

CONTRIBUTIONS
from the
CUSHMAN LABORATORY
for
FORAMINIFERAL RESEARCH

Volume 2, Part 4

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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

33. SOME NEW GENERA OF THE FORAMINIFERA.

BY JOSEPH A. CUSHMAN.

In the closer study of several genera it has become increasingly apparent that some of these include species that have different developments with definite phylo-genetic relationships and as such should be separated from one another. Several generic names are therefore proposed for these different groups for the benefit of greater definiteness and to show better the relationships.

GENUS PLANOGLOBULINA Cushman, new genus.

Genotype, *Planoglobulina acervulinoides* (EGGER) (*Guembelina acervulinoides* EGGER.)

Test with the earliest chambers in the microspheric form planospiral, followed by a series arranged biserially and in the adult by a series of globular chambers spread out fan shaped or even partially extending back toward the earlier chambers on either side, the later chambers in a single plane; wall calcareous, perforate.

This genus represents an end form developed from *Pseudotextularia* Rzehak which in its earlier stages is similar but in the adult has the chambers in a coiling series about the apertural end. Both genera are characteristic of the Upper Cretaceous of Europe and America.

GENUS SPIROPLECTOIDES Cushman, new genus.

Genotype, *Spiroplecta rosula* EHRENBURG, Mikrogeologie, 1854, pl. 32 (2), fig. 36.

Test with the early chambers planospiral, later ones biserial, the test elongate, sides nearly parallel and the biserial chambers very numerous; wall calcareous, finely perforate; aperture elliptical, terminal or nearly so in the adult.

Ehrenberg described this species from the Upper Cretaceous of America. I have lately had specimens from the Upper Cretaceous of Texas and Mexico which are evidently identical with Ehrenberg's species. The genus *Heterohelix* afterward changed to *Spiroplecta* by Ehrenberg has as its type *H. americana* Ehrenberg with planospiral young but the later chambers as in *Guembelina*, a genus derived from it.

GENUS SPIROPLECTINA Cushman, new genus.

Genotype, *Textularia annectens* PARKER AND JONES, Ann. Mag. Nat. Hist., ser. 3, vol. 11, 1863, p. 92, fig. 1, (in text).

Test with the early chambers planospiral, later ones biserial, sides of the test straight and nearly parallel, the last group of chambers uniserial with distinctly constricted necks and a rounded terminal aperture.

The specimens from the Cretaceous (Gault) show the uniserial adult stage and probably represent an end stage developing from *Spiroplectoides*. Many arenaceous biserial forms have been referred to *Spiroplecta* but they should be referred elsewhere.

GENUS TUBULOGENERINA Cushman, new genus.

Genotype, *Textularia (Bigenerina) tubulifera* PARKER AND JONES, Ann. Mag. Nat. Hist., ser. 3, vol. 11, 1863, p. 94, fig. 2, (in text).

Test with the early chambers biserial, later ones uniserial, compressed or rounded in transverse section; wall with numerous tubuli extending out from the test either open, forming a tubular connection with the interior or closed, forming lobular connections with the chamber; wall calcareous; aperture elongate, narrow or in the adult with numerous rounded openings in the terminal face, the interior of the chambers at least in some species with a curved structure from roof to floor.

This genus occurs in the Upper Eocene of the Paris Basin and in the Miocene of Australia. It was originally figured in the above reference from Grignon by Parker and Jones. Later Terquem in 1882 (Mém. Soc. Géol. France, ser. 3, vol. 2, p. 121, pl. 12, fig. 35 a, b) referred it to *Clavulina eocenica* Gümbel. Heron-Allen and Earland (Journ. Roy. Micr. Soc., 1909, p. 329, pl. 16, fig. 1) had a specimen from the Eocene of Selsey and recognizing that Terquem's placing of the species was erroneous gave it a new name *Bigenerina conica* not recognizing the earlier name of Parker and Jones. Heron-Allen and Earland place under *B. conica* much larger specimens from the Miocene of Aus-

Already
name used
by Schuchert
but never
mentioned

tralia (Pl. 16, figs. 2-6) which from a study of specimens in my own collection from the Filter Quarry of Moorabool River and comparison with *T. tubulifera* from the Eocene of the Paris Basin appears to be a different species. The Australian species is much larger, has the biserial development much more restricted, the rows of tubules two or three in the adult whereas they are usually single in the Eocene species. This Australian Miocene species may be known as *Tubulogenerina mooraboolensis* Cushman, new species. Other species are *Tubulogenerina ferox* (Heron-Allen and Earland) from the same locality and *T. papillosa* (Halkyard) from the Eocene of Biarritz.

