

CONTRIBUTIONS
FROM THE
CUSHMAN LABORATORY
FOR
FORAMINIFERAL RESEARCH

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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

66. CRETACEOUS FORAMINIFERA FROM TRINIDAD

By JOSEPH A. CUSHMAN and P. W. JARVIS

INTRODUCTION

Recent collections from the island of Trinidad have disclosed clays which contain beautifully preserved foraminifera in addition to many crushed ones. The color and material of the wall is usually very well preserved. These collections are of particular interest as they represent Upper Cretaceous foraminifera very closely identical with the fauna of the Upper Cretaceous, Velasco shale, of the Tampico region of Mexico.

The Velasco shale itself represents for the most part an offshore assemblage of species including many Globigerinas and other forms related to living species which are known to occur in waters of considerable depth. This Trinidad fauna while similar in many of its species seems in some respects to represent a still deeper water fauna, such genera as *Rzehakina*, *Glomospira*, *Ammodiscus*, *Ammolagena*, *Hormosina* and others of the arenaceous group being common. They are very closely related to or identical with species now living in the general region in comparatively deep water.

This paper may be considered preliminary to a more detailed one which will include more of the species with additional figures. These collections have served to give in much greater detail the finer structures of some of the species already known from the Velasco shale of Mexico where the species are often not nearly so well preserved.

Family HYPERAMMINIDAE

Genus HYPERAMMINA H. B. Brady, 1878

HYPERAMMINA ELONGATA H. B. Brady

Plate 12, figure 1

Hyperammina elongata H. B. BRADY, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 433, pl. 20, figs. 2 *a*, *b*.

Rare. This specimen is very close to Recent ones in its general characters as will be seen from the figure.

Family REOPHACIDAE

Genus REOPHAX Montfort, 1808

REOPHAX sp. (?)

Plate 12, figure 2

The broken specimen figured here evidently belongs to this genus, but its specific determination must be left until other specimens are found.

Genus HORMOSINA H. B. Brady, 1879

HORMOSINA GLOBULIFERA H. B. Brady

Plate 12, figure 3

Hormosina globulifera H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 60, pl. 4, figs. 4, 5.

There are some very beautifully preserved specimens in the collection with the original grains of the surface clear and the whole test colored as in Recent specimens. In others there is a great amount of contortion due to subsequent pressure. The two early chambers of the figured specimen might almost belong to a Recent specimen but the third chamber is badly crushed and discolored.

Family AMMODISCIDAE

Genus AMMODISCUS Reuss, 1861

AMMODISCUS GLABRATUS Cushman and Jarvis, new species

Plate 12, figures 6 *a*, *b*

Test planispiral, much compressed, concave on both sides,

periphery broadly curved; tubular chamber very gradually and uniformly increasing in size with succeeding coils; wall thin, composed almost entirely of cement, of a brownish color, very smooth and polished; aperture semicircular, at the end of the tubular chamber. Diameter 0.65 mm.; thickness 0.12 mm.

Holotype (Cushman Coll. No. 9683) from Pit at Lizard Springs, Trinidad, B. W. I.

This species is very smooth and polished, in this character more like the species of *Glomospira* noted below. The cement at the sides of the base of the coil is almost pure, and in the earlier coils translucent.

AMMODISCUS PENNYI Cushman and Jarvis, new species

Plate 12, figures 4, 5

Test planispiral, comparatively large, periphery broadly rounded, of a few coils, the tubular chamber increasing gradually in diameter; suture deep and distinct; wall thick, conspicuously arenaceous but fairly smoothly finished; aperture semicircular at the end of the tube. Microspheric form up to 2 mm. in diameter.

Holotype (Cushman Coll. No. 9670) from well at Lizard Springs, Trinidad, B. W. I., at a depth of 720 feet.

The holotype is a megalospheric specimen but a portion of a microspheric one is given (Pl. 12, fig. 14) with *Tolypammima* attached. The species is named for Mr. F. W. Penny who has collected the foraminifera of Trinidad for many years.

This is one of the largest species of the genus and is nearest *A. mestayeri* Cushman in size.

Genus GLOMOSPIRA Rzehak, 1888

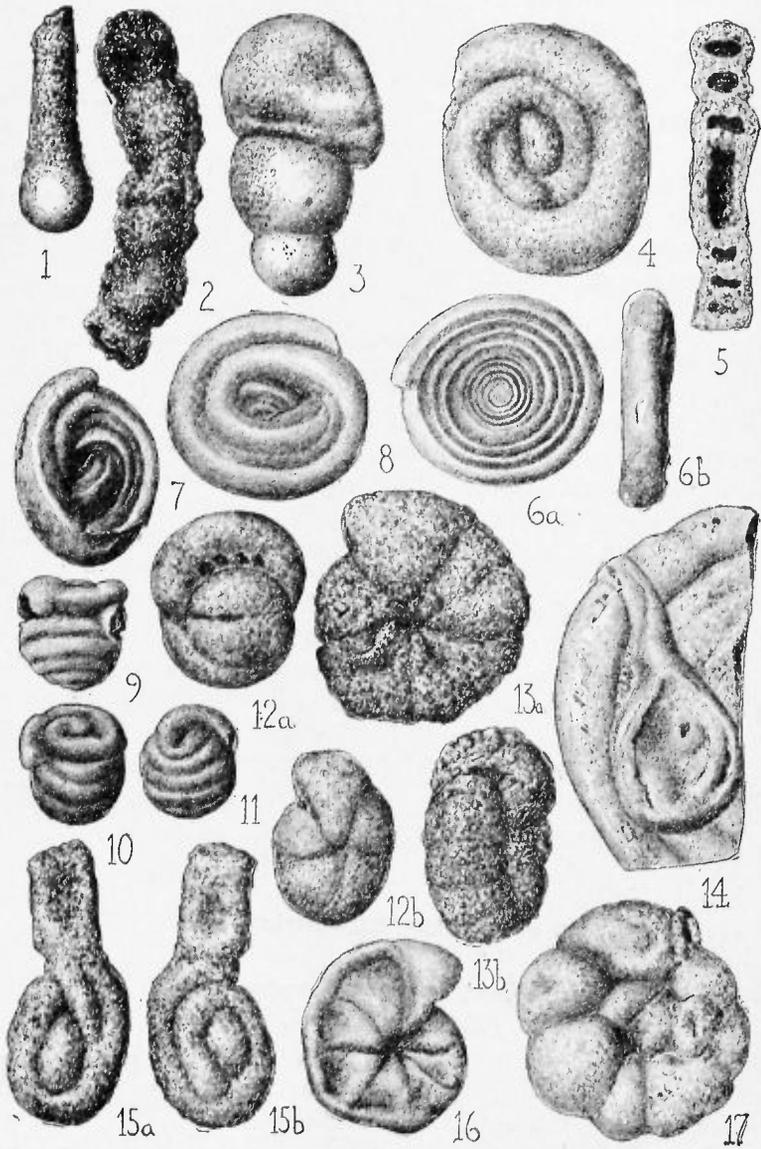
GLOMOSPIRA GORDIALIS (Jones and Parker)

Plate 12, figures 7, 8

Trochammima squamata, var. *gordialis* JONES and PARKER, Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.—PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 408, pl. 15, fig. 32.

Glomospira gordialis CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 99, pl. 36, figs. 7-9.

Specimens are of the usual shape for this species. Later chambers tend to become more open than the earlier ones.



