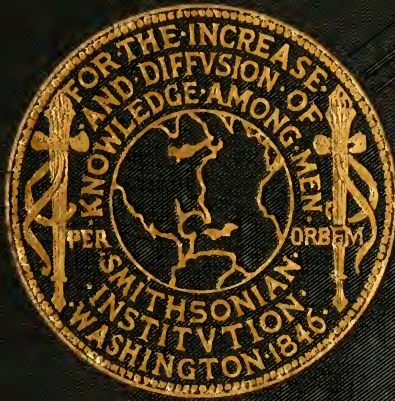


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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
BULLETIN 161

THE FORAMINIFERA OF THE
TROPICAL PACIFIC COLLECTIONS OF
THE "ALBATROSS," 1899-1900

PART 2.—LAGENIDAE TO ALVEOLINELLIDAE

BY

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1933

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THE FORAMINIFERA OF THE TROPICAL PACIFIC COLLECTIONS OF THE "ALBATROSS," 1899-1900

PART 2.—LAGENIDAE TO ALVEOLINELLIDAE

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INTRODUCTION

THIS PAPER is the second part of a work the intent of which is to describe and illustrate the foraminifera of the tropical Pacific collected by the United States Bureau of Fisheries steamer *Albatross*, together with certain other related material from shallow water of the same region. Part 3 will take up in systematic order the rest of the families after the Alveolinellidae. Readers are referred to Part 1¹ (p. 3) for a map showing the general route of the *Albatross* through the South Pacific.

It has become evident from our study of the shallow-water foraminifera from about the various oceanic islands that many species are very localized in their distribution, and probably a careful survey of the different island groups will show that there are many of these isolated species or varieties that have not yet been recognized. Where these occur, they are often to be found in great numbers, as is frequently the case with such localized species in other groups.

TABLE 1.—Abbreviations used in the tables in this report to denote the character of the bottoms of the stations

| Abbreviation | Meaning | Abbreviation | Meaning | Abbreviation | Meaning |
|--------------|--------------|--------------|------------|--------------|------------|
| br..... | brown. | gy..... | gray. | pter..... | pteropods. |
| brk..... | broken. | lav..... | lava. | pum..... | pumice. |
| c..... | clay. | lt..... | light. | rd..... | red. |
| co..... | coral. | m..... | mud. | s..... | sand. |
| crs..... | coarse. | mang..... | manganese. | sh..... | shells. |
| fne..... | fine. | min..... | mineral. | vol..... | volcanic. |
| frag..... | fragments. | nod..... | nodules. | wh..... | white. |
| glob..... | globigerina. | oz..... | ooze. | yl..... | yellow. |
| gn..... | green. | part..... | particles. | | |

¹ The foraminifera of the tropical Pacific collections of the *Albatross*, 1899-1900. *Astrorhizidae* to *Trochamminidae*. U. S. Nat. Mus. Bull. 161, pt. 1, 84 pp., 1 fig., 17 pls., June 18, 1932.

Family LAGENIDAE

Subfamily NODOSARIINAE

Genus ROBULUS Montfort, 1808

Robulus MONTFORT, Conch. Syst., vol. 1, p. 215, 54th genre, 1808.

Synonyms: *Phonemus* MONTFORT, 1808; *Pharamum* MONTFORT, 1808; *Patrocles* MONTFORT, 1808; *Spincterules* MONTFORT, 1808; *Herion* MONTFORT, 1808; *Rhinocurus* MONTFORT, 1808; *Lampas* MONTFORT, 1808; *Scortimus* MONTFORT, 1808; *Linthuris* MONTFORT, 1808; *Astaculus* (?) MONTFORT, 1808; *Periples* MONTFORT, 1808; *Robulina* D'ORBIGNY, 1826; *Cristellaria* (part) of authors.

Genoholotype.—*Robulus cultratus* Montfort.

Test planispiral, bilaterally symmetrical, typically close coiled, usually involute; chambers numerous, triangular in side view; wall very finely perforate, glassy; aperture an elongate slit on the median line of the usually somewhat concave apertural face in addition to the radiate aperture of the outer peripheral angle. Jurassic to Recent.

It is often difficult to distinguish between *Robulus* and *Lenticulina*. In the Jurassic, where *Robulus* is the dominating genus, the distinctions are much greater. In Recent material, however, the apertural chamberlet has been developed with a radiate external aperture, and in the species assigned to *Robulus* the median ventral opening is usually more elongate and enlarged. It is, however, difficult in all the genera of the Lagenidae to draw hard and fast lines between generic characters.

ROBULUS RENIFORMIS (d'Orbigny)

PLATE 1, FIGURES 2, 3

Cristellaria reniformis D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, p. 88, pl. 3 figs. 39, 40, 1846.

Test planispiral, very much compressed, often nearly twice as long as broad, periphery acute but usually not strongly keeled; chambers distinct, fairly numerous, 8 or 9 in the adult coil, early portion completely involute, later chambers becoming more elongate and slightly evolute; sutures distinct, rather strongly curved, those of the last-formed portion somewhat sigmoid, slightly limbate; wall smooth, very finely perforate; aperture slightly produced, radiate, at the peripheral angle of the test. Length, up to 1 mm; breadth, 0.45 mm; thickness, 0.12 mm.

Two specimens of this species are figured, one coming from *Albatross* Station H3875, southwest point of Tahanae, about one-half mile offshore, 3 miles northeast, in 269 fathoms, and the other from Rangiroa. These specimens are comparatively small, but seem to fit more nearly d'Orbigny's description and figure of his species as described from the Miocene of the Vienna Basin than some of the later figures that have been referred to his species.

ROBULUS LIMBOSUS (Reuss)

PLATE 1, FIGURES 4-6; PLATE 2, FIGURES 5a, b

Robulina limbosa REUSS, Sitz. Akad. Wiss. Wien, vol. 48, pt. 1, p. 55, pl. 6, figs. 69 a, b, 1863 (1864).

Test close coiled, slightly evolute, strongly biconvex in peripheral view, periphery strongly keeled; chambers usually 6 to 8 in the adult coil, those of the early portion often seen through the somewhat clear umbilical region, of rather uniform shape and increasing regularly in size as added, very slightly if at all inflated; sutures very distinctly limbate, slightly curved, and in general tangential in position in rela-

TABLE 2.—*Robulus limbosus*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature ° F. | Character of bottom ¹ | Occurrence |
|--------------|---------------------|-------------------|--|---------------------|----------------------------|------------------------------------|------------|
| 22099 | 1 | H3812 | Entrance to Avatoru Pass, Rabi-roa Atoll, 7.5 miles S. | Fath- oms 819 | ----- | wh. co. s. glob. oz. vol. part. | Rare. |
| 22100 | 1 | H3815 | Lat. 15° 15' S., long. 147° 51' 35'' W. | 524 | ----- | wh. co. s. brk. sh. | Do. |
| 22093 | 1 | H3826 | Lat. 14° 56' S., long. 148° 44' W. | 711 | ----- | wh. pter. oz. | Do. |
| 22115 | 1 | H3828 | Lat. 14° 51' 20'' S., long. 148° 51' 20'' W. | 624 | ----- | wh. co. s. | Do. |
| 22113 | 1 | H3834 | West coast of Makatea Island, 1.3 miles E. | 1,363 | ----- | wh. co. s. mang. nod. | Do. |
| 22095 | 1 | H3849 | Village west side of Niau Atoll, 1.75 miles NE. | 491 | ----- | co. s. pter. oz. | Do. |
| 22101 | 1 | H3873 | Southwest point of Tahanae, 65° N., 4 miles E. | 966 | ----- | glob. oz. mang. | Do. |
| 22103 | 1 | H3876 | Northwest entrance of Makemo Lagoon, 1 mile SE. | 467 | ----- | wh. co. s. | Do. |
| 22102 | 1 | H3883 | Northwest pass of Raroia, 5 miles SE. | 1,385 | 35.7 | gy. yl. glob. oz. mang. part. | Do. |
| 22114 | 1 | H3885 | Southwest point of Takume Atoll, 1.5 miles NE. | 572 | 38.7 | crs. co. s. | Do. |
| 22098 | 1 | H3894 | Midway between Marutea and Nihiru Islands. | 1,135 | 36.0 | glob. oz. | Do. |
| 22105 | 1 | H3901 | Northwest point of Marokau, 8 miles E. | 1,620 | 35.6 | glob. oz. mang. | Do. |
| 22106 | 1 | H3924 | Nukutipipi Atoll, 1 mile NW. | 649 | 39.0 | co. s. brk. sh. | Do. |
| 22094 | 1 | H3925 | Nukutipipi Atoll, 65° S., 1 mile E. | 736 | ----- | do. | Do. |
| 22107 | 1 | H3928 | Anu Anurunga, 1 mile SE. | 659 | 38.5 | co. s. brk. sh. pter. oz. | Do. |
| 22104 | 1 | H3930 | Anu Anuraro Atoll, ¾ mile NW. | 438 | 40.7 | co. s. | Do. |
| 22108 | 2 | H3931 | Anu Anuraro Atoll, ½ mile SE. | 405 | 42.5 | co. s. pter. oz. mang. part. | Do. |
| 22096 | 1 | H3954 | West end of Nomuka Island, 33° N., 6 miles E. | 600 | 39.2 | co. s. pum. pter. oz. | Do. |
| 22097 | 1 | H3978 | Wotju Island, Elmore Atoll, 6 miles SE. | 1,068 | 36.5 | co. s. | Do. |
| 22116 | 1 | H3989 | South Pass, Likieb, ½ mile N. | 468 | 42.6 | crs. co. s. | Do. |

¹ Key to abbreviations is given in Table 1.

tion to the earlier central portion; wall smooth, finely perforate, translucent or in parts almost transparent; aperture radiate at the

peripheral angle, usually with the ventral slit characteristic of *Robulus* very distinctly developed. Diameter, up to 1 mm; thickness, 0.4 mm.

This is a fairly common species in the South Pacific material, especially at those stations occupied by the *Albatross* from deeper water. Distribution of the various specimens is given in Table 2. There is a considerable degree of variation in the closeness of coiling of the test and also in the number of chambers, as well as in the relative development of the peripheral keel.

In addition to the stations given in the table, there are small, rather poorly developed specimens referred to this species from near Nairai, Fiji.

ROBULUS LARVUS (Stache)

PLATE 1, FIGURE 7

Cristellaria larva STACHE, *Novara-Exped.*, Geol. Theil, vol. 1, p. 232, pl. 23, figs. 11 a, b, 1864.

Test much compressed, slightly evolute, peripheral end distinctly keeled and somewhat irregular in outline; chambers distinct, very slightly inflated, usually 8 to 10 in the last-formed coil, of uniform shape and increasing uniformly in size as added; sutures very broadly limbate, strongly curved, slightly if at all depressed; wall smooth, finely perforate; aperture slightly projecting, at the peripheral angle, and the ventral slit usually strongly developed. Length, 0.9 mm; breadth, 0.75 mm; thickness, 0.3 mm.

The specimen figured seems to be very close to the species described and figured by Stache from the Tertiary of New Zealand. So far as the present material is concerned, this seems to be a rare species occurring only at *Albatross* Station H3905, northwest point of Hao Atoll, one-half mile SE., in 425 fathoms.

ROBULUS COLORATUS (Stache)

PLATE 1, FIGURE 8

Cristellaria colorata STACHE, *Novara-Exped.*, Geol. Theil, vol. 1, p. 229, pl. 23, figs. 9 a, b, 1864.

Test strongly biconvex in peripheral view, in side view close coiled, completely involute, with 6 or 8 chambers in the last-formed coil, periphery strongly keeled; chambers of rather uniform shape, but increasing rather rapidly in size as added, generally of a triangular form; sutures distinct, limbate, distinctly curved; wall smooth, finely perforate; aperture at the peripheral angle, rather definitely projecting, and the ventral opening usually distinct. Diameter, 1.1 mm; thickness, 0.5 mm.

This species, like the preceding described by Stache from the Tertiary of New Zealand, seems to be rare as a Recent form in the South

Pacific, our only specimens occurring at *Albatross* Station D3690, northwest face of Hao Atoll, 2 miles E., Paumotu, in 812 fathoms, and Station H3914, northeast point of Nukutavake, 1 mile S., in 636 fathoms.

ROBULUS NIGRISEPTUS (Koch)

PLATE 1, FIGURES 9a, b

Cristellaria nigrisepta KOCH, Ber. Schweiz. Pal. Ges., vol. 19, no. 3, p. 740, fig. 14 (in text), 1926.

Test strongly biconvex, involute, the periphery acute, sometimes with a slight keel, especially on the earlier portion; chambers elongate, strongly curved, 7 or 8 in the final coil; sutures very strongly limbate, peculiarly formed with a distinct angle toward the inner end; wall smooth, finely perforate; aperture radiate, somewhat extended, with a ventral slit. Diameter, 1.1 mm; thickness, 0.5 mm.

Our specimens seem to be identical with this species described from the Middle Tertiary of East Borneo. The sutures are variable in the degree of limbation, but the peculiar angle of the chambers is evident, and the last-formed chamber is often very small, as indicated in our figure, and also in the type figure given by Koch. The species is rare at all the stations at which it was found, but it has occurred at several of these, as shown in Table 3.

TABLE 3.—*Robulus nigriseptus*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|---------|--------------------|-----------------------------|------------|
| | | | | Fathoms | ° F. | | |
| 22119 | 1 | H3813 | Lat. 15° 13' 10" S., long. 147° 53' 10" W. | 341 | ----- | wh. co. s. glob. pter | Rare. |
| 22120 | 1 | H3860 | Southwest end of Fakarava, 2 miles NE. | 602 | ----- | co. s. pter. oz.----- | Do. |
| 22121 | 1 | H3899 | Northwest point of Hikueru Atoll, 1.3 miles E. | 798 | 37.8 | ----do----- | Do. |
| 22122 | 1 | H3924 | Nukutipipi Atoll, 1 mile NW | 649 | 39.0 | co. s. brk. sh.----- | Do. |
| 22123 | 1 | H3927 | Anu Anurunga, 1 mile W | 574 | 39.0 | crs. co. s. mang. pter. oz. | Do. |
| 22124 | 1 | H3936 | Hercheretue Atoll, 0.3 mile E | 189 | 62.1 | co. s. mang. part... | Do. |
| 22125 | 1 | H3961 | Center south coast of Tarawa, 10 miles N. | 413 | 43.5 | crs. br. glob. oz.----- | Do. |
| 22126 | 1 | H3980 | South point of Leuen Island, Namu, 2 miles N. | 630 | 39.7 | crs. co. s.----- | Do. |

ROBULUS VORTEX (Fichtel and Moll)

PLATE 2, FIGURES 1a, b

"*Nautili globuli*" SOLDANI, Testaceographia, vol. 1, pt. 1, p. 66, pl. 59, fig. *tt*, 1789.

Nautilus vortex FICHEL and MOLL, Test. Micr., p. 33, pl. 2, figs. *d-i*, 1803.

Polystomella vortex BLAINVILLE, Man. Malac., p. 389, 1825.

Robulina vortex D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 288, no. 4, 1826.

Cristellaria vortex PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 8, p. 240, pl. 10, fig. 82, 1871.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 548, pl. 69, figs. 14–16, 1884.—FLINT, U. S. Nat. Mus. Rep. for 1897, p. 317, pl. 65, fig. 1, 1899.—BAGG, Proc. U. S. Nat. Mus., vol. 34, p. 148, 1908.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 68, pl. 32, fig. 3, 1913.

Test planispiral, close coiled, entirely involute, strongly biconvex, peripheral end with a distinct keel; chambers numerous, 8 to 12, of uniform shape and increasing only slightly in size as added, elongate, strongly curved, usually not inflated; sutures distinct, strongly limbate, very strongly curved, especially toward the inner end; wall smooth, very finely perforate; aperture radiate, at the peripheral margin, with a distinct, ventrally pointing slit in well-preserved specimens, the side of the apertural face distinctly raised. Diameter, up to 2.5 mm; thickness, up to 1 mm.

This species is widely distributed, although various specimens that do not belong here have probably been referred to it by various authors. It has not been common in our material, and occurred only in *Albatross* collections from the deeper water stations. The data for these are given in Table 4.

TABLE 4.—*Robulus vortex*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|---------|--------------------|------------------------------|------------|
| | | | | Fathoms | ° F. | | |
| 22127 | 1 | H3876 | Northwest entrance of Makemo Lagoon, 1 mile SE. | 467 | ----- | wh. co. s.----- | Rare. |
| 22128 | 1 | H3930 | Anu Anuraro Atoll, ¾ mile NW... | 438 | 40.7 | co. s.----- | Do. |
| 22129 | 1 | H3931 | Anu Anuraro Atoll, ½ mile SE... | 405 | 42.5 | co. s. pter. oz. mang. part. | Do. |

ROBULUS GIBBUS (d'Orbigny)

PLATE 2, FIGURES 2a, b, 6, 7

Cristellaria gibba D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 292, no. 17, 1826; *in* DE LA SAGRA, Hist. Fis. Pol. Nat. Cuba, "Foraminifères," p. 63, pl. 7, figs. 20, 21, 1839.

Test very strongly biconvex, usually somewhat longer than broad, the peripheral angle usually with only a slight keel, if any, close coiled, the peripheral face somewhat concave with raised sides; chambers numerous, 7 to 10 in the adult coil, elongate, strongly curved, of nearly uniform shape throughout, increasing slowly in size as added; sutures distinct, limbate, rather strongly and evenly curved; wall smooth,

finely perforate; aperture radiate, at the peripheral angle, with a distinct enlarged slit on the ventral side. Length, up to 0.9 mm; breadth, 0.75 mm; thickness, 0.45 mm.

This specific name has been used by many authors, but a reference to the various forms will show that many specimens have been recorded under this name that are quite different from the species as defined and figured by d'Orbigny. Specimens are rare, but occur at several *Albatross* stations in deeper water, as shown in Table 5. In addition to the deep-water *Albatross* stations, there are three specimens from Mokaujar Anchorage, Fiji, in comparatively shallow water.

TABLE 5.—*Robulus gibbus*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|---------------------|--------------------|------------------------------------|------------|
| 22130 | 1 | H3810 | Entrance to Avatoru Pass, Rabi-roa Atoll, 3.5 miles S. | Fath- oms 661 | ° F. ----- | wh. co. s. glob. oz. min. frag. | Rare. |
| 22131 | 1 | H3822 | Lat. 15° 1' 40" S., long. 148° 25' W. | 670 | ----- | wh. co. s.----- | Do. |
| 22132 | 1 | H3826 | Lat. 14° 56' S., long. 148° 44' W. | 711 | ----- | wh. pter. oz.----- | Do. |
| 22133 | 1 | H3855 | Northwest point of Apataki, 1 mile SE. | 654 | 38.8 | crs. co. s.----- | Do. |
| 22134 | 2 | H3916 | Pinaki Atoll, 1 mile E.----- | 486 | 41.0 | crs. co. s. pter. oz. | Do. |
| 22135 | 1 | | | | | | |
| 22136 | 1 | H3928 | Anu Anurunga, 1 mile SE.----- | 659 | 38.5 | co. s. brk. sh. pter. oz. | Do. |
| 22137 | 1 | H3961 | Center south coast of Tarawa, 10 miles N. | 413 | 43.5 | crs. br. glob. oz.--- | Do. |

ROBULUS CALCAR (Linnaeus)

PLATE 2, FIGURES 3a, b

"*Nautilus minimus non umbilicatus*" GUALTIERI, Index Test., pl. 19, fig. C, 1742.

"*Nautili (Lenticulae radiatae)*" SOLDANI, Testaceographia, vol. 1, pt. 1, p. 54, pl. 33, figs. aa, bb, 1789.

Nautilus calcar LINNAEUS, Syst. Nat., ed. 12, p. 1162, no. 272, 1767; (Gmelin's) ed. 13, p. 3770, no. 2, 1788.

Cristellaria calcar H. B. BRADY (part), Rep. Voy. *Challenger*, Zoology, vol. 9, p. 55, pl. 70, figs. 9-12 (not figs. 13-15), 1884.—H. B. BRADY, PARKER, and JONES, Trans. Zool. Soc. London, vol. 12, p. 224, pl. 44, fig. 14, 1888.—FLINT, U. S. Nat. Mus. Rep. for 1897, p. 318, pl. 66, fig. 1 (part), 1899.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 72, pl. 32, fig. 4, 1913; U. S. Nat. Mus. Bull. 104, pt. 4, p. 115, pl. 30, fig. 7; pl. 31, figs. 4, 5, 1923.

Robulus calcar GALLOWAY and MORREY, Bull. Amer. Pal., vol. 15, p. 20, pl. 2, fig. 10, 1929.—CUSHMAN, Contr. Cushman Lab. For. Res., vol. 5, p. 84, pl. 12, fig. 18, 1929.—CUSHMAN and JARVIS, Journ. Pal., vol. 4, p. 358, pl. 32, fig. 9, 1930.

Test close coiled, strongly biconvex, periphery usually with a single acicular spine extending from each chamber, the spines usually

opposite the middle of the chamber but sometimes at the angle; chambers distinct, slightly inflated, of uniform shape and increasing only slightly in size as added, few in number, usually 5 to 7 in the adult coil, those of the earlier coils often showing through the clear umbilical region; sutures distinct, strongly limbate, nearly straight and tangential; wall smooth, very finely perforate; aperture somewhat projecting, radiate, with a ventral slit along the middle of the apertural face, which is slightly depressed and has raised sides. Diameter without spines, usually about 1 mm or less.

Forms similar to that figured here are not uncommon in many parts of the world in the present oceans and in the late Tertiary. References are very numerous to this species, but only a few that refer to typical material are given here. Specimens are only in the deep-water material of the *Albatross* dredgings, and even there seem to be extremely rare, occurring only at H3961, center south coast of Tarawa, 10 miles N., in 413 fathoms.

ROBULUS EXPANSUS (Cushman) var. PLANULATUS (Cushman)

PLATE 2, FIGURES 4a, b

Cristellaria expansa CUSHMAN var. *planulata* CUSHMAN, Proc. U. S. Nat. Mus., vol. 51, p. 658, 1917; U. S. Nat. Mus. Bull. 100, vol. 4, p. 237, pl. 46, figs. 3a, b, 1921.

Variety differing from the typical form mainly in the lack of the characteristic ornamentation, which consists of raised beads, and in the variety if at all ornamented, consisting of indistinct costae in the axis of growth; the test is also more compressed than in the typical form.

This variety was originally described from the Philippines, and is present in the *Albatross* dredgings in typical form from a single station, H3924, Nukutipipi Atoll, 1 mile NW., in 649 fathoms.

Genus MARGINULINA d'Orbigny, 1826

Marginulina D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 258, 1826.

Genotype.—By designation, *Marginulina glabra* d'Orbigny.

Test subcylindrical, very early portion close coiled, later uncoiled, final chambers often inflated; aperture in the early coiled portion as in *Lenticulina*, in the uncoiled portion becoming central and terminal. Triassic to Recent.

A distinction is sometimes attempted between the more rounded and flattened uncoiled forms usually assigned to *Marginulina*, with the name *Hemicristellaria* Stache applied to those forms that are flattened. There is no possibility of drawing a dividing line between these forms, and moreover the designated type of *Hemicristellaria*, *H. procera* Stache, is not a compressed but a rounded form, as a study of

the types in Vienna has shown. This choice of type, therefore, unfortunately leaves no real distinction between these two genera.

MARGINULINA cf. CREPIDULA (Fichtel and Moll)

PLATE 1, FIGURES 1a, b; PLATE 2, FIGURES 10a, b

Two specimens are here figured which may belong to this species described by Fichtel and Moll from the Mediterranean. They evidently belong to the genus *Marginulina*, as they are becoming slightly uncoiled. Specimens of this sort are extremely rare in the collections studied, and the figured specimens are from *Albatross* Stations H3798, Cape Martin, Nukuhiva Island, 30° N., 6½ miles E., in 687 fathoms, and H3840, latitude 17° 21' S., longitude 149° 15' W., in 1,585 fathoms.

MARGINULINA cf. SUBCRASSA Schwager

PLATE 2, FIGURES 11a, b

The form figured is possibly to be referred to Schwager's species. It is nearly transparent, and the coiling at the base is almost entirely reduced, but the sutures are distinctly oblique. The specimen is from *Albatross* Station H3878, latitude 16° 13' S., longitude 143° 48' W., in 987 fathoms.

MARGINULINA INSOLITA (Schwager)

PLATE 3, FIGURES 1a, b

Cristellaria insolita SCHWAGER, *Novara-Exped.*, Geol. Theil, vol. 2, p. 242, pl. 6, fig. 85, 1866.

Test somewhat elongate, much compressed, earlier chambers close coiled, later ones tending to elongate and become uncoiled, periphery rounded; chambers distinct, fairly numerous, elongating considerably as added in the adult portion; sutures distinct, very slightly if at all depressed, not limbate, only slightly curved; wall smooth, very finely perforate; aperture radiate, peripheral. Length, 0.35 mm; breadth, 0.15 mm; thickness, 0.1 mm.

This form seems to be very closely related to the species described by Schwager from the Pliocene of Car Nicobar. The figured specimen is from Port Lotten, Kersail, Caroline Islands. There is also a single specimen from *Albatross* Station H3876, northwest entrance of Makemo Lagoon, 1 mile SE., in 467 fathoms.

Genus SARACENARIA Defrance, 1824

Saracenaria DEFRANCE, *Dict. Sci. Nat.*, vol. 32, p. 177, 1824.

Synonym: *Cristellaria* (part) of authors.

Genoholotype.—*Saracenaria italica* Defrance.

Test with the earliest chambers close coiled, later uncoiling, usually triangular in transverse section; aperture as in *Robulus*. Jurassic to Recent.

Some authors have attempted to separate forms from this genus that are described as having a simple slitlike aperture instead of a radiate one. In our experience the median ventral slit of the radiating aperture is almost always enlarged and more elongate, but no examples have been noted where the other shorter radiating slits were absent. It is therefore questionable whether this distinction is a valid one, particularly as the type species of *Saracenaria* normally has this enlargement.

SARACENARIA sp. (?)

PLATE 2, FIGURES 8a, b

The figured specimen represents all that is known of this particular form in the *Albatross* collections, and it seems to be a distinct form rather well ornamented with the raised sutures and strongly developed keel, and worthy of record here. It is from *Albatross* Station H3876, northwest entrance of Makemo Lagoon, 1 mile SE., in 467 fathoms.

Genus LINGULINA d'Orbigny, 1826

Lingulina D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 256, 1826.

Synonyms: *Nodosaria* (*Mucronina*) D'ORBIGNY, 1826; *Lingulinopsis* REUSS, 1860.

Genotype.—By designation, *Lingulina carinata* d'Orbigny.

Test in the early stages, at least in the microspheric form, planispiral, later ones in a rectilinear series, compressed; aperture becoming elongate, elliptical. Permian to Recent.

The microspheric forms often attain large size and show a number of coiled chambers at the base, a fact that has been recently reaffirmed by Hofker in his work on tropical Pacific material.

LINGULINA GLANDIGENA (Schwager)

PLATE 2, FIGURES 9a, b

The peculiar small form figured here seems to be referable to Schwager's species. It is very small, measuring only 0.35 mm in length, and has a few simple chambers, somewhat compressed, and a terminal simple aperture. The sutures are slightly depressed and somewhat convexly curved. The wall of the test is smooth. The only specimens are the figured one from *Albatross* Station H3832, latitude 15° 33' S., longitude 148° 45' W., in 2,267 fathoms, and one from Station H3812, entrance to Avatoru Pass, Rahoira Atoll, 7.5 miles S., in 819 fathoms.

Genus DENTALINA d'Orbigny, 1826

Dentalina D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 254, 1826.

Genotype.—By designation, *Nodosaria* (*Dentalina*) *obliqua* d'Orbigny.

Test arcuate, elongate, of numerous chambers in a linear series; sutures usually oblique, at least in the early portion; aperture radiate,

at least in the early stages, at or near the periphery but becoming more nearly central in the last chambers. Jurassic to Recent.

There is no sharp line of difference drawn between many species of *Dentalina* and *Nodosaria*, as the obliquity of the sutures and the curvature of the test are variable in the microspheric and megalospheric forms of the same species. Some species, however, can definitely be placed in *Dentalina*, while it is much more difficult to place the microspheric forms of *Nodosaria*.

