CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

84. A LATE TERTIARY FAUNA OF VENEZUELA AND OTHER RELATED REGIONS

By JOSEPH A. CUSHMAN

Some time ago Mr. M. N. Bramlette presented me with some excellent foraminiferal material from Venezuela. The study of these collections, especially one collected by J. A. Tong from a Sea Cliff, S. 55° E. of Cemetery of Aguide, District of Zemorra, Venezuela labelled Miocene, has been interesting. It is identical with a collection from Manta, Ecuador given me by Mr. Bramlette several years ago, and a part of the same sample used by Galloway and Morrey in their paper (Bull. Amer. Pal., vol. 15, No. 55, 1929). In that paper the authors judge the fauna to be Upper Eocene in age. This age determination is due to the errors in identification of numerous species, and probably due particularly to the general method of identification from figures rather than by comparison with either types or large series of topotype specimens. The figures given by many of the earlier authors were more or less conventionalized or generalized, and do not represent the species in detail. From a single figure or specimen, it is often very difficult to judge the limits of variation. Thus many of the species described as *Dentalina* or *Nodosaria* from the Oligocene and Miocene of Central Europe are found to be *Ellipsonodosaria* when carefully studied. Young and adult stages should be carefully compared as well as microspheric and megalospheric forms which are often very different in superficial examination.

The Venezuela collection has practically all the species of the Ecuador fauna and a number of others, as it is somewhat richer.

Both are closely related to faunas of Trinidad that have usually been placed in the Miocene. They are being studied in detail by Mr. P. W. Jarvis and myself, and the relations will be brought out more in detail later. Nuttall has found many of the species in Trinidad that occur in the other two regions. It may be definitely stated that the fauna is not Eocene, but is much younger. In Ecuador, another older fauna is present containing *Hantkenina* which is older and is also very closely related to another of the older faunas of Trinidad. Many of the species of the fauna here dealt with are widely distributed in the later Oligocene and especially the Miocene of America and Europe. Notes on the fauna and figures of some of the more important species follow:

Family RHIZAMMINIDAE

Genus BATHYSIPHON M. Sars, 1872

BATHYSIPHON sp.(?)

Plate 12, figure 1

There are fragmentary species of a *Bathysiphon* in the Venezuelan material. This species is more slender than *B. eocenica* from the Tertiary of California, but there are not large enough specimens for specific determination.

Family SACCAMMINIDAE

Genus PROTEONINA Williamson, 1858

PROTEONINA DIFFLUGIFORMIS (H. B. Brady)

Plate 12, figure 2

A single specimen, compressed in fossilization, apparently belongs to this species which is known from the Miocene of Florida. Its recorded geologic range is very wide.

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

HAPLOPHRAGMOIDES EMACIATUM (H. B. Brady)

Plate 12, figure 3

Specimens from Venezuela are identical with Recent material from the Caribbean.

Family TEXTULARIIDAE

Genus TEXTULARIA Defrance, 1824

TEXTULARIA MEXICANA Cushman

Plate 12, figure 4

Textularia rugosa REUSS, var., GOËS, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 43, pl. 5, figs. 4, 5.

Textularia carinata FLINT (not D'ORBIGNY), Rep. U. S. Nat. Mus., 1897 (1899), p. 284, pl. 29, fig. 1.

Textularia mexicana CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 17, pl. 2, fig. 9.

Textularia flabelliformis GALLOWAY and MORREY (not GÜMBEL), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 35, pl. 5, figs. 8 *a*, *b*.

Test much compressed, about 1½ times as long as broad, the apical end triangular, bluntly pointed, apertural end rounded or slightly angular, periphery sharp, test thickest near the middle, rhomboid in end view; chambers numerous, distinct, broadest at the apertural end, thence concave toward the inferior margin; sutures clear-cut, depressed; wall closely arenaceous, roughened, especially over the sutures which are raised, united in the center to form a definite high ridge, especially in the latter half of the test; aperture semicircular, at the base of the inner margin of the last-formed chamber; color grayish-white.

The above description is the original which applies equally well to the fossil forms. This is a rather localized species in the Western Atlantic and closely related to *Textularia millettii* Cushman of the Pacific. It has no close resemblance to Gümbel's species which is nearly smooth as European specimens show and probably the young of *Vulvulina haeringensis* Gümbel of both of which I have European specimens for comparison. The Ecuador specimens are not the young of *Vulvulina*, as good specimens of that genus were obtained, and one of which is figured from Ecuador. The sutures are rounded and the wall is very differently finished. It may be noted here that the *Textularia mexicana* recorded by Cole from the Eocene of Mexico is very close to *T. mississippiensis* and very different from true *T. mexicana*.

Ecuador and Venezuela.

TEXTULARIA MISSISSIPPIENSIS Cushman

Plate 12, figure 5

A single specimen was found in the Venezuela collection.

Genus VULVULINA d'Orbigny, 1826

VULVULINA CAPREOLUS d'Orbigny

Plate 12, figure 6

The figured specimen which is one of several obtained from Manta, Ecuador, is identical with large series I have from the Western Atlantic. Brady figures this form excellently (Rep. Voy. *Challenger*, Zoology, 1884, pl. 45, figs. 1-4), the originals of which are from the same region. It is common in the Trinidad Tertiary. It is very different from the older *V. spinosa* Cushman from the Eocene.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA TRINITATENSIS Nuttall

Plate 12, figure 7

Gaudryina trinitatensis NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 76, pl. 3, figs. 15, 16.

The single specimen figured here is from Manta, Ecuador, and seems identical with Nuttall's species from the Tertiary of Trinidad.

Genus CLAVULINA d'Orbigny, 1826

CLAVULINA CYCLOSTOMATA (Galloway and Morrey)

Plate 12, figures 8, 9

Verneuilina cyclostomata GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 33, pl. 5, fig. 2.

Clavulina pallida GALLOWAY and MORREY (not CUSHMAN), l. c., p. 34, pl. 5, figs. 6, 7.

The two species noted are identical as a comparison of a large series from Manta shows. The early triserial stage is usually abundant where adult Clavulinas are found, and may be distinguished from true *Verneuilina* by its aperture. This species is very close to typical *C. communis* from the type locality of Rimini. The triserial portion may be slightly more rotund, but shape, size and texture of the wall is very close. If the name be kept, it should according to the Rules take the name of the young stage which is used first. It is not at all the same as *C. pallida* Cushman which is more slender, very finely arenaceous, almost chalky in texture although firmly cemented and has an especially long series of triserial chambers.

Ecuador and Venezuela.

CLAVULINA CURTA Galloway and Morrey

Plate 12, figure 10

Clavulina curta GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 34, pl. 5, fig. 5.

This occurs in Venezuela and Ecuador. The roughened triserial stage is common with adults.

CLAVULINA BRAMLETTEI Cushman, new species

Plate 12, figure 11

Test composed of few chambers, early triserial portion of very few chambers; the other sides flattened, angles broadly rounded, uniserial portion of usually three, occasionally four chambers, rounded, with deep sutures, apertural end with a short neck; wall slightly roughened, especially about the sutures; aperture small and circular. Length up to 1.25 mm.; diameter 0.35 mm.

Holotype (Cushman Coll. No. 12219) from Tertiary of Manta, Ecuador.

The species is named for M. N. Bramlette, the collector.

Family MILIOLIDAE

Genus SIGMOILINA Schlumberger, 1887

SIGMOILINA TENUIS (Czjzek)

Plate 12, figures 12-14

Quinqueloculina tenuis CZJZEK, Haidinger's Nat. Abhandl., vol. 2, 1847, p. 149, pl. 13, figs. 31-34.

Sigmoilina tenuis CHASTER, First Rept. Southport Soc. Nat. Sci., 1890-91 (1892), p. 56.—JONES, Foram. Crag, pt. 2, 1895, p. 125, pl. 7, fig. 2.—CUSHMAN, Bull. 103, U. S. Nat. Mus., 1918, p. 81, pl. 31, figs. 4 *a-c;* Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 139.