GLOMOSPIRA CHAROIDES (Jones and Parker), var. CORONA Cushman and Jarvis,
new variety

Plate 12, figures 9-11

Variety differing from the typical in having the irregularly coiled later portion in a sort of irregular crown at the end of the test instead of coiling about the whole test as in the typical form.

Holotype of variety (Cushman Coll. No. 9668) from Lizard Springs, Southeastern Trinidad, B. W. I.

This variety also occurs in the Cretaceous, Velasco shale of Mexico from which we have specimens. It is the form figured by White (Journ. Pal., vol. 2, 1928, pl. 27, fig. 7) from the Velasco. Recent specimens that we have seen as well as those figured, have the later portion coiling in the long axis of the test after the spiral is completed.

EXPLANATION OF PLATE 12

- FIG. 1. *Hyperammina elongata* H. B. Brady. $\times 35$.
 FIG. 2. *Reophax* sp. (?). $\times 40$.
 FIG. 3. *Hormosina globulifera* H. B. Brady. $\times 35$.
 FIGS. 4, 5. *Ammodiscus pennyi* Cushman and Jarvis, n. sp. $\times 35$.
 Fig. 4, Holotype. Fig. 5, Transverse section of megalo-
 spheric specimen.
 FIGS. 6 a, b. *Ammodiscus glabratus* Cushman and Jarvis, n. sp. $\times 40$.
 a, side view; b, peripheral view.
 FIGS. 7, 8. *Glomospira gordialis* (Jones and Parker). $\times 40$.
 FIGS. 9-11. *Glomospira charoides* (Jones and Parker), var. *corona*
 Cushman and Jarvis, n. var. $\times 40$.
 FIGS. 12 a, b. *Cribrostomoides trinitatensis* Cushman and Jarvis, n. sp.
 $\times 40$. a, side view; b, apertural view.
 FIGS. 13 a, b. *Haplophragmoides* cf. *subglobosum* (G. O. Sars). $\times 40$.
 a, side view; b, apertural view.
 FIG. 14. *Ammolagena clavata* (Jones and Parker). $\times 35$. Attached
 to microspheric specimen of *Ammodiscus pennyi*.
 FIGS. 15 a, b. *Lituotuba lituiformis* (H. B. Brady). $\times 40$. a, b, opposite
 sides.
 FIG. 16. *Haplophragmoides* sp. (?). $\times 60$.
 FIG. 17. *Haplophragmoides coronata* (H. B. Brady). $\times 35$.

Genus LITUOTUBA Rhumbler, 1895

LITUOTUBA LITUIFORMIS (H. B. Brady)

Plate 12, figures 15 a, b

Trochammina lituiformis H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 59, pl. 5, fig. 16.

Lituotuba lituiformis RHUMBLER, Nachr. Königl. Ges. Wiss. Göttingen, 1895, p. 84; Arch. Prot., vol. 3, 1903, p. 279, figs. 128 a, b.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 114, fig. 175 (in text).

The figured specimen is evidently megalospheric and may be a distinct species but the microspheric form should be studied. The uncoiled portion is partially collapsed.

Genus AMMOLAGENA Eimer and Fickert, 1899

AMMOLAGENA CLAVATA (Jones and Parker)

Plate 12, figure 14

Trochammina irregularis, var. *clavata* JONES and PARKER, Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.

Webbina clavata H. B. BRADY, Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 711; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 349, pl. 41, figs. 12-16.

Ammolagena clavata EIMER and FICKERT, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 673.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 68, figs. 86-89 (in text).

Specimens occur attached especially to *Ammodiscus pennyi* as shown in the figure. This association of these two genera is interesting as it occurs in the Palaeozoic and in Recent material as well, showing the long generic range of these simple arenaceous forms.

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

HAPLOPHRAGMOIDES CORONATA (H. B. Brady)

Plate 12, figure 17

Trochammina coronata H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 58, pl. 5, fig. 15; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 340, pl. 40, figs. 10-12.

Haplophragmoides coronata CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 99, figs. 145-147 (in text).

There are some very excellent specimens of this species although most of them are crushed. They have the typical characters even to the color.

HAPLOPHRAGMOIDES sp. (?)

Plate 12, figure 16

This is a crushed specimen of a species which has since figuring been found in its normal form, and is left here rather than to disturb the plate, and will be described in a later paper.

HAPLOPHRAGMOIDES cf. **SUBGLOBOSUM** (G. O. Sars)

Plate 12, figures 13 a, b

The figured specimens resemble Sar's species but they are not in sufficient numbers to be positively identified.

Genus CRIBROSTOMOIDES Cushman, 1910

CRIBROSTOMOIDES TRINITATENSIS Cushman and Jarvis, new species

Plate 12, figures 12 a, b

Test subglobular, close coiled, completely involute, periphery very broadly rounded; chambers five or six in number, inflated, rather low; sutures distinct, very slightly depressed; wall coarsely arenaceous but smoothly finished; aperture consisting of a number of pores just above the base of the apertural face. Length 0.60 mm.; breadth 0.50 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 9728) from Lizard Springs, Southeastern Trinidad, B. W. I.

This seems to be the first record of this genus from the Cretaceous. It is a broader and more globular form than is usually present in Recent specimens.

Family TEXTULARIIDAE

Genus TEXTULARIA Defrance, 1824

TEXTULARIA CONCINNA Reuss

Plate 13, figure 1

Textularia concinna REUSS, Verstein. Böhm. Kreide, 1845-46, pt. 2, p. 109, pl. 24, fig. 54.

The figured specimen may be referred to this Cretaceous species of Reuss to which it is very close.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA FILIFORMIS Berthelin

Plate 13, figure 2

Gaudryina filiformis BERTHELIN, Mém. Soc. Geol. France, ser. 3, vol. 1, 1880, p. 25, pl. 1 (24), figs. 8 *a-d*.

A few specimens belong to this slender long species which is widely distributed in the Upper Cretaceous of Europe and America.

GAUDRYINA RETUSA Cushman

Plate 13, figures 3, 4

Gaudryina retusa CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 588, pl. 16, figs. 10 *a, b*.

This species which was described originally from the Velasco shale of Mexico is present in the Trinidad material in some numbers.

GAUDRYINA LAEVIGATA Franke, var. PYRAMIDATA Cushman

Plate 13, figure 6

Gaudryina laevigata FRANKE, var. *pyramidata* CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 587, pl. 16, figs. 8 *a, b*.

This variety was described from the Velasco shale of Mexico and is present in this equivalent formation from Trinidad.

GAUDRYINA INDENTATA Cushman and Jarvis, new species

Plate 13, figure 7

Test somewhat elongate, tapering from the subacute initial end, the sides of the adult nearly parallel, circular in transverse section; chambers numerous, early ones triserial, adult biserial, the middle portion of each chamber indented and the sutures raised in rounded ridges; wall arenaceous but smoothly finished; aperture small, semicircular, at the base of the inner margin of the last-formed chamber. Length 0.50 mm.; diameter 0.40 mm.

Holotype (Cushman Coll. No. 9733) from Lizard Springs, Southeastern Trinidad, B. W. I.

This species is peculiar in having depressed chambers. The same form occurs in the Upper Cretaceous of the Velasco shale of Mexico.

Genus CLAVULINA d'Orbigny, 1826

CLAVULINA TRILATERA Cushman

Plate 13, figure 8

Clavulina trilatera CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 588, pl. 17, fig. 2; Journ. Pal., vol. 1, 1927, p. 149, pl. 28, fig. 1.