GENUS BOLIVINELLA Cushman, new genus.

Genotype, *Textularia folium* PARKER AND JONES, Trans. Roy. Soc., vol. 155, 1865, pp. 370, 420, pl. 18, fig. 19.

Test much compressed, the proloculum in the megalospheric form rectangular, in the microspheric form the young is apparently planospiral, later chambers biserial, chambers long and recurved, not overlapping; wall calcareous, perforate; aperture transverse to the compression of the test with numerous papillae at the base of the opening.

This genus is most nearly related to *Guembelina* and its allies. It occurs as far back as the Eocene and continues to the present ocean where it is found in the Indo-Pacific. Besides *Bolivinella folium* (Parker and Jones) there are other species occurring both fossil and in the present ocean.

GENUS NODOGENERINA Cushman, new genus.

Genotype, *Nodogenerina bradyi* CUSHMAN, new species.

Test uniserial, straight, chambers increasing in size as added, distinct, inflated, constricted at the connection between the chambers; wall calcareous, finely perforate; aperture terminal, central, rounded, with a cylindrical neck and phialine lip.

NODOGENERINA BRADYI Cushman, new species.

Sagrina virgula H. B. BRADY (in part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 76, fig. 8 (not 4-6, 9, 10).

Test uniserial, chambers increasing in size as added, inflated, widest near the base, which is finely spinose, lower portion rapidly constricted; wall smooth except at the basal ridge, finely perforate; aperture rounded or elliptical, with a short neck and slightly flaring phialine lip.

Brady does not give the locality for this specimen although

those figured on the same plate, figs. 9, 10 came from off the Ki Islands.

The genus resembles *Nodosaria* in its superficial characters but is not glassy, and does not have a radiate aperture. It is a derivative as an end form from *Siphogenerina*.

GENUS NODOMORPHINA Cushman, new genus.

Genotype, *Nodosaria compressiuscula* NEUGEBOREN, Verh. Mitth. Siebenburg Ver. Nat., vol. 3, 1852, p. 59, pl. 1, figs. 54-56; Denkschr. Akad. Wiss. Wien, Vol. 12, pt. 2, 1926, p. 79, pl. 2, figs. 1-7.

Test compressed, especially in the earlier portion; chambers numerous, early ones quadrilateral in section, later ones more nearly circular; sutures distinct, slightly depressed, especially between the later chambers; wall ornamented by numerous raised costae in pairs one at either side of the median line giving a bilateral symmetry to the test; aperture circular or elliptical without teeth or radiate fissures, terminal.

This genus includes those forms figured above. *Nodomorphina compressiuscula* may be distinguished from *Nodosaria* by the lack of a radiate aperture and by the paired character of the costae making up the ornamentation and compressed test. It is an end form developed through *Plectofrondicularia* and *Amphimorphina*.

GENUS CRIBROBULIMINA Cushman, new genus.

Plate 11, figs. 1-5.

Genotype, *Valvulina mixta* PARKER AND JONES in Carpenter, Parker and Jones, Introd. Foram., 1862, p. 146, pl. 11, fig. 19.

Test in the early stages trihedral, angled, the sides flattened, chambers triserially arranged, adult chambers in a loose spiral, five or more in a coil; sutures distinct; wall arenaceous; aperture in the young as in *Valvulina* later developing an opening in the plate-like tooth and in the adult a series of small openings forming a cribrate plate, pl. 11, fig. 5.

The type species, *Criobulimina mixta* (Parker and Jones) is from Australia. It develops from an angular verneuiline form while the next genus came from a rounded one and is more accelerated.

GENUS ARENOBULIMINA Cushman, new genus.

Genotype, *Bulimina presli* REUSS, Verstein Böhm. Kreide, 1845-46, pt. 1, p. 38, pl. 13, fig. 72.