Sigmoilina elliptica GALLOWAY and WISSLER, Journ. Pal., vol. 1, 1927, p. 39, pl. 7, fig. 2.

Quinqueloculina angusta GALLOWAY and MORREY (not PHILIPPI), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 8, pl. 3, fig. 3.

This is a variable species. I have a large series of topotypes, and the range of variation is great. In the Ecuador series, all stages may be found as shown here. This species is one of fairly deep water and has a wide distribution. In America, it occurs in the Miocene of the Coastal Plain of the United States from Maryland to Florida, in the Miocene of the Panama Canal Zone, in the Late Tertiary of California, and is living in the present oceans. It occurs both in Ecuador and Venezuela.

Philippi's *Triloculina angusta* is a true *Triloculina* and not related to this species.

SIGMOILINA CELATA (Costa)

Abundant in Ecuador, rare in Venezuela. This is a common species in the present oceans in fairly deep water. The fossil records for this species are from the Miocene and Pliocene of widely distributed localities.

Genus SPIROLOCULINA d'Orbigny, 1826

SPIROLOCULINA LIMBATA d'Orbigny

Plate 12, figure 15

Specimens occur only in the Venezuela material.

Family OPHTHALMIDIIDAE

Genus CORNUSPIRA Schultze, 1854

CORNUSPIRA cf. CARINATA Costa

A single specimen from Venezuela may belong here.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS sp.(?)

Specimens of the form figured by Galloway and Morrey and referred to as *"Lenticulina occidentalis novangliae* (Cushman)" occur both in the Ecuador and Venezuela material. They have the supplementary slit characteristic of *Robulus* as do the types

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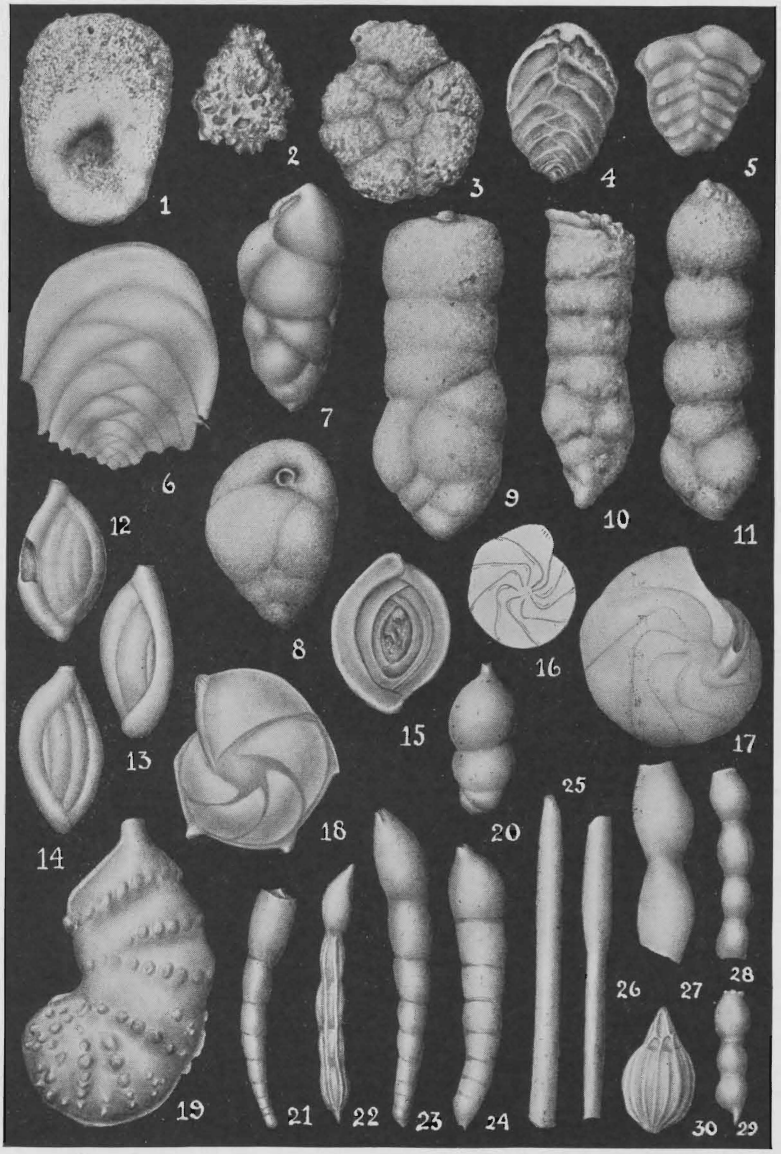
EXPLANATION OF PLATE 12

FIG. 1, *Bathysiphon* sp.(?) × 25. FIG. 2, *Proteonina difflugiformis* (H. B. Brady). × 50. FIG. 3, *Haplophragmoides emaciatum* (H. B. Brady). × 35. FIG. 4, *Textularia mexicana* Cushman. × 40. FIG. 5, *T. mississippiensis* Cushman. × 50. FIG. *6, *Vulvulina capreolus* d'Orbigny. FIG. *7, *Gaudryina trinitatensis* Nuttall. × 35. FIGS. *8, *9, *Clavulina cyclostomata* (Galloway and Morrey). × 25. 8, Triserial stage; 9, Adult. FIG. *10, *C. curta* Galloway and Morrey. × 25. FIG. *11, *C. bramlettei* Cushman, n. sp. × 35. FIGS. *12, *13, 14, *Sigmoilina tenuis* (Czjzek). × 45. FIG. 15, *Spiroloculina limbata* d'Orbigny. × 45. FIGS. 16, 17, *Robulus clericii* (Fornasini). 16, (After Fornasini); 17, × 35. FIG. 18, *R. calcar* (Linné). × 35. FIG. 19, *R. subaculeata* (Cushman). var. *glabrata* (Cushman). × 25. FIG. 20, *Marginulina subbullata* Hantken. × 35. FIG. 21, *Dentalina inornata* d'Orbigny. × 35. FIG. 22, *D. acuta* d'Orbigny. × 35. FIGS. 23, 24, *D. pauperata* d'Orbigny. × 35. FIGS. 25, 26, *Nodosaria longiscata* d'Orbigny. × 35. FIGS. 27-29, *Dentalina consobrina* d'Orbigny. × 50. FIG. 30, *Lagena* sp.(?) or young of *Nodosaria* (?). × 50.

* Specimen from Manta, Ecuador. All other from Venezuela.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of *"Cristellaria occidentalis"* and its varieties. Variety *novangliae* is a very large form, 5 mm. or more in diameter, and like *R. occidentalis* has nearly straight sutures. The specimens from Ecuador and Venezuela are very small and the sutures are curved. There are not sufficient specimens to be sure that one is not dealing with the young stages, and I do not feel warranted in giving them a specific name.

ROBULUS CALCAR (Linné)

Plate 12, figure 18

Specimens are common both in Ecuador and Venezuela, and also in Trinidad.

ROBULUS CLERICII (Fornasini)

Plate 12, figures 16, 17

Cristellaria clericii FORNASINI, "Cristellaria clericii, n. sp.", Bologna, 1895 (text fig.); Mem. R. Accad. Sci. Bologna, ser. 5, vol. 9, 1901, p. 65, fig. 17 (in text).—NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 87, pl. 5, fig. 10.

Robulus duracina GALLOWAY and MORREY (not STACHE), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 21, pl. 2, fig. 13.

I have this species from Ecuador, Venezuela and Trinidad. Nuttall has figured it well, and that of Galloway and Morrey gives the characters fairly well, their figures indicating about eight chambers while their description reads 12 to 15. Why the authors referred this to Stache's species with its description and figure of about five chambers to the whorl, its nearly straight sutures and very large umbo, it is difficult to see. Chapman has referred Stache's species to *macrodiscus* Reuss, to which it seems to be clearly related. *R. clericii* seems to be a very distinct species. A copy is given of Fornasini's original figure.