Specimens of this species described from the Velasco shale of Mexico occur in typical form in the Trinidad collections.

CLAVULINA TRILATERA Cushman, var. ASPERA Cushman

Plate 13, figure 5

Clavulina trilatera, var. *aspera* CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 589, pl. 17, fig. 3.

Coarse forms with the typical characters of this variety which was described from the Velasco shale of Mexico also occur in Trinidad.

CLAVULINA AMORPHA Cushman

Plate 13, figure 9

Clavulina amorpha CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 589, pl. 17, fig. 5.

The figured specimen is an immature one, but this Velasco species occurs in rather typical form at Trinidad.

Family SILICINIDAE

Genus RZEHAKINA Cushman, 1927

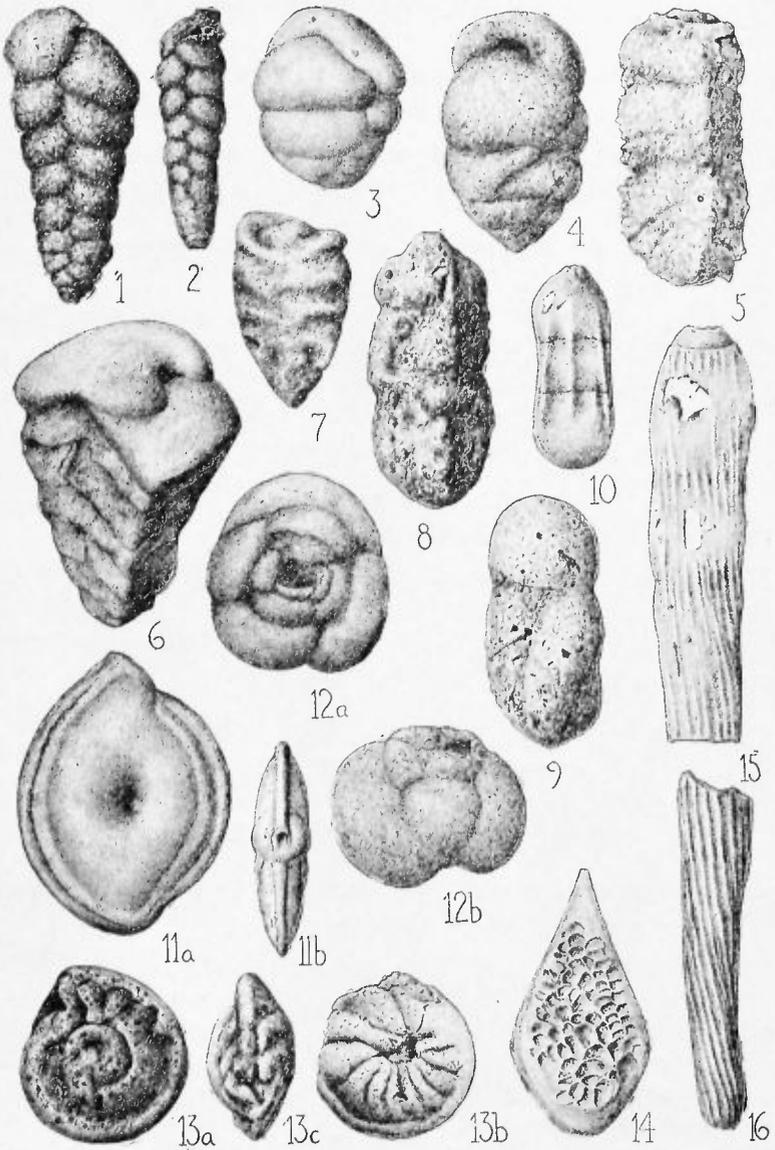
RZEHAKINA EPIGONA (Rzehak), var. LATA Cushman and Jarvis, new variety

Plate 13, figures 11 a, b

Test differing from the typical in the broader, nearly circular form and the much more prominent appearance of the last coil forming almost a rounded carina about the periphery. This is the most common form in the collection. Some young specimens show the early coils making a flattened test before the lateral thickenings are added.

Holotype of variety (Cushman Coll. No. 9731) from Lizard Springs, Southeastern Trinidad, B. W. I.

This variety is more rounded and much larger than the form found in the Velasco shale of Mexico.



Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1860

TROCHAMMINA GLOBIGERINIFORMIS (Parker and Jones)

Plate 13, figures 12 a, b

Lituola globigeriniformis PARKER and JONES, Phil. Trans., vol. 55, 1865, p. 407, pl. 15, figs. 46, 47; (pl. 17, figs. 96-98?).

Haplophragmium globigeriniforme CARPENTER, The Microscope, 6th ed., 1881, p. 561, figs. 320 a, b.

Trochammina globigeriniformis CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 124, pl. 24, figs. 193-195 (in text).

There are numerous excellent specimens of this species in the collection from Trinidad. Many specimens are crushed but a number of them are in their original form like the figured one.

TROCHAMMINA TRINITATENSIS Cushman and Jarvis, new species

Plate 13, figures 13 a-c

Test nearly circular in dorsal view, biconvex from the periphery, trochoid, somewhat keeled, slightly umbilicate on the ventral side; chambers numerous, 12 or more in the final whorl, not very distinct except from the slight collapse of the wall; central portion of the dorsal side showing the spiral suture slightly depressed, the sutures of the ventral side nearly

EXPLANATION OF PLATE 13

- FIG. 1. *Textularia concinna* Reuss. $\times 60$.
 FIG. 2. *Gaudryina filiformis* Berthelin. $\times 60$.
 FIGS. 3, 4. *Gaudryina retusa* Cushman. $\times 40$.
 FIG. 5. *Clavulina trilatera* Cushman, var. *aspera* Cushman. $\times 35$.
 FIG. 6. *Gaudryina laevigata* Franke, var. *pyramidata* Cushman. $\times 40$.
 FIG. 7. *Gaudryina indentata* Cushman and Jarvis, n. sp. $\times 40$.
 FIG. 8. *Clavulina trilatera* Cushman. $\times 60$.
 FIG. 9. *Clavulina amorpha* Cushman. $\times 35$.
 FIG. 10. *Nodosaria brevitesta* Franke. $\times 40$. *lata*
 FIGS. 11 a, b. *Rzehakina epigona* (Rzehak), var. *carinata* Cushman and Jarvis, n. var. $\times 40$. a, side view; b, apertural view.
 FIGS. 12 a, b. *Trochammina globigeriniformis* (~~H. B. Brady~~). $\times 40$. a, (Parker & Jones) dorsal view; b, side view.
 FIGS. 13 a-c. *Trochammina trinitatensis* Cushman and Jarvis, n. sp. $\times 60$. a, dorsal view; b, ventral view; c, peripheral view.
 FIG. 14. *Flabellina semireticulata* Cushman and Jarvis, n. sp. $\times 60$.
 FIGS. 15, 16. *Nodosaria velascoensis* Cushman. $\times 40$.

radial, slightly curved, depressed; wall arenaceous with numerous angular fragments and much cement; aperture elongate, ventral, at the base of the chamber. Diameter 0.40 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 9729) from Lizard Springs, Southeastern Trinidad, B. W. I.

This is a striking species appearing at first glance something like an *Anomalina*, but having an arenaceous test which is easily collapsed.

Family LAGENIDAE

Genus LENTICULINA Lamarck, 1804

LENTICULINA GRATA (Reuss)

Plate 14, figure 3

Cristellaria grata REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), p. 70, pl. 7, figs. 14 *a*, *b*.—CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 598, pl. 19, figs. 1 *a*, *b*.