DENTALINA NEUGEBORENI (Schwager)

PLATE 3, FIGURES 2, 3

Nodosaria neugeboreni SCHWAGER, *Novara-Exped.*, Geol. Theil, vol. 2, p. 236, pl. 6, fig. 67, 1866.

Test elongate, slightly curved; chambers distinct, later ones becoming slightly inflated; sutures distinct, slightly limbate, oblique in side view; wall smooth, finely perforate; aperture radiate, at the peripheral angle, terminal. Length, 1.1 mm; breadth, 0.2–0.22 mm; thickness, 0.18–0.2 mm.

This species was described by Schwager from the Pliocene of Car Nicobar, and our specimens seem to be identical with that of Schwager. The species is very rare, but occurs at the *Albatross* stations given in Table 6.

TABLE 6.—*Dentalina neugeboreni*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|----------------|--------------------|------------------------|------------|
| 22153 | 1 | H3814 | Lat. 15° 14' 10" S., long. 147° 51' 5" W. | Fathoms 391 | ° F. ----- | wh. co. s. sh. glob. | Rare. |
| 22154 | 1 | H3920 | Lat. 19° 52' S., long. 140° 16' W... | 2, 284 | 35.0 | rd. c. glob.----- | Do. |
| 22155 | 1 | H3971 | Lat. 4° 25' N., long. 171° 13' E... | 2, 505 | 34.7 | lt. gy. glob. oz.----- | Do. |
| 22156 | 1 | H3991 | Lat. 9° 40' N., long. 169° 32' E... | 1, 583 | 35.5 | glob. oz.----- | Do. |

DENTALINA COSTAI (Schwager)

PLATE 3, FIGURE 6

Nodosaria costai SCHWAGER, *Novara-Exped.*, Geol. Theil, vol. 2, p. 229, pl. 6, fig. 62, 1866.

Test elongate, slender, tapering, last-formed chamber distinct, inflated; sutures distinct, slightly limbate, very slightly oblique; wall smooth, finely perforate; aperture radiate, terminal, at the peripheral angle. Length, 1.8 mm; diameter, 0.2 mm.

There are but two specimens in our material which can be referred to this species of Schwager originally described from the Pliocene of

Car Nicobar. They are from *Albatross* Stations H3900, midway between Hikueru and Marokau, in 1,372 fathoms, and H3954, west end of Nomuka Island, 33° N., 6 miles E., in 600 fathoms.

DENTALINA SIDEBOTTOMI, new species

PLATE 3, FIGURE 4

Nodosaria radricula SIDEBOTTOM (not Linnaeus), Journ. Roy. Mier. Soc., 1918, pl. 4, figs. 1-5.

Test elongate, very slightly tapering, not compressed, slightly curved; chambers distinct, somewhat inflated, increasing somewhat in length as added, the diameter nearly uniform throughout; sutures distinct, very slightly oblique, limbate; wall translucent, smooth, very finely perforate; aperture radiate, terminal, at the peripheral angle. Length of holotype, 0.8 mm; diameter, 0.15 mm.

Holotype.—U.S.N.M. No. 22158, from *Albatross* Station H3815, latitude 15° 15' S., longitude 147° 51' 35'' W., in 524 fathoms.

This species was figured by Sidebottom in his South Pacific paper in the above reference. It seems to be a distinct one in the South Pacific, and can be distinguished by its strongly limbate depressed sutures, the gradual increase in the length of the chambers, and the general outline. It is probably to be found rather widely distributed in the South Pacific in comparatively deep water.

DENTALINA POMULIGERA Stache

PLATE 3, FIGURE 7

Dentalina pomuligera STACHE, *Novara-Exped.*, Geol. Theil, vol. 1, p. 204, pl. 22, fig. 31, 1864.

Test elongate, curved, tapering, especially in the early portion; chambers distinct, the earlier ones only slightly inflated, later ones much inflated and very distinct, the earlier ones rapidly increasing in size as added, those of the later portion of uniform diameter and changing but little in size as added; sutures very strongly limbate, the earlier ones only slightly depressed, later ones very strongly so; wall smooth, very finely perforate; aperture terminal, radiate, very slightly projecting. Length, 1.9 mm; diameter, 0.25 mm.

This species seems to be similar to that described by Stache from the Tertiary of New Zealand. A similar form has also been figured by Koch from the Tertiary of the Pacific. Our figured specimen is from *Albatross* Station H3866, latitude 17° 17' S., longitude 145° 45' 30'' W., in 804 fathoms.

DENTALINA ELEGANS d'Orbigny

PLATE 3, FIGURE 8

The large figured specimen seems best referred to this species of d'Orbigny. It has a length of 5 mm and a diameter of 0.35 mm.

Specimens are rare in the material examined, our figured specimen coming from *Albatross* Station H3961, center south coast of Tarawa, 10 miles N., in 413 fathoms.

DENTALINA sp. (?)

PLATE 3, FIGURES 5a, b

The large distinct specimen figured is from *Albatross* Station H3891, latitude 16° 30' S., longitude 143° 41' W., in 540 fathoms, and while it may represent an abnormal form, it seems worthy of being figured. The early portion has very oblique sutures which are not depressed, while the later portion consists of inflated chambers with somewhat depressed limbate sutures.

Genus NODOSARIA Lamarck, 1812

Nodosaria LAMARCK, Extrait du cours de zoologie, p. 121, 1812.

Genotype.—By designation, *Nautilus raphanistrum* Linnaeus.

Test with the chambers in a straight linear series, the chambers distinct, not strongly embracing; sutures normally at right angles to the axis; wall calcareous, finely perforate, glassy; aperture central and terminal, radiate, often with a chamberlet below with a rounded opening into the main cavity of the chamber. Triassic to Recent.

TABLE 7.—*Nodosaria perversa*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|------------------|--------------------|--------------------------|------------|
| 22143 | 1 | H3804 | Entrance of Ahii Lagoon, 2.5 miles SE. | Fathoms 1,208 | ° F. ----- | lt. gy. oz. glob. | Rare. |
| 22144 | 1 | H3815 | Lat. 15° 15' S., long. 147° 51' 35'' W. | 524 | ----- | wh. co. s. brk. sh. | Do. |
| 22145 | 1 | H3853 | Pakaka entrance of Apataki Lagoon, 50° N., 2 miles E. | 613 | 39.4 | co. vol. | Do. |
| 22146 | 1 | H3858 | Ngaruae Pass, Fakarava Atoll, 28° S., 1 mile E. | 599 | ----- | crs. co. s. | Do. |
| 22147 | 1 | H3924 | Nukutipipi Atoll, 1 mile NW. | 649 | 39.0 | co. s. brk. sh. | Do. |
| 22148 | 1 | H3989 | South Pass, Likieib, ½ mile N. | 468 | 42.6 | crs. co. s. | Do. |

The earliest forms that are recorded as *Nodosaria* have simple rounded openings and apparently have not yet developed the apertural chamberlet with its radiate and terminal aperture.

NODOSARIA PERVERSA Schwager

PLATE 3, FIGURES 13-15

Nodosaria perversa SCHWAGER, *Novara-Exped.*, Geol. Theil, vol. 2, p. 212, pl. 5, fig. 29, 1866.

Test elongate, somewhat tapering, the initial end with a slight spine; chambers few, distinct, slightly overlapping, increasing in length as added, circular in transverse section; sutures distinct, slightly depressed, not limbate; wall ornamented by numerous longitudinal costae, which are continuous over adjacent chambers, the outer portion of the last-formed chamber in the adult often smooth; aperture radiate, at the end of a distinct cylindrical neck, occasionally with circular raised costae. Length, up to 1.15 mm; diameter, 0.3 mm.

This species described originally by Schwager from the Pliocene of Car Nicobar occurs at a number of stations in the *Albatross* material. There is some variation in the number of the costae as seen in the figured specimens. The occurrence of the species in our material is shown in Table 7.

NODOSARIA PRAVA, new species

PLATE 4, FIGURES 1-4

Test elongate, somewhat tapering, early chambers usually somewhat overlapping in the microspheric form, and either 2 or 3 in number, increasing slightly in size as added, followed by two or more chambers obliquely placed, the obliquity becoming more pronounced as chambers are added, in the megalospheric form the early stages often entirely wanting, and the entire test consisting of somewhat obliquely placed, inflated chambers; sutures distinct, those of the early portion in the microspheric form only slightly depressed, later ones very much depressed, and the connection between the chambers greatly constricted; wall ornamented by longitudinal costae, in the early portion continuous over adjacent chambers, on the inflated chambers the costae usually independent on each chamber; aperture at the end of a cylindrical or tapering neck with definite teeth about the margin, the neck itself usually oblique to the axis of the test, and often ornamented by longitudinal costae. Maximum length, 2 mm; diameter, 0.5 mm.

Holotype.—U.S.N.M. No. 22334, from *Albatross* Station H3858, Ngaruae Pass, Fakarava Atoll, 28° S., 1 mile E., in 599 fathoms.

The megalospheric form of the species occurs alone at *Albatross* Stations H3808, entrance to Avatoru Pass, Rahoira Atoll, 1.5 miles S., in 604 fathoms, and H3857, Center Tikei Island, ½ mile E., in 360 fathoms. This is a very unusual form, and the peculiar oblique chambers seem to be a definite character, and they are not in any way abnormal, as shown by the number of specimens of this character.

NODOSARIA sp. (?)

PLATE 3, FIGURE 11

The figured specimen shows what may be a very young specimen or an adult. As it is a single specimen from *Albatross* Station H3898,

northwest point of Hikueru Atoll, $\frac{1}{2}$ mile E., in 348 fathoms, and no others have occurred, it is simply figured here for future reference. The form has an elongate neck and a smooth exterior.

Genus PSEUDOGLANDULINA Cushman, 1929

Pseudoglandulina CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, p. 87, 1929.

Synonyms: *Nodosaria* (part) of authors; *Glandulina* (part) of authors (not d'Orbigny).

Genoholotype.—*Nautilus comata* Batsch.

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

As the type species of *Glandulina* has been shown to be biserial in the early stage, particularly of the microspheric form, it becomes evident that it is a genus belonging in the Polymorphinidae. There are, however, uniserial rectilinear forms that have the chambers embracing and for which the new genus *Pseudoglandulina* was erected. It is possible that some of the forms referred to this genus may be uniserial, derived from *Glandulina* by acceleration and the dropping out of the biserial stage.

PSEUDOGLANDULINA PROPINQUA (Stache)

PLATE 3, FIGURE 12

Lingulina propinqua STACHE, *Novara-Exped.*, Geol. Theil, vol. 1, p. 191, pl. 22, figs. 15a-c, 1864.

Test elongate, slightly tapering, composed of few chambers, five usually the maximum number; chambers of somewhat irregular shape but increasing in diameter as added, strongly overlapping, slightly inflated, later chambers more elongate than the earlier ones; sutures distinct, slightly depressed, not limbate; wall smooth, very finely perforate; apertural end projecting, aperture itself radiate, terminal, central. Length, 0.4 mm; diameter, 0.12 mm.

The form here figured seems to agree almost exactly with Stache's figure 15e. The species seems to be rare in the Recent material examined, occurring only at *Albatross Station* H3812, entrance to Avatoru Pass, Rahoira Atoll, 7.5 miles S., in 819 fathoms.

Genus VAGINULINA d'Orbigny, 1826

Vaginulina D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 257, 1826.

Synonym: *Nautilus* (part) LINNAEUS, 1758.

Genotype.—By designation, *Nautilus legumen* Linnacus.

Test compressed, usually with one side straight, representing the periphery of the coiled forms, the other typically convex; sutures oblique, highest on the straight side of the test; aperture at or near the peripheral angle. Jurassic to Recent.

The forms of the Cretaceous, particularly the Lower, which have been called *Citharina* by d'Orbigny, form a more or less distinctive group, but in later formations and in the present ocean there seems to be less distinction between these two groups, and many of the forms referred to *Vaginulina* by one author may be placed in *Marginulina* or will be found in the old literature under the name *Cristellaria*.

VAGINULINA ELEGANS d'Orbigny

PLATE 3, FIGURES 9, 10

Vaginulina elegans D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 257, no. 1, 1826; Modèles no. 54, 1826.

Vaginulina legumen (LINNAEUS) var. *elegans* FORNASINI, Soc. Geol. Italiana Boll., vol. 5, p. 25, pl. 1, figs. 1 ?, 2-8, 1886.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 258, pl. 41, fig. 4, 1921.

The figured specimens show a rather common, somewhat compressed form found in the deeper water of the South Pacific as well as elsewhere. It is very similar to the form figured by Fornasini and referred to d'Orbigny's species. D'Orbigny's model No. 54 seems to have definite raised costae, whereas in our Recent form the sutures are very strongly limbate, transparent, and usually not raised above the surface. The initial end usually has a distinct spine. Such forms have occurred at a few *Albatross* stations, as noted in the Table 8.

TABLE 8.—*Vaginulina elegans*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|----------------|--------------------|------------------------|------------|
| 22138 | 1 | H3859 | Ngaruae Pass, Fakarava Atoll, 35° S., 3.5 miles E. | Fathoms 666 | ° F. ----- | pter. oz. vol. part. | Rare. |
| 22139 | 2 | H3873 | Southwest point of Tahanae, 68° N., 4 miles E. | 966 | ----- | glob. oz. mang. | Do. |
| 22140 | 1 | H3878 | Lat. 16° 13' S., long. 143° 48' W. | 987 | ----- | glob. pter. vol. part. | Do. |
| 22141 | 1 | H3879 | Lat. 16° 03' S., long. 143° 32' 30'' W. | 1,084 | 36.3 | gy. yl. glob. oz. | Do. |
| 22142 | 2 | H3954 | West end of Nomuka Island, 33° N., 6 miles E. | 600 | 39.2 | co. s. pum. pter. oz. | Do. |

Genus LAGENA Walker and Jacob, 1798

Lagena WALKER and JACOB, in Kanmacher's edition of Adams's Essays Micr., p. 634, 1798.

Synonyms: *Vermiculum* MONTAGU, 1803; *Lagenula* (?) MONTFORT, 1803; *Oolina* D'ORBIGNY, 1839; *Amphorina* D'ORBIGNY, 1849; *Fissurina* REUSS, 1850; *Ovulina* EHRENBERG, 1854; *Phialina* COSTA, 1856; *Hyaleina* COSTA, 1856; *Tetragonulina* SEGUENZA, 1862; *Trigonulina* SEGUENZA, 1862; *Obliquina* (?) SEGUENZA, 1862; *Ovolina* TERQUEM, 1866; *Lagenulina* TERQUEM, 1876; *Capitellina* MARSSON, 1878.

Genotype.—By designation, *Serpula (Lagena) sulcata* Walker and Jacob.

Test unilocular; aperture typically radiate, rounded or elliptical, terminal, central; wall vitreous, very finely perforate, variously ornamented; chambers typically without an internal tube. Silurian (?) to Recent.

The various species assigned to *Lagena* probably have several different sources, and it is quite possible that the type species of the genus should be placed with *Uvigerina* and *Siphogenerina*, but the forms are left here under the Lagenidae, to accord with the usual custom among most authors and to facilitate use in reference.

There are in the collections from the South Pacific a great many specimens which are all here referred to *Lagena*. This is done not because numerous of these are not referable to *Entosolenia*, but to bring together the entire group so that they may be easily referred to. The distinction between *Lagena* and *Entosolenia* is an important one, but so little has been done with a great many of the forms referred to *Lagena* that it is difficult at this time to make the distinction that will be made when further studies of this great group shall be undertaken and completed by future workers. Many of the species of *Lagena* seem to be very widely distributed, while others have very definite ranges, as do other characteristic foraminifera. This is due partly to the fact that with a single chamber the amount of specific character is somewhat limited, being dependent on general form and especially on the ornamentation of the test. This latter character may vary considerably, as anyone familiar with this group will understand. On the other hand, certain very characteristic types of ornamentation, such as those of *Lagena radiato-marginata* and *L. wrightiana*, are so definite and distinctive that the species can hardly be confused with any others. As a result, such species have comparatively limited ranges, which conform with the distribution of numerous other foraminifera. There is hardly any other group of foraminifera in which so much is needed in the way of detailed studies in regard to structure and variation.

LAGENA MARGINATA (Montagu)

PLATE 4, FIGURES 9a, b, 11, 12, 14-16; PLATE 5, FIGURES 2a, b, 4a, b, 6a, b, 8, 9

Serpula (Lagena) marginata WALKER and BOYS, Test. Min., p. 2, pl. 1, fig. 7, 1784.

Vermiculum marginatum MONTAGU, Test. Brit., p. 524, 1803.

Entosolenia marginata WILLIAMSON (part), Ann. Mag. Nat. Hist., ser. 2, vol. 1, p. 17, pl. 2, figs. 15-17, 1848.

Lagena marginata BROWN, Illus. Conch. Great Britain, pl. 1, figs. 30, 31, 1827.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 476, pl. 59, figs. 21-23, 1884.—FLINT, U. S. Nat. Mus. Rep. for 1897, p. 307, pl. 54, fig. 2, 1899.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 37, pl. 22, figs. 1-7, 1913; U. S. Nat. Mus. Bull. 100, vol. 4, p. 182, 1921.

So many specimens have been referred to this species that it is very difficult indeed to make strict limits for the species. Undoubtedly many of the forms figured here may with further studies be determined to be distinct varieties or perhaps even species. So little is known in regard to the distribution of these various forms, and many of them have so little in the way of distinctive characters, that it is a very difficult group to deal with. A number of the different forms with or without keels in their development have been figured, and the record is given in Table 9 of stations from which very similar forms were obtained. Almost all these margined forms have an entosolenian aperture, and probably belong in the genus *Entosolenia*, but as already stated both typical *Lagena* and others have been placed together here for ease in referring to them.

TABLE 9.—*Lagena marginata*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|----------------|--------------------|---------------------------------------|------------|
| 22170 | 1 | H3812 | Entrance to Avatoru Pass, Raha-roa Atoll, 7.5 miles S. | Fathoms 819 | ° F. | wh. co. s. glob. oz. vol. part. | Rare. |
| 22171 | 1 | H3818 | Lat. 15° 24' 10" S., long. 147° 56' W. | 897 | ----- | glob. pter. vol. part. | Do. |
| 22172 | 1 | H3823 | Lat. 15° 01' S., long. 148° 27' W. | 782 | ----- | wh. pter. oz. vol. part. | Do. |
| 22173 | 1 | H3824 | Lat. 15° 20" S., long. 148° 30' W. | 850 | ----- | wh. pter. glob. oz. | Do. |
| 22174 | 1 | H3825 | { Lat. 14° 58' 35" S., long. 148° 35' W. | 844 | ----- | { wh. glob. oz. mang. } vol. part. | Do. |
| 22175 | 1 | | | | | | |
| 22176 | 1 | H3827 | Lat. 14° 53' 20" S., long. 148° 42' 30" W. | 486 | ----- | crs. wh. co. s. vol. part. | Do. |
| 22177 | 1 | H3829 | Lat. 14° 56' S., long. 148° 48' W. | 860 | ----- | { wh. co. s. glob. vol. } part. | Do. |
| 22178 | 1 | | | | | | |
| 22179 | 1 | H3850 | Niau Atoll, 3° S., 14 miles E. | 677 | ----- | co. s. glob. oz. | Do. |
| 22180 | 1 | H3871 | Lat. 17° 10' S., long. 145° 19' W. | 1,679 | 36.0 | lt. gy. glob. oz. | Do. |
| 22181 | 1 | H3873 | Southwest point of Tahanae, 65° N., 4 miles E. | 966 | ----- | glob. oz. mang. | Do. |
| 22182 | 1 | H3874 | Southwest point of Tahanae, 2 miles E. | 654 | 33.6 | co. s. mang. | Do. |
| 22183 | 1 | H3879 | Lat. 16° 03' S., long. 143° 32' 30" W. | 1,084 | 36.3 | gy. yl. glob. oz. | Do. |
| 22184 | 1 | H3889 | Southwest face of Taenga Atoll, 67° N., 3 miles E. | 928 | 36.5 | glob. pter. oz. | Do. |
| 22185 | 1 | H3912 | Lat. 18° 56' S., long. 139° 05' W. | 2,343 | 35.1 | rd. e. | Do. |
| 22186 | 1 | H3984 | Entrance of South Pass, Rongelap, 1½ miles N. | 746 | 39.0 | crs. co. s. | Do. |
| 22187 | 1 | H3991 | Lat. 9° 40' N., long. 169° 32' E. | 1,583 | 35.5 | glob. oz. | Do. |

LAGENA MARGINATO-PERFORATA Seguenza

PLATE 4, FIGURES 13a, b; PLATE 5, FIGURES 1a, b; PLATE 6, FIGURES 1a, b

Lagena marginato-perforata SEGUENZA, Atti Accad. Lincei, ser. 3, vol. 6, p. 332, pl. 17, fig. 34, 1880.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 50, no. 5, p. 10, pl. 2, fig. 5, 1906; vol. 54, no. 16, p. 18, 1910.—HERON-ALLEN and EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, p. 86, pl. 7, figs. 5, 6, 1913; Trans. Zool. Soc. London, vol. 20, p. 663, 1915; Trans. Linn. Soc. London, ser. 2, vol. 11, p. 252, 1916; Journ. Roy. Mier. Soc., 1916, p. 46.—CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 4, p. 37, pl. 7, fig. 4, 1923.—HERON-ALLEN and EARLAND, Journ. Roy. Mier. Soc., vol. 50, p. 168, 1930.—CUSHMAN, Florida State Geol. Surv. Bull. 4, p. 32, pl. 5, fig. 12, 1930.

Test somewhat compressed, oval, apertural end slightly projecting, periphery somewhat keeled; wall of the test covered with numerous pits of rather even size, and of more or less regular distribution. Length, 0.3 mm; breadth, 0.18 mm; thickness, 0.1 mm.

An examination of the literature will show that there are numerous forms assigned to this species, some of which fit rather closely the original figure given by Seguenza, and others are not at all like it. The original figure has a somewhat compressed body with a distinct keel, and the general body of the test has rather large, evenly distributed perforations. Such forms are figured here, and seem to have a rather wide distribution. In shoal water the species occurs at the anchorage off Guam, Ladrone Islands, 21 fathoms; Port Lotten, Kersail, Caroline Islands; Rongelap Atoll, Marshall Islands; off Levuka, Fiji; and at Viva Anchorage, Fiji. Table 10 gives the data for the four *Albatross* stations from which the species was obtained.

TABLE 10.—*Lagena marginato-perforata*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|----------------|--------------------|----------------------|------------|
| 22188 | 1 | H3809 | Entrance of Avatoru Pass, Rabi-roa Atoll, 2.5 miles S. | Fathoms 645 | ° F. ----- | fne. wh. co. s.----- | Rare. |
| 22189 | 1 | H3889 | Southwest face of Taenga Atoll, 67° N., 3 miles E. | 928 | 36.5 | glob. pter. oz.----- | Do. |
| 22190 | 1 | H3984 | Entrance of South Pass, Rongelap, 1½ miles N. | 746 | 39.0 | crs. co. s.----- | Do. |
| 22191 | 1 | H3996 | North point of Arhno Atoll, 50° S., 7 miles E. | 1,325 | 36.0 | crs. glob. oz.----- | Do. |

LAGENA LAEVIS (Montagu)

PLATE 4, FIGURES 5a, b

No attempt has been made to give a complete synonymy for this species, as it has been used by many authors to include various types of smooth *Lagena*. In its typical form it has a somewhat elongate

body to the test, the apertural end extended into an elongate tapering neck, and the basal end broadly rounded. Such specimens are figured here, but they are not common in our material, the only specimens occurring at *Albatross* Stations H3819, latitude 15° 25' S., longitude 148° 08' W., in 1,123 fathoms, and H3879, latitude 16° 03' S., longitude 143° 32' 30'' W., in 1,084 fathoms.

LAGENA PERLUCIDA (Montagu)

PLATE 4, FIGURES 6-8

Vermiculum perlucidum MONTAGU, Test. Brit., p. 525, pl. 14, fig. 3, 1803.

Lagena perlucida BROWN, Illus. Conch. Great Britain, flyleaf, pl. 1, fig. 29, 1827; ed. 2, p. 3, pl. 56, fig. 29, 1844.—SCHLUMBERGER, Feuille des Jeunes Naturalistes, ann. 13, pl. 1, fig. 2, 1882.—HERON-ALLEN and EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, p. 78, 1913; Trans. Zool. Soc. London, vol. 20, p. 659, 1915; Trans. Linn. Soc. London, ser. 2, vol. 11, p. 246, 1916; Journ. Roy. Micr. Soc., 1916, p. 45.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 3, p. 123, pl. 24, fig. 3, 1927.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., vol. 50, p. 165, 1930.—CUSHMAN, Florida State Geol. Surv. Bull. 4, p. 29, pl. 5, fig. 5, 1930.—CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 7, p. 6, pl. 1, fig. 22, 1931; Proc. U. S. Nat. Mus., vol. 80, art. 3, p. 8, pl. 3, fig. 6, 1931.

Lagena vulgaris WILLIAMSON var. *perlucida* WILLIAMSON, Rec. Foram. Great Britain, p. 5, pl. 1, figs. 7, 8, 1858.

The type figure given by Montagu shows a clavate form with a rather long, tapering, nearly cylindrical neck, and the body of the test with a few distinct raised costae. Later authors have very largely referred this specific name to a form which has the test with a similar type of neck, but the costae limited to the basal portion of the test. In the collections studied here we have limited the name to similar specimens. These have occurred rarely and only in shoal water from off Rotonga, and from Viva Anchorage, Fiji.

LAGENA GLOBOSA (Montagu)

PLATE 4, FIGURES 10a, b

A rather complete list of references to this species has already been given in Bulletin 104.² So many forms have been referred to this species by numerous authors that it has come to be a sort of dumping ground for almost any globular form of *Lagena* or *Entosolenia*. It is to be suspected that many of the forms referred to this species are really the prolocula of various genera of the Lagenidae, which at that stage are indistinguishable from forms of *Lagena*. Such globular forms are rare in the collections of the South Pacific which we have studied, and occur as single specimens. Outside of one specimen from Mokaujar Anchorage, Fiji, the other three are from *Albatross* stations, data for which are given in Table 11.

² Cushman, J. A., The foraminifera of the Atlantic Ocean. Lagenidae. U. S. Nat. Mus. Bull. 104, pt. 4, p. 20, 1923.

TABLE 11.—*Lagena globosa*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|-------------------|--------------------|-------------------------|------------|
| 22204 | 1 | H3838 | Lat. 16° 57' S., long. 148° 58' W.... | Fathoms 2, 224 | ° F. ----- | vol. m. glob.----- | Rare. |
| 22205 | 1 | H3841 | Point Venus, Tahiti Island, 32° S., 4.2 miles W. | 775 | ----- | crs. vol. s. mang. nod. | Do. |
| 22206 | 1 | H3904 | Lat. 18° 07' S., long. 141° 26' W.... | 1, 713 | ----- | glob. oz.----- | Do. |

LAGENA ALVEOLATA H. B. Brady

PLATE 4, FIGURES 17a, b

Lagena alveolata H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 487, pl. 60, figs. 30, 32, 1884.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 50, no. 5, p. 15, pl. 2, fig. 17, 1906.—SCHUBERT, Abh. geol. Reichsanst., vol. 20, pt. 4, p. 70, 1911.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 424, pl. 21, figs. 1, 2, 1912.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 33, pl. 18, fig. 1, 1913.—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, p. 1020, 1914.—HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, p. 167, 1922.—YABE and HANZAWA, Jap. Journ. Geol. Pal., vol. 4, p. 50, 1925 (1926).

Test pyriform, somewhat compressed, broadest toward the basal end, the apertural end tapering into a short neck, smooth except for the basal end, which has a median keel that is somewhat thin and transparent marked by radial lines, and at each side a secondary lateral carina uniting at the middle and at the margin to form two distinct lips on each side of the test viewed from the base. Length, 0.65 mm; breadth, 0.4 mm; thickness, 0.25 mm.