ROBULUS sp.(?)

Galloway and Morrey (l. c., p. 21, pl. 2, fig. 14) have referred a smooth *Robulus* to Stache's *taettowata* from the Upper Eocene of New Zealand. The species occurs in Ecuador, Venezuela and Trinidad. Their description gives about six chambers to the whorl, but the figure has 10 or 11. It may be noted that the figures assigned to *R. taettowata* and to *Lenticulina occidentalis novangliae* are very similar. The development of the keel is a very variable character.

ROBULUS SUBACULEATA (Cushman), var. GLABRATA (Cushman)

Plate 12, figure 19

Cristellaria aculeata FLINT (not D'ORBIGNY), Rep. U. S. Nat. Mus., 1897 (1899), p. 318, pl. 66, fig. 3.

Cristellaria subaculeata CUSHMAN, var. *glabrata* CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 124, pl. 32, fig. 4; pl. 33, figs. 2, 3; pl. 34, fig. 3.—NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 90, pl. 6, figs. 1, 5.

This form which occurs rather commonly at certain stations in the Gulf of Mexico is common in the Later Tertiary of Trinidad and Venezuela. I have one incomplete specimen from Ecuador.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA SUBBULLATA Hantken

Plate 12, figure 20

I have recorded this species from the Alazan clays of Mexico. The figured specimen from Venezuela is identical with the Mexican ones. It is also very close to *M. pedum* d'Orbigny and numerous species described by Neugeboren.

Genus DENTALINA d'Orbigny, 1826

DENTALINA PAUPERATA d'Orbigny

Plate 12, figures 23, 24

This species described from the Miocene by d'Orbigny occurs in the collections from Ecuador, Venezuela and Trinidad.

DENTALINA ACUTA d'Orbigny

Plate 12, figure 22

d'Orbigny described this species also from the Miocene of the Vienna Basin. It is somewhat variable, as a series from the type locality shows. The initial end has a spine, the walls longitudinally costate and the final chamber somewhat separated from the others. Venezuela.

DENTALINA INORNATA d'Orbigny

Plate 12, figure 21

Rare in the Venezuela material. Originally described from the Miocene of the Vienna Basin.

DENTALINA CONSOBRINA d'Orbigny

Plate 12, figures 27-29

d'Orbigny's figure of this species represents only partially the various forms that are developed in the Vienna Basin Miocene. Venezuela, Ecuador and Trinidad.

DENTALINA ADOLPHINA d'Orbigny

Plate 13, figures 3, 4

Occurs in material from Trinidad, Venezuela and Ecuador. This is a very widely distributed species. Of Galloway and Morrey's report, "*Nodosaria adolphina* d'Orbigny" Pl. 2, fig. 1, "*Nodosaria lepidula* Schwager" Pl. 2, fig. 2, and "*Lagenonodosaria monilis* (Silvestri)" Pl. 3, fig. 1 should all be included under this species. These modifications of the ornamentation are common at the type locality of Baden, and occur even in different parts of the same specimen.

DENTALINA SPINOSA d'Orbigny

Plate 13, figures 7, 8

This is a modification of the species described from the Miocene of the Vienna Basin by d'Orbigny. It is not the same as the form noted by Cole from the Eocene of Mexico as shown by a comparison with material received from Mr. Cole. A portion of the costae fuse between the chambers.

Genus NODOSARIA Lamarck, 1812

NODOSARIA VERTEBRALIS (Batsch)

Rare in both Ecuador and Venezuela collections, more common in Trinidad.

NODOSARIA ACUMINATA Hantken

Plate 13, figures 5, 6

Numerous specimens occur, Ecuador and Venezuela.

NODOSARIA LONGISCATA d'Orbigny

Plate 12, figures 25, 26

Specimens from Venezuela and Trinidad seem to belong to this species while those from Ecuador are more like specimens I have from the Pliocene of the Pacific Islands, and which are closer to *N. arundinea* Schwager, (Pl. 13, figs. 1, 2). The two species are very close, especially when a large series from the

Vienna Basin is available for comparison. Nuttall has united the two. It is common in the Mexican Alazan.

NODOSARIA SCHLICHTI Reuss

Plate 13, figures 9, 10

Specimens from Trinidad are referred to this species by Nuttall. It is apparently the same as that referred by Galloway and Morrey to *N. conspurcata* Reuss. One of the Venezuela specimens shows the later chambers, and is figured here. There is much variation in the amount of closeness of the chambers. It may be noted here that both Nuttall and Galloway and Morrey figure a single or two-chambered specimen, the former as "*Lagena aspera* Reuss", the latter as "*L. asperoides* n. sp.". The resemblance of this to a very large megalospheric proloculum with a small secondary chamber such as occurs in many species is marked. It is still more striking as von Schlicht publishes just such a figure on the plate with the type of *N. schlichti*. Such forms also occur in Venezuela with *Nodosaria schlichti*.

Genus PSEUDOGLANDULINA Cushman, new genus

Genoholotype, *Nautilus comata* Batsch

Nodosaria (part) of authors.
Glandulina (part) of authors.

Test similar to *Nodosaria*, but the chambers embracing, the last-formed one making up a large proportion of the surface of the test; chambers uniserial throughout; aperture radiate.

The genotype of *Glandulina* is *G. laevigata* d'Orbigny. Ozawa and I have studied the types and much topotype material of this species as well as large series of recent and fossil material, and find that it is derived from the Polymorphinidae. This is discussed in our paper now in press. This leaves the Nodosarian forms without a name as the other synonyms of *Glandulina* seem all to refer to species with Polymorphine young, at least in the microspheric form.

PSEUDOGLANDULINA GALLOWAYI Cushman, new species

Plate 13, figure 13

Glandulina comata GALLOWAY and MORREY (not BATSCH), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 13, pl. 1, figs. 7 *a*, *b*.

Test nearly as broad as long, somewhat pyriform, initial end subacute, composed of a very few chambers in a rectilinear

series, much overlapping; sutures largely obscured by the costae, of which there are 18-24, high and rather thick, continuous from the initial end to the middle of the last-formed chamber, the apertural face being smooth; aperture large, with radiating slits giving a toothed appearance. Length 0.75 mm.; diameter 0.55 mm.

Holotype (Cushman Coll. No. 12221) from Tertiary of Manta, Ecuador, collected by M. N. Bramlette.

This species is referred by Galloway and Morrey to *Glandulina comata* (Batsch). That species as shown by a series of recent specimens from Rimini, has very fine, close set and very low costae compared with this species, and the whole test is much more rounded.

The early stage consisting of the megalospheric proloculum or with one additional chamber is so close to the specimens figured by Galloway and Morrey as "*Lagena semistriata*" (Pl. 2, fig. 7) and "*L. strumosa*" (Pl. 2, fig. 8) that it is probable that they represent the early stages of this species.

Genus SARACENARIA Defrance, 1824

SARACENARIA ITALICA Defrance (?)

Plate 13, figure 14

There is a single specimen in the Venezuela collection of the short form with few chambers noted by Nuttall from Trinidad. It may prove to be distinct from Defrance's species.

SARACENARIA ACUTAURICULARIS (Fichtel and Moll)

Plate 13, figure 12

Nuttall records this from Trinidad where it is rare as it is also in Venezuela.

Genus LAGENA Walker and Jacob, 1798

LAGENA GRACILIS Williamson

Plate 13, figure 11

Rare in the Venezuela collection.

LAGENA sp.(?)

Plate 12, figure 30

The figured specimen is probably the young of a *Nodosaria*. There are a few other Lagenas in the Venezuela collection represented by single specimens, but they are held until the Trini-

dad collections are completely studied when more specimens will be available.