This species described by Reuss from the Cretaceous of Europe and recorded from the Cretaceous by other authors is already known from the Cretaceous, Velasco shale of Mexico.

LENTICULINA NUDA (Reuss)

Plate 14, figure 2

Cristellaria nuda REUSS, Sitz. Akad. Wiss. Wien, vol. 44, pt. 1, 1861 (1862), p. 328, pl. 6, figs. 1-3.

This species described by Reuss from the Cretaceous of the Island of Rügen and recorded from the Cretaceous of Europe by other authors occurs in the collection from Trinidad.

There are other species of *Lenticulina* that will be left for a later paper.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA BULLATA Reuss

Plate 14, figures 7, 8

Marginulina bullata REUSS, Verstein. Böhm. Kreide, pt. 1, 1845-46, p. 29, pl. 13, figs. 34-38.

A few specimens may be referred to this species described by Reuss from the Cretaceous of Europe.

Genus DENTALINA d'Orbigny, 1826

DENTALINA cf. ADOLPHINA d'Orbigny

Plate 14, figure 6

There are specimens in the collection which are similar to those from the European Cretaceous that have been referred to this species by various authors. It is to be doubted if they are the same as d'Orbigny's Miocene species.

Genus NODOSARIA Lamarck, 1812

NODOSARIA CONCINNA Reuss

Plate 14, figures 5, 11

Nodosaria concinna REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 178, pl. 1, fig. 3.

In some respects certain of the specimens resemble d'Orbigny's *Nodosaria limbata* from the Chalk of the Paris Basin. The specimens usually do not have a basal spine. This is a common Cretaceous species of Europe.

NODOSARIA BREVITESTA Franke

Plate 13, figure 10

Nodosaria brevitesta FRANKE, Abhandl. geol. pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 42, pl. 3, fig. 37.

The specimen figured seems close to this species described by Franke from the Cretaceous of Germany. It is a short, stout form with a very few remote costae, uninterrupted at the sutures.

NODOSARIA VELASCOENSIS (Cushman)

Plate 13, figures 15, 16

Nodosaria fontannesii, var. *velascoensis* CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 504, pl. 18, fig. 12.

This seems to be a distinct species noted from the Velasco shale of Mexico and also occurring in the Upper Cretaceous of Europe. In the adult the costae are limited to the depressed region between the chambers.

NODOSARIA cf. MARCKI Reuss

Plate 14, figure 4

The figured specimen is very close to a figure given by Franke from the Cretaceous of Germany (Abhandl. geol. pal. Instit.

Univ. Greifswald, vol. 6, 1925, pl. 3, fig. 22 a). Identical specimens were found in the Velasco shale of Mexico.

Genus **FLABELLINA** d'Orbigny, 1839

FLABELLINA SEMIRETICULATA Cushman and Jarvis, new species

Plate 13, figure 14

Test rhomboid in front view, much compressed, apertural end extended; chambers and sutures obscured by the surface ornamentation which consists of a more or less irregular reticulation, the sides of the polygonal areas raised, thin and plate-like. Length 0.60 mm.; breadth 0.35 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 9727) from Lizard Springs, Southeastern Trinidad, B. W. I.

This is the species from the Velasco shale of Mexico referred to as *Frondicularia* cf. *interpunctata* (Cushman, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 598, pl. 20, fig. 3.) It is very different from *F. reticulata* which has the reticulations small and very regular, in single uniform rows between the sutures.

Genus **FRONDICULARIA** Defrance, 1824

FRONDICULARIA ELONGATA White (?)

Plate 14, figure 1

Frondicularia archiaciana CUSHMAN (not D'ORBIGNY), Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 21, pl. 3, fig. 4.

Frondicularia sp. (?) CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 598, pl. 20, fig. 2.

Frondicularia elongata WHITE, Journ. Pal., vol. 2, 1928, p. 205, pl. 29, fig. 3.

This species described from the Upper Cretaceous of Mexico is also found in the Trinidad collection. The figure given by White shows the costae only between the sutures, and the description reads "with longitudinal ribs crossing the interspaces" as though they were independent on the different chambers. His figure also seems to clearly indicate that the costae are independent of one another on different chambers as it will be seen especially on the left side of the specimen that the different series are not at all aligned. If the figure and description are accurate it would seem that *F. elongata* is a synonym of *F. dechemi* Reuss from the Cretaceous of Germany, and that our species figured here from Trinidad and from Mexico is another species.

Family HETEROHELICIDAE

Genus BOLIVINOIDES Cushman, 1927

BOLIVINOIDES DECORATA (Jones), var. **DELICATULA** Cushman

Plate 14, figure 9

Bolivina decorata CUSHMAN (not JONES), Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 19, pl. 2, figs. 3 a, b.

Bolivinoides decorata (JONES), var. *delicatula* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, 1927, p. 90, pl. 12, fig. 8; Journ. Pal., vol. 1, 1927, p. 158, pl. 28, fig. 7.

This variety is quite distinct from European specimens of *B. decorata* (Jones). The figured specimen gives a better idea of the character of the surface ornamentation than do completely adult specimens in which the thickening of the apertural end is so pronounced as to obscure the sutures. The variety is described from the Velasco shale of Mexico.

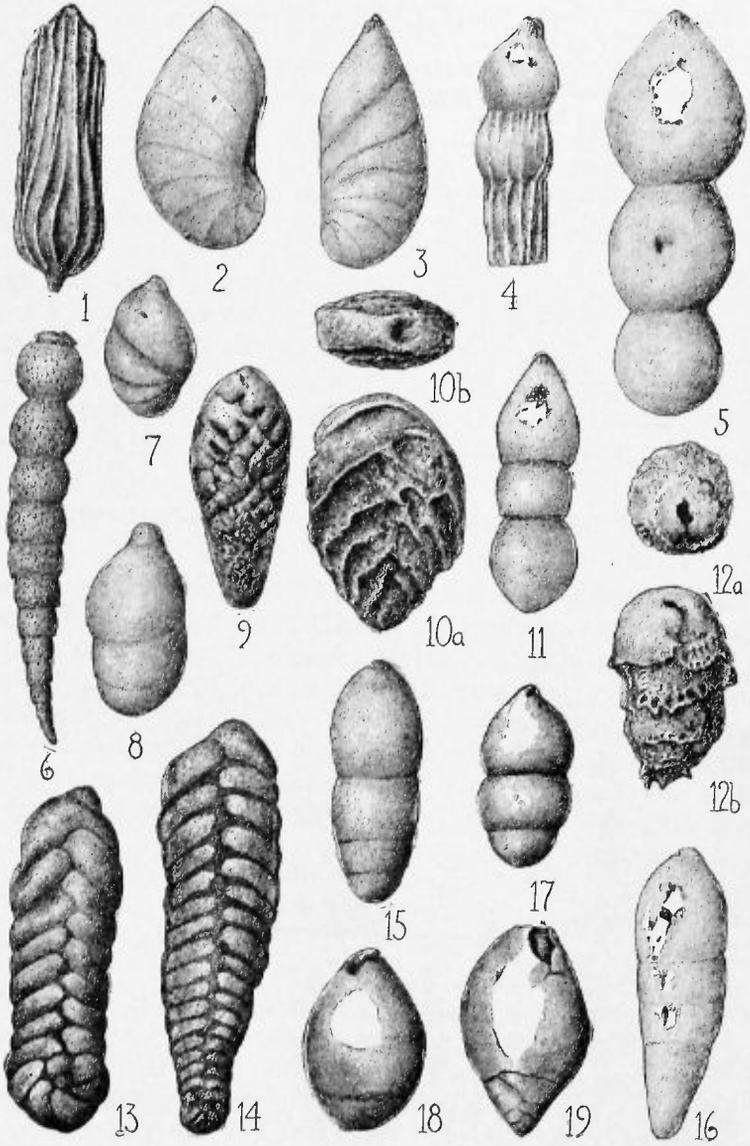
BOLIVINOIDES TRINITATENSIS Cushman and Jarvis, new species