This species has almost always been recorded from fairly deep water, but has a wide distribution, as do many of the deep-water forms. The only specimens we have in this South Pacific material came from two *Albatross* stations, as noted in Table 12.

TABLE 12.—*Lagena alveolata*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|-------------------|--------------------|------------------------|------------|
| 22207 | 2 | H3971 | Lat. 4° 25' N., long. 171° 13' E.----- | Fathoms 2, 505 | ° F. 34.7 | lt. gy. glob. oz.----- | Rare. |
| 22208 | 1 | H3996 | North point of Arhno Atoll, 50° S., 7 miles E. | 1, 325 | 36.0 | crs. glob. oz.----- | Do. |

LAGENA SEMINIFORMIS Schwager

PLATE 5, FIGURES 5a, b

Lagena seminiformis SCHWAGER, *Novara-Exped.*, Geol. Theil, vol. 2, p. 208, pl. 5, fig. 21, 1866.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 478, pl. 59, figs. 28–30, 1884.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 37, pl. 11, fig. 2, 1913.

Lagena marginata var. *seminiformis* MILLETT, Journ. Roy. Micr. Soc., 1901, p. 620, pl. 14, fig. 3.

Test circular or ovate in front view with a comparatively long tubular neck, the whole surrounded by a broad, thin, peripheral keel extended at each side of the base in long pointed projections; wall smooth and usually nearly transparent. The figured specimen, which is somewhat irregular at the base, probably should be referred to Schwager's species, the types of which are from the Pliocene of Car Nicobar. It has been recorded previously from the Pacific by Brady and Millett, and there are a few other records mostly from the Pacific, but these do not give figures. The figured specimen is from *Albatross Station* H3881, latitude 15° 54' S., longitude 143° 6' W., in 1,568 fathoms.

LAGENA AURICULATA H. B. Brady var. DUPLICATA Sidebottom

PLATE 5, FIGURES 3a, b

Lagena auriculata H. B. BRADY (in part), Rep. Voy. *Challenger*, Zoology, vol. 9, pl. 60, fig. 33, 1884.

Lagena auriculata var. *duplicata* SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 422, pl. 20, fig. 23, 1912; vol. 12, p. 200, pl. 18, figs. 7, 8, 1913.

There are a very few specimens in our collections that may be referred to this variety, which is one of many named by Sidebottom. It is evidently distinct from Brady's typical form, which should be the specimen figured in the *Challenger* Report, pl. 60, fig. 29. It is very close to one of the forms figured by Rymer-Jones as *Lagena vulgaris* Williamson var. *petasna-marginata*. Figure 38 of Rymer-Jones's plate should be the type of his variety, and that is evidently quite a distinct thing from his Figure 39, which is much more like

TABLE 13.—*Lagena auriculata* var. *duplicata*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|------------------|--------------------|------------------------|------------|
| 22209 | 1 | H3856 | Northeast point of Apataki, 7 miles SW. | Fathoms 1,364 | ° F. ----- | crs. co. s.----- | Rare. |
| 22210 | 1 | H3971 | Lat. 4° 25' N., long. 171° 13' E.----- | 2,505 | 34.7 | lt. gy. glob. oz.----- | Do. |

that to which Sidebottom gave the name var. *duplicata*. The variety has a smooth test with a distinct keel, and the base with a few costae. There are added at the base four tubular projections, two on each side, which seem to be characteristic of this variety. The only localities are shown in Table 13.

LAGENA AURICULATA H. B. Brady var. COSTATA H. B. Brady

PLATE 6, FIGURES 2a, b

Lagena auriculata H. B. BRADY var. *costata* H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, p. 61, 1881; Rep. Voy. *Challenger*, Zoology, vol. 9, p. 487, pl. 60, fig. 38, 1884.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 422, pl. 20, figs. 21, 22, 1912.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 32, pl. 14, fig. 2, 1913.—HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, p. 235, 1922.

Variety differing from the typical in having the body of the test costate as well as carinate. Length, 0.45 mm; breadth, 0.18 mm; thickness, 0.12 mm.

Besides the figured specimen, which is from *Albatross* Station H3912, latitude 18° 56' S., longitude 139° 5' W., in 2,343 fathoms, there is only one other specimen of this species, and that is from *Albatross* Station H3879, latitude 16° 3' S., longitude 143° 32' 30'' W., in 1,084 fathoms.

LAGENA FIMBRIATA H. B. Brady var. OCCLUSA Sidebottom

PLATE 5, FIGURES 7a, b

Lagena fimbriata H. B. BRADY var. *occlusa* SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 423, pl. 20, figs. 27, 28, 1912; vol. 12, p. 202, 1913.—HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, p. 166, 1922.

This is a peculiar form with the base having distinct winglike projections, which are more or less opaque and wrinkled as described by Sidebottom. The space beneath these winglike projections both in his specimens and in ours is filled, but whether this is a natural condition or whether the material is from some outside source is very difficult to determine with the small size and delicateness of the specimens. Sidebottom's types were from the South Pacific, and those recorded by Heron-Allen and Earland from the Antarctic. Our only specimens are from *Albatross* Station H3838, latitude 16° 57' S., longitude 148° 58' W., in 2,224 fathoms.

LAGENA SIGMOIDELLA, new species

PLATE 5, FIGURES 10, 11

Test in end view sigmoid, in front view oval or ovate, broadest at the base and somewhat tapering toward the apertural end, with a distinct peripheral keel, thin and translucent, the ends at each side

overlapping at the base; wall of the test distinctly perforate; aperture at the end of a short neck, which has a somewhat everted lip, and apparently so far as may be determined, a short entosolenian neck. Length, 0.25–0.35 mm; breadth, 0.2–0.25 mm; thickness, 0.1–0.13 mm.

Holotype.—U.S.N.M. No. 22336, from *Albatross* Station H3830, latitude 15° 30' S., longitude, 148° 47' W., in 1,257 fathoms.

This species has also occurred at *Albatross* Station H3812, entrance to Avatoru Pass, Rāhīroa Atoll, 7.5 miles S., in 819 fathoms. Besides these Recent stations, the species occurs in the Pliocene of California.

This is a peculiarly formed species, which at first might be thought to be an abnormal one, but its occurrence at widely separated stations and in both Recent and late Tertiary material shows that its distinct form has been kept for a considerable period.

LAGENA LAGENOIDES (Williamson)

PLATE 6, FIGURES 3–5

Entosolenia marginata WALKER and BOYS var. *lagenoides* WILLIAMSON, Rec. Foram. Great Britain, p. 11, pl. 1, figs. 25, 26, 1858.

Lagena lagenoides REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, p. 324, pl. 2, figs. 27, 28, 1862 (1863).—BALKWILL and WRIGHT, Proc. Roy. Irish Acad., ser. 2, vol. 3, p. 548, 1882.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 479, pl. 60, figs. 6, 8, 9, 12, 1884.—BALKWILL and WRIGHT, Trans. Roy. Irish Acad., vol. 28, p. 341, pl. 12, fig. 22, 1885.—H. B. BRADY, Journ. Roy. Micr. Soc., 1887, p. 906.—H. B. BRADY, PARKER, and JONES, Trans. Zool. Soc. London, vol. 12, p. 223, pl. 44, fig. 23, 1888.—WRIGHT, Ann. Mag. Nat. Hist., ser. 6, vol. 4, p. 448, 1889.—PEARCEY, Trans. Glasgow Nat. Hist. Soc., vol. 2, p. 177, 1890.—WRIGHT, Proc. Roy. Irish Acad., ser. 3, vol. 1, p. 481, 1891.—BALKWILL and MILLETT, Rec. Foram. Galway, p. 6, 1908.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 39, pl. 16, fig. 2, 1913.—HERON-ALLEN and EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, p. 88, 1913; Trans. Linn. Soc. London, ser. 2, vol. 11, p. 252, 1916; Journ. Roy. Micr. Soc., 1916, p. 46.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 183, 1921; British Antarctic Exped., Zoology, vol. 6, p. 158, 1922; U. S. Nat. Mus. Bull. 104, pt. 4, p. 30, pl. 5, figs. 6–8, 1923; Bull. Scripps Inst. Oceanog., Tech. Ser., vol. 1, no. 10, p. 145, 1927.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., vol. 50, p. 170, 1930.

Test flask-shaped, usually much compressed, the body portion oval or ovate surrounded by a simple peripheral keel of varying width in different specimens, and with numerous radiating tubulations, giving it in side view a somewhat scalloped appearance; body of the test smooth, and usually nearly transparent; aperture projecting with a distinct neck, slightly tapering, but in some specimens at least with a distinct entosolenian tube. Length, up to 0.5 mm; breadth, 0.28 mm; thickness, 0.15 mm.

This is a variable species, and widely distributed, as the above references will show. If all the forms referred to this species are really one, there is a considerable degree of variation.

In our South Pacific material this species occurs at several stations in comparatively shallow water, as follows: Near Nairai, Fiji; Mokaujar Anchorage, Fiji; Levuka, Fiji, 12 fathoms; and Rangiroa. Data for the deeper water *Albatross* stations will be found in Table 14.

TABLE 14.—*Lagena lagenoides*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|------------------|--------------------|--------------------------------|------------|
| 22156 | 1 | H3830 | Lat. 15° 30' S., long. 148° 47' W. | Fathoms 1,257 | ° F. ----- | wh. co. s. glob. vol. part. | Rare. |
| 22157 | 1 | H3920 | Lat. 19° 52' S., long. 140° 16' W. | 2,284 | 35.0 | rd. c. glob.----- | Do. |
| 22158 | 1 | H3930 | Anu Anuraro Atoll, ¾ mile NW. | 438 | 40.7 | co. s.----- | Do. |
| 22159 | 1 | H3961 | Center south coast of Tarawa, 10 miles N. | 413 | 43.5 | crs. br. glob. oz.--- | Do. |

LAGENA FORMOSA Schwager

PLATE 6, FIGURES 6, 9, 10

Lagena formosa SCHWAGER (in part), *Novara*-Exped., Geol. Theil, vol. 2, p. 206, pl. 4, figs. 19a, 19d (not 19b, 19c), 1866.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 480, pl. 60, figs. 10, 18–20, 1884.—GoËs, Bull. Mus. Comp. Zool., vol. 29, p. 53, 1896.—MILLETT, Journ. Roy. Micr. Soc., 1901, p. 624, pl. 14, figs. 10–12.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 414, pl. 19, figs. 6–9, 1912.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 41, pl. 11, fig. 6, 1913.—HERON-ALLEN and EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, p. 88, 1913.—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, p. 1019, 1914.—HERON-ALLEN and EARLAND, Trans. Linn. Soc. London, ser. 2, vol. 11, p. 252, 1916; Journ. Roy. Micr. Soc., 1916, p. 46.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 131.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 183, 1921.—HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, p. 159, pl. 6, figs. 24, 25, 1922.—YABE and HANZAWA, Jap. Journ. Geol. Pal., vol. 4, p. 50, 1925 (1926).

Lagena lagenoides EGGER (not Williamson), Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 335, pl. 10, fig. 85, 1893.

Test flask-shaped, compressed, body of the test elongate, oval, with a long, tapering, slender neck, the central portion of the test immediately surrounded on each side by a raised ridge outside of which peripherally is a keel of varying width with radiating fine tubulations, which are more distinctly transparent than the keel itself; apertural and basal ends of the central portion of the test passing into the inner keel by a series of interrupted costae, the basal end of the test usually emarginate; aperture at the end of the projecting neck, circular, slightly expanded, or in some specimens elliptical. Length, up to 1 mm; breadth, 0.4 mm; thickness, 0.2 mm.

This is one of the most beautiful species of the genus, and is very largely confined to the Pacific. Heron-Allen and Earland have lately

recorded this species from about the British Isles. There is evidently a great degree of variation in the development of the species. Some of these variations are shown in the accompanying plate, those specimens which are largest and finest developed showing a much greater degree of ornamentation than do the smaller ones.

In our material this species has occurred in 12 fathoms off Levuka, Fiji, and at the *Albatross* stations given in Table 15.

TABLE 15.—*Lagena formosa*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--------------------------------------|--------------------------|--------------------|----------------------|------------|
| 22211 | 1 | H3790 | Lat. 6° 25' S., long. 138° 59' W... | <i>Fathoms</i> 2, 475 | ° F. 35.0 | lt. gy. glob. oz.... | Rare. |
| 22212 | 1 | H3838 | Lat. 16° 57' S., long. 148° 58' W... | 2, 224 | ----- | vol. m. glob. | Do. |
| 22213 | 1 | H3896 | Tekokoto Atoll, 1 mile E..... | 617 | 38.4 | co. s..... | Do. |

LAGENA ORBIGNYANA (Seguenza)

PLATE 6, FIGURES 7, 8, 11

This is another of those species to which a great many forms have been assigned and a great many varietal names have been given. In its general form it consists of a central body about which is a depressed area surrounded by a raised region, outside of which are developed supplementary keels. Some of the variations of this species as developed in our material are figured here. The typical form of the species has occurred only at *Albatross* stations in comparatively deep water as shown in Table 16.

TABLE 16.—*Lagena orbignyana*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|-----------------------|--------------------|-----------------------|------------|
| 22214 | 1 | H3859 | Ngaruae Pass, Fakarava Atoll, 35° S., 3.5 miles E. | <i>Fathoms</i> 666 | ° F. ----- | pter. oz. vol. part.. | Rare. |
| 22215 | 1 | H3882 | Lat. 15° 55' S., long. 142° 39' W... | 1, 503 | ----- | lt. br. glob. oz.... | Do. |
| 22216 | 1 | H3900 | Midway between Hikueru and Marokau. | 1, 372 | 35.7 | glob. oz..... | Do. |
| 22217 | 1 | H3903 | Lat. 18° 08' S., long. 141° 49' W... | 2, 187 | 35.2 | vol. m. glob. | Do. |
| 22218 | 1 | H3974 | South point of Jaluit Atoll, 14° N., 5 miles E. | 1, 937 | 35.0 | crs. gy. glob. oz... | Do. |
| 22219 | 1 | H3991 | Lat. 9° 40' N., long. 169° 32' E... | 1, 583 | 35.5 | glob. oz..... | Do. |

LAGENA ORBIGNYANA (Seguenza) var. LACUNATA Burrows and Holland

PLATE 7, FIGURES 1-5, 8

Lagena castrensis H. B. BRADY (not Schwager), Rep. Voy. *Challenger*, Zoology, vol. 9, p. 485, pl. 60, figs. 1, 2, 1884.—BALKWILL and WRIGHT, Trans. Roy. Irish Acad., vol. 28 (Sci.), p. 341, pl. 12, figs. 20, 21, 1885.—EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 333, pl. 10, figs. 71, 72, 1893.—FLINT, U. S. Nat. Mus. Rep. for 1897, p. 308, pl. 54, fig. 5, 1899.

Lagena lacunata BURROWS and HOLLAND, in Jones, Paleont. Soc., 1895, p. 205, pl. 7, fig. 12.

Lagena orbignyana var. *castrensis* MILLETT, Journ. Roy. Micr. Soc., 1901, p. 626, pl. 14, fig. 20.

Lagena orbignyana var. *lacunata* SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, no. 16, p. 19, pl. 2, fig. 14, 1910; Journ. Quekett Micr. Club, vol. 11, p. 416, pl. 19, figs. 16-18, 1912.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 43, pl. 20, fig. 1, 1913; Florida State Geol. Surv. Bull. 4, p. 32, pl. 5, figs. 13a, b, 1930.

Test rounded or ovate, much compressed, whole test surrounded by a peripheral keel inside of which on each side is a complete raised rim about the body proper, neck somewhat elongate; wall with the body portion ornamented by a network of lacunae or pitted areas of varying size usually with an outlining ring about each pit. Length, 0.25 mm; breadth, 0.18 mm; thickness, 0.08 mm.

Our specimens show a great range of variation, from specimens with distinct, somewhat rounded pits, to irregular ones becoming polygonal, these merging into specimens with an irregular hexagonal network, and portions of the test in some cases becoming longitudinally costate. There seems to be no distinction between these various gradations, and all are assigned to Burrows and Holland's variety that seems to be a very widely distributed one. Most of the records for the variety in our material are from comparatively shallow water in Levuka, Fiji; near Nairai, Fiji, in 12 fathoms; and Makemo Lagoon. In addition the variety has occurred at three *Albatross* stations, data for which are given in Table 17.

TABLE 17.—*Lagena orbignyana* var. *lacunata*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|----------------|--------------------|-----------------------------|------------|
| 22220 | 1 | H3870 | Village, point Anaa Atoll, 50° S., 5 miles W. | Fathoms 1, 110 | ° F. 36.0 | fne. co. s. pter. oz. glob. | Rare. |
| 22221 | 1 | H3878 | Lat. 16° 13' S., long. 143° 48' W. | 987 | ----- | glob. pter. vol. part. | Do. |
| 22222 | 1 | H3896 | Tekokoto Atoll, 1 mile E.----- | 617 | 38.4 | co. s.----- | Do. |

LAGENA ORBIGNYANA (Seguenza) var. CLATHRATA H. B. Brady

PLATE 7, FIGURES 6, 7

Lagena clathrata H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 484, pl. 60, fig. 4, 1884.—BALKWILL and MILLETT, Journ. Micr., vol. 3, p. 82, pl. 2, fig. 14; pl. 4, fig. 3, 1884.—HERON-ALLEN and EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, p. 90, pl. 7, fig. 10, 1913; Trans. Zool. Soc. London, vol. 20, p. 668, 1915; Trans. Linn. Soc. London, ser. 2, vol. 11, p. 254, 1916; British Antarctic Exped., Zoology, vol. 6, p. 165, 1922; Journ. Linn. Soc. Zool., vol. 35, p. 624, 1924.

Lagena orbignyana var. *clathrata* MILLETT, Journ. Roy. Micr. Soc., 1901, p. 628, pl. 14, fig. 23.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 418, 1912.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 44, pl. 11, fig. 4, 1913; U. S. Nat. Mus. Bull. 104, pt. 4, p. 42, pl. 8, fig. 5, 1923.—YABE and HANZAWA, Jap. Journ. Geol. Pal., vol. 4, p. 50, 1925 (1926).

Variety differing from the typical in the ornamentation of the body of the test which has numerous longitudinal costae. Length, up to 0.4 mm; breadth, 0.25 mm; thickness, 0.15 mm.

This form described by Brady shows some variation in the degree of ornamentation, especially in the number and coarseness of the costae. It has been widely recorded, but seems to exist in its typical form only in the Indo-Pacific. Our specimens are from the two *Albatross* stations noted in Table 18.

TABLE 18.—*Lagena orbignyana* var. *clathrata*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|------------------|--------------------|-----------------------|------------|
| 22223 | 1 | H3835 | South coast, Makatea Island, 5 miles N. | Fathoms 1,363 | ° F. ----- | wh. co. s. mang. nod. | Rare. |
| 22224 | 1 | H3954 | West end of Nomuka Island, 33° N., 6 miles E. | 600 | 39.2 | co. s. pum. pter. oz. | Do. |

LAGENA YOKOYAMAE Millett

PLATE 6, FIGURES 13a, b

Lagena yokoyamae MILLETT, Trans. Geol. Soc. Cornwall, vol. 11, p. 657, 1894.

Lagena orbignyana (SEGUENZA) var. *yokoyamae* HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, p. 163, pl. 6, figs. 17, 18, 1922.

Millett gave the above name to a species from the Pliocene of St. Erth, Cornwall, England, but gave no figures. Heron-Allen and Earland, by comparison of their New Zealand specimens with an original drawing of Millett, now in their possession, have been able to identify and figure this variety. The specimen figured here evidently is close to this variety, and should be included under Millett's name. It is from *Albatross* Station H3961, center south coast of Tarawa, 10 miles

N., in 413 fathoms. Our specimen measures: Length, 0.4 mm; breadth, 0.3 mm; thickness, 0.15 mm; making it very slightly larger than the measurements given by Heron-Allen and Earland of their material from off New Zealand. It may be noted here also that this form is close to that figured by Rymer-Jones in his Plate 19, Figure 32, of the *Lagenae* off Java as *Lagena vulgaris* Williamson var. *marginata* Montagu.

LAGENA PARADOXA Sidebottom

PLATE 7, FIGURES 9, 10

Lagena foveolata REUSS? var. *paradoxa* SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 395, pl. 16, figs. 22, 23, 1912.

Lagena paradoxa CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 4, p. 45, pl. 8, fig. 11, 1923.

Test flask-shaped, elongate, the basal end broadly rounded and the greatest width near the base, thence tapering gradually to the apical end, which is furnished with a short, cylindrical, slender neck with a slight phialine lip, the base of the neck rather abruptly joined with the test; wall of the test compound, the outer surface longitudinally costate, with fine crossbars between them, the inner layer mere or less spinose connecting it with the surface wall; wall opaque. Length, 0.3 mm; diameter, 0.1 mm.

This species was originally described by Sidebottom from the Southwest Pacific. I have given records in the above reference of its occurrence at four stations in the western Atlantic, which seem to be this same species all in comparatively deep water. It is extremely rare in the present collections, occurring at but two *Albatross* stations, as shown in Table 19.

TABLE 19.—*Lagena paradoxa*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|----------------|--------------------|------------------------------------|------------|
| 22225 | 1 | H3812 | Entrance to Avatoru Pass, Rahu-roa Atoll, 7.5 miles S. | Fathoms 819 | ° F. ----- | wh. co. s. glob. oz. vol. part. | Rare. |
| 22226 | 1 | H3904 | Lat. 18° 07' S., long. 141° 26' W. | 1,713 | ----- | glob. oz.----- | Do. |

LAGENA DESMOPHORA Rymer-Jones

PLATE 7, FIGURES 11-14

Lagena vulgaris WILLIAMSON var. *desmophora* RYMER-JONES, Trans. Linn. Soc. London, vol. 30, p. 54, pl. 19, figs. 23, 24, 1872.

Lagena desmophora H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 468, pl. 58, figs. 42, 43, 1884.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11,

p. 394, 1912; vol. 12, p. 176, 1913.—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, p. 108, 1914.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 56, p. 609, 1919.—HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, p. 149, 1922.

Test flask-shaped, slender, neck obliquely set on the test itself; wall ornamented by several longitudinal costae with tubulations appearing at the surface in a series of chainlike openings; aperture at the end of the neck, often with a slightly expanded lip. Length, up to 0.4 mm; diameter, 0.1 mm.

Later authors have referred numerous forms to this species originally described by Rymer-Jones from the Java Sea. He gives two figures, the first of which has the oblique neck and the truncate base similar to the specimens figured here, but his other figure has a rounded base and the neck is not oblique. Much more rounded forms with chainlike costae have also been referred to this species. Our specimens are all of the typical form given by Rymer-Jones in his Figure 23, and four of them are figured on our plate. All our specimens are from shallow water, and the species did not occur at all in any of the *Albatross* soundings, seeming to indicate that the species is one of shallow water in the general Indo-Pacific region.

The localities for our specimens are as follows: Mokaujar Anchorage, Fiji; 40–50 fathoms off Fiji; and 21 fathoms, Guam Anchorage, Ladrone Islands.

LAGENA SPIRALIS H. B. Brady

PLATE 7, FIGURES 15, 16

Lagena spiralis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 468, pl. 114, fig. 9, 1884.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 402, 1902.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 660, 1915.
Lagena striato-punctata PARKER and JONES var. *spiralis* MILLETT, Journ. Roy. Micr. Soc., p. 489, pl. 8, fig. 7, 1901.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 394, pl. 16, fig. 14, 1912; vol. 12, p. 176, 1913; Journ. Roy. Micr. Soc., 1918, p. 130.

Test flask-shaped, not compressed, the apertural end extended into a long tapering neck, ornamentation of the test consisting of a few costae, which are tubulated and form a distinct spiral from the base to the neck. Maximum length, 0.4 mm; diameter, 0.15 mm.

This is a distinctly Indo-Pacific species, occurring usually in shoal water. It is recorded from the Southwest Pacific by Sidebottom, from the Kerimba Archipelago of southeast Africa by Heron-Allen and Earland, from Funafuti by Chapman, and from the Malay Archipelago by Millett. The specimens recorded by Chaster³ are evidently not the same as the Indo-Pacific species. The types are from the *Challenger* station off Raine Island, Torres Strait, at 155

³ 1st Rep. Southport Soc. Nat. Hist., 1890-91, p. 60, pl. 1, fig. 8, 1892.

fathoms. Our specimens are very typical, and occur at Guam Anchorage, Ladrone Islands, 21 fathoms, and a single specimen from *Albatross* Station H3866, latitude $17^{\circ} 17' S.$, longitude $145^{\circ} 45' 30'' W.$, in 804 fathoms.

LAGENA RADIATO-MARGINATA Parker and Jones

PLATE 7, FIGURES 17, 18

Lagena radiato-marginata PARKER and JONES, Philos. Trans., vol. 155, p. 355, pl. 18, fig. 3, 1865.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 481, pl. 61, figs. 8, 9, 1884.—MILLETT, Journ. Roy. Micr. Soc., 1901, p. 622.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 402, 1902.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 411, 1912.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 664, 1915.

Test elliptical or ovate in front view, much compressed, narrowly elliptical in end view, periphery slightly keeled, sides of the test very peculiarly ornamented with a series of fine longitudinal costae in the central portion, from which radiates a series of curved costae forming a distinct border about the central portion; apertural end somewhat extended into a slight neck. Maximum length, 0.45 mm; breadth, 0.20 mm; thickness, 0.08 mm.

This is one of the most beautifully ornamented species of the genus, and is one which is confined to the Indo-Pacific region, although there is a reference for it by Halkyard from the Eocene of Biarritz. All the other records are from the Indo-Pacific. Parker and Jones's types were from Australian coral reefs although they record it also from the Miocene of France. Other records include that of Millett at the Malay Archipelago, where it is recorded as common, from the Southwest Pacific by Sidebottom, rare at Funafuti by Chapman, at several stations in the Kerimba Archipelago by Heron-Allen and Earland, in the *Challenger* collection by Brady from Nares Harbor, Admiralty Islands, at 37 fathoms, and from Raine Island, Torres Strait. The species is rare in our collections, occurring off Levuka, Fiji, and at *Albatross* Station H3993, Schischmarev Pass, Wotje, 3 miles N., in 1,187 fathoms.

LAGENA WRIGHTIANA H. B. Brady

PLATE 7, FIGURES 19, 20

Lagena wrightiana H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, p. 32, 1881; Rep. Voy. *Challenger*, Zoology, vol. 9, p. 482, pl. 61, figs. 6, 7, 1884.—EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 334, pl. 10, figs. 42, 43, 1893.—MILLETT, Journ. Roy. Micr. Soc., 1901, p. 622.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 30, p. 410, 1910.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 411, 1912; vol. 12, p. 189, 1913.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 665, 1915.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

Test in front view elongate, oval, much compressed, in end view narrowly elliptical, with a very slight keel about the border, central portion transparent and clear, the border with generally longitudinal costae, very fine and numerous, and slightly curved toward the sides; apertural end slightly extended into a somewhat thickened neck. Length, 0.3 mm; breadth, 0.15 mm.

This species is evidently closely related to *Lagena radiato-marginata* Parker and Jones, but seems to be specifically distinct. The types were from the *Challenger* station at Nares Harbor, Admiralty Islands, in 37 fathoms, and Brady did not have it from any other station. It has been recorded from Mauritius and from off West Australia by Egger, but his figures are not very definite. Millett found it to be widely diffused in the Malay Archipelago. Chapman has recorded it from off Funafuti in 2,400 fathoms, but his specimen may have been carried out into deeper water. Sidebottom's records are from the Southwest Pacific and off the east coast of Australia in 465 fathoms. Heron-Allen and Earland have recorded it from the Kerimba Archipelago off southeast Africa. This makes a rather definite Indo-Pacific range for the species. Our specimens are all from Port Lotten, Kersail, Caroline Islands.

LAGENA SEMISTRIATA Williamson

PLATE 8, FIGURES 1a, b

The only specimens we have in the present collections referable to this species are from Port Lotten, Kersail, Caroline Islands. They represent a small form which has peculiarly raised costae at the base of the chamber, somewhat projecting into spines. Such forms are close to those which we have previously referred to as *Lagena perlucida*.