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1826

GUTTULINA IRREGULARIS (d'Orbigny)

Plate 13, figures 15, 16

This species occurs in the collections from Ecuador, Venezuela and Trinidad. *"Polymorphina byramensis* Cushman" is a synonym, and a full discussion is given by Ozawa and myself in a paper now in press.

Genus GLANDULINA d'Orbigny, 1826

GLANDULINA LAEVIGATA d'Orbigny

Plate 13, figure 17

Common in the collections from Ecuador, Venezuela and Trinidad. The figure shows the oblique sutures of the microspheric form. A discussion of this genus and its various species is given by Ozawa and myself in a forthcoming paper.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION POMPILIOIDES (Fichtel and Moll)

Plate 13, figures 25 *a*, *b*

This species is common in Ecuador, Venezuela and Trinidad, and is widely distributed in the Late Tertiary.

NONION AFFINIS (Reuss)

Plate 13, figures 24 *a*, *b*

Nonionina affinis REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 72, pl. 5, fig. 32.

Planulina affinis GALLOWAY and MORREY (not *Pulvinulina affinis* HANTKEN), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 32, pl. 4, figs. 12 *a-c*.

This species is close to the preceding, differing in the strongly compressed test and slightly larger number of chambers. The limbate sutures fused into a ring about the umbilici is similar in both. I have specimens of Reuss's species from the Upper Oligocene of Germany which are identical with those of Ecuador and Venezuela, where it is common. Nuttall records this from

Trinidad as *"Nonionina depressula* (Walker and Jacob)". Like many of Reuss's figures, those of this species are somewhat conventionalized and specimens are necessary for obtaining the full characters.

Family HETEROHELICIDAE

Genus PLECTOFRONDICULARIA Liebus, 1903

PLECTOFRONDICULARIA CALIFORNICA Cushman and Stewart

Plate 13, figures 18, 19

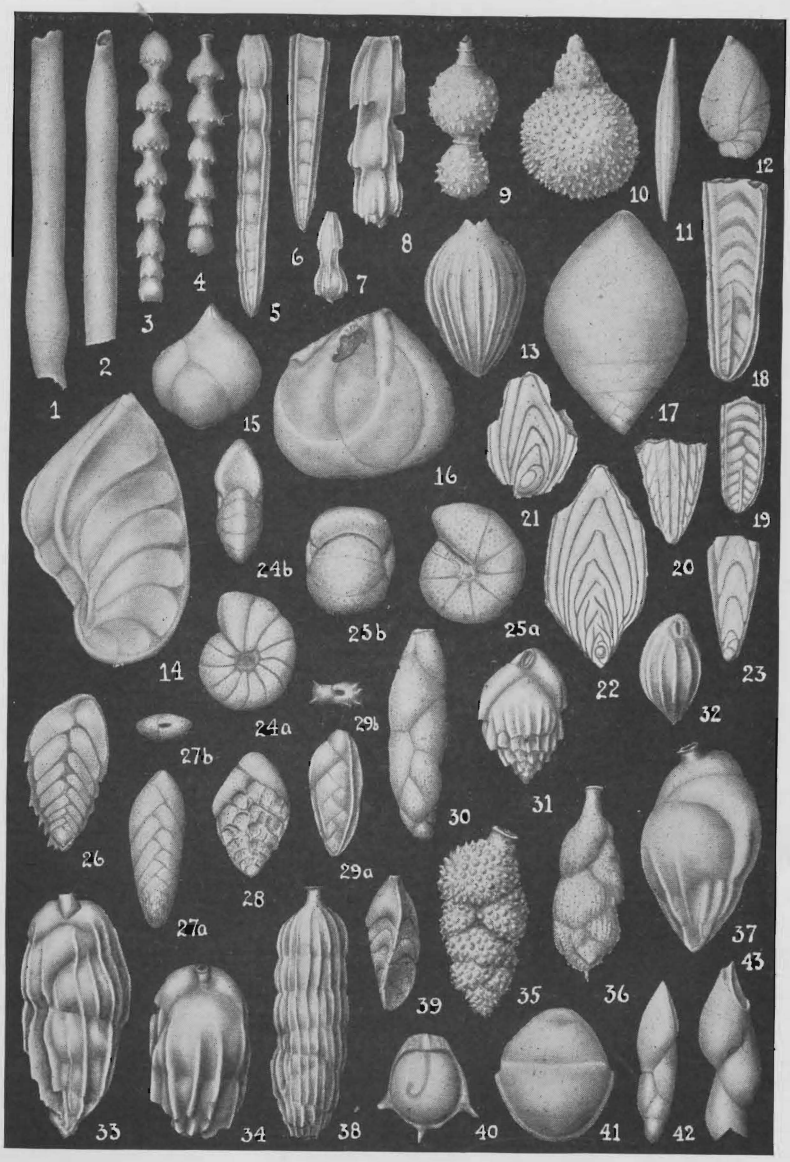
Plectofrondicularia californica CUSHMAN and STEWART, Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 39, pl. 6, figs. 9-11.—NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 92, pl. 6, fig. 9.—GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 36, pl. 5, fig. 11.

This occurs in the collections from Ecuador, Trinidad and Venezuela. It is abundant in the Lower Pliocene of California. A very closely related species occurs in the Miocene of Florida. The specimens have a somewhat longer biserial stage as shown in the figure, and it is probably the ancestral form of *californica* but so close as to hardly warrant a distinct name unless further study shows it to be useful.

EXPLANATION OF PLATE 13

FIGS. *1, *2, *Nodosaria arundinea* Schwager. × 35. FIGS. 3, 4, *Dentalina adolphina* d'Orbigny. × 35. FIGS. 5, 6, *Nodosaria acuminata* Hantken. × 35. FIGS. 7, *8, *Dentalina spinosa* d'Orbigny. FIGS. 9, *10, *Nodosaria schlichti* Reuss. × 35. FIG. 11, *Lagena gracilis* Williamson. × 50. FIG. 12, *Saracenaria acutauricularis* (Fichtel and Moll). × 35. FIG. *13, *Pseudoglandulina gallowayi* Cushman, n. sp. × 35. FIG. 14, *Saracenaria italica* Defrance (?). × 25. FIGS. 15, *16, *Guttulina irregularis* (d'Orbigny). × 35. FIG. *17, *Glandulina laevigata* d'Orbigny. × 35. FIGS. *18, *19, *Plectofrondicularia californica* Cushman and Stewart. × 40. FIG. 20, *P. miocenica* Cushman. × 40. FIGS. *21, 22, *P. vaughani* Cushman. × 40. FIG. *23, *P. morreyae* Cushman, n. sp. × 40. FIG. *24, *Nonion affinis* (Reuss). × 35. FIG. *25, *N. pompilioides* (Fichtel and Moll). × 40. FIG. 26, *Bolivina pisciformis* Galloway and Morrey. × 40. FIG. *27, *B. mantaensis* Cushman, n. sp. × 65. FIG. 28, *B. caelata* Cushman. × 65. FIG. 29, *B. tongi* Cushman, n. sp. × 65. FIG. 30, *Virgulina bramletti* Galloway and Morrey. × 50. FIG. 31, *Bulimina inflata* (Seguenza). × 35. FIG. 32, *B. rostrata* H. B. Brady. × 65. FIGS. *33, *34, *Uvigerina gallowayi* Cushman, n. sp. × 35. 33, Microspheric; 34, Megalospheric. FIG. 35, *U. hispida* Schwager. × 35. FIG. 36, *U. auberiana* d'Orbigny. × 65. FIG. 37, *U. beccarii* Fornasini. × 35. FIG. 38, *Siphogenerina multicostata* Cushman and Jarvis. × 35. FIG. 39, *Trifarina bradyi* Cushman. × 40. FIG. 40, *Entosolenia staphyllearia* (Schwager). × 50. FIG. 41, *Gonatosphaera prolata* Guppy. × 20. FIGS. 42, 43, *Pleurostomella alternans* Schwager. × 50.