Plate 14, figures 10 a, b

Test generally biserial, broadest near the apertural end, tapering to the subacute initial end, whole test thickening rapidly toward the apertural end which is formed of a smooth thickened area; chambers marked by the highly ornate character of the test, consisting of thin convex plate-like extensions backward from the thickened terminal face of the chamber having a deep area below with truss-like raised costae, the areas over the chambers deeply depressed; aperture a somewhat elongate opening marking the suture which is otherwise obscured by the thickening of the apertural end of the test. Length 0.60 mm.; breadth 0.38 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 9675) from Lizard Springs, Southeastern Trinidad, B. W. I.

This species is closely allied to *B. velascoensis* Cushman from which it differs in the much greater development of the plate-like extensions and very deep excavations below them. The type is not so extreme in this as are other specimens. This is one of the most highly ornamented species of *Bolivinoides*, and serves to link these collections with the Velasco shale of Mexico.



Genus SPIROPLECTOIDES Cushman, 1927

SPIROPLECTOIDES CLOTHO (Grzybowski)

Plate 14, figures 13, 14

Spiroplecta clotho GRZYBOWSKI, Rozprawy Wydz. mat. przyr., vol. 41, 1901, p. 283, pl. 7, fig. 18.

Spiroplecta annectens CUSHMAN (not PARKER and JONES), Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 584, pl. 15, figs. 4 *a*, *b*.

Spiroplectoides clotho CUSHMAN, Journ. Pal., vol. 1, 1927, p. 159, pl. 28, fig. 6.

This species which occurs in the Velasco shale of Mexico is common and beautifully preserved in the Trinidad collection. The series is an excellent one to show the differences in the microspheric and megalospheric forms. The microspheric form (Pl. 14, fig. 14) is the longer and has many more chambers, the sides tapering to the initial portion while the megalospheric form (Pl. 14, fig. 13) has fewer chambers, the sides are nearly parallel, and the resulting test shorter.

EXPLANATION OF PLATE 14

- FIG. 1. *Frondicularia elongata* White (?). × 40.
 FIG. 2. *Lenticulina nuda* Reuss. × 40.
 FIG. 3. *Lenticulina grata* Reuss. × 40.
 FIG. 4. *Nodosaria marcki* Reuss. × 40.
 FIGS. 5, 11. *Nodosaria concinna* Reuss. × 40.
 FIG. 6. *Dentalina* cf. *adolphina* d'Orbigny. × 40.
 FIGS. 7, 8. *Marginulina bullata* Reuss. × 40.
 FIG. 9. *Bolivinooides decorata* (Jones), var. *delicatula* (Cushman). × 60.
 FIGS. 10 *a*, *b*. *Bolivinooides trinitatensis* Cushman and Jarvis, n. sp. × 60. *a*, front view; *b*, apertural view.
 FIGS. 12 *a*, *b*. *Bulimina trinitatensis* Cushman and Jarvis, n. sp. × 60. *a*, front view; *b*, apertural view.
 FIGS. 13, 14. *Spiroplectoides clotho* (Grzybowski). × 60. Fig. 13, Megalospheric. Fig. 14, Microspheric.
 FIGS. 15, 16. *Ellipsonodosaria subnodosa* (Guppy). × 60.
 FIG. 17. *Ellipsoglandulina exponens* (H. B. Brady). × 60.
 FIGS. 18, 19. *Ellipsopleurostomella curta* Cushman. × 60. Fig. 18, Megalospheric. Fig. 19, Microspheric.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA TRINITATENSIS Cushman and Jarvis, new speciesPlate 14, figures 12 *a, b*

Test somewhat longer than broad, rounded in transverse section, chambers distinct with the lower border extended into an overhanging plate which is marked on the upper side by an irregular network of reticulate areas, the outer angles ending in short spines; aperture elongate, comma-shaped, the apertural face smooth. Length 0.50 mm.; diameter 0.30 mm.

Holotype (Cushman Coll. No. 9682) from Lizard Springs, Southeastern Trinidad, B. W. I.

The peculiar ornamentation will distinguish the species.

Family ELLIPSOIDINIDAE

Genus ELLISOPLEUROSTOMELLA A. Silvestri, 1903

ELLISOPLEUROSTOMELLA CURTA Cushman

Plate 14, figures 18, 19

Ellisopleurostomella curta CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 590, pl. 16, figs. 6 *a, b*.

There are specimens apparently the same as this species described from the Velasco shale of Mexico. Fig. 19 shows a microspheric form in which the biserial chambers are very distinct, and fig. 18 a megalospheric form with a very large proloculum and the biserial stage entirely skipped.

Genus ELLIPSONODOSARIA A. Silvestri, 1900

ELLIPSONODOSARIA SUBNODOSA (Guppy)

Plate 14, figures 15, 16

Ellipsoidina subnodosa GUPPY, Proc. Zool. Soc., 1894, p. 650, pl. 41, fig. 12.

Ellipsonodosaria subnodosa NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 95, pl. 6, fig. 20.

The specimens figured are referred to this species especially as Nuttall says that Guppy's figure has the depressions more marked than is usual in Trinidad specimens.

Genus *ELLIPSOGLANDULINA* A. Silvestri, 1900*ELLIPSOGLANDULINA EXPONENS* (H. B. Brady)

Plate 14, figure 17

Ellipsoidina exponens H. B. BRADY, in JUKES-BROWN and HARRISON, Quart. Journ. Geol. Soc., vol. 48, 1892, p. 198.—GUPPY, Proc. Zool. Soc., 1894, p. 650, pl. 41, fig. 13.

Ellipsoylandulina exponens A. SILVESTRI, Atti Pont. Accad. N. Lincei, vol. 54, 1901, pp. 103-109.—NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 95, pl. 6, fig. 17.

Specimens referable to this species were found in the collection of Mr. Jarvis. They evidently are the same as the species described by Brady and afterward recorded by Guppy and Nuttall from Trinidad.

There are numerous other species which we hope to record in a later paper.

67. ON *ROTALIA BECCARII* (LINNÉ)

By JOSEPH A. CUSHMAN

Many of the older species of foraminifera are imperfectly understood. A glance at the series of figures that are assigned to almost any of the Linnean or other pre-d'Orbignyan species will show how much at variance later figures are with the earlier ones. Instead of going back to the earlier figures, type specimens or even toptype material, many workers have followed more or less blindly the figures given by much later authors which are not at all typical. In this manner, great confusion has arisen. A year ago this summer, the writer studied many of the older collections which contained types and also collected abundant material from the older classic localities such as Rimini on the Adriatic, Coroncina near Siena, etc. A study of this toptype material together with the older material has yielded interesting results, and the author wishes to pass on to other workers the results of some of these studies.

