4, 1925 (1926), pp. 33–45.)
Tokio.

A list of 254 species and varieties of foraminifera is given with their frequency at a number of stations.

Cushman, Joseph A.
Some Palaeontologic Evidence Bearing on a Classification of the Foraminifera.
(Amer. Journ. Sci., vol. 13, Jan. 1927, pp. 53–56.)
New Haven.

A review of the evidence, especially from the Palaeozoic, of what is primitive in the Foraminifera and its bearing on Classification is given.

Cushman, Joseph A.
Phylogenetic Studies of the Foraminifera. Part I.
(Amer. Journ. Sci., vol. 13, April 1927, pp. 315–326, text figures.)
New Haven.

The lines of development as shown in the Buliminidae and Heterohelicidae are discussed and the abundance of parallelisms shown.

Cushman, Joseph A.
The Occurrence of *Lituonella* and *Coskinolina* in America.
(Journ. Washington Acad. Sci., vol. 17, No. 8, April 1927, pp. 198, 199.)
Washington.

These two genera occur in the Middle Eocene of Florida with a number of others which show the correlation in age between these beds and those of Southern Europe.

Hanna, G. Dallas.
The Photography of Small Objects.
(Trans. Amer. Micr. Soc., vol. 46, Jan. 1927. pp. 15–25.)
New York.

The mathematical side of the photography of foraminifera and other micro-organisms is carefully worked out and the possibilities and limits of direct photography shown.

Hanna, Marcus A.
Separation of Fossils and Other Light Materials by Means of Heavy Liquids.
(Economic Geol., vol. 22, 1927, pp. 14–17.)
Lancaster.

The use of heavy liquids especially bromoform is described and the application to foraminifera and other objects discussed.

Tobler, Aug.
Über *Cyclammina (Choffatella) sequana* Merian spec.
(Ber. Schweizerischen Paläontologischen Gesellschaft, vol. 19, 1926, pp. 714–719, 1 plate.)
Basel.

Notes are given on the occurrences and earlier references to this and related forms, and a new name proposed.

Tobler, Aug.
Miogypsina im untersten Neogen von Trinidad und Borneo.
(Ber. Schweizerischen Paläontologischen Gesellschaft, vol. 19, 1926, pp. 719–722.)
Basel.

A discussion of the occurrences and relationships of this genus in the two regions is discussed.

Tobler, Aug.
Meandropsina im Tertiär von Ostborneo.
(Ber. Schweizerischen Paläontologischen Gesellschaft, vol. 20, 1927, pp. 321–323, 1 plate.)
Basel.

The occurrence is discussed and the species illustrated from photographs.

Tobler, Aug.

Verkalkung der Lateral-Kammern bei *Miogypsina*.

(Ber. Schweizerischen Paläontologischen Gesellschaft, vol. 20, 1927, pp. 323–330, 5 text figures.)

Basel.

Two new species are described and illustrated by sections.

Cushman, Joseph A. and G. Dallas Hanna.

Foraminifera from the Eocene Near Coalinga, California.

(Proc. Calif. Acad. Sci., ser. 4, vol. 16, April 22, 1927, pp. 205–229, pls. 13, 14.)

San Francisco.

Thirty-three species and varieties are recorded with nine of them new.

Heron-Allen, E. and A. Earland.

Report on the Foraminifera of the Cambridge Expedition to the Suez Canal.

(Trans. Zool. Soc. London, vol. 22, Part 1, No. 9, December 1926, pp. 65–70.)

London.

A report on material from nine stations with notes and a list of species with distribution.

J. A. C.