* Specimens from Manta, Ecuador. All others from Venezuela.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PLECTOFRONDICULARIA MIOCENICA Cushman
Plate 13, figure 20

Plectofrondicularia miocenica CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 58, pl. 7, figs. 10-12; pl. 8, figs. 11-12.—GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 37, pl. 5, fig. 12.

This species originally described from the Miocene of California occurs both in Ecuador and Venezuela.

PLECTOFRONDICULARIA VAUGHANI Cushman
Plate 13, figures 21, 22

Plectofrondicularia vaughani CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 112, pl. 23, fig. 3; Journ. Pal., vol. 1, 1927, pl. 25, fig. 11.

Flabellina budensis GALLOWAY and MORREY (not HANTKEN), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 11, pl. 1, fig. 3.

This species is common in Trinidad, Venezuela and Ecuador as well as in Mexico. Hantken's species is apparently a *Flabellina,* but this species is a *Plectofrondicularia.* An Ecuador specimen is figured as well as one from Venezuela. The early development is very striking but is easily overlooked unless specimens are very clean or else cleared to show the sutures. It is possible that Nuttall's *"Frondicularia advena"* may belong here as his figure shows what may be a biserial young. At any rate, our species is very common in Trinidad.

PLECTOFRONDICULARIA MORREYAE Cushman, new species
Plate 13, figure 23

Test elongate, tapering, much compressed, with a wide, thin, peripheral keel, only the earliest chambers biserial, later ones frondicularian, narrow at the sides but high in the median region; sutures distinct, slightly depressed; wall smooth. Length 0.50 mm. or more.

Holotype (Cushman Coll. No. 12222) from Tertiary of Manta, Ecuador, collected by M. N. Bramlette.

This is a distinctive but smooth species easily distinguished from others of the genus.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA MANTAENSIS Cushman, new species
Plate 13, figures 27 *a, b*

Bolivina applinae GALLOWAY and MORREY (not PLUMMER), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 35, pl. 5, fig. 9.

Test small, elongate, somewhat compressed, very gradually

tapering, periphery somewhat rounded; chambers numerous, 8-10 pairs, not inflated; sutures strongly oblique, very slightly if at all curved, very slightly limbate, not depressed; wall distinctly perforate, basal portion with a few somewhat irregularly broken longitudinal ridges, very slightly raised, later portion smooth; aperture elongate, narrow, meeting the base of the chamber. Length 0.35-0.40 mm.; breadth 0.12-0.15 mm.

Holotype (Cushman Coll. No. 12223) from Tertiary of Manta, Ecuador, collected by M. N. Bramlette.

This is a small but distinctive species. It is not related to *Loxostomum applinae* (Plummer) which is a large and very finely characterized species of the Upper Cretaceous and Midway Eocene growing to more than a millimeter in length. In that species the reëntrants at the base of the later chambers are very distinct, but in the small Ecuador species are very inconspicuous or wanting. A large series was obtained from the collection from Manta, and the characters are very constant. This is a much smaller species than *Bolivina advena* Cushman, and the chambers are differently shaped as in the whole test.

BOLIVINA PISCIFORMIS Galloway and Morrey

Plate 13, figure 26

Bolivina pisciformis GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 35, pl. 5, fig. 10.

This form is very abundant in Ecuador, Venezuela and Trinidad. It is very closely related to and perhaps a varietal form of *B. mexicana* Cushman.

BOLIVINA FLORIDANA Cushman

Nuttall records this species from Trinidad. It is abundant in the Miocene of Florida, rare in Venezuela.

BOLIVINA CAELATA Cushman

Plate 13, figure 28

This species is common in the Oligocene of the Coastal Plain of the United States, and occurs in Trinidad as well as Mexico. Frequent in Venezuela.

BOLIVINA TONGI Cushman, new species

Plate 13, figures 29 *a*, *b*

Test small, somewhat compressed, very gradually tapering, periphery truncated; chambers comparatively few, usually 5 or

6 pairs, very slightly inflated, rapidly increasing in size as added; sutures distinct, slightly if at all depressed, oblique, not curved; wall thin and translucent, very finely perforate, ornamented by a few longitudinal sharp costae near the sides of the test; aperture rather large for the size of the test, broad. Length up to 0.35 mm.; breadth 0.10-0.12 mm.

Holotype (Cushman Coll. No. 12224) from Tertiary of Aguide, Dist. of Zemorra, Venezuela, collected by J. A. Tong.

This is a very distinctive little species with its truncate sides and few plate-like costae near the borders.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA INFLATA (Seguenza)

Plate 13, figure 31

This common species occurs in material from Ecuador, Venezuela and Trinidad, and is widely distributed elsewhere in the Later Tertiary.

BULIMINA ROSTRATA H. B. Brady

Plate 13, figure 32

This species is known from Recent and Pliocene collections. It is fairly numerous in the Venezuela collection.

Genus VIRGULINA d'Orbigny, 1826

VIRGULINA BRAMLETTI Galloway and Morrey

Plate 13, figure 30

Virgulina bramletti GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 37, pl. 5, figs. 14 *a*, *b*.

The specimens from Venezuela are almost exactly like those from Ecuador.

Genus UVIGERINA d'Orbigny, 1826

UVIGERINA GALLOWAYI Cushman, new species

Plate 13, figures 33, 34

Uvigerina alata GALLOWAY and MORREY (not CUSHMAN and APPLIN), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 38, pl. 6, fig. 1.

Test rather short, especially in the megalospheric form, more elongate and fusiform in the microspheric, apertural end truncate; chambers somewhat inflated; sutures largely obscured by the ornamentation; wall ornamented by 12-18 high, plate-like

longitudinal costae mostly independent of the chamber lines, becoming almost spinose at the base and diminishing toward the apertural end leaving the last chambers nearly smooth; aperture with a short neck and lip, in a depression of the outer face. Length up to 1.10 mm.; breadth 0.45 mm.

Holotype (Cushman Coll. No. 12225) from Tertiary of Manta, Ecuador, collected by M. N. Bramlette.

This is distinct from the Eocene *U. alata* which has a differently shaped test and with the costae broken at the individual chambers. Rare in Venezuela.

UVIGERINA BECCARII Fornasini

Plate 13, figure 37

This species with its few costae near the base and smooth apertural end occurs both in Ecuador and Venezuela, abundant at both localities. It is very variable in its characters, some specimens being almost entirely smooth, and all gradations exist up to rather heavily costate forms. The types are from the Pliocene of Italy.

UVIGERINA HISPIDA Schwager

Plate 13, figure 35

Common in Ecuador, Venezuela and Trinidad. The spines are blunt. The types are from the Pliocene of Kar Nicobar.

UVIGERINA AUBERIANA d'Orbigny

Plate 13, figure 36

This species now living in the western Atlantic is fairly common in Venezuela. Nuttall records it from Trinidad.

Genus SIPHOGENERINA Schlumberger, 1883

SIPHOGENERINA MULTICOSTATA Cushman and Jarvis

Plate 13, figure 38

This species described from Trinidad (these Contributions, vol. 5, 1929, p. 14, pl. 3, fig. 6) occurs in typical form in the Venezuela collection.

SIPHOGENERINA RAPHANA (Parker and Jones), var. TRANSVERSA Cushman

This variety known from the Miocene of Panama has been already recorded from Trinidad, and occurs commonly in Venezuela.

Genus TRIFARINA Cushman, 1923

TRIFARINA BRADYI Cushman

Plate 13, figure 39

Specimens are fairly common in the Venezuela collection, and seem to be identical with the living species of the Atlantic.

Genus ENTOSOLENIA Ehrenberg, 1848

ENTOSOLENIA STAPHYLLEARIA (Schwager)

Plate 13, figure 40

A few specimens of this species occur in the Venezuela collection.