Test with the earlier chambers triserial, the angles rounded,

later chambers spirally arranged, close-coiled; sutures distinct, not depressed, of fine calcareous cement; wall finely arenaceous, smoothly finished; aperture with a broad rounded tooth.

Arenobulimina presli (Reuss) occurs in the Upper Cretaceous of Europe with other related species. I have for study a set of this species named and selected by Reuss himself and they show even better than the published figures the differences between this and the calcareous, finely perforate, thin walled *Bulimina*.

GENUS PSEUDOUVIGERINA Cushman, new genus

Genotype, *Uvigerina cristata* MARSSON, Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, Jahrg. 10, 1878, p. 150, pl. 3, figs. 20 a-c.

Test in the early stages biserial, later triserial; wall calcareous, coarsely perforate; aperture with a tubular neck and phialine lip.

Pseudouvigerina cristata (Marsson) is one of the species which have apparently originated from the triserial condition foreshadowed by *Eouvigerina*. There are a number of very small species in the Upper Cretaceous of Europe and America which evidently arose in this manner and should not be confused with the later developed group represented by *Uvigerinella* Cushman and *Uvigerina* d'Orbigny which are apparently a direct derivation from *Bulimina*. The squarish periphery seen in *Eouvigerina cretacea* (Heron-Allen and Earland) and *E. americana* Cushman is seen in *Pseudouvigerina cristata* (Marsson) and in some of the American Cretaceous species. All the species noted are angular in character.

**34. SOME ARENACEOUS FORAMINIFERA FROM THE
UPPER CRETACEOUS OF TEXAS.**

BY JOSEPH A. CUSHMAN AND JAMES A. WATERS.

A study of the species of the Upper Cretaceous of Texas has resulted in the finding of numerous species of arenaceous foraminifera. As there are certain zones especially in the Navarro formation where few other forms occur, it has seemed best to

describe a number of these. After a careful search of the literature nearly all these species seem to be undescribed in spite of the fact that so many of the calcareous Upper Cretaceous species of Texas and Mexico are identical with European ones. The arenaceous species considered here, belong to the genera *Proteonina*, *Reophax*, *Haplophragmoides* and *Trochammina*.

PROTEONINA DIFFLUGIFORMIS (H. B. Brady.)

Plate 10, figure 1.

Reophax difflugiformis H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 51, pl. 4, figs. 3 *a*, *b*; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 289, pl. 30, figs. 2-4 (not 1, 5).

Proteonina difflugiformis RHUMBLER, Arch. Prot., vol. 3, 1903, p. 245, figs. 80 *a*, *b* (in text).—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 42, figs. 40, 41 (in text).

Test a single elongate oval or pyriform chamber with a more or less distinct tubular neck usually tapering gradually from the body of the chamber, undivided; wall fairly thick, of sand grains of variable size, firmly cemented, aperture circular, simple, terminal. Length up to 0.5 mm.

Just east of Richland, specimens occurred in the Navarro formation in cores from Navarro County, Texas. In some of these specimens, the neck is more pronounced than in the figured specimen.

REOPHAX TEXANA Cushman and Waters, new species.

Plate 10, figure 2.

Test generally rectilinear, uniserial, the chambers spherical or nearly so, slightly overlapping; wall coarsely arenaceous of angular sand grains with the cement mostly inconspicuous, aperture small, rounded or angular, central, terminal. Length up to 1.25 mm., diameter 0.50 mm.

Holotype, (Cushman Coll. No. 6087) from Navarro formation, east of Richland, Navarro County, Texas.

This species is widely distributed in the Navarro formation breaking easily at the sutures so that complete specimens are rare, single chambers or two chambered fragments being most frequently met with.

HAPLOPHRAGMOIDES EXCAVATA Cushman and Waters, new species.

Plate 10, figures 3 *a*, *b*.

Test close-coiled, planospiral, compressed, periphery subacute;

chambers distinct, ten in the last-formed coil in the adult, the borders of each chamber distinctly thickened, central portion depressed; sutures straight, radial, not usually distinct; wall finely arenaceous with little cement, smoothly finished; color light gray. Length 0.45-0.50 mm., breadth 0.35-0.40 mm., thickness 0.15-0.18 mm.