Figures are given of a series of individuals from Rimini, the type locality, showing the characters at different stages of development. This is one of the most abundant of all the many species at this locality. Something of the synonymy will be given but to be complete in later years, it would mean the study of other collections than those which were examined. The author is not so much concerned with placing the later references as in determining definitely what should be the characters of the type form. Copies of the pre-Linnean figures of Plancus (Bianchi) are given (Pl. 15, figs. 1, 2). Those of Gualtieri referred to by Linné are too poor to be of much use.

ROTALIA BECCARII (Linné)

Plate 15

- "Cornu Hammonis" Plancus, Conch. Min. 1739, p. 8, pl. 1, fig. 1.
 "Ammonia unita" Gualtieri, Index Test., 1742, pl. 19, figs. H, I.
Nautilus beccarii LINNÉ, Syst. Nat., Ed. 12, 1767, p. 1162; Ed. 13 (GMELIN'S) 1788, p. 3370.
Streblus beccarii FISCHER, Advers. Zool., fasc. 2, 1819, p. 75.
Rotalia (Turbinulina) beccarii D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 275, No. 42; Modèles, No. 74.
Discorbula ariminensis LAMARCK, Tabl. Encycl. et Méth., 1816, pl. 466, figs. 6 a, b.
Rotalina beccarii WILLIAMSON, Rec. Foram. Gt. Britain, 1858, p. 48, pl. 4, figs. 90-92.

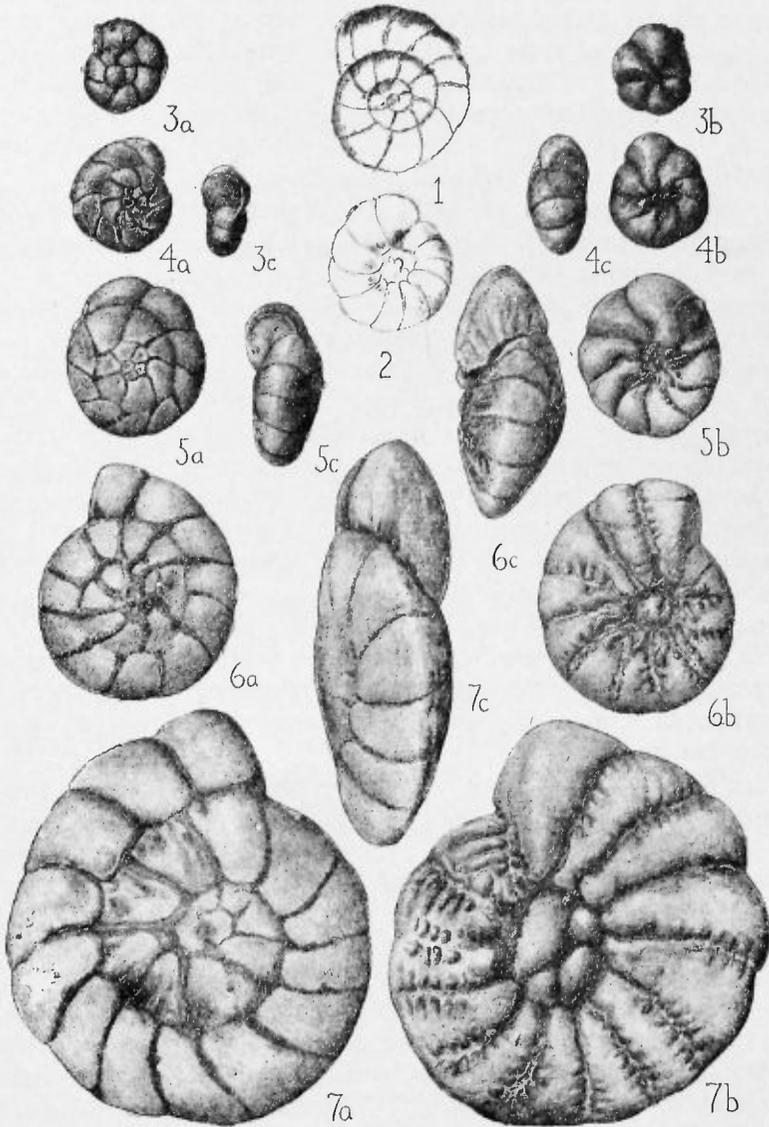
Brady in the *Challenger* Report, pp. 704-5, gives the following very excellent description: "*Rotalia beccarii*, the central species of the genus from a morphological point of view, and by far the best known, is not well represented in the Challenger collections.

"In its typical presentment the test forms a depressed turbinoid spire, the two faces of which are nearly equally convex, and the peripheral edge rounded and more or less lobulated. The segments, which are numerous and a little inflated, are arranged

EXPLANATION OF PLATE 15

Rotalia beccarii (Linné)

- FIGS. 1, 2. After Plancus (Bianchi). Original figures referred to by Linné.
 FIGS. 3-7. Series from Rimini showing the developmental stages. a, dorsal view; b, ventral view; c, peripheral view. All $\times 40$.



in three to four convolutions; on the superior side the sutures are flush or very slightly depressed, and marked by the broad lines of the thick clear septa within; whilst on the inferior they are irregularly excavated, and their borders, as well as the umbilical portion of the surface, are studded with irregular exogenous granules. The septa of well-developed typical shells are double."

This is a very good general description of the species as it occurs at its type locality at Rimini. The description should go farther however, and the series of figures given will illustrate the further points. Fig. 3 is of a megalospheric specimen with a large proloculum, that has 10 chambers, and although this is a young specimen the characters show the smooth surfaces, the sutures on the ventral side without the ornamentation seen in older specimens. Six chambers make up a whorl and the central plug of the umbilical area is not developed. The ending of the chambers on the ventral side is somewhat similar to *Discorbis*.

Fig. 4 shows a specimen with a microspheric proloculum and 18 chambers. There are 8 chambers in the whorl although but 6 in the earlier stages. There is a definite development of the central plug of the ventral side, but beading of the sutures is not yet developed.

Fig. 5 shows a microspheric specimen that has 21 chambers, 9 making up the last-formed whorl. The central plug is already somewhat ornate and there is a tendency for the sutures to open up and become beaded.

Fig. 6 shows a specimen with more chambers than the preceding, probably microspheric but as the dorsal side is covered with secondary shell material, it is difficult to make out the early chambers. The central plug has become enlarged and the sides of the sutures on the ventral side are decidedly beaded and fluted. There are 11 chambers in the last-formed whorl.

Fig. 7 shows an adult microspheric specimen in which the covering of the central part of the dorsal side of the test is carried much further than the preceding. The ventral plug is broken into several large bosses at the surface. The sutures are heavily beaded and fluted. The last-formed coil has 13 chambers, nearly double that of the younger individuals. Specimens of this general form are very abundant at Rimini. The difference in relative thickness of the test is also shown in the peripheral views, the young stages being much thicker in proportion than the adult.

A comparison of these figures with those given by different authors from various parts of the world will show the wide deviation from this typical form. A study of fossil and recent *Rotalias* related to *R. beccarii* should prove useful as numerous varieties or species will be found with definite distributions and the true *R. beccarii* will be found to have a rather restricted area.

An example of this is the form named *Rotalia beccarii*, var. *tepida* Cushman (Publ. 344, Carnegie Instit. Washington, 1926, p. 79, pl. 1). This is a small form not over 0.35 mm. in diameter, thick, with only 6-7 chambers in the adult whorl. It is most like the young megalospheric form from Rimini. This is however the adult form which occurs in great numbers not only at Porto Rico, the type locality, but elsewhere in the West Indies. It is very abundant in the very warm shallow waters of the Keys. This is different from the related forms developed along the shores of the Gulf of Mexico and from that of the cooler waters of the Atlantic Coast of the United States. Many other distinct species and varieties of restricted range will undoubtedly be found as intensive studies are made.