LAGENA STRIATA (d'Orbigny)

PLATE 8, FIGURES 11, 13

The two specimens figured on Plate 8 are referred to d'Orbigny's species. One of these is somewhat typical, but the other has a peculiar development about the apertural end brought about by the excessive development of certain of the costae. They are from *Albatross* Stations H3855, northwest point of Apataki, 1 mile SE., in 654 fathoms, and H3996, north point of Arhno Atoll, 50° S., 7 miles E., in 1,325 fathoms.

LAGENA STRIATA (d'Orbigny) var. STRUMOSA Reuss

PLATE 8, FIGURES 2, 3

Lagena strumosa REUSS, Zeitschr. geol. Ges., 1858, p. 434; Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, p. 328, pl. 4, fig. 49, 1862 (1863).

Lagena striata (D'ORBIGNY) var. *strumosa* CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 20, pl. 7, figs. 7-10, 1913; U. S. Nat. Mus. Bull. 103, p. 58, pl. 21, fig. 7, 1918; U. S. Nat. Mus. Bull. 100, vol. 4, p. 178, 1921.

This variety has a definite basal spine and an elongate neck with a distinct expanded lip, and the surface ornamented with distinct longitudinal costae. Such forms have been already recorded from the Philippines and from the North Pacific. Our specimens are from near Nairai, Fiji, in 12 to 24 fathoms, where it was very common. Except for this region the only other specimen is a single one from *Albatross* Station H3938, latitude 19° 22' S., longitude 145° 47' W., in 2,322 fathoms.

LAGENA STRIATA (d'Orbigny) var. INTERRUPTA Williamson

PLATE 8, FIGURES 4a, b

Under this variety have been placed a very few forms similar to that figured which have occurred off Niau and off Rotonga in 7 fathoms. There is also a single specimen from *Albatross* Station H3798, Cape Martin, Nukuhiva Island, 30° N., 6½ miles E., in 687 fathoms.

LAGENA GRACILIS Williamson

PLATE 8, FIGURES 5-7

Lagena gracilis WILLIAMSON, Ann. Mag. Nat. Hist., ser. 2, vol. 1, p. 13, pl. 1, figs. 3, 4, 1848.—CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 4, p. 22, pl. 4, figs. 3, 4, 1923.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1924, p. 148.—CHAPMAN and PARR, Journ. Linn. Soc. Zool., vol. 36, p. 374, pl. 17, fig. 4, 1926.—CUSHMAN, Bull. Scripps Inst. Oceanogr., Tech. Ser., vol. 1, no. 10, p. 144, 1927.—HANNA and CHURCH, Journ. Pal., vol. 1, p. 198, 1928.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, p. 67, pl. 11, fig. 2; p. 88, pl. 13, fig. 11, 1929.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., vol. 50, p. 164, 1930.—CUSHMAN and MOYER, Contr. Cushman Lab. Foram. Res., vol. 6, p. 53, 1930.

Test elongate, fusiform, broadest in the middle, apertural end when complete tapering into a long cylindrical neck with a slightly extended lip, outside end pointed; wall ornamented by a few longitudinal costae, 6 to 12 in number.

This is a very widely distributed and variable form. It has occurred in our collections only at the *Albatross* stations given in Table 20.

TABLE 20.—*Lagena gracilis*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|------------------|--------------------|--------------------------|------------|
| 22227 | 1 | H3836 | Lat. 16° 10' S., long. 148° 26' W. | Fathoms 2,238 | ° F. ----- | vol. m. glob. mang. nod. | Rare. |
| 22228 | 1 | H3856 | Northeast point of Apataki, 7 miles SW. | 1,364 | ----- | crs. co. s. ----- | Do. |
| 22229 | 1 | H3898 | Northwest point of Hikueru Atoll, ½ mile E. | 348 | 43.8 | co. s. brk. sb. ----- | Do. |
| 22230 | 1 | H3909 | Aki Aki Atoll, 5 miles E. ----- | 1,364 | 35.6 | glob. mang. ----- | Do. |

LAGENA WILLIAMSONI (Alcock)

PLATE 8, FIGURE 8

Entosolenia williamsoni ALCOCK, Proc. Lit. Philos. Soc., vol. 4, p. 193, 1865.

Lagena williamsoni WRIGHT, Proc. Belfast Nat. Field Club, App. 4, p. 104, pl. 4, fig. 14, 1876-77.—CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 4, p. 61, pl. 11, figs. 8, 9, 1923; Bull. Scripps Inst. Oceanogr., Tech. Ser., vol. 1, no. 10, p. 146, 1927; Contr. Cushman Lab. Foram. Res., vol. 5, p. 70, pl. 11, figs. 7, 8, 1929.—CUSHMAN, STEWART, and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, no. 2, p. 59, pl. 8, fig. 5, 1930.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., vol. 50, p. 165, 1930.

Test subglobular to pyriform, broadest toward the base, apertural end tapering to a short slender neck; wall ornamented with a few high platelike costae, occasionally twisted, coalescing at the upper end and forming a collar made up of a reticulate network below the neck.

This species has a wide distribution both in the Atlantic and Pacific, and it has been recorded in the Tertiary of Europe and the Pliocene of California. The only specimen in our collections is the figured one from *Albatross Station* H3965, Apaiang Atoll, in line with north point of Tarawa, 2 miles N., in 170 fathoms.

LAGENA ACUTICOSTA Reuss

PLATE 8, FIGURES 9, 10, 12

Lagena acuticosta REUSS, Sitz. Akad. Wiss. Wien, vol. 44, pt. 1, p. 305, pl. 1, fig. 4, 1861 (1862); vol. 46, pt. 1, p. 331, pl. 5, fig. 63, 1862 (1863).—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 464, pl. 57, figs. 31, 32; pl. 58, figs. 20 (?), 21, 1884.—PEARCEY, Trans. Glasgow Nat. Hist. Soc., vol. 2, p. 177, 1890.—EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 329, pl. 10, figs. 47, 48, 82, 83, 1893.—WRIGHT, Irish Nat., vol. 9, no. 3, p. 53, 1900.—MILLET, Journ. Roy. Micr. Soc., 1901, p. 8.—CHAPMAN, The Foraminifera, p. 402, 1902.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1909, p. 423.—CHAPMAN, Subantarctic Islands, New Zealand, p. 334, 1909; Journ. Linn. Soc. Zool., vol. 30, p. 407, 1910.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, no. 16, p. 16, 1910; Journ. Quekett Micr. Club, vol. 11, p. 388, pl. 15, fig. 22, 1912.—BAGG, U. S. Geol. Surv. Bull. 513, p. 45, pl. 14, fig. 28, 1912.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 23, pl. 8, figs. 9, 10; pl. 23, fig. 2, 1913.—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, p. 1017, 1914.—HERON-ALLEN and EARLAND, Trans. Linn. Soc. London, ser. 2, vol. 11, p. 247, 1916.—MESTAYER, Trans. New Zealand Inst., vol. 48, p. 129, 1916.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 56, p. 610, 1919; U. S. Nat. Mus. Bull. 100, vol. 4, p. 180, 1921; U. S. Nat. Mus. Bull. 104, pt. 4, p. 5, pl. 1, figs. 1-3, 1923.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1924, p. 150.—HANZAWA, Jap. Journ. Geol. Pal., vol. 4, p. 40, 1925 (1926).—YABE and HANZAWA, Jap. Journ. Geol. Pal., vol. 4, p. 50, 1925 (1926).—CUSHMAN, Bull. Scripps Inst. Oceanogr., Tech. Ser., vol. 1, no. 10, p. 146, 1927.—CUSHMAN, STEWART, and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, no. 2, p. 57, pl. 3, fig. 10, 1930.

Lagena sulcata (WALKER and JACOB) var. *acuticosta* H. B. BRADY, PARKER, and JONES, Trans. Zool. Soc. London, vol. 12, p. 222, pl. 44, figs. 26, 31, 1888.

Test subglobular to pyriform, greatest breadth usually at the middle or below, base rounded or occasionally ending in slight spinose projections of the costae; wall ornamented with a number of longitudinal, strongly raised, thin costae, running from the base to near the apertural end where they coalesce into a platelike area below the aperture. Length, up to 0.35 mm; diameter, 0.27 mm.

This is one of the commonest species in our material from the South Pacific, all the specimens, however, coming from the deeper-water samples dredged by the *Albatross*, data for which are given in Table 21. The species is widely distributed in the present oceans in deeper water.

TABLE 21.—*Lagena acuticosta*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bot- tom tem- pera- ture | Character of bottom | Occur- rence |
|--------------|---------------------|-------------------|--|---------------------|--------------------------------------|------------------------------------|-----------------|
| 22192 | 1 | H3812 | Entrance to Avatoru Pass, Rahiroa Atoll, 7.5 miles S. | Fath- oms 819 | ° F. ----- | wh. co. s. glob. oz. vol. part. | Rare. |
| 22193 | 1 | H3813 | Lat. 15° 13' 10" S., long. 147° 53' 10" W. | 341 | ----- | wh. co. s. glob. pter. | Do. |
| 22194 | 1 | H3825 | Lat. 14° 58' 35" S., long. 148° 35' W. | 844 | ----- | wh. glob. oz. mang. vol. part. | Do. |
| 22195 | 1 | H3826 | Lat. 14° 56' S., long. 148° 44' W. | 711 | ----- | wh. pter. oz.----- | Do. |
| 22196 | 1 | H3873 | Southwest point of Tahanae, 68° N., 4 miles E. | 966 | ----- | glob. oz. mang.--- | Do. |
| 22197 | 1 | D3690 | Northwest face of Hao Atoll, 2 miles E., Paumotus. | 812 | 37.6 | co. s.----- | Do. |
| 22198 | 1 | H3909 | Aki Aki Atoll, 5 miles E.----- | 1,364 | 35.6 | glob. mang.----- | Do. |
| 22199 | 1 | H3914 | Northeast point of Nukutavake, 1 mile S. | 636 | 38.9 | co. s.----- | Do. |
| 22200 | 1 | H3919 | Lat. 19° 45' 30" S., long. 139° 54' W. | 1,494 | 35.4 | glob. mang.----- | Do. |
| 22201 | 1 | H3924 | Nukutipipi Atoll, 1 mile NW.----- | 649 | 39.0 | co. s. brk. sh.----- | Do. |
| 22202 | 1 | H3931 | Anu Anuraro Atoll, ½ mile SE.. | 405 | 42.5 | co. s. pter. oz. mang. part. | Do. |
| 22203 | 1 | H3991 | Lat. 9° 40' N., long. 169° 32' E.--- | 1,583 | 35.5 | glob. oz.----- | Do. |

LAGENA PULCHELLA H. B. Brady

PLATE 9, FIGURES 1a, b

Lagena pulchella H. B. BRADY, Rep. Brit. Assoc. (Nottingham), 1866, p. 70; Ann. Mag. Nat. Hist., ser. 4, vol. 6, p. 294, pl. 12, figs. 1a, b, 1870.—BALKWILL and MILLETT, Journ. Micr., vol. 3, p. 82, pl. 2, fig. 13, 1884.—BALKWILL and WRIGHT, Trans. Roy. Irish Acad., vol. 28, p. 342, pl. 12, fig. 19, 1885.—H. B. BRADY, Journ. Roy. Micr. Soc., 1887, p. 906.—PEARCEY, Trans. Glasgow Nat. Hist. Soc., vol. 2, p. 177, 1890.—WRIGHT, Irish Nat., vol. 9, no. 3, p. 54, 1900.—HERON-ALLEN and EARLAND, Trans. Linn. Soc. London, ser. 2, vol. 11, p. 253, 1916.—CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 4, p. 47, pl. 9, fig. 3, 1923.

The figured specimen seems to represent the trigonal form of the species which has been figured from Great Britain and elsewhere. The figured specimen is from *Albatross* Station H3840, latitude 17° 21' S., longitude 149° 15' W., in 1,585 fathoms.

LAGENA COSTATA (Williamson)

PLATE 9, FIGURES 5a, b

Entosolenia costata WILLIAMSON, Rec. Foram. Great Britain, p. 9, pl. 1, fig. 18, 1858.

Lagena costata REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, p. 329, pl. 4, fig. 54, 1862 (1863).—BALKWILL and WRIGHT, Proc. Roy. Irish Acad., ser. 2, vol. 3, p. 547, 1882; Trans. Roy. Irish Acad., vol. 28, p. 338, pl. 14, figs. 3-5, 1885.—H. B. BRADY, Journ. Roy. Micr. Soc., 1887, p. 903.—WRIGHT, Proc. Roy. Irish Acad., ser. 3, vol. 1, p. 479, 1891; Irish Nat., vol. 9, no. 3, p. 53, 1900.—MILLETT, Journ. Roy. Micr. Soc., 1901, p. 7, pl. 1, fig. 8.—WRIGHT, Irish Nat., vol. 11, p. 213, 1902.—SIDEBOTTOM, Journ. Quekett Micr. Club, vol. 11, p. 388, pl. 15, figs. 16-20, 1912.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 21, pl. 9, fig. 6; pl. 10, fig. 1; pl. 12, fig. 1, 1913.—HERON-ALLEN and EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, p. 75, 1913; Trans. Zool. Soc. London, vol. 20, p. 656, 1915; Trans. Linn. Soc. London, ser. 2, vol. 11, p. 243, 1916; Journ. Roy. Micr. Soc., 1916, p. 45.—CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 4, p. 12, pl. 1, fig. 16; pl. 2, figs. 1, 2; pl. 3, fig. 8, 1923.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1924, p. 150.—YABE and HANZAWA, Jap. Journ. Geol. Pal., vol. 4, p. 50, 1925 (1926).—HADA, Trans. Sapporo Nat. Hist. Soc., vol. 11, pt. 1, p. 12, 1929.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, p. 70, pl. 11, fig. 9, 1929.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., vol. 50, p. 166, 1930.—CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 7, p. 6, pl. 1, fig. 21, 1931.—CUSHMAN and LAI-MING, Journ. Pal., vol. 5, p. 101, pl. 11, fig. 3, 1931.

Test subglobular; wall ornamented with a few, usually rather remote costae; the apertural end not produced.

From the records this is a very widely distributed species, most of the records possibly due to the wide range allowed for its specific limits. The only specimens that we have which are referred to this species are the figured one from *Albatross* Station H3900, midway between Hikueru and Marokau in 1,372 fathoms, and another similar specimen from Viva Anchorage, Fiji, in 3 fathoms.

LAGENA LINEATA (Williamson)

PLATE 9, FIGURES 3, 4

Entosolenia lineata WILLIAMSON, Ann. Mag. Nat. Hist., ser. 2, vol. 1, p. 18, pl. 2, fig. 18, 1848.

Entosolenia globosa (MONTAGU) var. *lineata* WILLIAMSON, Rec. Foram. Great Britain, p. 9, pl. 1, fig. 17, 1858.

Lagena lineata REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, p. 328, pl. 4, fig. 48, 1862 (1863).—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 461, pl. 57, fig. 13, 1884.—BALKWILL and WRIGHT, Trans. Roy. Irish Acad., vol. 28, p. 336, pl. 14, figs. 13-16, 1885.—H. B. BRADY, Journ. Roy. Micr. Soc.,

1886, p. 902.—H. B. BRADY, PARKER, and JONES, *Trans. Zool. Soc. London*, vol. 12, p. 222, pl. 44, fig. 33, 1888.—PEARCEY, *Trans. Glasgow Nat. Hist. Soc.*, vol. 2, p. 177, 1890.—EGGER, *Abh. kön. bay. Akad. Wiss. München*, Cl. II, vol. 18, p. 326, pl. 10, figs. 29, 30, 1893.—MORTON, *Proc. Portland Soc.*, 1897, p. 118.—WRIGHT, *Irish Nat.*, vol. 9, no. 3, p. 54, 1900.—MILLETT, *Journ. Roy. Micr. Soc.*, 1901, p. 7.—EARLAND, *Journ. Quekett Micr. Club*, ser. 2, vol. 9, no. 57, p. 210, 1905.—SIDEBOTTOM, *Mem. Proc. Manchester Lit. Philos. Soc.*, vol. 50, no. 5, p. 4, 1906.—BALKWILL and MILLETT, *Rec. Foram. Galway*, p. 5, 1908.—CHAPMAN, *Subantarctic Islands New Zealand*, p. 334, pl. 15, fig. 3, 1909.—SIDEBOTTOM, *Mem. Proc. Manchester Lit. Philos. Soc.*, vol. 54, no. 16, p. 15, 1910.—HERON-ALLEN and EARLAND, *Proc. Roy. Irish Acad.*, vol. 31, pt. 64, p. 75, 1913.—PEARCEY, *Trans. Roy. Soc. Edinburgh*, vol. 49, p. 1017, 1914.—HERON-ALLEN and EARLAND, *Trans. Zool. Soc. London*, vol. 20, p. 656, 1915; *Journ. Linn. Soc. Zool.*, ser. 2, vol. 11, p. 243, 1916; *Journ. Roy. Micr. Soc.*, 1916, p. 44.—CUSHMAN, *U. S. Nat. Mus. Bull.* 104, pt. 4, p. 31, pl. 5, fig. 10; pl. 6, figs. 5-8, 1923.—HERON-ALLEN and EARLAND, *Journ. Linn. Soc. Zool.*, vol. 35, p. 623, 1924; *Journ. Roy. Micr. Soc.*, 1924, p. 148; vol. 50, p. 162, 1930.

The above references will give the rather wide records for this species, and the figures given in them will show what a wide range of form has been assigned to this species. The specimens we have referred to it from the South Pacific collection are similar to those figured in which the apertural end is truncate and the opposite end tapering to a slight spine, the body of the test either entirely covered with very fine costae or the apertural end somewhat smooth. Our specimens are from *Albatross* Stations H3855, northwest point of Apataki, 1 mile SE., in 654 fathoms, and H3965, Apaiang Atoll, in line with north point of Tarawa, 2 miles N., in 170 fathoms.

LAGENA AMPULLA-DISTOMA Rymer-Jones

PLATE 9, FIGURES 2a, b

- Lagena vulgaris* WILLIAMSON var. *ampulla-distoma* RYMER-JONES, *Trans. Linn. Soc. London*, vol. 30, p. 63, pl. 19, fig. 52, 1872.
- Lagena ampulla-distoma* H. B. BRADY, *Rep. Voy. Challenger, Zoology*, vol. 9, p. 458, pl. 57, fig. 5, 1884.—MILLETT, *Journ. Roy. Micr. Soc.*, 1901, p. 5, pl. 1, fig. 5.—SIDEBOTTOM, *Journ. Quekett Micr. Soc.*, vol. 11, p. 384, 1912.—CUSHMAN, *U. S. Nat. Mus. Bull.* 71, pt. 3, p. 14, pl. 14, fig. 7, 1913.—HERON-ALLEN and EARLAND, *Trans. Zool. Soc. London*, vol. 20, p. 655, 1915.—SIDEBOTTOM, *Journ. Roy. Micr. Soc.*, 1918, p. 130.—HERON-ALLEN and EARLAND, *British Antarctic Exped., Zoology*, vol. 6, p. 145, 1922; *Journ. Roy. Micr. Soc.*, 1924, p. 147.
- Lagena favoso-punctata* H. B. BRADY (in part), *Rep. Voy. Challenger, Zoology*, vol. 9, pl. 61, fig. 2, 1884.

The peculiar form here figured seems to belong to this species figured by Rymer-Jones from his collections from Java. There is a peculiar ornamentation of the surface, which apparently is variable in different specimens. The base itself is broadly rounded with a tubular spine, and the apertural end slightly extended into a very

short neck. The single specimen we have is that figured from *Albatross* Station H3993, Schischmarev Pass, Wotje, 3 miles N., in 1,187 fathoms.

LAGENA sp.(?)

PLATE 6, FIGURES 12a, b

The peculiar small form figured here seems worthy of being placed on record, although no attempt has been made to refer this single specimen to any described species. It is from *Albatross* Station H3892, northeast pass, Makemo, 1 mile S., in 603 fathoms.

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1826

Guttulina D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 266, 1826 (not a subgenus of *Polymorphina*).

Synonym: *Polymorphina* (part) of authors (not d'Orbigny), s. str.

Genotype.—By designation, *Polymorphina* (*Guttulina*) *communis* d'Orbigny.

Test rounded, spherical to fusiform; chambers spheroidal to ellipsoidal or clavate, not at all compressed, arranged more or less in an elongate spiral series, so that they form generally a clockwise, close, sigmoid series viewed from the base, successive chambers added in planes less than 180°, three or four chambers in a cycle; sutures distinct; aperture radiate. Jurassic to Recent.

Guttulina is one of the most primitive genera of the family and is developed directly from the spiral *Eoguttulina* of the Jurassic; it appears first in the Upper Jurassic and is common in the Cretaceous and later formations. The 5-chambered whorl at the base is generally primitive and is found in the microspheric form of most of the other genera of the family. Some authors have attempted to derive *Guttulina* from *Polymorphina*, although the opposite is evident, both from the development of the microspheric form of the two genera and from the fact that true Polymorphinas do not appear until the beginning of the Tertiary. *Polymorphina* represents a specialized genus the biserial arrangement of which has been derived from the more primitive quinqueloculine young.

GUTTULINA sp.(?)

PLATE 9, FIGURES 10a, b

The peculiar costate form figured here from *Albatross* Station H3814, latitude 15° 14' 10'' S., longitude 147° 51' 5'' W., in 391 fathoms, seems worthy of record, although with the single specimen there is not enough to warrant any specific description.

Genus *PYRULINA* d'Orbigny, 1839

"Pyrulines, Les," D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 267, 1826.

Pyrulina D'ORBIGNY, in de la Sagra's "Cuba" (Foram.), p. 107, 1839 (non 1826, vernac.).

Genoholotype.—*Pyrulina gutta* d'Orbigny.

Test fusiform or cylindrical; chambers more or less elongated and embracing, arranged at first in a somewhat quinqueloculine series, later becoming biserial. Upper Cretaceous to Recent.

There has been some question as to the use of the genus *Pyrulina*, and an attempt has been made to substitute the name *Apiopterina* Zborzewski, 1834, on the basis that d'Orbigny used the "e" at the end of the subgeneric name *Pyruline*. As Zborzewski's species *A. orbignyi* is entirely unrecognizable, and as it is even a question in what genus it should be placed, the name is invalid, and *Pyrulina*, which was used later by d'Orbigny, is the first name available if the 1826 name should be left out. The same is true with *Globulina*, the species *Raphanulina humboldtii* Zborzewski being entirely unrecognizable and the genus therefore being invalid.

PYRULINA CYLINDROIDES (Roemer)

PLATE 9, FIGURES 13a, b

The specimens of this genus are extremely rare in our Pacific collections. The form figured under this name is from *Albatross* Station H3971, latitude 4° 25' N., longitude 171° 13' E., in 2,505 fathoms.

PYRULINA EXTENSA (Cushman)

PLATE 9, FIGURE 12

Polymorphina longicollis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 572, pl. 73, figs. 18, 19, 1884.—EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 310, pl. 9, fig. 21, 1893.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 90, pl. 41, figs. 1-3, 1913.

Polymorphina extensa CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 3, p. 90, pl. 41, figs. 1-3, 1913; U. S. Nat. Mus. Bull. 104, pt. 4, p. 156, pl. 41, figs. 7, 8, 1923.

Pyrulina extensa CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, art. 6, p. 53, pl. 12, figs. 5a-c, 1930.

Test elongate, fusiform, margin almost entire, initial end more or less pointed, apertural end produced into an elongate, cylindrical neck; chambers not numerous, inflated; sutures fairly distinct, but not depressed, except in the case of the last-formed one; wall more or less hispid, the last chamber especially more inflated and spinose and often covered with fistulose tubes; aperture at the end of a long neck, not radiate.

This deep-sea species has been recorded from the South Pacific previously, and also from the Pliocene of Fiji. The figured specimen is from *Albatross* Station H3791, latitude 7° 58' S., longitude 139° 9' W., in 2,287 fathoms, and seems to be rather typical.

Genus **PSEUDOPOLYMORPHINA** Cushman and Ozawa, 1928

Pseudopolymorphina CUSHMAN and OZAWA, Contr. Cushman Lab. Foram. Res., vol. 4, p. 15, 1928.

Synonym: *Polymorphina* (part) of authors.

Genoholotype.—*Pseudopolymorphina hanzawai* Cushman and Ozawa.

Test elongate, often somewhat compressed; chambers rounded, generally as long as broad, arranged in a closed sigmoid series in the earlier stages, becoming biserial in the adult; sutures distinct, depressed; aperture radiate. Jurassic to Recent.

Recently this genus has been placed as a synonym of *Apiopterina* Zborzewski. As already noted the latter is not recognizable and is based on a more or less globular form, whereas *Pseudopolymorphina* is biserial in the adult.

PSEUDOPOLYMORPHINA cf. **SUBNODOSA** (Reuss)

PLATE 9, FIGURES 11a, b

The small, somewhat immature specimen figured may possibly belong to this species of Reuss, which has been mainly recorded from the Tertiary of Europe. It is from Port Lotten, Kersail, Caroline Islands.

Genus **SIGMOMORPHINA** Cushman and Ozawa, 1928

Sigmomorphina CUSHMAN and OZAWA, Contr. Cushman Lab. Foram. Res., vol. 4, p. 17, 1928.

Genoholotype.—*Sigmomorphina yokoyamai* Cushman and Ozawa.

Test, at least in the adult, with the chambers added in planes slightly less than 180° and more than 144° apart from one another, each succeeding chamber farther removed from the base. Eocene to Recent, possibly also in the uppermost Cretaceous.

This genus will not be confused with *Guttulina* when forms of the two genera are studied, the later development of *Sigmomorphina* being very different and being derived from *Guttulina* by the addition of distinct characters.

SIGMOMORPHINA SEMITECTA (Reuss) var. **TERQUEMIANA** (Fornasini)

PLATE 9, FIGURES 6-9

There are fairly numerous specimens from off Nairai, Fiji, and from Levuka, Fiji, in 12 fathoms, several of which are here figured and which seem close to this variety. It has not previously been recorded from the Pacific, but has been recorded from the shallow water of the Mediterranean.

Genus **GLANDULINA** d'Orbigny, 1826

Glandulina d'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 251, 1826.

Synonym: *Nodosaria* (part) of authors.

Genotype.—By designation, *Nodosaria (Glandulina) laevigata* d'Orbigny.

Test similar to *Nodosaria*, but the chambers embracing, the last-formed one making up a large part of the surface of the test. Jurassic to Recent.

Topotypes of d'Orbigny's original species of this genus, which were studied by Ozawa, show that the early stage is definitely biserial, as do others of the Recent and Tertiary species; hence it is placed in the family Polymorphinidae. This biserial early stage can be demonstrated by anyone who will take the trouble to examine the microspheric form, and the distinction between this genus and *Pseudoglandulina* will at once be clear.

GLANDULINA LAEVIGATA d'Orbigny

PLATE 9, FIGURES 14a, b

The only specimen referred to this species in the entire collection is the one figured. It is from Guam Anchorage, Ladrone Islands, in 21 fathoms, and evidently represents the megalospheric form of the species.

Family NONIONIDAE

Genus NONION Montfort, 1808

Nonion MONTFORT, Conch. Syst., vol. 1, p. 211, 1808.

Synonyms: *Melonis* MONTFORT, 1808; *Florilus* MONTFORT, 1808; *Pulvinulus* (part) LAMARCK, 1816; *Placentula* (part) LAMARCK, 1822; *Cristellaria* (part) LAMARCK, 1822; *Lenticulina* (part) DEFRANCE, 1824 (not Lamarck); *Polystomella* (part) DEFRANCE and authors (not Lamarck); *Nonionina* d'ORBIGNY, 1826.

Test free, planispiral, more or less involute, bilaterally symmetrical, periphery broadly rounded to acute; chambers numerous; wall finely perforate; aperture an arched, usually narrow opening between the base of the apertural face and the preceding coil. Carboniferous (?), Jurassic to Recent.

NONION POMPILIOIDES (Fichtel and Moll)

PLATE 10, FIGURES 1, 2

"*Nautilus Melo*" SOLDANI, Testaceographia, vol. 2, p. 38, pl. 8, figs. ZZ, A. B. C., 1798.