Holotype, (Cushman Coll. No. 6089) from Navarro formation, near Quinlan, Hunt Co., Texas.

This is a common species especially in the upper part of the Navarro where it is often almost the only species present in certain zones.

HAPLOPHRAGMOIDES RUGOSA Cushman and Waters, new species.

Plate 10, figures 4 *a*, *b*.

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

Holotype, (Cushman Coll. No. 6088) from the Navarro formation just east of Richland, Navarro County, Texas.

In some respects this resembles most closely some of the fossil forms referred to *H. canariensis* (d'Orbigny). It is very distinct from that species however.

HAPLOPHRAGMOIDES CALCULA Cushman and Waters, new species.

Plate 10, figures 5 *a*, *b*.

Test close coiled, planospiral, very strongly compressed, sometimes slightly lobulated; chambers and sutures usually indistinct except in exceptional specimens: wall very coarsely arenaceous, roughly finished in spite of the considerable amount of cement: color dark greenish black. Length 0.67-0.75 mm., thickness 0.18-0.20 mm.

Holotype, (Cushman Coll. No. 6090) from the Navarro formation from dug well at Tona School, near Quinlan, Hunt Co., Texas collected by Mrs. Helen J. Plummer. The species seems rather limited in its vertical distribution, and varies very little in its general characters.

HAPLOPHRAGMOIDES GLABRA Cushman and Waters, new species.

Plate 10, figures 6 *a*, *b*.

Test close-coiled, planospiral, somewhat compressed and um-

bilicate, periphery rounded; chambers fairly distinct, 9-11 in the last-formed coil in the adult, rounded, evenly curved; sutures slightly curved, slightly depressed; wall finely arenaceous, smoothly finished; color dark gray. Length of type specimen 0.33 mm; breadth 0.30 mm; thickness 0.14 mm.

Holotype, (Cushman Coll. No. 6091) from Navarro formation, Hunt Co., Texas.

While this species occurs with *H. excavata* it is a very different species.

TROCHAMMINA DIAGONIS (Carsey).

Plate 10, figures 7 a-c.

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

Test trochoid, compressed, periphery lobulated; chambers distinct, 6 or 7 in the last-formed coil; sutures distinct, depressed, on the dorsal side slightly curved, on the ventral side nearly radial; wall arenaceous with considerable cement. Diameter 0.65-0.80 mm.

This species was described as a *Haplophragmoides* but a study of a large series of specimens including some from the type locality seems to show that the form is trochoid. The last-formed coil is slightly below the preceding one so that when shearing takes place as is frequent in this formation, there is a tendency for the specimens to show a peculiar irregular appearance. Well preserved specimens like that figured are found with those which have been subjected to strain and connect the two. The figured specimen (Cushman Coll. No. 6092) is from the Navarro formation, from core at Mexia, Limestone Co., Texas.

TROCHAMMINA GYROIDES Cushman and Waters, new species.

Plate 10, figures 8 a, b.

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

Holotype, (Cushman Coll. No. 6093) from Navarro formation, east of Richland, Navarro County, Texas.

This species is much the thickest of those described. It varies

somewhat having the chambers occasionally more loosely arranged.

TROCHAMMINA TEXANA Cushman and Waters, new species.

Plate 11, figures 8 *a-c*.

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

Holotype, (Cushman Coll. No. 6094) from the Navarro formation, Tona School near Quinlan, Hunt Co., Texas, collected by Mrs. Helen J. Plummer.

This species resembles *Haplophragmoides excavata* somewhat in the last chambers and the texture of the test. It is typically a *Trochammina* however.

35. AMERICAN UPPER CRETACEOUS SPECIES OF
BOLIVINA AND RELATED SPECIES.

BY JOSEPH A. CUSHMAN.

Many of the Upper Cretaceous species of Europe and America are identical and others while they may be distinguished in one area from the other are nevertheless closely related. A study of the species usually assigned to *Bolivina* shows this same relationship. I am indebted to several European workers for excellent sets of Cretaceous species from the type formations from which they were described. It has thus been possible to make accurate comparisons of material from the two areas. Ehrenberg apparently figures species of *Bolivina* on Plate 32 of his *Mikrogeologie* which is entirely of American Cretaceous species.