68. FISTULOSE SPECIES OF GAUDRYINA AND HETEROSTOMELLA

By JOSEPH A. CUSHMAN

The Indo-Pacific Recent species described as *Textularia siphonifera* H. B. Brady has been a very striking one. Its relationships have been somewhat puzzling. I have had large suites of this species for twenty years from the Philippines especially where it is very highly developed. A study of Cretaceous species of *Gaudryina* which also show fistulose characters has shown that the two series of specimens are somewhat closely related. The Recent species should undoubtedly be placed as a *Gaudryina* and not as *Textularia*, the earlier portion being triserial and only the later portion biserial. In the American Up-

per Cretaceous there are species allied to Cretaceous ones of Europe which also show fistulose characters. These may be derived from such species as *Gaudryina carinata* Franke, (Zeitschr. deutsch. geol. Ges., vol. 66, 1914, p. 431, pl. 27, figs. 4-6) a species which also seems to occur in the Cretaceous of America. In this species the early portion is triserial and tricarinate, the later portion biserial and the chambers with two distinct outer angles. Another species of this same general type is *Gaudryina jonesiana* Wright (Proc. Belfast Nat. Field Club, Appendix, 1885-86, p. 329, pl. 27, figs. 1, 2) from the Cretaceous of Keady Hill, County Derry, Ireland. Wright's species also occurs in the Upper Cretaceous of America.

From these decidedly angled species it is but a step to the development of the keeled angles into a series of fistulose projections. Such species are found in the American Upper Cretaceous. A development into a more irregular series is found in *Heterostomella foveolata* (Marsson) (*Tritaxia foveolata* Marsson, Mitth. nat. Ver. Neu-Vorpommern und Rügen, Jahrb. 10, 1878, p. 161, pl. 3, f. 30 a-c.) This species is also found in the Upper Cretaceous of America.

In the Recent species *Gaudryina siphonifera* (H. B. Brady), there are more series of fistulose outgrowths but the early development is much like the American Cretaceous species. A series of figures of these species is given on Plate 16.

GAUDRYINA STEPHENSONI Cushman, new species

Plate 16, figures 6-8

Test elongate, tapering, greatest width near the apertural end, the early portion triserial and tricarinate rapidly increasing in size from the subacute initial end, later and larger portion biserial, with quadrate chambers, the angles distinct, the broader faces of the test flattened or slightly concave, the angles of each chamber marked by fistulose processes which are usually broken through at the tip showing the hollow within; chambers fairly distinct in well preserved specimens; sutures very slightly depressed; wall finely arenaceous, somewhat rough on the exterior; aperture a low, elongate opening on the inner margin of the last-formed chamber. Length 0.70 mm.; breadth 0.25 mm.; thickness 0.15 mm.

Holotype from the Upper Cretaceous, Basal Wolfe City sand, McKinny Road, 3 miles West of Farmersville, Colliers Co.,

Texas collected by Dr. L. W. Stephenson. Pl. 16, fig. 8 is from the Upper Wolfe City sand, 3 miles West of Barry, Navarro Co., Texas also collected by Dr. Stephenson.

This is a rather common species in certain zones of the Wolfe City sand, and is a striking species.

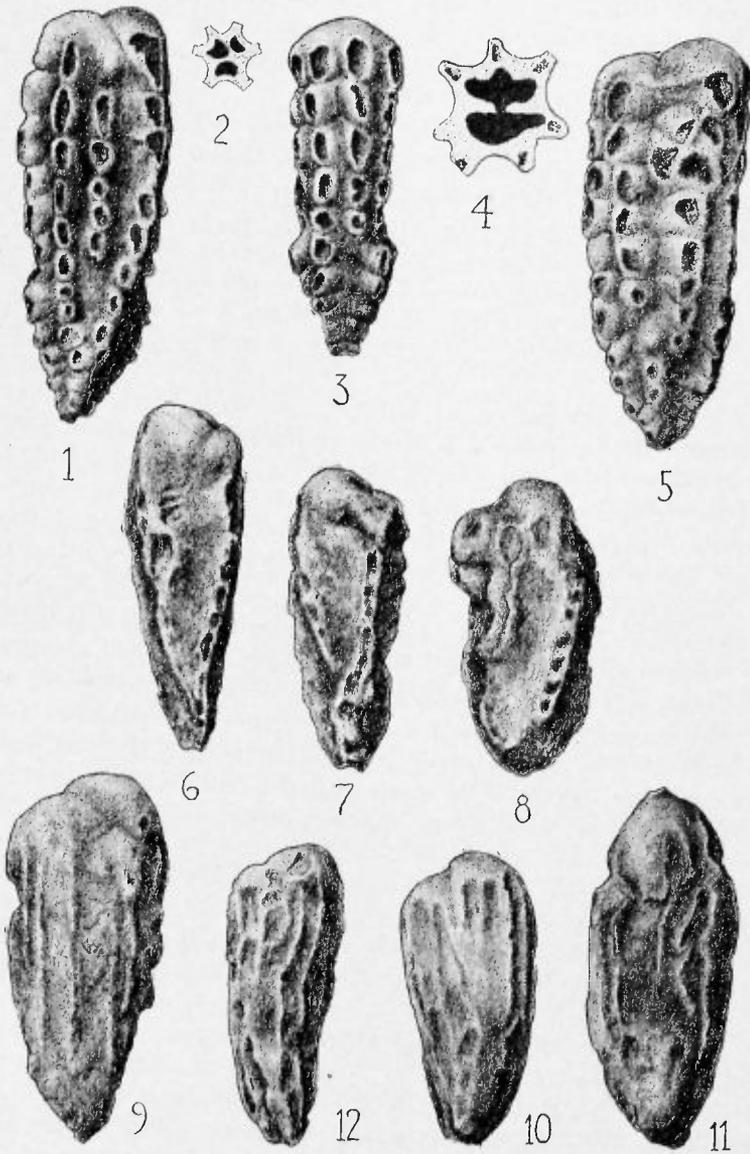
GAUDRYINA SIPHONIFERA (H. B. Brady)

Plate 16, figures 1-5

Textularia siphonifera H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 53; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 362, pl. 42, figs. 25-29.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, 1902, p. 387 (list).—BAGG, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 131.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 17, figs. 28, 29 (in text); Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 115, pl. 21, figs. 4-7; Bull. 27, Bernice P. Bishop Mus., 1925, p. 123.

Test elongate, the early portion triserial and tricarinate, later becoming bicarinate at each side in some specimens before the later biserial character is taken on, later and larger part of the test biserial, with increasing numbers of angular longitudinal ridges becoming fistulose and 3 or 4 to each chamber so that the end view is broadly oval with 6 or 8 projecting portions, ends of these projections in well preserved specimens probably closed, later broken and showing the cavity within; chambers numerous and fairly distinct; sutures slightly depressed; wall finely agglutinated, of calcareous fragments; aperture in the adult, elongate, low, at the inner margin of the last-formed chamber.