Nautilus pompilioides FICHEL and MOLL, Test. Micr., p. 31, pl. 2, figs. a-c, 1798.

Melonis etruscus MONTFORT, Conch. Syst., p. 67, xvii^e genre, 1808.

Polystomella etrusca DEFRANCE, Dict. Sci. Nat., vol. 32, p. 183, 1824.

Nonionina umbilicatula d'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 293, pl. 15, figs. 10-12, Modèles no. 86, 1826.

Nonionina melo d'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 293, 1826.

Nonionina pompilioides PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 8, p. 246, pl. 12, fig. 158, 1871.—TERRIGI, Atti Accad. Pont. Nuovi Lincei, vol. 35, p. 204, pl. 4, fig. 49, 1883.—H. B. BRADY, Rep. Voy.

Challenger, Zoology, vol. 9, p. 727, pl. 109, figs. 10, 11, 1884.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 4, p. 25, pl. 17, figs. 2 a, b, 1914.

Nonion pompilioides CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 7, p. 4, pl. 1, figs. 7-11; pl. 2, figs. 1, 2, 1930.

Test planispiral, bilaterally symmetrical, entirely involute, except that the umbilici are deeply excavated, periphery very broadly rounded, entire; chambers 8 to 10 in the last-formed coil of the same general shape, not inflated; sutures flush with the surface, generally limbate, fusing along the umbilicus to form a slight thickening about it but not raised above the surface; wall smooth, coarsely perforate; aperture slitlike, between the base of the apertural face and the previous coil, apertural face broad and low. Length, 0.6 mm; thickness, 0.4 mm.

This is essentially a deep-water species, and all the specimens obtained were from *Albatross* stations, data for which are given in Table 22.

TABLE 22.—*Nonion pompilioides*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|------------------|--------------------|-----------------------|------------|
| 22231 | 1 | D3684 | Lat. 50' N., long. 137° 54' W..... | Fathoms 2,463 | ° F. ----- | gy. yl. glob. oz..... | Rare. |
| 22232 | 1 | H3833 | Lat. 15° 42' S., long. 148° 44' W.... | 2,243 | ----- | vol. m. glob..... | Do. |
| 22233 | 2 | H3847 | Lat. 16° 8' S., long. 146° 42' W.... | 609 | 39.0 | glob. oz..... | Do. |
| 22234 | 1 | H3859 | Ngaruae Pass, Fakarava Atoll, 35° S., 3.5 miles E. | 666 | ----- | pter. oz. vol. part.. | Do. |
| 22235 | 1 | H3862 | Lat. 16° 51' S., long. 143° 42' W.... | 1,300 | ----- | yl. glob. oz..... | Do. |
| 22236 | 1 | H3881 | Lat. 15° 54' S., long. 143° 6' W..... | 1,568 | 35.4 | glob. oz. mang.... | Do. |
| 22237 | 2 | H3900 | Midway between Hikueru and Marokau. | 1,372 | 35.7 | glob. oz..... | Do. |
| 22238 | 2 | H3901 | Northwest point of Marokau, 8 miles E. | 1,620 | 35.6 | glob. oz. mang.... | Do. |
| 22239 | 1 | H3903 | Lat. 18° 8' S., long. 141° 49' W.... | 2,187 | 35.2 | vol. m. glob..... | Do. |
| 22240 | 1 | H3918 | Lat. 19° 35' S., long. 139° 13' W.... | 2,335 | 35.1 | rd. c. glob..... | Do. |
| 22241 | 1 | H3923 | Nukutipipi Atoll, 5 miles NW.... | 2,315 | 35.0 | ----do..... | Do. |
| 22242 | 1 | H3940 | South end of Mehetia Island, 14 miles NW. | 2,129 | 34.8 | vol. m..... | Do. |
| 22243 | 1 | H3984 | Entrance to South Pass, Rongelap, 1½ miles N. | 746 | 39.0 | crs. co. s..... | Do. |
| 22244 | 2 | H3986 | Lat. 10° 30' N., long. 167° 42' E.... | 2,586 | 35.0 | glob. oz. vol. part.. | Do. |

NONION BOUEANUM (d'Orbigny) (?)

PLATE 10, FIGURES 3a-c

There are a very few specimens which may possibly be referred to this species of d'Orbigny described from the Miocene of the Vienna Basin. The figured specimen is from Rutavu. There are also single specimens from two *Albatross* stations, as shown in the Table 23.

TABLE 23.—*Nonion boueanum*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|----------------|--------------------|-----------------------|------------|
| 22262 | 1 | H3954 | West end of Nomuka Island, 33° N., 6 miles E. | Fathoms 600 | ° F. 39.2 | co. s. pum. pter. oz. | Rare. |
| 22263 | 1 | H3956 | Lat. 18° 56' 30'' S., long. 179° 16' W. | 990 | 37.0 | fine. co. s. oz.----- | Do. |

NONION SUBTURGIDUM (Cushman)

PLATE 10, FIGURES 4-7

Nonionina suburgida CUSHMAN, Carnegie Inst. Washington Publ. 342, p. 47, pl. 16, fig. 2, 1924.

Test bilaterally symmetrical, compressed, last-formed coil composed of 8 or 9 chambers, greatly increasing in length as added, the last-formed one extending the entire length of the test; periphery rounded; sutures very slightly depressed, distinct; apertural face broadly rounded, umbilical area often filled with secondary material; aperture at the base of the last-formed chamber at the median line. Length, up to 0.65 mm; breadth, 0.45-0.5 mm; thickness, 0.16-0.25 mm.

This species was originally described from off Samoa. It has proved to be the most common species in the region from which our material came, at least in shallow water. We have specimens from off Nairai, Fiji, 12 fathoms, common; Viva Anchorage, Fiji, 3 fathoms, common; and off Rotonga, common. There is some variation in the width of the apertural face, and in the extent of involution of the last-formed chambers.

NONION GRATELOUPI (d'Orbigny) (?)

PLATE 10, FIGURES Sa-c

There are a few specimens from Guam Anchorage in 21 fathoms, and from Mokaujar Anchorage, Fiji, which resemble this species, which is characteristically developed in the shallow water of the West Indian region. These Pacific specimens, while of the same general shape as those of the Atlantic, are much smaller in size, the figured specimen being only about 0.2 mm in length; breadth, 0.12 mm; and thickness, 0.07 mm.

This may represent a distinct species developed in the shallow water of the Pacific region.

NONION PACIFICUM (Cushman)

PLATE 10, FIGURES 9a, b

Nonionina umbilicatula (MONTAGU) var. *pacifica* CUSHMAN, Carnegie Inst. Washington Publ. 342, p. 48, pl. 16, fig. 3, 1924.

Nonion umbilicatum (MONTAGU) var. *pacificum* CUSHMAN, Bull. Scripps Inst. Oceanogr., Tech. Ser., vol. 1, no. 10, p. 49, pl. 2, fig. 5, 1927.

Test much compressed, entirely involute, slightly umbilicate, periphery rounded; chambers distinct, usually about eight in the last-formed coil, not inflated; sutures distinct, not limbate, very slightly curved; wall smooth, finely and evenly perforate; aperture an elongate, narrow slit, at the base of the apertural face. Length, 0.6 mm; breadth, 0.5 mm; thickness, 0.3 mm.

This was originally described from Samoa as a variety of Montagu's species. As Montagu's species is more or less uncertain in its characters, and as our form seems to be widely distributed in the Pacific, it seems best to refer to it as a definite species as was indicated at the time that it was originally described from Samoa. It is widely distributed in the Pacific, and our specimens are from *Albatross* stations in deeper water, data for which are given in Table 24. There is some variation in the degree of compression of the test, in the depth of the umbilici, and in the fineness of the perforations of the surface.

TABLE 24.—*Nonion pacificum*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|-------|--------------------|------------------------------------|------------|
| 22245 | 2 | H3787 | Lat. 6° 41' N., long. 137° W | 2,776 | ° F. | lt. gy. glob. oz. | Rare. |
| 22246 | 1 | H3791 | Lat. 7° 58' S., long. 139° 9' W | 2,287 | | gy. yl. oz. crs. glob. | Do. |
| 22247 | 1 | H3796 | Haunau Point, Ua Huka Island, Marquesas, 43° S., 15½ miles E. | 1,040 | | gn. oz. lav. | Do. |
| 22248 | 1 | H3810 | Entrance to Avatoru Pass, Raihira Atoll, 3.5 miles S. | 661 | | wh. co. s. glob. oz. min. frag. | Do. |
| 22249 | 1 | H3826 | Lat. 14° 56' S., long. 148° 44' W | 711 | | wh. pter. oz. | Do. |
| 22250 | 2 | H3832 | Lat. 15° 33' S., long. 148° 45' W | 2,267 | | lt. gy. oz. glob. | Do. |
| 22251 | 1 | H3837 | Lat. 16° 32' S., long. 148° 40' W | 2,363 | | vol. m. glob. | Do. |
| 22252 | 1 | H3838 | Lat. 16° 57' S., long. 148° 58' W | 2,224 | | do. | Do. |
| 22253 | 3 | H3841 | Point Venus, Tahiti Island, 32° S., 4.2 miles W. | 775 | | crs. vol. s. mang. nod. | Do. |
| 22254 | 1 | H3858 | Ngaruae Pass, Fakarava Atoll, 28° S., 1 mile E. | 599 | | crs. co. s. | Do. |
| 22255 | 1 | H3870 | Village, point of Anaa Atoll, 50° S., 5 miles W. | 1,110 | 36.0 | fne. co. s. pter. oz. glob. | Do. |
| 22256 | 2 | H3875 | Southwest point of Tahanae, about ½ mile offshore, 3 miles NE. | 269 | | crs. co. s. | Do. |
| 22257 | 1 | H3888 | Lat. 16° 14' S., long. 142° 50' W | 1,516 | 35.5 | glob. oz. mang. | Do. |
| 22258 | 1 | H3890 | Lat. 16° 25' S., long. 143° 33' W | 1,108 | 36.1 | do. | Do. |
| 22259 | 1 | H3896 | Tckokoto Atoll, 1 mile E. | 617 | 38.4 | co. s. | Do. |
| 22260 | 1 | H3935 | Hereheretue Atoll, 1 mile W | 594 | 39.5 | crs. co. s. | Do. |
| 22261 | 1 | H3936 | Hereheretue Atoll, 0.3 mile E. | 189 | 62.1 | co. s. mang. part. | Do. |

Genus *NONIONELLA* Cushman, 1926

Nonionella CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, p. 64, 1926.
Synonym: *Nonionina* (part) of authors.

Genoholotype.—*Nonionella miocenica* Cushman.

Test subtrochoid, the dorsal side only partially involute, ventral side completely so, close coiled; chambers, especially in the adult, inequilateral, the ventral side developing a distinct elongate lobe at the umbilical end, which covers the umbilicus itself; wall calcareous, finely perforate; aperture at the base of the apertural face of the chamber low and elongate, extending from the peripheral border toward the ventral side. Cretaceous to Recent.

NONIONELLA AURIS (d'Orbigny)

PLATE 10, FIGURES 10, 11; PLATE 11, FIGURES 1a-c

Valvulina auris d'ORBIGNY, Voy. Amér. Mérid., vol. 5, pt. 5, "Foraminifères," p. 47, pl. 2, figs. 15-17, 1839.

Nonionella auris CUSHMAN and KELLETT, Proc. U. S. Nat. Mus., vol. 75, art. 25, p. 5, pl. 1, fig. 9; pl. 2, figs. 2, 3, 1929.—CUSHMAN, Florida State Geol. Surv. Bull. 4, p. 38, pl. 7, figs. 1a-c, 1930.

Test asymmetrical, slightly trochoid, the spire not raised, periphery in the adult broadly rounded; chambers 9 to 11 in the adult, low and broad, very distinct, slightly inflated, in the adult with the last-formed chamber having an enlarged portion extending over the umbilicus on the ventral side; sutures distinct, depressed, gently curved; wall smooth, polished, very finely perforate; aperture at the base of the last-formed chamber extending from the periphery ventrally, low and broad. Length, 0.35 mm; breadth, 0.25 mm; thickness, 0.1 mm.

Our specimens are not entirely typical, as the extension of the last-formed chamber on the ventral side is not nearly so well marked as in the types and in the fossil material that has been referred to this species. It is rare, being found only at one *Albatross* station, H3840, latitude 17° 21' S., longitude 149° 15' W., in 1,585 fathoms, at Vavau Anchorage, Tonga Islands, and at Rutavu.

NONIONELLA TRANSLUCENS, new species

PLATE 11, FIGURES 2a-c

Test small, elongate, dorsal side flattened or slightly convex with all the coils visible, ventral side with only the last-formed coil visible, the inner side of the last-formed chambers projecting toward the umbilicus, periphery rounded; chambers distinct, slightly inflated, especially on the ventral side, 9 or 10 in the last-formed coil, of rather uniform shape and increasing only slightly in size as added; sutures distinct, strongly limbate; wall thin, translucent, very finely perforate, shining; aperture at the ventral margin of the last-formed

chamber, slightly ventral to the periphery. Length of holotype, 0.32 mm; breadth, 0.2 mm; thickness, 0.12 mm.

Holotype.—Cushman Coll. No. 15669, from 12 fathoms off Levuka, Fiji.

This is a small but very distinctive and fairly common species in the collections from the South Pacific.

The species is also recorded from Rongelap Atoll; 21 fathoms, Guam Anchorage, Ladrone Islands; Port Lotten, Kersail, Caroline Islands; Mokaujar Anchorage, Fiji; and a few specimens from the *Albatross* stations in deeper water, data for which are given in Table 25.

TABLE 25.—*Nonionella translucens*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|----------------|--------------------|------------------------------------|------------|
| 22264 | 2 | H3812 | Entrance to Avatoru Pass, Rahi-roa Atoll, 7.5 miles S. | Fathoms 819 | ° F. | wh. co. s. glob. oz. vol. part. | Rare. |
| 22265 | 1 | H3815 | Lat. 15° 15' S., long. 147° 51' 35" W. | 524 | ----- | wh. co. s. brk. sh. | Do. |
| 22266 | 1 | H3824 | Lat. 15° 20' S., long. 148° 30' W. | 850 | ----- | wh. pter. glob. oz. | Do. |
| 22267 | 1 | H3825 | Lat. 14° 58' 35" S., long. 148° 35' W. | 844 | ----- | wh. glob. oz. mang. vol. part. | Do. |
| 22268 | 1 | H3841 | Point Venus, Tahiti Island, 32° S., 4.2 miles W. | 775 | ----- | crs. vol. s. mang. nod. | Do. |

NONIONELLA sp. (?)

PLATE 11, FIGURES 3a-c

The small specimen figured, while apparently a *Nonionella*, is represented by a single specimen from *Albatross* Station H3829, latitude 14° 56' S., longitude 148° 48' W., in 860 fathoms, and until more is known about it from further specimens it seems wise not to assign a definite name to it.

Genus **ELPHIDIUM** Montfort, 1808

Elphidium MONTFORT, *Conch. Syst.*, vol. 1, p. 15, 1808.

Synonyms: *Geophonus* MONTFORT, 1808; *Pelorus* MONTFORT, 1808; *Andromedes* MONTFORT, 1808; *Sporilus* MONTFORT, 1808; *Themeon* MONTFORT, 1808; *Cellanthus* MONTFORT, 1808; *Vorticialis* LAMARCK, 1812; *Polystomella* LAMARCK, 1822; *Robulina* (part) MÜNSTER, 1838; *Geoponus* EHRENBERG, 1839 (1841); *Nonionina* (part) BOLL, 1846; *Helicoza* MOEBIUS, 1880.

Test typically planispiral, bilaterally symmetrical, mostly involute; chambers numerous, with distinct sutures either depressed or raised and limbate, with septal bridges and depressions; wall calcareous,

perforate; apertures one or more at the base of the apertural face. Jurassic to Recent.

This genus is a highly developed one in the Indo-Pacific region, where there are numerous species, some of which at least are rather limited in their distribution, for the most part being confined to shallow water where they are often exceedingly abundant. Some of the species are identical with, or closely related to, species already described from other regions, but most of them seem to be distinctive of the Indo-Pacific itself. In some of the groups of islands there seem to be very definite varieties or forms which can be distinguished from those of other groups, but it has not been thought best to give these definite varietal names at present, as much more material and study are needed to define more closely these isolated forms.

ELPHIDIUM CRISPUM (Linnaeus)

PLATE 11, FIGURES 4a, b

There are numerous forms similar to the one figured from off Fiji which have many of the characters of Linnaeus's species. They never seem, however, to develop the very large size and the complex form found in the typical material from the Adriatic and developed in the Late Tertiary of Italy. Nevertheless, the characters are similar, and the fact that numerous species of the Mediterranean are widely spread in the Indo-Pacific region makes it seem possible to use this name for these specimens until more is known of their structure and distribution. The specimens are as a rule not very abundant in our material, and occur at the following shallow-water stations: Mokaujar Anchorage, Fiji; 40 to 50 fathoms off Fiji; Makemo Lagoon, Paumotu Islands; Rongelap Atoll, Marshall Islands; Port Lotten, Kersail, Caroline Islands; and in 21 fathoms, Guam Anchorage, Ladrone Islands. Rare specimens occur at three *Albatross* stations noted in Table 26.

TABLE 26.—*Elphidium crispum*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|-------------------------|--------------------|---------------------|------------|
| 22269 | 3 | H3978 | Wotju Island, Elmore Atoll, 6 miles SE. | <i>Fathoms</i> 1,068 | ° F. 36.5 | co. s.----- | Rare. |
| 22270 | 1 | H3983 | Entrance to South Pass, Rongelap, ½ mile N. | 400 | 43.4 |do----- | Do. |
| 22271 | 2 | H3984 | Entrance to South Pass, Rongelap, 1½ miles N. | 746 | 39.0 | crs. co. s.----- | Do. |

ELPHIDIUM CRATICULATUM (Fichtel and Moll)

PLATE 11, FIGURES 5a, b

Nautilus craticulatus FICHTEL and MOLL, Test. Micr., p. 51, pl. 5, figs. h-k, 1803.
Polystomella craticulata D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 284, no. 3, 1826.—
 CARPENTER, Intr. Foram., p. 279, pl. 16, figs. 1, 2, 1862.—H. B. BRADY,
 Rep. Voy. *Challenger*, Zoology, vol. 9, p. 739, pl. 110, figs. 16, 17, 1884.—
 EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 433, pl. 20,
 figs. 24, 25, 1893.—MILLETT, Journ. Roy. Micr. Soc., 1904, p. 604.—CUSH-
 MAN, U. S. Nat. Mus. Bull. 71, pt. 4, p. 34, pl. 19, fig. 4, 1914.

Test subglobose, composed of as many as 50 chambers in the last-formed coil; in face view broadly lenticular, about one and one-half times as long as wide, periphery bluntly rounded; umbilical region umbonate, filled with clear shell material for one-third or more of the diameter of the test, with large pores, rest of surface reticulate; aperture a long narrow opening subdivided into a number of pores.

This species, which is a typical shallow-water one of the Indo-Pacific, has turned out to be extremely rare in our collections. The only specimens are from Vavau Anchorage, Tonga Islands, and in 12 fathoms off Nairai, Fiji. At neither of these localities were the specimens at all well developed.

ELPHIDIUM JENSENI (Cushman)

PLATE 11, FIGURES 6, 7

Polystomella macella (FICHTEL and MOLL) var. JENSEN, Proc. Linn. Soc. New South Wales, vol. 29, p. 817, pl. 23, fig. 4, 1904(1905).
Polystomella jenseni CUSHMAN, Carnegie Inst. Washington Publ. 342, p. 49, pl. 16, figs. 4(?), 6, 1924.

Test very strongly compressed, periphery very slightly keeled; chambers numerous, distinct, not inflated; sutures distinct, somewhat raised, retral processes elongate, thin, bridging almost entirely the area between the sutures with flat depressed areas between, umbilical area finely papillate. Length, up to 0.6 mm; breadth, 0.45 mm; thickness, 0.1 mm.

Jensen originally described this species from off Australia in 100 fathoms. It occurs also in considerable numbers off Samoa, and in our present collections has proved to be fairly common, occurring at the following shallow-water stations: Vavau Anchorage, Tonga Islands, 18 fathoms; Mokaujar Anchorage, Fiji; Levuka, Fiji, 12 fathoms; Nairai, Fiji, 12 fathoms; Rongelap Atoll, Marshall Islands; and 21 fathoms, Guam Anchorage, Ladrone Islands. At some of these stations it was fairly common. It is very rare in the few *Albatross* stations given in Table 27, most of which specimens are probably ones carried out from shoal water, and were not living at the depth from which they were obtained.

TABLE 27.—*Elphidium jensenii*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|----------------|--------------------|-----------------------|------------|
| 22272 | 1 | H3809 | Entrance to Avatoru Pass, Raha-roa Atoll, 2.5 miles S. | Fathoms 645 | ° F. ----- | fne. wh. co. s.----- | Rare. |
| 22273 | 1 | H3815 | Lat. 15° 15' S., long. 147° 51' 35" W. | 524 | ----- | wh. co. s. brk. sh.. | Do. |
| 22274 | 2 | H3858 | Ngaruae Pass, Fakarava Atoll, 28° S., 1 mile E. | 599 | ----- | crs. co. s.----- | Do. |
| 22275 | 1 | D3689 | Northwest point of Marokau, 40° N., 4 miles E. | 807 | 37.6 | co. s. mang.----- | Do. |
| 22276 | 1 | H3961 | Center south coast Tarawa, 10 miles N. | 413 | 43.5 | crs. br. glob. oz.--- | Do. |

ELPHIDIUM MILETTI (Heron-Allen and Earland)

PLATE 11, FIGURES 8a, b

Polystomella vericulata MILLETT (not H. B. Brady), Journ. Roy. Mier. Soc., 1904, p. 604, pl. 11, fig. 3.

Polystomella milletti HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 735, pl. 53, figs. 38-42, 1915.—SIDEBOTTOM, Journ. Roy. Mier. Soc., 1918, p. 263.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 56, p. 633, 1919; Carnegie Inst. Washington Publ. 342, vol. 21, p. 48, pl. 16, figs. 7, 8, 1924.

Elphidium milletti HERON-ALLEN and EARLAND, Journ. Linn. Soc. Zool., vol. 35, p. 640, 1924; Trans. Zool. Soc. London, vol. 22, pt. 1, p. 70, 1926.

Test compressed, periphery rounded, and in side view lobulate; chambers inflated, increasing in size somewhat as added; sutures depressed, distinct; wall ornamented with fine spinose projections along the periphery, the main portion of the sides of the chambers having irregular, raised costae, which tend to form a chevronlike pattern with the angle opening toward the periphery; aperture at the base of the apertural face, indistinct. Length, 0.55 mm; breadth, 0.45 mm; thickness, 0.2 mm.

This is a typical Indo-Pacific species. Millett records it from the Malay Archipelago, and Heron-Allen and Earland from 15 stations in the Kerimba Archipelago off southeast Africa. Sidebottom's records give it from 465 fathoms off the east coast of Australia, and I have recorded it from this same region as well as from Samoa. It has not been common in our present material, but occurred at Vavau Anchorage, Tonga Islands, in 18 fathoms, and in 12 fathoms off Nairai, Fiji.

ELPHIDIUM MACELLUM (Fichtel and Moll) var. LIMBATUM (Chapman)

PLATE 11, FIGURES 9a, b

Polystomella macella (FICHEL and MOLL) var. *limbata* CHAPMAN, Journ. Quekett Micr. Club, ser. 2, vol. 10, p. 142, pl. 10, figs. 9a, b, 1907.

Chapman described this variety from off Australia. It has the umbilical region depressed, and the periphery subacute, but the sutures are raised. The only specimens we have that can be perhaps referred to this form are from 12 fathoms off Levuka, Fiji, and off Niau.

ELPHIDIUM ADVENUM (Cushman)

PLATE 12, FIGURES 1-3

Polystomella subnodosa H. B. BRADY (not Münster), Rep. Voy. Challenger, Zoology, vol. 9, p. 734, pl. 110, figs. 1a, b, 1884.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 203, 1901.—MILLETT, Journ. Roy. Micr. Soc., 1904, p. 604.—BAGG, Proc. U. S. Nat. Mus., vol. 34, p. 165, 1908.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 733, 1915.

Polystomella advena CUSHMAN, Carnegie Inst. Washington Publ. 311, p. 56, pl. 9, figs. 11, 12, 1922; Carnegie Inst. Washington Publ. 342, p. 48, 1924; Carnegie Inst. Washington Publ. 344, p. 80, 1926.

Elphidium advenum CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 7, p. 25, pl. 10, figs. 1, 2, 1930; Florida State Geol. Surv. Bull. 4, p. 40, pl. 7, figs. 7a, b, 1930.

Test equally biconvex, periphery acute, often with a narrow keel, and in the last-formed portion somewhat lobulate in side view, umbilical region usually with a small boss; chambers numerous, somewhat inflated, especially in the last-formed portion; sutures depressed, the retral processes in the later portion only about one-fourth the width of the chamber, in depressed channels above the sutures the intermediate portions raised; wall smooth, translucent, very finely perforate; aperture a series of rounded pores, at the base of the apertural face of the chamber. Diameter, up to 0.8 mm; thickness, 0.35 mm.

TABLE 28.—*Elphidium advenum*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|---------------|--------------------|------------------------|------------|
| 22277 | 2 | H3804 | Entrance to Ahii Lagoon, 2.5 miles SE. | Fathoms 1,208 | ° F. ----- | lt. gy. oz. glob. | Rare. |
| 22278 | 3 | H3840 | Lat. 17° 21' S., long. 149° 15' W. | 1,585 | ----- | vol. m. | Do. |

The figured specimens show the type of this species as developed in our material. It occurs most abundantly in shallow water from which we have specimens from Levuka, Fiji, 12 fathoms; Viva Anchorage, Fiji, 3 fathoms; Rotonga, 7 fathoms; and Makemo Lagoon, Paumotu Islands. Specimens from the last locality are very small, and may represent the young stages, and the few specimens from the two *Albatross* stations given in Table 28 are also very small and immature.

ELPHIDIUM ADVENUM (Cushman) DEPRESSULUM, new variety

PLATE 12, FIGURES 4a, b

Variety differing from the typical in the umbilical region, which is depressed and without a definite boss, occupied by a few large pits, the periphery more lobulate and much sharper, with a more distinct keel; chambers fewer, broader, and somewhat more inflated.

Holotype of variety.—Cushman Coll. No. 15670, from Vavau Anchorage, Tonga Islands.

It is common at the type locality, and also in 7 fathoms, Rotonga, and 3 fathoms, Viva Anchorage, Fiji. This variety seems to be rather easily distinguished in the collections we have had, and apparently is at least varietally distinct.

ELPHIDIUM RETICULOSUM, new species

PLATE 12, FIGURES 5a, b

Test compressed, umbilical region excavated, periphery broadly rounded, in side view the later portion strongly lobulate, no definite keel developed; chambers increasing in size as added, rather rapidly in the last-formed portion, and becoming much inflated; sutures distinct, depressed, especially in the later portion, retral processes in the early portion occupying a large part of the chamber width, in the later portion very much reduced in relative size on account of the great increase in the width of the chambers; wall ornamented by peculiar depressions of the surface, forming a very fine network or reticulation; aperture formed by numerous small pores at the base of the apertural face. Diameter, 0.55 mm; thickness, 0.18 mm.

Holotype.—Cushman Coll. No. 15671, from Vavau Anchorage, Tonga Islands, in 18 fathoms.

The species also occurs in typical form at Rotonga in 7 fathoms. The wall of this species is very peculiar in its ornamentation. It is a very fine network of irregular pattern entirely covering the inflated chambers. It is hardly to be confused with any other of the species from the South Pacific.

ELPHIDIUM SUBEVOLUTUM, new species

PLATE 12, FIGURES 6a, b

Test very strongly compressed, the early coils not covered as the test becomes evolute, periphery acute and distinctly keeled; chambers numerous, strongly inflated, of nearly uniform shape, and increasing only slightly in size as added, retral processes very narrow, occupying but a narrow band above the sutures, which are strongly depressed; wall smooth, finely perforate; aperture consisting of a few pores at the base of the apertural face, indistinct. Length, 0.5 mm; breadth, 0.45 mm; thickness, 0.12 mm.