Family ELLIPSOIDINIDAE

Genus PLEUROSTOMELLA Reuss, 1860

PLEUROSTOMELLA ALTERNANS Schwager

Plate 13, figures 42, 43

Originally described from the Pliocene of Kar Nicobar, this species is widely distributed in the Late Tertiary. Ecuador, Venezuela and Trinidad.

Genus ELLIPSONODOSARIA A. Silvestri, 1900

ELLIPSONODOSARIA VERNEUILI (d'Orbigny)

Plate 14, figures 1-3

Dentalina verneuili D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 48, pl. 2, figs. 7, 8.

Nodosaria verneuili NUTTALL, Quart. Journ. Geol. Soc., vol. 84, p. 81, pl. 4, figs. 14, 15.

Nodosaria crassielegans NUTTALL, l. c., p. 80, pl. 4, figs. 6, 7.

Nodosarella camerani GALLOWAY and MORREY (not DERVIEUX), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 41, pl. 6, figs. 9-11.

Good figures of this species are given by Nuttall and by Galloway and Morrey. A study of types and topotypes of this species shows that only the microspheric form was figured by d'Orbigny, and that was conventionalized somewhat as far as the aperture is concerned. The megalospheric form has a basal spine, and in both forms the apertural end has a very thin tubular neck, elliptical in shape, with a tooth at one side. This is usually broken but in the very large series I have had from the Vienna Basin, it occurs frequently. Other species of d'Orbigny's belong here also, although his figures do not show the apertural characters.

This group is very common in the later Tertiary of Europe, and reaches a very great development in Trinidad. Nuttall has correctly identified this species which is entirely different from Dervieux's species. The error in identification of this species among others accounts for the placing of the Ecuador material much too low in the geologic column by Galloway and Morrey. It is an abundant species in Ecuador, Trinidad and Venezuela.

Nuttall's species *"crassielegans"* is evidently the megalospheric form of the species. Such forms occur with the typical in Ecuador, Venezuela and Trinidad as well as at the type locality of Baden. Fornasini has figured similar specimens from the Tertiary of Italy.

ELLIPSONODOSARIA VERNEUILI (d'Orbigny), var. PAUCISTRIATA (Galloway and Morrey)

Plate 14, figures 4, 5

Nodosaria intermittens NUTTALL (not ROEMER), Quart. Journ. Geol. Soc., vol. 84, p. 82, pl. 4, fig. 17.

Nodosarella paucistriata GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, p. 42, pl. 6, figs. 12 *a*, *b*.

Nuttall figures a specimen showing the chambers of the initial end of this variety which occurs with the typical in Ecuador and Trinidad. I have examined topotype specimens of *"intermittens"* Reuss, *"buchi"* Reuss and *"capitata"* Boll noted by Nuttall, and they all have typical radiate apertures. At Hermsdorf however, other species occur which would probably be assigned to *Ellipsonodosaria.*

Genus GONATOSPHAERA Guppy, 1894

GONATOSPHAERA PROLATA Guppy

Plate 13, figure 41

Gonatosphaera prolata GUPPY, Proc. Zool. Soc. London, 1894, p. 651, pl. 41, figs. 14-19; Proc. Victoria Inst. Trinidad, vol. 2, pt. 1, 1904, p. 7, pl. 1, figs. 1-7.

Lingulina prolata NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 84, pl. 5, fig. 6.

Guppy and Nuttall record this species from Trinidad, and I have numerous specimens from there. It is rare in the Venezuela collection. The figured specimen has the last chamber broken away.

Family ROTALIIDAE

Genus EPONIDES Montfort, 1808

EPONIDES UMBONATA (Reuss)

Plate 14, figures 8 *a-c*

Rotalina umbonata REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 75, pl. 5, fig. 35.

Eponides umbonata COLE, Bull. Amer. Pal., vol. 14, 1928, p. 15, pl. 2, fig. 6.

Rotalia umbonata GALLOWAY and MORREY, l. c., vol. 15, No. 55, 1929, p. 26, pl. 4, figs. 1 *a-c*.

Rotalia ecuadorensis GALLOWAY and MORREY, l. c., 1929, p. 26, pl. 3, figs. 13 *a-c*.

This is a species which keeps its characters in a wide geologic range. I have abundant specimens from Reuss's type locality, one slide alone having more than fifty specimens. The original figure shows the ventral sutures nearly straight, but in the specimens are rarely if ever straight having the characteristic curve on the inner end. In some specimens these are limbate, others not. The convexity of the spire is variable in microspheric and megalospheric specimens. The species occurs at least as low as the Middle Eocene (I have examined a set of specimens recorded by Cole) and probably extends to the Recent seas where it is usually recorded as *tenera* (H. B. Brady). Abundant in Ecuador, rather rare in Venezuela. The figured specimen is from the type locality, Hermsdorf, near Berlin.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA SOLDANII d'Orbigny

Plate 14, figures 6, 7

This widely distributed species is abundant in Ecuador, Venezuela and Trinidad as well as in the Miocene of the Coastal

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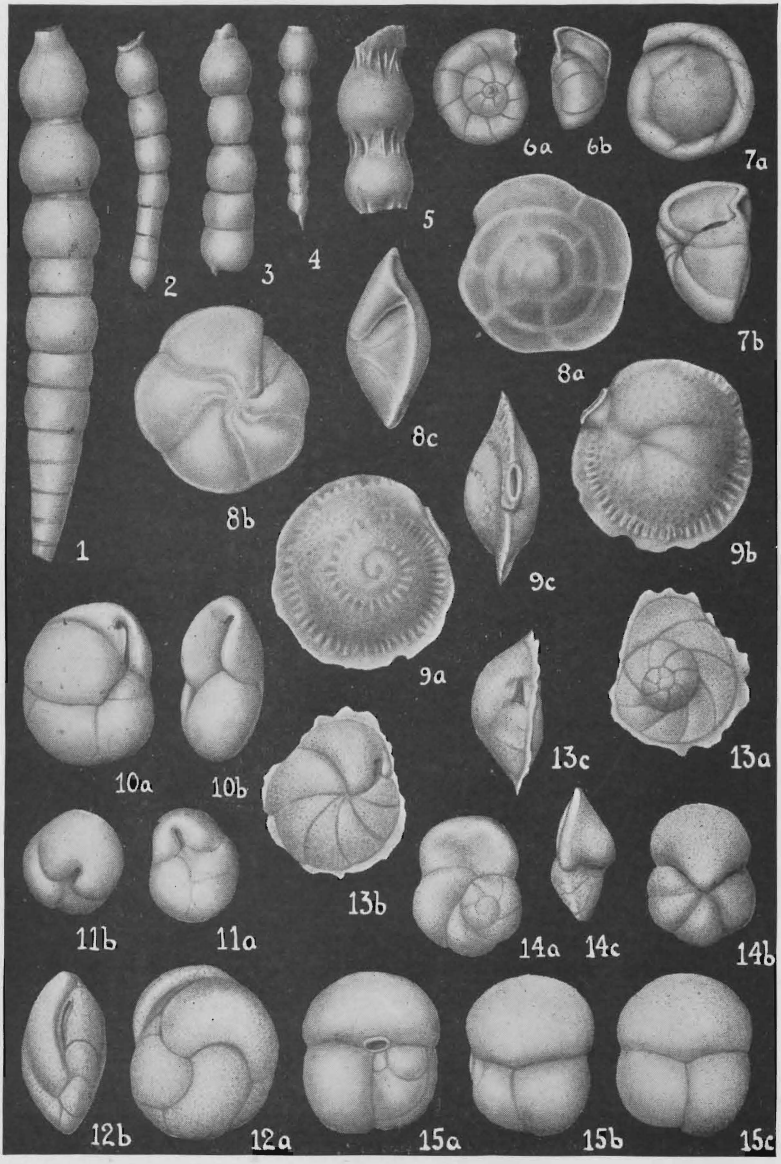
EXPLANATION OF PLATE 14

FIGS. 1-3, *Ellipsonodosaria verneuili* (d'Orbigny). × 25. 1, Microspheric; 2, 3, Megalospheric. FIGS. *4, *5, *E. verneuili* (d'Orbigny), var. *paucistriata* (Galloway and Morrey). × 25. FIGS. 6, 7, *Gyroidina soldanii* d'Orbigny. × 50. 6, Young; 7, Adult. FIGS. 8 *a-c*, *Eponides umbonata* (Reuss). × 50. FIGS. 9 *a-c*, *Siphonina tenuicarinata* Cushman. × 50. FIGS. 10 *a*, *b*, *Cassidulina crassa* d'Orbigny. × 50. FIGS. 11 *a*, *b*, *C. subglobosa* H. B. Brady. × 70. FIGS. 12 *a*, *b*, *C. delicatula* Cushman. × 125. FIGS. 13 *a-c*, *Pulvinulinella culter* (Parker and Jones). × 50. FIGS. 14 *a-c*, *Globorotalia canariensis* (d'Orbigny). × 70. FIGS. 15 *a-c*, *Sphaeroidina variabilis* Reuss. × 70.