The distribution of this large and striking species is interesting. Brady's original specimens were from 40 fathoms, coral reefs of Honolulu; two stations from the Admiralty Islands, 15-25 fathoms; off Tongatabu, Friendly Islands, 18 fathoms, and Gulf of Suez, 30 fathoms. Chapman records it from about Funafuti from shallow water to 60 fathoms with a single station at 200 fathoms. Bagg adds a Hawaiian station at 1,307 fathoms. I have found it abundant in collections from the Philippines and from the islands northwest of Hawaii as well as from Samoa. I did not find it from Murray Island, Great Barrier Reef, nor did Heron-Allen and Earland record it from their rich material from the Kerimba Archipelago off Southeastern Africa, nor Dakin from the shallow water of the Gulf of Manaar. Mr. W. J. Parr sends me the following note, "In view of your remarks on the distribution of *Textularia siphonifera* Brady in 'Samoan Foraminifera', you will be inter-



ested to know that a specimen of this species identical with the form figured by Brady occurs in a dredging from 20 fathoms off Masthead Island, in the Capricorn group, Great Barrier Reef."

The whole distribution of the species with the exception of that from Suez is tropical Pacific.

Chapman records this species from the Miocene of Australia (Journ. Linn. Soc. Zool., vol. 30, 1907, p. 26, pl. 3, fig. 56). I have through the kindness of Mr. Parr, specimens from several localities in the Balcombian and Janjukian of Australia. They are not the same as Brady's species but are truly textularian throughout and belong elsewhere. The specimens I have recorded from Samoa (Publ. 342, Carnegie Instit. Washington, 1924, p. 13, pl. 3, fig. 5; pl. 4, figs. 4, 5) are also *Textularia* and not this species.

The sections given show the triserial arrangement of the early stage and the later biserial form from Philippine specimens.

HETEROSTOMELLA FOVEOLATA (Marsson)

Plate 16, figures 9-12

Tritaxia foveolata MARSSON, Mitth. nat. Ver. Neu-Vorpommern und Rügen, Jahrb. 10, 1878, p. 161, pl. 3, figs. 30 a-c; FRANKE, Abhandl. geol. pal. Institut. Univ. Greifswald, vol. 6, 1925, p. 19, pl. 2, fig. 3.

Test elongate, conical, greatest breadth near the apertural end, early portion triserial, later portion biserial, sides of the test with longitudinal ridges which have irregular fistulose portions, often broken down into irregular openings; chambers and sutures rather obscured by the surface characters of the test; wall finely arenaceous; aperture in the adult small, terminal, with a slight neck.

Marsson's types are from the Cretaceous of the Island of Rügen off the coast of Germany. Franke records it from the Cretaceous of Pomerania, Germany. Egger's figures (Abhandl. kon. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, pl. 4, figs.

EXPLANATION OF PLATE 16

FIGS. 1-5. *Gaudryina siphonifera* (H. B. Brady). × 35. Figs. 1, 5, Front views. Fig. 3, Side view. Fig. 2, Transverse section of early triserial portion. Fig. 4, Transverse section of later biserial section.

FIGS. 6-8. *Gaudryina stephensoni* Cushman, n. sp. × 60.

FIGS. 9-12. *Heterostomella foveolata* (Marsson). × 60.

32-34) are not at all like the originals of Marsson. Heron-Allen and Earland record the species without comment or figures in their paper on the Foraminifera of Selsey Bill, England (Journ. Roy. Micr. Soc., 1910, p. 406).

I have figured here specimens from the American Upper Cretaceous. Fig. 11 is from the extreme Upper Annona Chalk, 6.5 miles East of Clarkesville, Texas; Fig. 9 from the Middle Taylor, 3 miles West of Rogers, Bell Co., Texas, and Figs. 10, 12 from the Upper Taylor, Rugby road, 1.9 miles East of Deport, Red River Co., Texas, all collected by L. W. Stephenson.

69. HYPERAMMINOIDES, A NEW NAME FOR HYPERAMMINELLA CUSHMAN AND WATERS

By JOSEPH A. CUSHMAN and JAMES A. WATERS

The following new name is proposed for one already preoccupied:

Genus HYPERAMMINOIDES Cushman and Waters, new name

Hyperamminella CUSHMAN and WATERS (not deFOLIN, 1881), Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 36.

The generic name *Hyperamminella* was already used by deFolin in 1881, but like so many of deFolin's names is not used by later authors. The genoholotype of *Hyperamminoides* will be *H. elegans* (Cushman and Waters) (= *Hyperammina elegans* Cushman and Waters, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 36, pl. 4, figs. 3, 4). Other species are *Hyperamminoides protea* (Cushman and Waters), *H. minuta* (Cushman and Waters), and *H. glabra* (Cushman and Waters).

Our thanks are due to Dr. J. J. Galloway for calling attention to deFolin's name.

RECENT LITERATURE ON THE FORAMINIFERA

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

van der Vlerk, I. M.

The Genus *Lepidocyclina* in the Far East.

(*Eclogae Geologicae Helvetiae*, vol. 21, No. 1, 1928, pp. 182-211, pls. VI-XXIII, with 3 tables). *Basel*.

There are 50 species and varieties treated with figures, synonyms and distribution. A new subgenus *Trybliolepentina* and one new species are described. A determination key to all the species is given and a bibliography of 127 papers.

Vaughan, Thomas Wayland.

New Species of *Operculina* and *Discocyclina* from the Ocala Limestone.

(19th Ann. Rep't Florida Geol. Survey, 1928, pp. 155-165, pls. 1, 2.) *Tallahassee*.

A new species of *Operculina* and 3 of *Discocyclina* are described and figured. The species of larger foraminifera of the Ocala limestone are listed and briefly discussed.

Moberg, M. Wilcox.

New Species of *Coskinolina* and *Dictyoconus* ? from Florida.

(19th Ann. Rep't Florida Geol. Survey, 1928, pp. 166-175, pls. 3-5). *Tallahassee*.

A new species of each genus is described and figured.

Koch, Richard.

Tertiärer Foraminiferenkalk von der Insel Curacao (Niederländisch West-Indian).

(*Eclogae Geologicae Helvetiae*, vol. 21, No. 1, 1928, pp. 51-56, pl. III, 1 text fig.) *Basel*.

A new species of *Lepidocyclina* is described and figured, and notes given on other species.

Silvestri, Alfredo.

Di Alcune *Facies* Lito-paleontologiche del Terziario di Derna, nella Cirenaica.

(Boll. Soc. Geol. Ital., vol. 47, fasc. 1, 1928, pp. 109-113,
pl. VI.) Rome.

Some excellent sections are given and notes on distribu-
tion.

Silvestri, A.

Nummuliti, operculina e planorbulina di Derna nella Cirena-
ica.

(Mem. Pont. Accad. Sci., Nuovi Lincei, vol. 11, 1928, pp.
263-278, pl. I, text figs. A-C.) Rome.

Several species are described at length and the plate has
excellent figures from photographs.

Hanna, G. Dallas.

The Monterey Shale of California at its Type Locality With
a Summary of its Fauna and Flora.

(Bull. Amer. Assoc. Petr. Geol., vol. 12, 1928, pp. 969-983,
pls. 7-10). Chicago.

A few figures of foraminifera are given.

Heron-Allen, Edward and Arthur Earland.

On the Pegididae, a New Family of Foraminifera.

(Journ. Roy. Micr. Soc., vol. 48, 1928, pp. 283-299, 3 pls.)

London.

This family is placed by the authors between the
Rotaliidae and the **Globigerinidae**. The following new gen-
era are described: *Physalidia*, *Rugidia*, *Pegidia* and
Sphaeridia with a number of new species all recent.

J. A. C.