Holotype.—Cushman Coll. No. 15672, from Rotonga, in 7 fathoms.

This species is abundant at this locality but was not found elsewhere. It is one of the few forms that is strongly evolute, and from this point of view is especially interesting.

ELPHIDIUM OCEANICUM, new species

PLATE 12, FIGURES 7a, b

Polystomella sp. (?) CUSHMAN, Carnegie Inst. Washington Publ. 342, p. 49, pl. 16, fig. 5, 1924.

Test rather small, nearly circular in side view, periphery broadly rounded, umbilical region depressed, and often with an irregularly raised pattern; chambers distinct, very slightly inflated, of uniform shape and increasing very slightly in size as added, usually 9 to 12 in number; sutures slightly depressed, the retral processes very distinct, but occupying only a narrow band above the sutures; wall translucent, very finely perforate; aperture consisting of one or more openings at the base of the apertural face. Diameter, 0.35–0.45 mm; thickness, 0.12–0.15 mm.

Holotype.—Cushman Coll. No. 15673, from Levuka, Fiji, in 12 fathoms.

This is a small species, but hardly to be confused with any other in the region. This species was figured without a name from Samoa in the above reference. It is apparently a species of shoal water, and besides the record from Samoa we have it in the present collections from 3 fathoms, Viva Anchorage, Fiji; 12 fathoms, Levuka, Fiji, the type locality; 12 fathoms off Nairai, Fiji; Mokaumar Anchorage, Fiji; and Vavau Anchorage, Tonga Islands, 18 fathoms.

ELPHIDIUM SIMPLEX, new species

PLATE 12, FIGURES 8, 9

Test nearly circular in side view, periphery rounded, becoming very slightly lobulated in the later portion in side view, umbilical region occupied by a large flat boss; chambers numerous, distinct, 10 to 12 in the last-formed coil, of rather uniform shape, increasing

very slightly in size as added, the later ones slightly inflated; sutures distinct, depressed, rather strongly curved, retral processes often indistinct, but usually visible, especially in the later chambers; aperture one or more openings at the base of the apertural face. Length, up to 0.55 mm; breadth, 0.45 mm; thickness, 0.15 mm.

Holotype.—Cushman Coll. No. 15674, from Vavau Anchorage, Tonga Islands.

This species is one of the commonest ones, and often occurs abundantly. I have specimens from the type locality and from 12 fathoms, Levuka, Fiji; 12 fathoms off Nairai, Fiji; 3 fathoms, Viva Anchorage, Fiji; and from off Rotonga in 7 fathoms. This species is a rather simple primitive form in which the retral processes are very slightly developed. It is so abundant at some of the stations that it is to be suspected that it is a characteristic Indo-Pacific species.

Genus OZAWAIA Cushman, 1931

Ozawaia CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 7, p. 80, 1931.

Genoholotype.—*Ozawaia tongaensis* Cushman.

Test free, in the early stages planispiral, compressed, later uncoiling and becoming circular in transverse section, bilaterally symmetrical; sutures marked by retral processes both in the early stages and in the adult; wall calcareous, finely perforate; aperture in the early stages made up of numerous pores at the base of the apertural face, in the adult a series of rounded pores in the terminal face in the last-formed chamber. Recent.

OZAWAIA TONGAENSIS Cushman

PLATE 12, FIGURES 10-12

Polystomella crispa MILLETT (not Linnaeus), Journ. Roy. Micr. Soc., 1904, p. 603, pl. 11, fig. 2.

Ozawaia tongaensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 7, p. 80, pl. 10, figs. 7-10, 1931.

Test in the early stages close coiled, almost completely involute, somewhat keeled and with a distinct boss in the umbilical region; chambers distinct, inflated, in the early portion much compressed, in the uncoiled portion almost circular in transverse section; sutures distinct, depressed, rather strongly curved, retral processes short, but numerous and distinct; aperture in the coiled portion at the base of the apertural face, later becoming numerous rounded pores in the terminal face of the chamber in the uncoiled portion. Length, up to 0.6 mm; breadth, 0.35 mm; thickness, 0.15 mm.

This is evidently the same species that Millett figured from the Malay Archipelago in the above reference. It is very abundant at Vavau Anchorage, Tonga Islands, from which station it was origi-

nally described. Specimens less well developed but having the characteristic early stages and showing slight tendencies of becoming uniserial were found at Viva Anchorage, 3 fathoms, and Rotonga, 7 fathoms.

This species is a unique one, although from the records it is probably to be looked for as widely distributed in the Indo-Pacific region in shallow water. It represents the only attempt of this group, represented typically by *Elphidium*, to assume an uncoiled form, and is evidently a very recent development in the history of this family.

Family CAMERINIDAE

Subfamily CAMERININAE

Genus OPERCULINELLA Yabe, 1918

Operculinella YABE, Sci. Rep. Tohoku Univ., ser. 2 (Geol.), vol. 4, p. 126, 1918. Synonyms: *Amphistegina* W. B. CARPENTER, 1859 (not d'Orbigny); *Nummulites* H. B. BRADY, 1884 (not Lamarck).

Genoholotype.—*Amphistegina cumingii* W. B. Carpenter.

Test lenticular and involute in the young, bilaterally symmetrical, in the adult with a broadly flaring complanate border; chambers simple; aperture at the base of the apertural face, median. Late Tertiary and Recent.

OPERCULINELLA VENOSA (Fichtel and Moll)

PLATE 18, FIGURES 2-6

Nautilus venosus FICHEL and MOLL, Test. Micr., p. 59, pl. 8, figs. e-h, 1798.

Nummulites venosa CHAPMAN, Proc. Zool. Soc. London, 1895, p. 47.

Operculina venosa CHAPMAN, Proc. Roy. Soc. Victoria, vol. 26, p. 173, 1913.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 383, 1921.

Amphistegina cumingii CARPENTER, Philos. Trans., 1859, p. 32, pl. 5, figs. 13-17.

Nummulites cumingii H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 749, pl. 112, figs. 11-13; woodcut, fig. 22, 1884.—CUSHMAN, U. S. Nat.

Mus. Bull. 71, pt. 4, p. 39, pl. 14, fig. 6, 1914.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 739, 1915.

Operculinella cumingii YABE, Sci. Rep. Tohoku Imp. Univ., ser. 2 (Geol.), vol. 4, p. 126, pl. 17, figs. 8-12, 1918.

Operculinella venosa CUSHMAN, Carnegie Inst. Washington Publ. 342, p. 50, pl. 17, fig. 7, 1924.

Test free, involute, biconvex, early portion thick, later portion making a wide, thin flange about the central portion; sutures fairly distinct; supplementary canal system well developed; edge of test carinate in the flangelike portion.

The only specimens which can be referred to this species in the present collections are from off Levuka, Fiji, in 12 fathoms, and at Vavau Anchorage, Tonga Islands, in 18 fathoms. This form is rather common at both these localities, but none of the specimens are fully developed, and they do not seem quite typical. It is widely

recorded in the Indo-Pacific, and in the Philippine region, for example, reaches very large size. It was very rare in the material from Samoa, so that its range may be much more limited than seems probable from the numerous records of its occurrence.

Genus OPERCULINA d'Orbigny, 1826

Operculina D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 281, 1826.

Synonyms: *Nautilus* (part) of authors; *Lenticulites* (part) DEFRANCE, 1822; *Amphistegina* (part) D'ORBIGNY, 1826; *Nonionina* (part) WILLIAMSON, 1852; *Nummulina* (part) PARKER and JONES, 1865.

Genotype.—By designation, *Lenticulites complanata* DeFrance.

Test bilaterally symmetrical, planispiral, complanate, usually all the coils visible from the exterior, earlier coils sometimes involute; wall calcareous, perforate, smooth or ornamented with bosses; aperture single, at the base of the apertural face, median. Lower Cretaceous to Recent.

There are numerous specimens of *Operculina* from the various shallow-water collections. Specimens are not always so abundant as one would wish, on account of the limited material, but they seem to show, as was found in the collections from Samoa and particularly those from the Philippine region previously studied, that there are probably numerous localized species or varieties that with an extensive study of the shoal-water material of the Pacific may be found to have very definite distributions. It has usually been the custom to follow Brady's *Challenger* Report, and refer the smooth forms to *Operculina complanata*, and those which have beads and bosses on the surface to var. *granulosa*. That such a simple arrangement does not represent the true condition of the forms is apparent to anyone who has studied any quantity of material from the Indo-Pacific where this genus is still a common one. We have referred our material to two species, one of which is rather large, somewhat inflated in the middle, and while it is somewhat beaded in the early stages has the sutures limbate and entire in the later portion. The other form is marked by a depressed center in many cases, and there are large beads or bosses as a dominant feature of the ornamentation. A number of the forms are figured, but left under these two names until someone may have the opportunity to study in further detail the Indo-Pacific species of *Operculina*.

OPERCULINA GAIMAIRDII d'Orbigny

PLATE 13

Operculina gaimairdii D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 281, no. 5, 1826.—FORNASINI, Boll. Soc. Geol. Ital., vol. 22, pl. 14, fig. 4, 1903.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 375, 1921; Carnegie Inst. Washington Publ. 342, p. 50, pl. 17, fig. 4, 1924.

Test of medium size, much compressed, complanate, opaque; chambers numerous, curved; sutures distinct, the peripheral keel distinct, central area somewhat enlarged in megalospheric specimens, the rest of the test marked by chains of beads along the sutures, the intermediate areas smooth and unornamented. Diameter, up to 4 mm; thickness, 1.5 mm.

D'Orbigny originally described this species from Rawack. I had material from the Philippines and from Samoa which was referred to this same species. D'Orbigny's original figure later published by Fornasini shows a somewhat flattened test with beads along all the sutures, and this form which we figured may be found to be distinct when a study of d'Orbigny's types is made. The form figured has occurred at the following localities in shoal water: Mokaujar Anchorage, abundant; and 12 fathoms, Nairai, Fiji, common. There is a single specimen also from *Albatross* Station H3983, entrance to South Pass, Rongelap, $\frac{1}{2}$ mile north, in 400 fathoms, but this is small and not well developed.

OPERCULINA GRANULOSA (Leymerie) (?)

PLATES 14, 15; PLATE 16, FIGURES 1-3

As already noted, under this name have provisionally been placed all those forms which have in their ornamentation beads or bosses on the surface predominating either in part or in the whole specimen. There is a considerable range of variation in these as will be seen by the figures given. It has seemed best to make this disposal of this series rather than to complicate the literature with names based upon insufficient material or at least insufficient study. It may be remarked that the series from Rotonga has a very deep spiral suture, and the chambers show no tendency to becoming elongate, while those from Guam, for example, have the spiral suture very slightly depressed, and later chambers tend to become flattened and more elongate. Other localities show similar distinctive features, and it is probable that several species are really represented in this rather wide area. Specimens, except in one instance, are all from shoal water as follows: 12 fathoms off Levuka, Fiji; 3 fathoms, Viva Anchorage, Fiji; 12 and 24 fathoms off Nairai, Fiji; Mokaujar Anchorage, Fiji; 7 fathoms, Rotonga; 18 fathoms, Vavau Anchorage, Tonga Islands; and 21 fathoms, Guam Anchorage, Ladrone Islands. There are a few specimens from *Albatross* Station H3992, Schischmarev Pass, Wotje, 1 mile N., in 482 fathoms.

Genus HETEROSTEGINA d'Orbigny, 1826

Heterostegina D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 305, 1826.

Genotype.—By designation, *Heterostegina depressa* d'Orbigny.

Test similar to *Operculina*, the early chambers simple, later ones divided into chamberlets; aperture consisting of a row of rounded openings on the narrow apertural face. Eocene to Recent.

The same remarks already made under *Operculina* will apply almost equally well to this genus, although the range of variation does not seem to be so great, and the specimens fall more easily into a few distinct groups. It is rather striking that so many of the species are from *Albatross* stations, which may indicate that *Heterostegina curva* at least is represented in fairly deep water. There is always the possibility, however, that these may have been carried out by currents or wave action, and represent specimens which have been filled with air on dried beaches, and therefore float for some time until they are again picked up by waves.

HETEROSTEGINA DEPRESSA d'Orbigny

PLATE 16, FIGURES 4-9

Heterostegina depressa D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 305, no. 2, pl. 17, figs. 5-7, 1826; Modèles no. 99, 1826.—PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 3, vol. 16, p. 34, pl. 3, fig. 100, 1865.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 746, pl. 112, figs. 14-20, 1884.—EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 433, pl. 20, figs. 34, 35, 1893.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 18, pl. 3, figs. 6, 7, 1900.—MILLETT, Journ. Roy. Micr. Soc., 1904, p. 606.—RHUMBLER, Zool. Jahrb., Abt. Syst., vol. 24, p. 74, 1906.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 4, p. 38, pl. 19, fig. 5, 1914.—CHAPMAN, Biol. Results *Endeavour*, vol. 3, pt. 1, p. 33, 1915.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 738, 1915.—CUSHMAN, Carnegie Inst. Washington Publ. 213, p. 289, 1918.—HERON-ALLEN and EARLAND, Journ. Linn. Soc. Zool., vol. 35, p. 641, 1924.—YABE and HANZAWA, Sci. Rep. Tohoku Imp. Univ., ser. 2 (Geol.), vol. 14, p. 43, pl. 2, fig. 4; pl. 13, fig. 7 (part), 1930.

Test complanate, the early portion usually somewhat involute and thickened, later portion very thin and flaring, early chambers only slightly divided, becoming increasingly so in the later ones, periphery thin and rounded with a slight specialized border such as is frequent in this and the preceding genus; chambers elongate, curved, numerous, divided into chamberlets by transverse partitions usually alternating in adjacent chambers, the division into chamberlets first appearing on the periphery and progressively working farther and farther in toward the central portion as growth progresses; sutures distinct, slightly limbate, not raised but occasionally very slightly depressed in the adult, strongly curved, often somewhat sigmoid; aperture at the base of the final chamber together with a series of pores along the apertural face. Length, up to 2.5 mm; breadth, 1.85 mm; thickness, 0.35 mm.

This species has been recorded from numerous localities particularly in the Indo-Pacific. It is found at only a few stations in our material,

and there occurs as rare specimens only; 21 fathoms, Guam Anchorage, Ladrone Islands; 18 fathoms, Vavau Anchorage, Tonga Islands; and Makemo Lagoon, Paumotu Islands. I also have specimens from three *Albatross* stations in deeper water, as shown in Table 29.

TABLE 29.—*Heterostegina depressa*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|----------------|--------------------|-----------------------|------------|
| 22281 | 1 | H3855 | Northwest point of Apataki, 1 mile SE. | Fathoms 654 | ° F. 38.8 | crs. co. s.----- | Rare. |
| 22284 | 1 | H3891 | Lat. 16° 30' S., long. 143° 41' W. | 540 | 39.7 | co. s. pter. oz.----- | Do. |
| 22307 | 1 | H3849 | Village west side of Niau Atoll, 1.75 miles NE. | 491 | ----- | -----do.----- | Do. |

HETEROSTEGINA SUBORBICULARIS d'Orbigny

PLATE 17, FIGURES 6a, b

Heterostegina suborbicularis D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 305, 1826.—FORNASINI, Boll. Soc. Geol. Ital., vol. 22, pl. 14, fig. 6, 1903.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 385, 1921; Carnegie Inst. Washington Publ. 342, p. 51, 1924.

Test free, central portion thickened and involute, peripheral portion thin, especially toward the periphery, subdivisions of the chambers not appearing until the flange is developed; wall smooth. Diameter, up to 2.5 mm; thickness, 1 mm.

This species was described by d'Orbigny from the Sandwich Islands, and another form of the species from the Marianas and from Port Jackson. I have also recorded it from the Philippines and from Samoa. In the present collections the only specimens are from *Albatross* stations, data for which are given in Table 30. In these specimens the umbonate region is very strongly convex, while in the following species it is broad and flattened although the entire central portion is also somewhat thickened.

TABLE 30.—*Heterostegina suborbicularis*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|---|-------|--------------------|----------------------|------------|
| 22282 | 1 | H3857 | Center Tikei Island, ½ mile E. | 360 | ° F. ----- | crs. co. s.----- | Rare. |
| 22285 | 1 | H3885 | Southwest point of Takume Atoll, 1.5 mile NE. | 572 | 38.7 | -----do.----- | Do. |
| 22365 | 1 | H3814 | Lat. 15° 14' 10'' S., long. 147° 51' 5" W. | 391 | ----- | wh. co. s. sh. glob. | Do. |

HETEROSTEGINA CURVA Moebius

PLATE 17, FIGURES 1-5

Heterostegina curva MOEBIUS, Merresfauna Insel Mauritius, p. 105, pl. 13, figs. 1-6, 1880.—EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, p. 434, pl. 20, figs. 26-33, 1893.

Test strongly lenticular in edge view, rather rapidly flaring in side view, the central portion much thickened but smooth and not umbonate, periphery much compressed, rounded; chambers distinct, except

TABLE 31.—*Heterostegina curva*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|---------|--------------------|------------------------------|------------|
| | | | | Fathoms | ° F. | | |
| 22283 | 1 | H3814 | Lat. 15° 14' 10" S., long. 147° 51' 5" W. | 391 | ----- | wh. co. s. sh. glob.. | Rare. |
| 22286 | 3 | H3815 | Lat. 15° 15' S., long. 147° 51' 35" W. | 524 | ----- | wh. co. s. brk. sh.. | Do. |
| 22287 | 2 | H3834 | West coast of Makatea Island, 1.3 miles E. | 581 | ----- | crs. wh. co. s. | Do. |
| 22288 | 3 | H3849 | Village west side of Niau Atoll, 1.75 miles NE. | 491 | ----- | co. s. pter. oz. | Do. |
| 22289 | 6 | H3855 | Northwest point of Apataki, 1 mile. SE. | 654 | 38.8 | crs. co. s. | Few. |
| 22290 | 10+ | H3857 | Center Tikei Island, ½ mile E. | 360 | ----- | do. | Abundant. |
| 22291 | 1 | H3858 | Ngarua Pass, Fakarava Atoll, 28° S., 1 mile E. | 599 | ----- | do. | Rare. |
| 22292 | 3 | H3875 | Southwest point of Tahanae, about ½ mile offshore, 3 miles NE. | 269 | ----- | do. | Do. |
| 22293 | 4 | H3876 | Northwest entrance Makemo Lagoon, 1 mile SE. | 467 | ----- | wh. co. s. | Few. |
| 22294 | 3 | H3885 | Southwest point of Takume Atoll, 1.5 miles NE. | 572 | 38.7 | crs. co. s. | Rare. |
| 22295 | 10 | H3891 | Lat. 16° 30' S., long. 143° 41' W. | 540 | 39.7 | co. s. pter. oz. | Common. |
| 22296 | 6 | H3898 | Northwest point of Hikuera Atoll, ½ mile E. | 348 | 43.8 | co. s. brk. sh. | Do. |
| 22297 | 2 | H3905 | Northwest point of Hao Atoll, ½ mile SE. | 425 | 42.0 | crs. co. s. | Rare. |
| 22298 | 1 | H3909 | Aki Aki Atoll, 5 miles E. | 1,364 | 35.6 | glob. mang. | Do. |
| 22299 | 2 | H3910 | Southwest point of Aki Aki Atoll, 1 mile E. | 377 | 43.0 | co. s. | Do. |
| 22300 | 2 | H3916 | Pinaki Atoll, 1 mile E. | 486 | 41.0 | crs. co. s. pter. oz. .. | Do. |
| 22301 | 3 | H3926 | Midway between Nukutipipi and Anu Anurunga. | 1,609 | 35.5 | co. s. mang. glob.. | Do. |
| 22302 | 1 | H3927 | Anu Anurunga, 1 mile W. | 574 | 39.0 | crs. co. s. mang. pter. oz. | Do. |
| 22303 | 1 | H3930 | Anu Anuraro Atoll, ¾ mile NW. | 438 | 40.7 | co. s. | Do. |
| 22304 | 1 | H3931 | Anu Anuraro Atoll, ½ mile SE. | 405 | 42.5 | co. s. pter. oz. mang. part. | Do. |
| 22305 | 1 | H3936 | Hereheretue Atoll, 0.3 mile E.. | 189 | 62.1 | co. s. mang. part.. | Do. |
| 22306 | 3 | H3967 | Monument, west shore of Maraki Atoll, 56° S., ½ mile E. | 431 | ----- | ----- | Do. |

in the middle portion, where they are more or less indistinct on account of the thickening of the test, very strongly curved, divided into chamberlets progressively from the peripheral end; sutures distinct, slightly limbate, very strongly curved, slightly sigmoid toward the inner end. Diameter, up to 2.5 mm; thickness, 0.45 mm.

Moebius described this species from shallow-water material from Mauritius, and Egger records it from off West Australia. Most of the material we have can be definitely assigned to this species. Strangely enough all the specimens came from *Albatross* stations in the deeper water, and no typical specimens were found in the shoal-water material off any of the islands. The species is very distinctive in the considerable thickening of the central portion into a lenticular mass bordered by the thinner flange.

Genus *CYCLOCLYPEUS* W. B. Carpenter, 1856

Cycloclypeus W. B. CARPENTER, Philos. Trans., 1856, p. 555.

Genotype.—By designation, *Cycloclypeus carpenteri* H. B. Brady.

Test in the microspheric form like *Heterostegina* in the early stages, later with the chambers becoming annular, divided by radial portions into rectangular chamberlets, the test discoidal and much compressed. Miocene to Recent.

CYCLOCLYPEUS GUEMBELIANUS H. B. Brady

PLATE 18, FIGURES 1a, b

Cycloclypeus W. B. CARPENTER, Philos. Trans., vol. 146, p. 555, pl. 30, figs. 1, 3, 1856; *Introd. Foram.*, p. 292, 1862.

Cycloclypeus guembelianus H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, p. 66, 1881; *Rep. Voy. Challenger*, Zoology, vol. 9, p. 751, pl. 111, figs. 8a, b (young form), 1884.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 386, 1921.

Cycloclypeus carpenteri H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, p. 67, 1881; *Rep. Voy. Challenger*, Zoology, vol. 9, p. 751, 1884.—LISTER, Philos. Trans., vol. 186B, pp. 437, 438, pl. 9, figs. 52-54, 1895.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 22, pl. 2, figs. 6, 7; pl. 3, figs. 1-5, 1900.

There is a single specimen in the collections from *Albatross* Station H3876, northwest entrance to Makemo Lagoon, 1 mile SE., in 467 fathoms.

Family PENEROPLIIDAE

Subfamily SPIROLININAE

Genus *PENEROPLIS* Montfort, 1808

Peneroplis MONTFORT, Conch. Syst., vol. 1, p. 259, 1808.

Synonym: *Coscinospira* EHRENBURG, 1840.

Genoholotype.—*Peneroplis lanatus* Montfort = *Nautilus planatus* Fichtel and Moll.

Test, free, planispiral, close coiled in the young, usually involute, in the adult becoming variously shaped, close coiled, flaring, annular

or commencing to uncoil; chambers undivided; wall calcareous, imperforate except in the proloculum and sometimes the following chamber; aperture simple, at the base of the apertural face, or long and slitlike, occasionally divided. Cretaceous (?) Tertiary and Recent.

This is the oldest and most primitive genus of this group, and from it by modifications the other genera have been derived.

PENEROPLIS PLANATUS (Fichtel and Moll)

PLATE 19, FIGURES 1-3

Nautilus (Lituus) arietinus BATSCH (in part), Conch. Seesandes, p. 4, pl. 6, figs. 15a, b, 1791.

Nautilus planatus var. β , FICHEL and MOLL, Test. Micr., p. 91, pl. 16, figs. d, e, f, 1803.

Peneroplis planatus MONTFORT, Conch. Syst., vol. 1, p. 258, 65° genre, 1808.

Cristellaria planata LAMARCK, Tableau Encycl. Meth., pl. 467, figs. 1a-c, 1816.

Cristellaria dilatata LAMARCK, Tableau Encycl. Meth., pl. 467, figs. 2a-c, 1816.

Peneroplis planatus D'ORBIGNY, Ann. Sci. Nat., vol. 7, p. 285, no. 1, 1826; Modèles no. 16, 1826.—WILLIAMSON, Rec. Foram. Great Britain, p. 45, pl. 3, figs. 84, 85, 1858.—SCHLUMBERGER, Feuille Jeunes Nat., vol. 12, pl. 1, fig. 13, 1881.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 204, pl. 13, fig. 15, 1884.—JONES, Foram. Crag, pt. 2, p. 133, pl. 6, fig. 5, 1895.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 601, 1915.—CUSHMAN, U. S. Nat. Mus. Bull. 100, vol. 4, p. 481, 1921.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 22, p. 69 (list), 1926.—CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 7, p. 39, pl. 14, figs. 6, 7, 1930; Contr. Cushman Lab. Foram. Res., vol. 7, p. 71, pl. 9, figs. 17, 18, 1931.

Peneroplis pertusus var. *planatus* A. SILVESTRI, Atti Accad. Sci. Acireale, vol. 7, p. 42, 1895-96.—DAKIN, Rep. Pearl Oyster Fish. Ceylon, 1906, p. 231.—BAGG, Proc. U. S. Nat. Mus., vol. 34, p. 124, 1905.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, no. 16, p. 7, 1910.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 6, p. 87, pl. 37, fig. 3, 1917; Carnegie Inst. Washington Publ. 213, p. 290, 1918.

Test much compressed, the early portion coiled planispirally but often partially evolute, later portion very much complanate and spreading out, reaching back on both sides toward the earlier chambers, but not entirely embracing; chambers distinct, very slightly inflated, broad and low; sutures distinct, depressed, occasionally somewhat limbate; wall very distinctly striate, the striae numerous and nearly parallel to the periphery; apertures along the median line of the narrow apertural face. Length, 1.1 mm; breadth, 0.85 mm; thickness, 0.12 mm.

This is particularly a species of the Mediterranean and Indo-Pacific, and is the only representative of the genus in the material examined, most of the other forms appearing to be *Peneroplis* being only young stages of *Spirolina*.

The species is recorded in our material from off Fiji, 40-50 fathoms; Mokuajar Anchorage, Fiji; 12 fathoms off Levuka, Fiji; 12 fathoms off

Nairai, Fiji; 18 fathoms, Vavau Anchorage, Tonga Islands; and 7 fathoms, Rotonga.

Genus *SPIROLINA* Lamarck, 1804

Spirolina LAMARCK, Ann. Mus., vol. 5, p. 244, 1804.

Synonym: *Peneroplis* (part) of authors.

Genotype.—By designation, *Spirolina cylindracea* Lamarck.

Test similar to *Peneroplis*, thick, early chambers close coiled, usually not completely involute, later ones uncoiled; aperture rounded, terminal. Cretaceous (?) to Recent.

SPIROLINA ARIETINA (Batsch)

PLATE 19, FIGURES 4, 5

Nautilus (Lituus) arietinus BATSCH (in part), Conch. Seesandes, p. 4, pl. 6, fig. 15c, 1791.

Peneroplis arietinus PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 3, vol. 16, p. 26, pl. 1, fig. 18, 1865.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 204, pl. 13, figs. 18, 19, 22, 1884.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, pp. 179, 207 (list), 1901, p. 400 (list), 1902.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 602, 1915.—CUSHMAN, 13th Ann. Rep. Florida Geol. Survey, p. 62, 1921; U. S. Nat. Mus. Bull. 100, vol. 4, p. 482, 1921; Proc. U. S. Nat. Mus., vol. 59, p. 75, pl. 18, fig. 10, 1921.—HERON-ALLEN and EARLAND, Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 125.—CUSHMAN, Carnegie Inst. Washington Publ. 311, p. 79, 1922.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 22, p. 69 (list), 1926.

Peneroplis pertusus var. *arietinus* WOODWARD, The Observer, vol. 4, p. 77, 1893.—A. SILVESTRI, Atti Accad. Sci. Acireale, vol. 7, p. 42, 1895-96.—DAKIN, Rep. Pearl Oyster Fish. Ceylon, 1906, p. 231.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1909, p. 319.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, no. 16, p. 7, 1910.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 6, p. 88, pl. 36, fig. 2; pl. 37, fig. 5, 1917; Carnegie Inst. Washington Publ. 213, p. 290, 1918.