* Specimen from Manta, Ecuador. Figs. 8 *a-c*, Topotype specimen from Hermsdorf, near Berlin. All others from Venezuela.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Plain of the United States and in the later Tertiary of many regions as well as Recent. The young (figured by Galloway and Morrey, pl. 4, fig. 4) is usually smooth but the adult specimens (Galloway and Morrey, pl. 4, fig. 3 *"G. nitidula"*) have a channel of varying depth inside the last whorl on the dorsal side.

Genus SIPHONINA Reuss, 1849

SIPHONINA TENUICARINATA Cushman

Plate 14, figures 9 *a-c*

This species occurs in Venezuela and Trinidad as well as in Mexico.

Family CASSIDULINIDAE

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA EXIGUA (H. B. Brady)

Pulvinulina exigua H. B. BRADY, Rep. Voy. *Challenger*, Zoölogy, vol. 9, 1884, p. 696, pl. 103, figs. 13, 14.

Pulvinulinella exigua HANNA and CHURCH, Journ. Pal., vol. 1, 1928, p. 200.

Rotalia advena GALLOWAY and MORREY (not CUSHMAN), Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 25, pl. 3, fig. 12.

This species is known mainly as a Recent Pacific species. It is common in the Ecuador material. The aperture places this in *Pulvinulinella*. It is very different from *"Rotalia advena* Cushman" which is a much larger species belonging to the genus *Eponides*.

PULVINULINELLA CULTER (Parker and Jones)

Plate 14, figures 13 *a-c*

This keeled species is widely distributed in the Tertiary and in Recent seas. It is rare in Ecuador, but common in Venezuela and Trinidad.

Genus CASSIDULINA d'Orbigny, 1826

CASSIDULINA SUBGLOBOSA H. B. Brady

Plate 14, figures 11 *a*, *b*

Occurs in Ecuador, Venezuela and Trinidad. A common living species.

CASSIDULINA CRASSA d'Orbigny

Plate 14, figures 10 *a*, *b*

Venezuela only.

CASSIDULINA DELICATULA Cushman
Plate 14, figures 12 *a, b*

Common, living off the Pacific coast and in the California Pliocene. Venezuela only.

Family CHILOSTOMELLIDAE

Genus SPHAEROIDINA d'Orbigny, 1826

SPHAEROIDINA VARIABILIS Reuss
Plate 14, figures 15 *a-c*

Sphaeroidina variabilis REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 88, pl. 7, figs. 61-64.
Sphaeroidina bulloides, var. *chilostomata* GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 32, pl. 5, figs. 1 *a, b*.

This species is very variable in the form and arrangement of the chambers. It is very abundant at Hermsdorf near Berlin and in many European localities in the Oligocene and Miocene. The apertural characters are like those of the Ecuador, Venezuela and Trinidad specimens. I have series of *S. bulloides* from Rimini and from Coroncina as well as of *S. austriaca* from localities in the Vienna Basin, and in spite of seeming differences in the figures, they appear to be the same. The apertural characters are very variable in the Rimini specimens, and it may be that all of these names are used for a single species.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA CANARIENSIS (d'Orbigny)
Plate 14, figures 14 *a-c*

Specimens of this species occur in Ecuador, Venezuela and Trinidad.

Family ANOMALINIDAE

There are numerous specimens belonging to *Cibicides* and *Planulina* in the Ecuador, Venezuela and Trinidad collections which must be carefully studied and compared with European series.

85. *PLANULINA ARIMINENSIS* D'ORBIGNY AND *P. WUELLERSTORFI* (SCHWAGER)

By JOSEPH A. CUSHMAN

The genus *Planulina* d'Orbigny 1826 seems to need elucidation, as it is being used in a somewhat different sense apparently than d'Orbigny employed it. The genotype is *Planulina ariminensis* d'Orbigny, the first species he mentions, the only one he figures, and of which he made a Model in his series, No. 49. The type locality is given as "la mer Adriatique, près Rimini". I have numerous specimens which I collected at Rimini, Italy in 1927, one of which is figured here (Pl. 15, figs. 4 *a-c*). A copy of d'Orbigny's original figure is given (Pl. 15, figs. 3 *a-c*). The original description of the genus is as follows: "Côtés inégaux; spire régulière, plus apparente d'un côté que de l'autre. Coquille régulière, libre, subturbinée; ouverte en fente contre l'avant dernier tour de spire". With this description, the original figure and the Model together with a large series of topotype specimens from Rimini, it is possible to get a very adequate idea of this species.

Like all species of *Planulina* and *Cibicides* as well as in many other foraminifera, there is a tendency for the test to show a greater or less amount of calcareous material of which it is composed. Over the sutures and about the perforations, there is always a certain amount of thickening and redundancy of material. As a result, the ornamentation shows considerable variation in any species. Like many of his figures, d'Orbigny conventionalized those of this species, and specimens do not show the simple state indicated by the figure (Pl. 15, fig. 3 *a-c*). The essentials of the species are the nearly flat, nearly parallel sides with a very slight umbo on the ventral side, the periphery truncate, sutures strongly limbate and the wall coarsely perfor-

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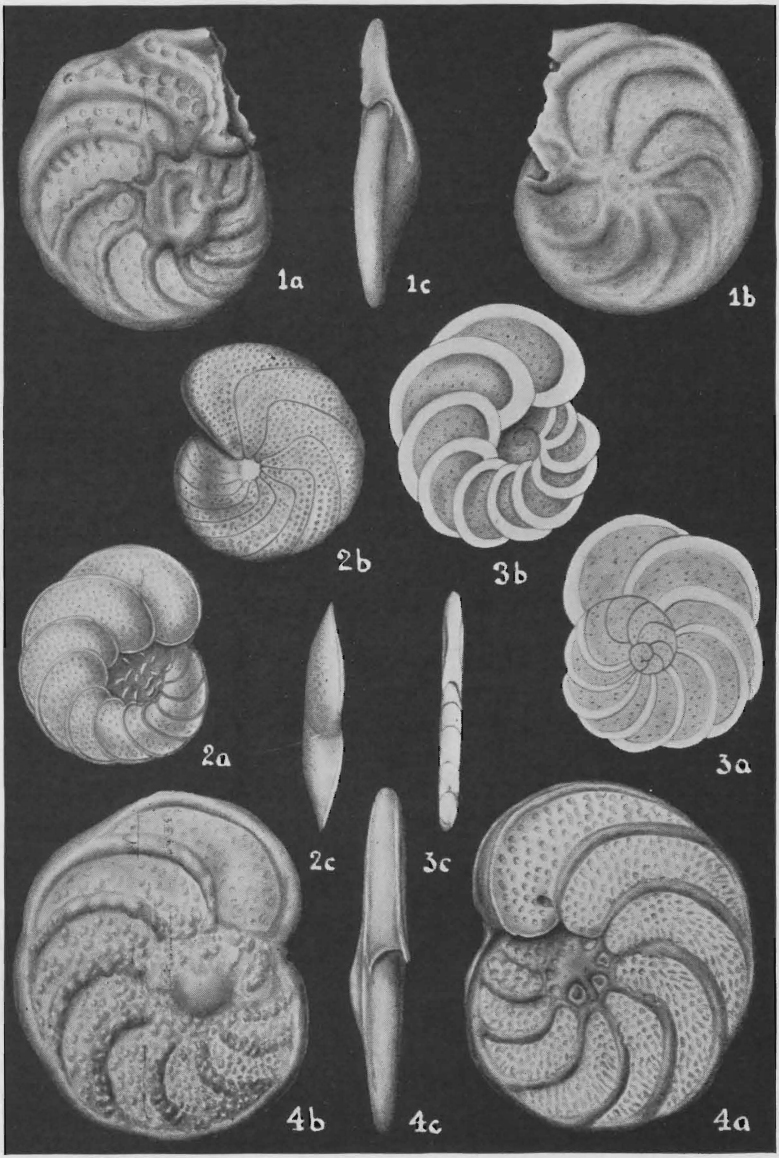
EXPLANATION OF PLATE 15