Spirolina arietina CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 7, p. 43, pl. 15, figs. 4, 5, 1930.

Test in the early portion close coiled but not completely involute, somewhat compressed, later portion uncoiling and the chambers broadly elliptical in transverse section; chambers distinct, the later ones slightly inflated; sutures distinct, earlier ones often slightly raised, somewhat limbate, later ones narrow and slightly depressed; wall longitudinally striate; aperture consisting of a series of independent pores in the central portion of the apertural face.

This is a common species in the Mediterranean and Indo-Pacific, and I have seen it rare in the West Indian region. The early stages are very similar to forms which have been often referred to *Peneroplis pertusus* (Forskål). Specimens showing the uncoiling well developed are not common in our material, but a few occur to connect the young coiled stages with the adult. All the specimens but one are from

shallow-water collecting as follows: Viva Anchorage, Fiji, 3 fathoms; Vavau Anchorage, Tonga Islands, 18 fathoms; Rangiroa; 7 fathoms, Rotonga; Rutavu; Makemo Lagoon, Paumotu Islands; off Hereheretue; and Port Lotten, Kersail, Marshall Islands. There is a single specimen from *Albatross* Station H3983, entrance to South Pass, Rongelap, $\frac{1}{2}$ mile N., in 400 fathoms.

SPIROLINA ACICULARIS (Batsch)

PLATE 19, FIGURES 6, 7

Test very elongate, slender, very slightly tapering, initial end closely coiled consisting of a few chambers, the diameter of which is usually slightly greater than the succeeding uncoiled chambers, early portion somewhat compressed, later uncoiled portion usually circular in transverse section, coiled portion occupying but a very small part of the entire test; chambers distinct, those of the early coiled portion not inflated, later ones much inflated and increasing somewhat in relative length as added; sutures in the early coiled portion distinct, strongly limbate, later ones depressed; wall especially in the later uncoiled portion marked by longitudinal costae which often become slightly beaded; aperture in the adult terminal, sometimes with a slight neck. Length, up to 2 mm; diameter, 0.1–0.18 mm.

There are numerous specimens especially in shallow water which seem to be referable to Batsch's species. There seems to be some question as to whether some of these specimens may really belong to the genus *Monalysidium*. The ornamentation is not so markedly beaded as in *Monalysidium*. Specimens are fairly abundant about Fiji, 40–50 fathoms; 12 fathoms, Levuka; Mokaujar Anchorage; 12 fathoms, Nairai. Specimens occur in fewer numbers in 18 fathoms, Vavau Anchorage, Tonga Islands; 7 fathoms, Rotonga; and very small specimens in Makemo Lagoon, Paumotu Islands.

Genus MONALYSIDIUM Chapman, 1900

Monalysidium CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 3, 1900 (as a subgenus of *Peneroplis*).

Genotype.—By designation, *Monalysidium sollasi* Chapman.

Test with the early chambers close coiled, later ones uncoiled in a rectilinear series; wall imperforate, smooth or with vertical rows of minute tubercles; aperture circular, terminal, sometimes with a short neck or lip. Recent.

MONALYSIDIUM POLITUM Chapman

PLATE 19, FIGURES 8, 9

Peneroplis lituus H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 205, pl. 13, figs. 24, 25 (?), 1884.

Peneroplis (Monalysidium) polita CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 4, pl. 1, fig. 5 (?), 1900.

Monalysidium politum HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 603, text-fig. 43G, 1915.—CUSHMAN, Carnegie Inst. Washington Publ. 311, p. 80, pl. 13, fig. 4, 1922; Publ. 344, p. 84, 1926; U. S. Nat. Mus. Bull. 104, pt. 7, p. 44, pl. 15, figs. 11, 12, 1930.

There are a very few specimens from scattered stations evidently belonging to this species described by Chapman. None of the specimens show the coiled early stages. The surface of the test is ornamented by beads arranged in longitudinal lines, and the apertural end usually has a distinct neck. All the specimens are from shallow-water stations as follows: Mokaujar Anchorage, Fiji; 12 fathoms, Levuka, Fiji; 12 fathoms, Nairai, Fiji; 7 fathoms, Rotonga; 18 fathoms, Vavau Anchorage, Tonga Islands; and Makemo Lagoon, Paumotu Islands.

Subfamily ORBITOLITINAE

Genus SORITES Ehrenberg, 1840

Sorites EHRENBURG, Abh. Akad. Wiss. Berlin, 1838, p. 134, 1840.

Synonym: *Orbitolites* (part) of authors (not Lamarck).

Genotype.—By designation, *Sorites dominicensis* Ehrenberg.

Test discoid, planispiral in the early stages at least of the microspheric form, later annular, completely divided into chamberlets, typically in a single layer, those of each annular chamber communicating with the adjacent ones as with those of the preceding and succeeding annular chambers; wall imperforate except in the very early chambers; apertures confined to a narrow band along the middle of the periphery. Miocene to Recent.

SORITES MARGINALIS (Lamarck)

Orbulites marginalis LAMARCK, Syst. Anim. sans Vert., vol. 2, p. 196, no. 1, 1816.

Orbitolites marginalis W. B. CARPENTER, Philos. Trans., vol. 174, p. 560, fig. 1 (in text), 1883; Rep. Voy. *Challenger*, "Orbitolites," p. 20, pl. 3, figs. 1-7; pl. 4, figs. 1-5, 1883.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 214, pl. 15, figs. 1-5, 1884.—FLINT, U. S. Nat. Mus. Ann. Rep. for 1897, p. 304, pl. 50, fig. 2; pl. 51, fig. 1, 1899.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 6, p. 92, pl. 38, figs. 1, 2, fig. 47 (in text), 1917.

Sorites marginalis CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 7, p. 49, pl. 18, figs. 1-4, 1930.

Test thin, much compressed, circular in outline in the adult, the whole test composed of a single layer of chambers, each with a single layer of chamberlets throughout, early chambers in a spiral, later extending back, finally meeting and in most of the chambers forming annuli; aperture consisting of a single row of pores along the periphery of the test.

This species is not so common in our material as it is in the West Indies, occurring commonly only at two or three of the stations in

the Fiji Islands. The distribution is as follows: Levuka, Fiji, 12 fathoms; off Nairai, Fiji, 12 fathoms; Mokaujar Anchorage, Fiji; Vavau Anchorage, Tonga Islands, 18 fathoms; Makemo Lagoon, Paumotu Islands; Rongelap Atoll, Marshall Islands; and 21 fathoms, Guam Anchorage, Ladrone Islands. Single, small, partially developed specimens occurred at *Albatross* Stations H3843, Point Venus, Tahiti Island, 55° S., 3.8 miles E., in 807 fathoms, and H3935, Hereheretue Atoll, 1 mile W., in 594 fathoms.

Genus AMPHISORUS Ehrenberg, 1840

Amphisorus EHRENBURG, Abh. Akad. Wiss. Berlin, 1838, p. 130, 1840.

Synonym: *Orbitolites* (part) of authors (not Lamareck).

Genoholotype.—*Amphisorus hemprichii* Ehrenberg.

Test discoid, planispiral in the early stages at least of the microspheric form, later annular, completely divided into chamberlets, typically in two layers, those of each annular chamber communicating with the adjacent ones of the preceding and succeeding annular chambers and those of the two layers communicating; wall imperforate except in the very early chambers; apertures in a double alternating line along the periphery. Miocene to Recent.

AMPHISORUS HEMPRICHII Ehrenberg

Amphisorus hemprichii EHRENBURG, Abh. Akad. Wiss. Berlin, 1838, p. 134, pl. 3, fig. 3, 1840.—CUSHMAN, U. S. Nat. Mus. Bull. 104, pt. 7, p. 51, pl. 18, figs. 5-7, 1930.

"*Orbitolites*, duplex type," W. B. CARPENTER, Philos. Trans., vol. 146, p. 120, pl. 5, fig. 10; pl. 9, fig. 10, 1856.

Orbitolites duplex W. B. CARPENTER, Rep. Voy. *Challenger*, Zoology, pt. 21, p. 25, pl. 3, figs. 8-14; pl. 4, figs. 6-10; pl. 5, figs. 1-13, 1883.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, p. 216, pl. 16, fig. 7, 1884.—W. B. CARPENTER, Journ. Quekett Micr. Club, ser. 2, vol. 2, p. 97, fig. 9 (in text), 1885.—WOODWARD, The Observer, vol. 4, p. 77, 1893.—FLINT, U. S. Nat. Mus. Rep. for 1897, p. 305, pl. 51, figs. 2, 3, 1899.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 28, p. 400 (list), 1902.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 48, no. 5, p. 23, 1904.—DAKIN, Rep. Pearl Oyster Fish. Ceylon, 1906, p. 232.—RHUMBLER, Zool. Jahrb., Abt. Syst., vol. 24, p. 53, 1906.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, no. 16, p. 7, 1910.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 605, 1915.—CUSHMAN, U. S. Nat. Mus. Bull. 71, pt. 6, p. 94, pl. 38, figs. 3, 4; pl. 39, fig. 1, 1917; Carnegie Inst. Washington Publ. 213, p. 290, 1918; Carnegie Inst. Washington Publ. 291, p. 70, pl. 5, figs. 9, 10, 1919; Proc. U. S. Nat. Mus., vol. 59, p. 77, 1921; U. S. Nat. Mus. Bull. 100, vol. 4, p. 485, 1921.—HERON-ALLEN and EARLAND, Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 125.—CUSHMAN, Carnegie Inst. Washington Publ. 311, p. 81, 1922; Publ. 342, p. 71, 1924.—HERON-ALLEN and EARLAND, Journ. Linn. Soc. Zool., vol. 35, p. 610, 1924.—CUSHMAN, Carnegie Inst. Washington Publ. 344, p. 84, 1926.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 22, pt. 1, p. 69 (list), 1926.

Test much compressed, circular in outline, the early chambers in the microspheric form coiled planispirally, soon widening and becoming annular, in the megalospheric form the annular chambers beginning at once after the large rounded or oval proloculum; chambers in two layers in the adult, and each divided into many chamberlets, the chamberlets of each newly added series alternating with those of the preceding series; wall imperforate except in the proloculum and succeeding chamber which are finely porous; apertures at the periphery of the chamberlets in a double series as are the chamberlets.

TABLE 32.—*Amphisorus hemprichii*—material examined

| U.S.N.M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temperature | Character of bottom | Occurrence |
|--------------|---------------------|-------------------|--|----------------|--------------------|-----------------------------|------------|
| | | | | <i>Fathoms</i> | <i>° F.</i> | | |
| 22312 | 1 | H3834 | West coast of Makatea Island, 1.3 miles E. | 581 | ----- | crs. wh. co. s.----- | Rare. |
| 22313 | 1 | H3848 | Village west side of Niau Atoll, ¾ mile E. | 252 | ----- | co. s. glob. oz.----- | Do. |
| 22314 | 1 | H3855 | Northwest point of Apataki, 1 mile SE. | 654 | 38.8 | crs. co. s.----- | Do. |
| 22315 | 10+ | H3858 | Ngaruae Pass, Fakarava Atoll, 28° S., 1 mile E. | 599 | ----- | do.----- | Abundant. |
| 22316 | 1 | H3875 | Southwest point of Tahanae, about ½ mile offshore, 3 miles NE. | 269 | ----- | do.----- | Rare. |
| 22317 | 10 | H3876 | Northwest entrance to Makemo Lagoon, 1 mile SE. | 467 | ----- | wh. co. s.----- | Common. |
| 22318 | 1 | H3885 | Southwest point of Takume Atoll, 1.5 miles NE. | 572 | 38.7 | crs. co. s.----- | Rare. |
| 22319 | 2 | H3891 | Lat. 16° 30' S., long. 143° 41' W. | 540 | 39.7 | co. s. pter. oz.----- | Do. |
| 22320 | 1 | H3898 | Northwest point of Hikueru Atoll, ½ mile E. | 348 | 43.8 | co. s. brk. sh.----- | Do. |
| 22321 | 1 | H3922 | Lat. 20° 31' S., long. 142° W. | 2,467 | 35.0 | ----- | Do. |
| 22322 | 1 | H3924 | Nukutipipi Atoll, 1 mile NW. | 649 | 39.0 | co. s. brk. sh.----- | Do. |
| 22323 | 1 | H3927 | Anu Anurunga, 1 mile W. | 574 | 39.0 | crs. co. s. mang. pter. oz. | Do. |
| 22324 | 3 | H3930 | Anu Anuraro Atoll, ¾ mile NW. | 438 | 40.7 | co. s.----- | Do. |
| 22325 | 3 | H3935 | Hereheretue Atoll, 1 mile W. | 594 | 39.5 | crs. co. s.----- | Do. |
| 22326 | 2 | H3983 | Entrance to South Pass, Rongelap, ½ mile N. | 400 | 43.4 | co. s.----- | Do. |
| 22327 | 1 | H3984 | Entrance to South Pass, Rongelap, 1½ miles N. | 746 | 39.0 | crs. co. s.----- | Do. |

This species is the most widely distributed of this particular group in the material we have examined. It is best developed in shoal water, probably being an attached form in this area as it is in the West Indies. There are, however, numerous specimens, usually either worn or small, in the *Albatross* collections. These probably represent specimens which have been carried out into deeper water by

waves and currents. In the shallow-water collections it has occurred at the following stations in shoal water; Pinaki Atoll, Paumotu Islands, abundant on the beaches and inside the lagoon; Hereheretue Atoll, Paumotu Islands, beach off wharf; Makemo Lagoon, Paumotu Islands; Apataki, Paumotu Islands; Rutavu; Rongelap Atoll, Marshall Islands; Vavau Anchorage, Tonga Islands; 40-50 fathoms, Fiji; Port Lotten, Kersail, Caroline Islands; and Aloji Niue. From the deeper-water *Albatross* stations the species has occurred as shown in Table 32.

Genus MARGINOPORA Blainville, 1830

Marginopora BLAINVILLE, Dict. Sci. Nat., vol. 60, p. 377, 1830 (Quoy and Gaimard, MS.); Man. Actin., p. 412, 1834.

Synonym: *Orbitolites* (part) of authors (not Lamarck).

Genoholotype.—*Marginopora vertebralis* Blainville.

Test in the early stages similar to *Sorites* with one or two rows of apertures, later with the two original planes of chambers forced apart and filled with a high series of chamberlets, those adjacent to each annular chamber connecting, the outer wall projecting beyond the peripheral plane of the lateral chambers; the apertures in more or less vertical rows on the periphery with a horizontal row above and below. Recent.

MARGINOPORA VERTEBRALIS Blainville

PLATE 19, FIGURES 11, 12

It is difficult to determine this species. There seem to be two distinct forms developed in the South Pacific, one of which attains a size of usually not more than 3 mm, having the central portion very much depressed and the periphery thickened. This form is abundant and widely distributed in shallow water, our specimens representing the following localities: Hereheretue Atoll, Paumotu Islands; Pinaki Atoll, Paumotu Islands; Apataki Atoll, Paumotu Islands; Makemo Lagoon, Paumotu Islands; Rutavu; 12 fathoms off Nairai, Fiji; and Mokaujar Anchorage, Fiji. There are also specimens from the *Albatross* deeper-water stations, mostly either worn or very small specimens.

The other form is a much larger and flatter one, the center being only slightly depressed, and attaining a diameter of nearly 10 mm. This larger form was found only at Mokaujar Anchorage, Fiji, where it was very abundant. A further study of these may show that the two forms are not closely related.

TABLE 33.—*Marginopora vertebralis*—material examined

| U.S.N. M. No. | Number of specimens | Albatross station | Locality | Depth | Bottom temper- ature | Character of bottom | Occurrence |
|------------------|------------------------|----------------------|--|---------------------|----------------------------|-----------------------|------------|
| 22328 | 4 | H3834 | West coast of Makatea Island, 1.3 miles E. | Fath- oms 581 | °F. ----- | crs. wh. co. s. | Few. |
| 22329 | 1 | H3858 | Ngartue Pass, Fakarava Atoll, 28° S., 1 mile E. | 599 | ----- | crs. co. s. | Rare. |
| 22330 | 2 | H3891 | Lat. 16° 30' S., long. 143° 41' W. | 540 | 39.7 | co. s. pter. oz. | Do. |
| 22331 | 2 | H3905 | Northwest point of Hao Atoll, ¼ mile SE. | 425 | 42.0 | crs. co. s. | Do. |
| 22332 | 3 | H3916 | Pinaki Atoll, 1 mile E. | 486 | 41.0 | crs. co. s. pter. oz. | Do. |
| 22333 | 1 | H3935 | Hereheretue Atoll, 1 mile W. ... | 594 | 39.5 | crs. co. s. | Do. |

Family ALVEOLINELLIDAE

Genus ALVEOLINELLA H. Douvillé, 1907

Alveolinella H. DOUVILLÉ, Bull. Soc. Géol. France, ser. 4, vol. 6, p. 585, 1907.
Synonym: *Alveolina* (part) D'ORBIGNY, 1826.

Genoholotype.—*Alveolina quoyi* d'Orbigny.

Test fusiform, planispirally coiled about an axis, all coils low; apertures very numerous, in several rows. Late Tertiary to Recent.

ALVEOLINELLA QUOYI (d'Orbigny)

PLATE 19, FIGURE 10

There are very few specimens of this species in any of the collections examined. Very typical specimens occurred at Mokaujar Anchorage, Fiji, in 13 fathoms, one of which is here figured. These specimens reach a total length of about 9 mm.

EXPLANATION OF PLATES

PLATE 1

- FIGURES 1a, b. *Marginulina* cf. *crepidula* (Fichtel and Moll). $\times 50$. a, Side view; b, peripheral view. *Albatross* H3798.
- 2, 3. *Robulus reniformis* (d'Orbigny). $\times 50$. a, a, Side views; b, b, peripheral views. Fig. 2, *Albatross* H3875. Fig. 3, Rangiroa.
- 4-6. *Robulus limbosus* (Reuss). Fig. 4, $\times 50$. Figs. 5, 6, $\times 40$. a, a, a, Side views; b, b, b, peripheral views. Fig. 4, *Albatross* H3885. Fig. 5, *Albatross* H3989. Fig. 6, *Albatross* H3834.
7. *Robulus larvus* (Stache). $\times 40$. a, Side view; b, peripheral view. *Albatross* H3905.
8. *Robulus coloratus* (Stache). $\times 40$. a, Side view; b, peripheral view. *Albatross* D3690.
- 9a, b. *Robulus nigriseptus* (Koch). $\times 40$. a, Side view; b, peripheral view. *Albatross* H3860.

PLATE 2

- FIGURES 1a, b. *Robulus vortex* (Fichtel and Moll). $\times 30$. a, Side view; b, peripheral view. *Albatross* H3876.
- 2a, b. *Robulus gibbus* (d'Orbigny). $\times 50$. a, Side view; b, peripheral view. *Albatross* H3916.
- 3a, b. *Robulus calcar* (Linnaeus). $\times 50$. a, Side view; b, peripheral view. *Albatross* H3961.
- 4a, b. *Robulus expansus* (Cushman) var. *planulatus* (Cushman). $\times 50$. a, Side view; b, peripheral view. *Albatross* H3924.
- 5a, b. *Robulus limbosus* (Reuss). $\times 50$. a, Side view; b, peripheral view. *Albatross* H3828.
- 6, 7. *Robulus gibbus* (d'Orbigny). $\times 40$. a, a, Side views; b, b, peripheral views. Fig. 6, *Albatross* H3855. Fig. 7, *Albatross* H3916.
- 8a, b. *Saracenaria* sp. (?). $\times 50$. a, Side view; b, peripheral view. *Albatross* H3876.
- 9a, b. *Lingulina glandigena* (Schwager). $\times 70$. a, Front view; b, side view. *Albatross* H3832.
- 10a, b. *Marginulina* cf. *crepidula* (Fichtel and Moll). $\times 70$. a, Side view; b, peripheral view. *Albatross* H3840.
- 11a, b. *Marginulina* cf. *subcrassa* Schwager. $\times 70$. a, Side view; b, peripheral view. *Albatross* H3878.

PLATE 3

- FIGURES 1a, b. *Marginulina insolita* (Schwager). $\times 70$. a, Side view; b, peripheral view. Port Lotten, Kersail, Caroline Islands.
- 2, 3. *Dentalina neugeborni* (Schwager). $\times 40$. Fig. 2a, Side view; b, peripheral view. Fig. 2, *Albatross* H3971. Fig. 3, *Albatross* H3991.
4. *Dentalina sidebottomi*, new species. $\times 40$. Holotype, *Albatross* H3815.
- 5a, b. *Dentalina* sp. (?). $\times 40$. a, Side view; b, peripheral view. *Albatross* H3891.
6. *Dentalina costai* (Schwager). $\times 40$. *Albatross* H3954.

- FIGURE 7. *Dentalina pomuligera* Stache. $\times 40$. Albatross H3866.
 8. *Dentalina elegans* d'Orbigny. $\times 30$. Albatross H3961.
 9, 10. *Vaginulina elegans* d'Orbigny. $\times 40$. Fig. 9a, Side view; b, peripheral view. Fig. 9, Albatross H3878. Fig. 10, Albatross H3859.
 11. *Nodosaria* sp. (?). $\times 70$. Albatross H3898.
 12. *Pseudoglandulina propinqua* (Stache). $\times 70$. Albatross H3812.
 13-15. *Nodosaria perversa* Schwager. $\times 40$. Fig. 13, Albatross H3858. Fig. 14, Albatross H3815. Fig. 15, Albatross H3924.

PLATE 4

- FIGURES 1-4. *Nodosaria prava*, new species. $\times 40$. Fig. 1, Holotype. Albatross H3858. Fig. 2, Albatross H3808. Fig. 3, Albatross H3857. Fig. 4, Albatross H3858.
 5a, b. *Lagena laevis* (Montagu). $\times 70$. a, Front view; b, apertural view. Albatross H3819.
 6-8. *Lagena perlucida* (Montagu). $\times 70$. Figs. 6a, 8a, Front views; b, b, apertural views. Fig. 6, Rotonga. Figs. 7, 8, Viva Anchorage, Fiji.
 9a, b. *Lagena marginata* (Montagu) var. $\times 70$. a, Front view; b, apertural view. Albatross H3825.
 10a, b. *Lagena globosa* (Montagu). $\times 70$. a, Front view; b, apertural view. Albatross H3904.
 11, 12. *Lagena marginata* (Montagu) var. $\times 70$. a, a, Front views; b, b, apertural views. Fig. 11, Albatross H3827. Fig. 12, Albatross H3818.
 13a, b. *Lagena marginato-perforata* Seguenza. $\times 70$. a, Front view; b, apertural view. Viva Anchorage, Fiji.
 14-16. *Lagena marginata* (Montagu) var. $\times 70$. Figs. 14a, 15a, Front views; b, b, apertural views. Fig. 14, Albatross H3829. Fig. 15, Albatross H3984. Fig. 16, Albatross H3825.
 17a, b. *Lagena alveolata* H. B. Brady. $\times 70$. a, Front view; b, apertural view. Albatross H3971.

PLATE 5

- FIGURES 1a, b. *Lagena marginato-perforata* Seguenza. $\times 70$. a, Front view; b, apertural view. Levuka, Fiji.
 2a, b. *Lagena marginata* (Montagu) var. $\times 70$. a, Front view; b, apertural view. Albatross H3812.
 3a, b. *Lagena auriculata* H. B. Brady var. *duplicata* Sidebottom. $\times 70$. a, Front view; b, apertural view. Albatross H3856.
 4a, b. *Lagena marginata* (Montagu) var. $\times 70$. a, Front view; b, apertural view. Albatross H3873.
 5a, b. *Lagena seminiformis* Schwager. $\times 70$. a, Front view; b, apertural view. Albatross H3881.
 6a, b. *Lagena marginata* (Montagu) var. $\times 70$. a, Front view; b, apertural view. Albatross H3874.
 7a, b. *Lagena fimbriata* H. B. Brady var. *occlusa* Sidebottom. $\times 70$. a, Front view; b, apertural view. Albatross H3838.
 8, 9. *Lagena marginata* (Montagu) var. $\times 70$. a, a, Front views; b, b, apertural views. Albatross H3984.
 10, 11. *Lagena sigmoidella*, new species. $\times 70$. a, a, Front views; b, b, apertural views. Fig. 10, Albatross H3812. Fig. 11, Holotype. Albatross H3830.

PLATE 6

- FIGURES 1a, b. *Lagena marginato-perforata* Seguenza. $\times 70$. a, Front view; b, apertural view. Albatross H3889.
- 2a, b. *Lagena auriculata* H. B. Brady var. *costata* H. B. Brady. $\times 70$. a, Front view; b, apertural view. Albatross H3912.
- 3-5. *Lagena lagenoides* (Williamson). $\times 70$. Fig. 3a, Front view; b, apertural view. Fig. 3, Albatross H3830. Fig. 4, Levuka, Fiji. Fig. 5, Albatross H3930.
- 6, 9, 10. *Lagena formosa* Schwager. $\times 70$. a, a, a, Front views; b, b, b, apertural views. Fig. 6, Levuka, Fiji. Fig. 9, Albatross H3896. Fig. 10, Albatross H3838.
- 7, 8, 11. *Lagena orbignyana* (Seguenza). $\times 70$. a, a, a, Front views; b, b, b, apertural views. Fig. 7, Albatross H3859. Fig. 8, Albatross H3882. Fig. 11, Albatross H3991.
- 12a, b. *Lagena* sp.(?). $\times 70$. a, Front view; b, apertural view. Albatross H3892.
- 13a, b. *Lagena yokoyamae* Millett. $\times 70$. a, Front view; b, apertural view. Albatross H3961.

PLATE 7

- FIGURES 1-5, 8. *Lagena orbignyana* (Seguenza) var. *lacunata* Burrows and Holland. $\times 70$. a, a, a, a, Front views; b, b, b, b, b, apertural views. Fig. 1, Levuka, Fiji. Fig. 2, Albatross H3878. Fig. 3, Albatross H3870. Fig. 4, Albatross H3896. Fig. 5, Makemo Lagoon, Paumotu Islands. Fig. 8, Distorted form. Near Nairai, Fiji.
- 6, 7. *Lagena orbignyana* (Seguenza) var. *clathrata* H. B. Brady. $\times 70$. a, a, Front views; b, b, apertural views. Fig. 6, Albatross H3954. Fig. 7, Albatross H3835.
- 9, 10. *Lagena paradoxa* Sidebottom. $\times 70$. Fig. 10a, Front view; b, apertural view. Fig. 9, Albatross H3904. Fig. 10, Albatross H3812.
- 11-14. *Lagena desmophora* Rymer-Jones. $\times 70$. Fig. 11, Guam Anchorage, Ladrone Islands, 21 fathoms. Figs. 12-14, Mokaupjar Anchorage, Fiji.
- 15, 16. *Lagena spiralis* H. B. Brady. $\times 70$. Fig. 15a, Front view; b, apertural view. Fig. 15, Guam Anchorage, Ladrone Islands, 21 fathoms. Fig. 16, Albatross H3866.
- 17, 18. *Lagena radiato-marginata* Parker and Jones. $\times 70$. Fig. 17a, Front view; b, apertural view. Fig. 17, Albatross H3993. Fig. 18, Levuka, Fiji.
- 19, 20. *Lagena wrightiana* H. B. Brady. $\times 70$. Fig. 20a, Front view; b, apertural view. Port Lotten, Kersail, Caroline Islands.

PLATE 8

- FIGURES 1a, b. *Lagena semistriata* Williamson. $\times 70$. a, Front view; b, apertural view. Port Lotten, Kersail, Caroline Islands.
- 2, 3. *Lagena striata* (d'Orbigny) var. *strumosa* Reuss. $\times 70$. Fig. 3a, Front view; b, apertural view. Near Nairai, Fiji.
- 4a, b. *Lagena striata* (d'Orbigny) var. *interrupta* Williamson. $\times 70$. a, Front view; b, apertural view. Off Niau.