FIGS. 1, 2. *Planulina wuellerstorfi* (Schwager). Fig. 1, Topotype, × 50. Fig. 2, After Schwager's type figure.

FIGS. 3, 4. *Planulina ariminensis* d'Orbigny. Fig. 3, After d'Orbigny's type figure. Fig. 4, Topotype, × 50.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ate. In this species the test is somewhat evolute on both sides showing the earlier coils. There is a greater or less degree of this in different species, but *Planulina* typically has the last-formed whorl much flattened and spreading. The aperture extends over onto the dorsal side along the base of the chamber as in *Cibicides*.

Brady's figures of this species under the name *"Anomalina ariminensis"* are good, and he states that it is common in the Mediterranean and widely distributed in the North Atlantic. His figured specimens are from off Brazil. The species occurs fossil in the Late Tertiary at least of the Mediterranean region.

Another species which has been widely referred to is *Planulina wuellerstorfi* (Schwager). Brady records this as *"Truncatulina wuellerstorfi"* in the *Challenger* Report, and figures two forms, one (Pl. 93, fig. 8) from West of Ireland. This is a thick form and not typical. The other (Pl. 93, fig. 9) is from the West Coast of New Zealand, and is more typical. The types are from the Pliocene of the island of Kar Nicobar in the Indian Ocean. The specimen figured here (Pl. 15, figs. 1 *a-c*) is a topotype specimen in my collection selected from some of Schwager's original material from Kar Nicobar. Figures 2 *a-c* are copies of the type figure.

The periphery is rounded, the whole test very much compressed with the ventral side somewhat unbonate. The ventral side is usually involute except in the largest specimens. There are more chambers than in *P. ariminensis*, and a characteristic feature is the decidedly angular character of the sutures on the ventral side. This is shown both in Schwager's original and in the specimen figured here. The perforations are very coarse, and the central area of the dorsal side has irregular masses of fused shell material built up above the sutures and is very variable.

Another species of characteristic form and definite features is *Planulina ornata* (d'Orbigny) which I have figured (Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, pl. 6, fig. 12). This is very common in the eastern Pacific and in the Late Tertiary of America.

One point which should be stressed here for workers on this group is that of the microspheric and megalospheric form in *Planulina* and *Cibicides*. With these widely spread out forms which are usually if not always megalospheric are others which

are microspheric, have higher umbos and do not spread out to any extent. These "pairs" of species are usually present as well as intermediates, and should be watched for in the examination of material. If these represent the two forms of a single species as is probable, the nomenclature of the group is probably a complicated one, and one that should be carefully considered.

86. *VIRGULINA GUNTERI* CUSHMAN — A CORRECTION OF NAME

By JOSEPH A. CUSHMAN

The species called *"Virgulina floridana"* in the last number of these Contributions, p. 54, pl. 9, figs. 7-10, is not that for which I have already used the name *"Virgulina floridana"* (Cushman, Prof. Paper 128-B, U. S. Geol. Survey, 1920, p. 68, pl. 11, fig. 1). For that species allied to *Virgulina pertusa* Reuss noted above, pl. 9, figs. 7-10, the name *Virgulina gunteri* Cushman, new name, is proposed in honor of Mr. Herman Gunter, State Geologist of Florida.

RECENT LITERATURE ON THE FORAMINIFERA

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

Vaughan, Thomas Wayland

Studies of Orbitoidal Foraminifera: The Subgenus Polylepidina of Lepidocyclina and Orbitocyclina, a New Genus.

(Proc. Nat. Acad. Sci., vol. 15, No. 3, March, 1929, pp. 288-295, 1 plate.) *Washington.*

Gives detailed notes on several species, and describes a new genus.

Vaughan, Thomas Wayland

Descriptions of New Species of Foraminifera of the Genus Discocyclina from the Eocene of Mexico.

(Proc. U. S. Nat. Mus., vol. 76, art. 3, 1929, pp. 1-18, pls. 1-7.) *Washington.*

Nine species and varieties are fully described and figured, and a key to the species is given.

Church, C. C.

Some Recent Shallow Water Foraminifera Dredged near Santa Catalina Island, California.

(Journ. Pal., vol. 3, No. 3, Sept., 1929, pp. 302-305, text figs. 1-3.) *Austin.*

Eight species are noted, of which two are new.

Palmer, Dorothy K.

A Note on the Occurrence of *Patellina corrugata* Williamson in the San Juan Archipelago, Washington.

(Journ. Pal., vol. 3, No. 3, Sept., 1929, pp. 306, 307.) *Austin.*

Notes the Pacific occurrence of this species.

Harlton, Bruce H.

Some Pennsylvanian Ostracoda and Foraminifera from Southern Oklahoma—A Correction.

(Journ. Pal., vol. 3, No. 3, Sept., 1929, p. 308.) *Austin.*

A correction of localities is made.

Carman, Katherine

Some Foraminifera from the Niobrara and Benton Formations of Wyoming.

(Journ. Pal., vol. 3, No. 3, Sept., 1929, pp. 309-315, pl. 34.) *Austin.*

Eight species are noted, two described as new.

Jarvis, P. W.

Some Notes on Cretaceous Occurrences at Lizard Springs, Trinidad.

(Journ. Instit. Petr. Tech., vol. 15, No. 75, Aug., 1929, pp. 440-442.) *London.*

Notes Cretaceous foraminifera from Trinidad.

Skelton, R. H.

Some Notes on a Portion of the Lizard Springs Anticline.

(Journ. Instit. Petr. Tech., vol. 15, No. 75, Aug., 1929, pp. 443-450.) *London.*

Notes Cretaceous foraminifera from Trinidad.

Cushman, Joseph A.

The Development and Generic Position of Sagrina (?) tessellata H. B. Brady.

(Journ. Washington Acad. Sci., vol. 19, No. 15, Sept. 19, 1929, pp. 337-339, text figs. 1-5.) *Baltimore.*

Notes structure and relationships of this rare species.

Church, C. C.

The Laboratory of Paleontology.

(The Record (Associated Oil Company), vol. 10, No. 9, Sept., 1929, pp. 14-15, text figs.) *San Francisco.*

Figures Temblor foraminifera without name.

Cushman, J. A. and C. C. Church.

Some Upper Cretaceous Foraminifera from near Coalinga, California.

(Proc. Cal. Acad. Sci., ser. 4, vol. xviii, No. 16, Oct. 4, 1929, pp. 497-530, pls. 36-41.) *San Francisco.*

Forty-three forms are figured, of which five are new, and one new genus, *Silicosigmoilina.*

J. A. C.