- FIGURES 5-7. *Lagena gracilis* Williamson. $\times 70$. *a, a, a*, Front views; *b, b, b*, apertural views. Fig. 5, *Albatross* H3836. Fig. 6, *Albatross* H3898. Fig. 7, *Albatross* H3856.
8. *Lagena williamsoni* (Alcock). $\times 100$. *Albatross* H3965.
- 9, 10, 12. *Lagena acuticosta* Reuss. $\times 70$. *a, a, a*, Front views; *b, b, b*, apertural views. Fig. 9, *Albatross* H3825. Fig. 10, *Albatross* H3931. Fig. 12, *Albatross* H3812.
- 11, 13. *Lagena striata* (d'Orbigny). $\times 70$. *a, a*, Front views; *b, b*, apertural views. Fig. 11, *Albatross* H3855. Fig. 13, *Albatross* H3996.

PLATE 9

- FIGURES 1a, b. *Lagena pulchella* H. B. Brady. $\times 70$. *a*, Front view; *b*, apertural view. *Albatross* H3840.
- 2a, b. *Lagena ampulla-distoma* Rymer-Jones. $\times 70$. *a*, Front view; *b*, apertural view. *Albatross* H3993.
- 3, 4. *Lagena lineata* (Williamson). $\times 70$. *a, a*, Front views; *b, b*, apertural views. Fig. 3, *Albatross* H3855. Fig. 4, *Albatross* H3965.
- 5a, b. *Lagena costata* (Williamson). $\times 70$. *a*, Front view; *b*, apertural view. *Albatross* H3900.
- 6-9. *Sigmomorphina semitecta* (Reuss) var. *terquemiana* (Fornasini). $\times 70$. Figs. 6a, 9a, Front views; *b, b*, basal views. Figs. 6-8, Nairai, Fiji. Fig. 9, Levuka, Fiji.
- 10a, b. *Guttulina* sp.(?). $\times 70$. *a*, Front view; *b*, basal view. *Albatross* H3814.
- 11a, b. *Pseudopolymorphina* cf. *subnodosa* (Reuss). $\times 70$. *a*, Front view; *b*, basal view. Port Lotten, Kersail, Caroline Islands.
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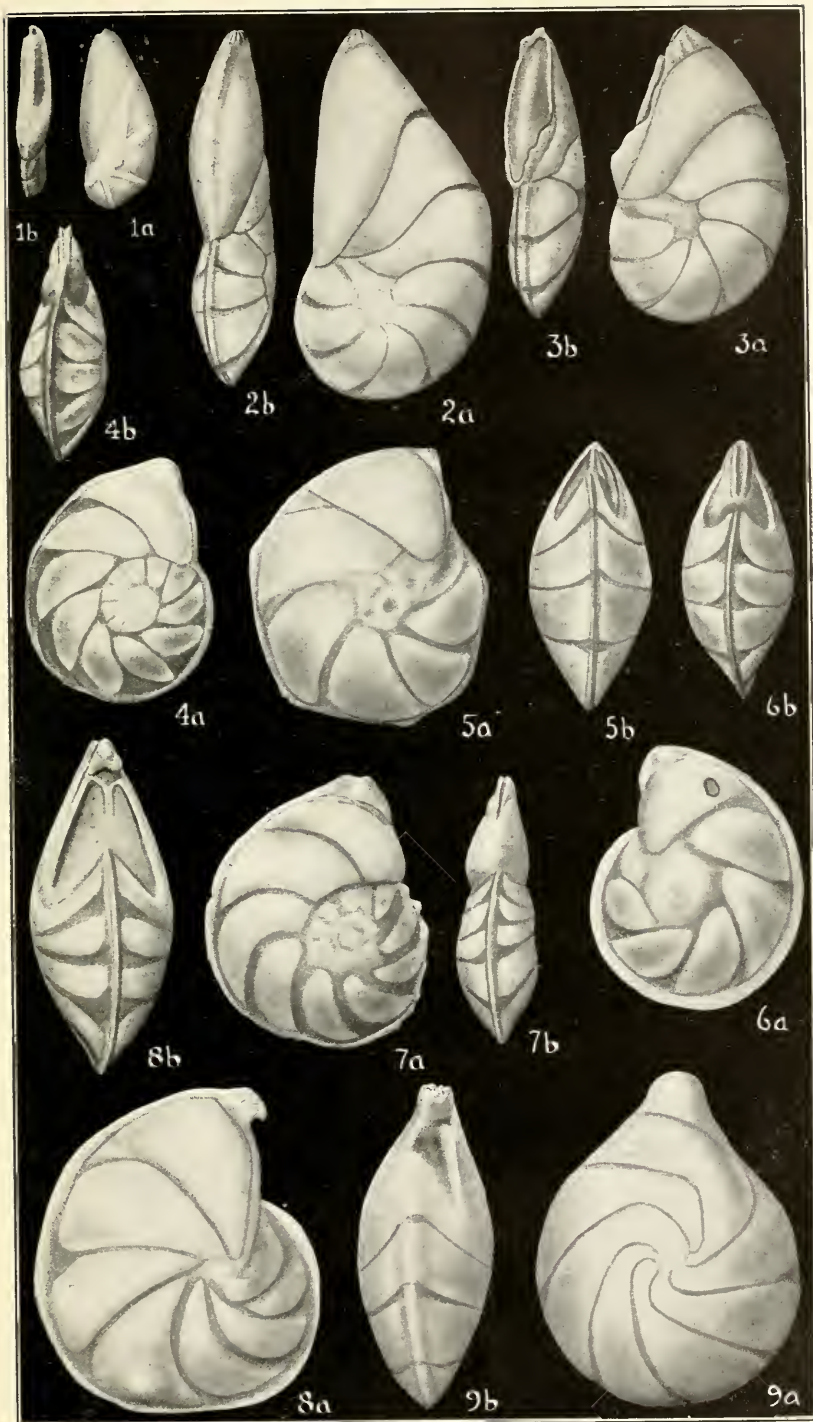
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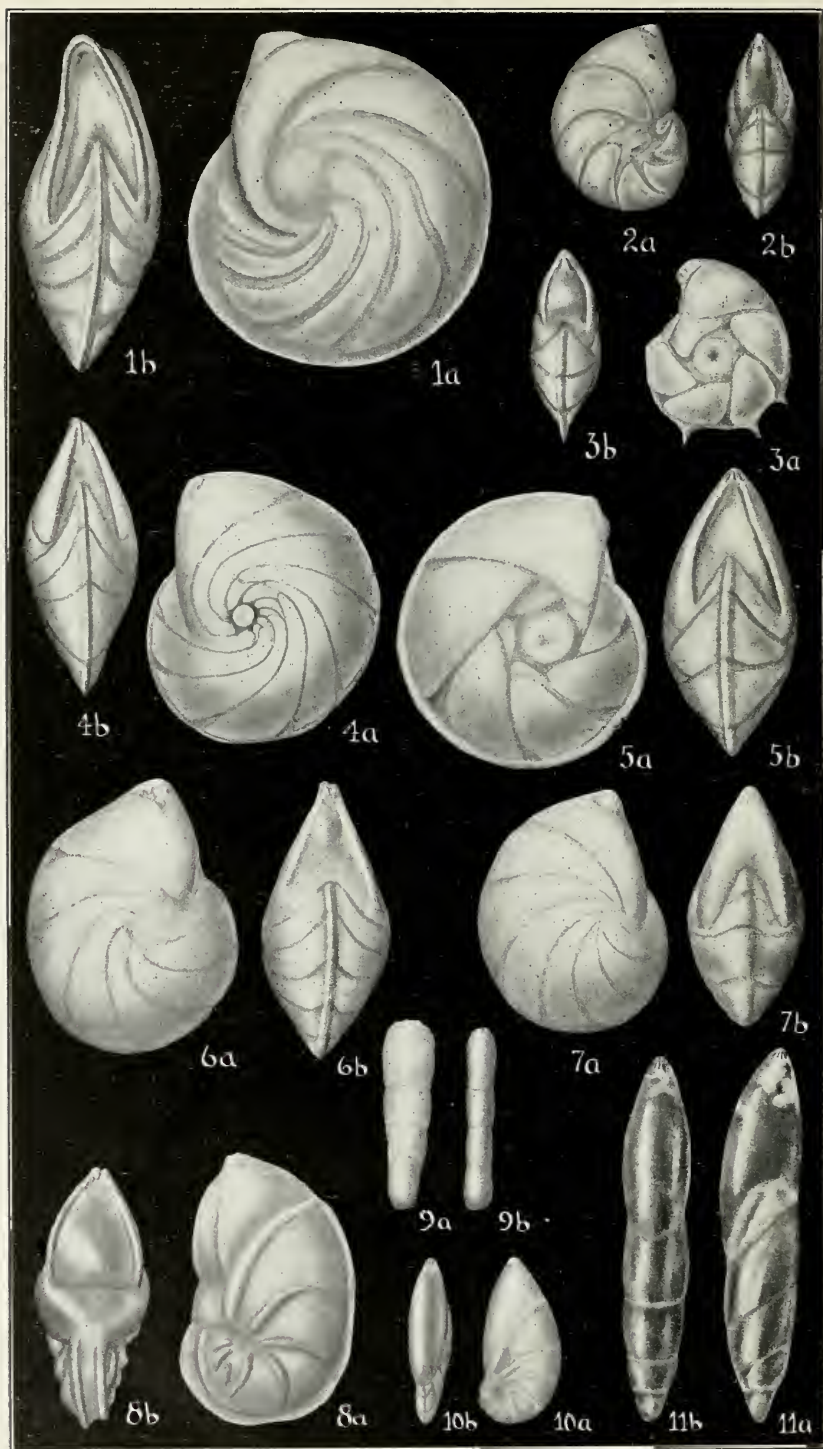
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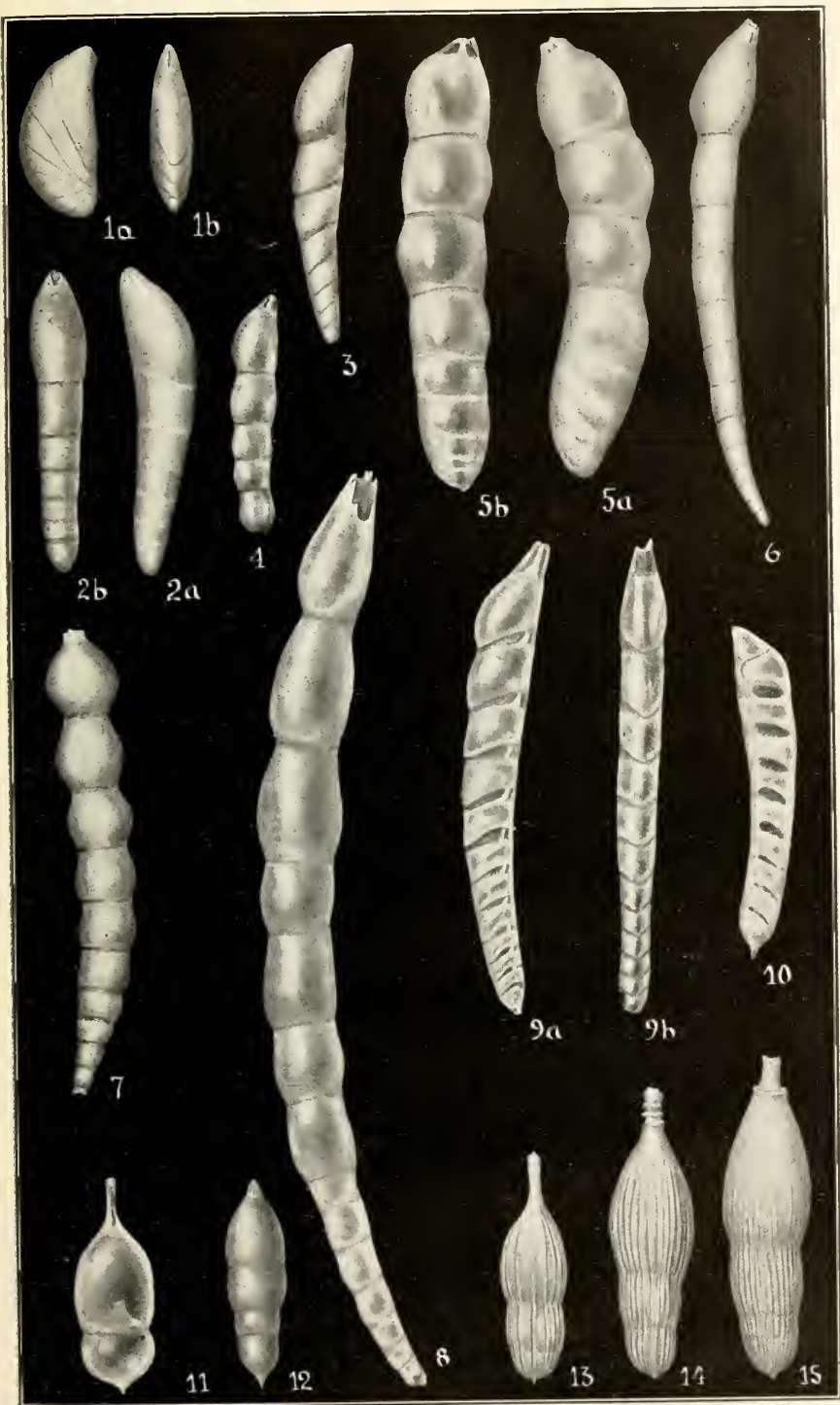
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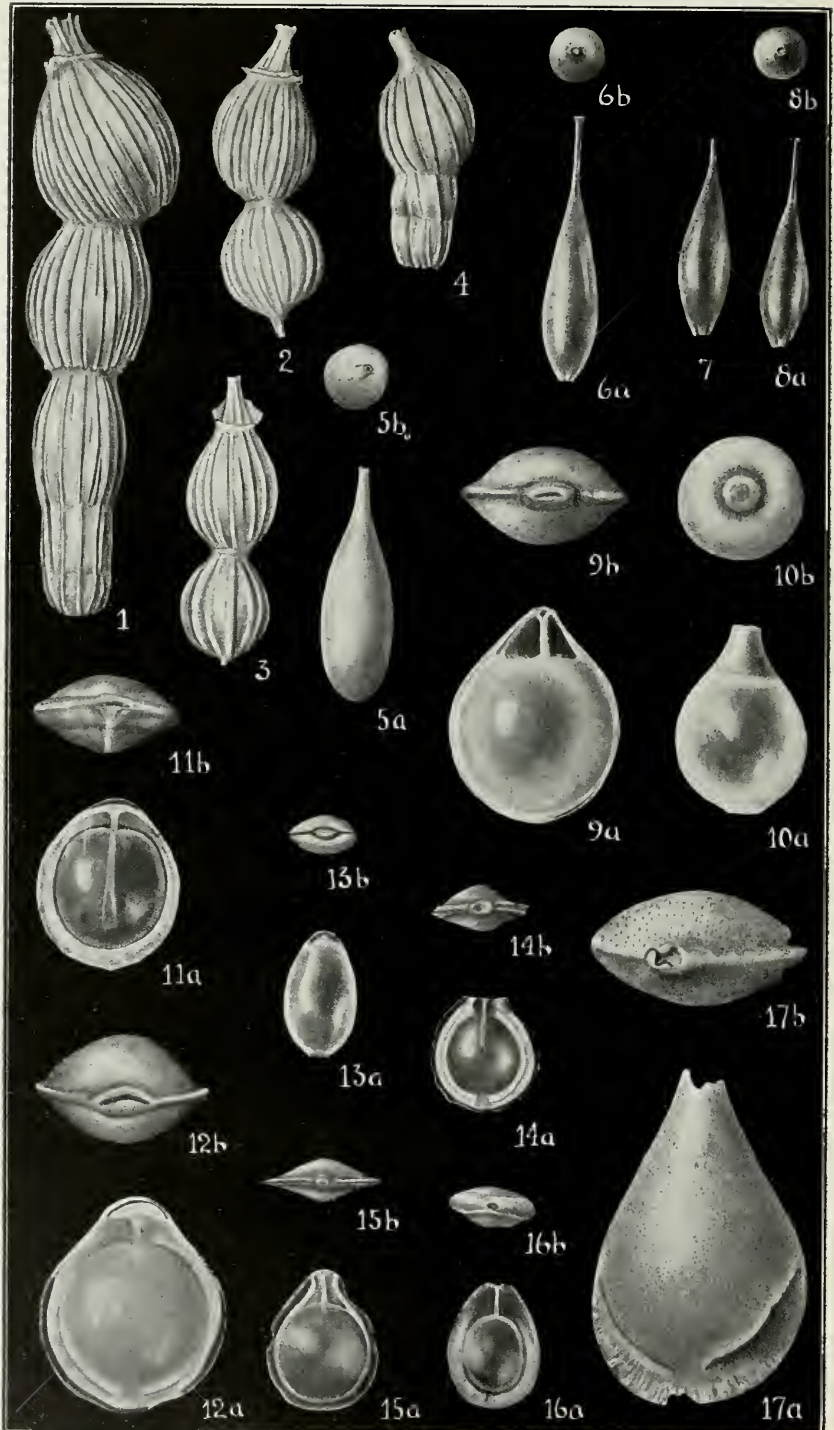


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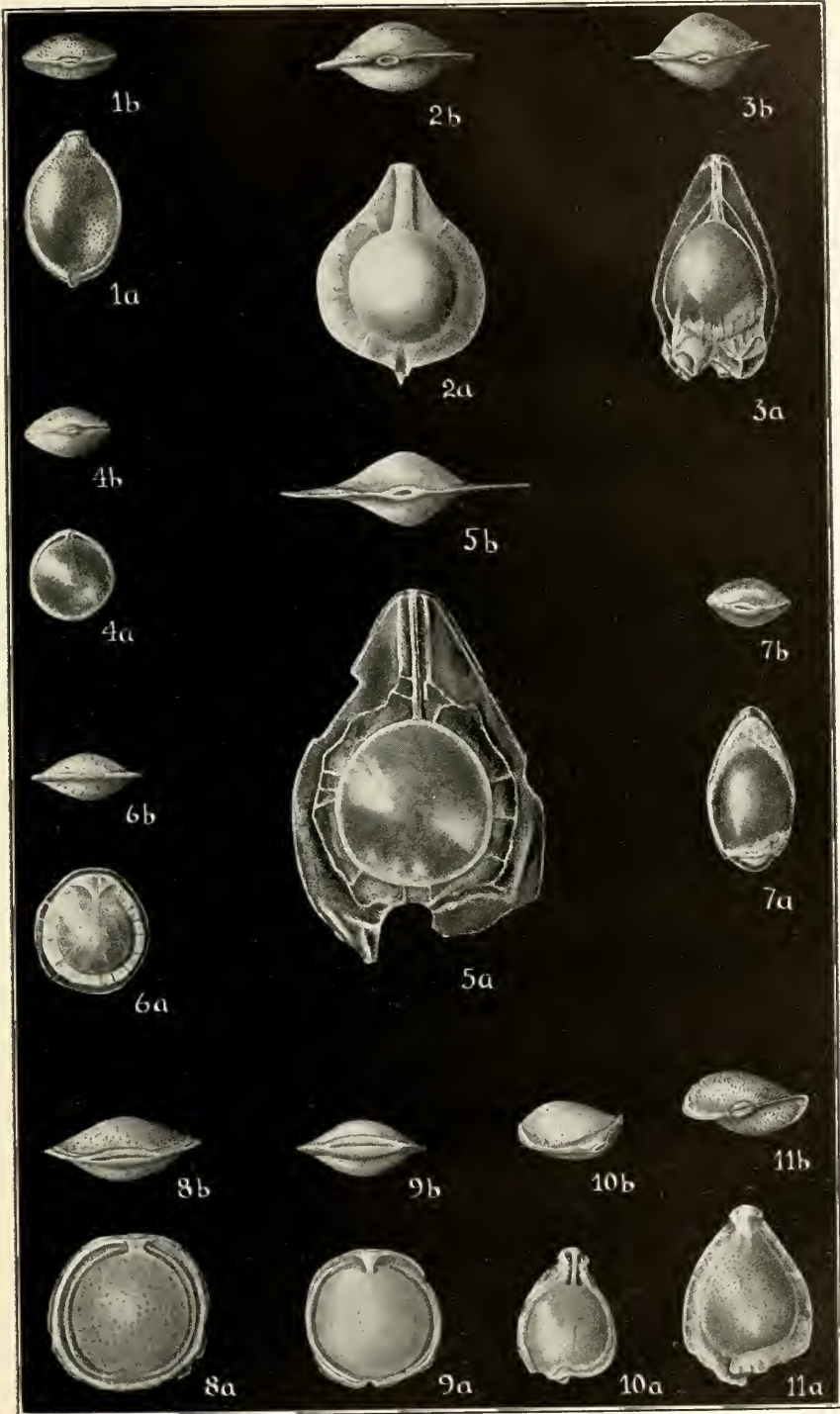
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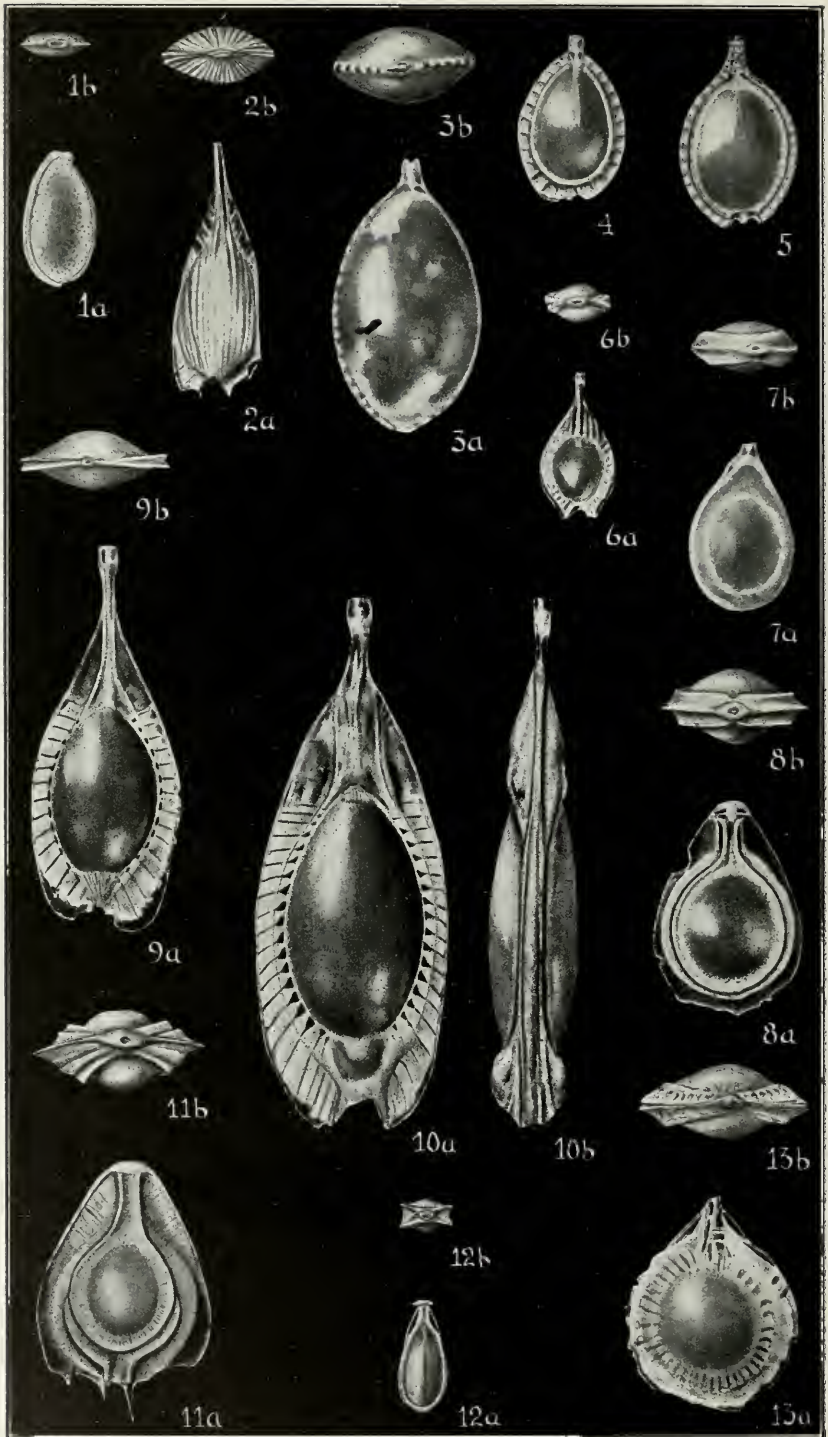


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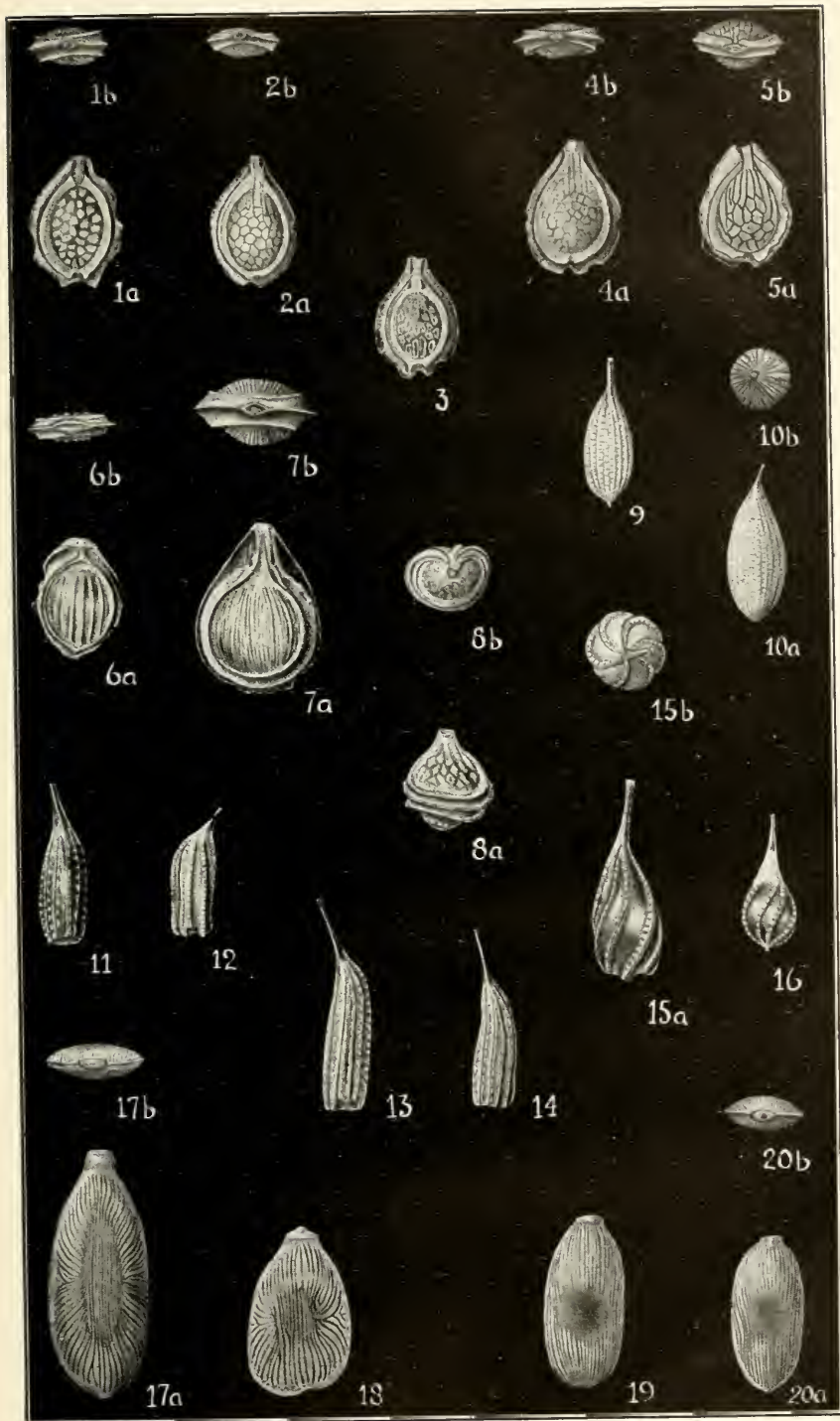
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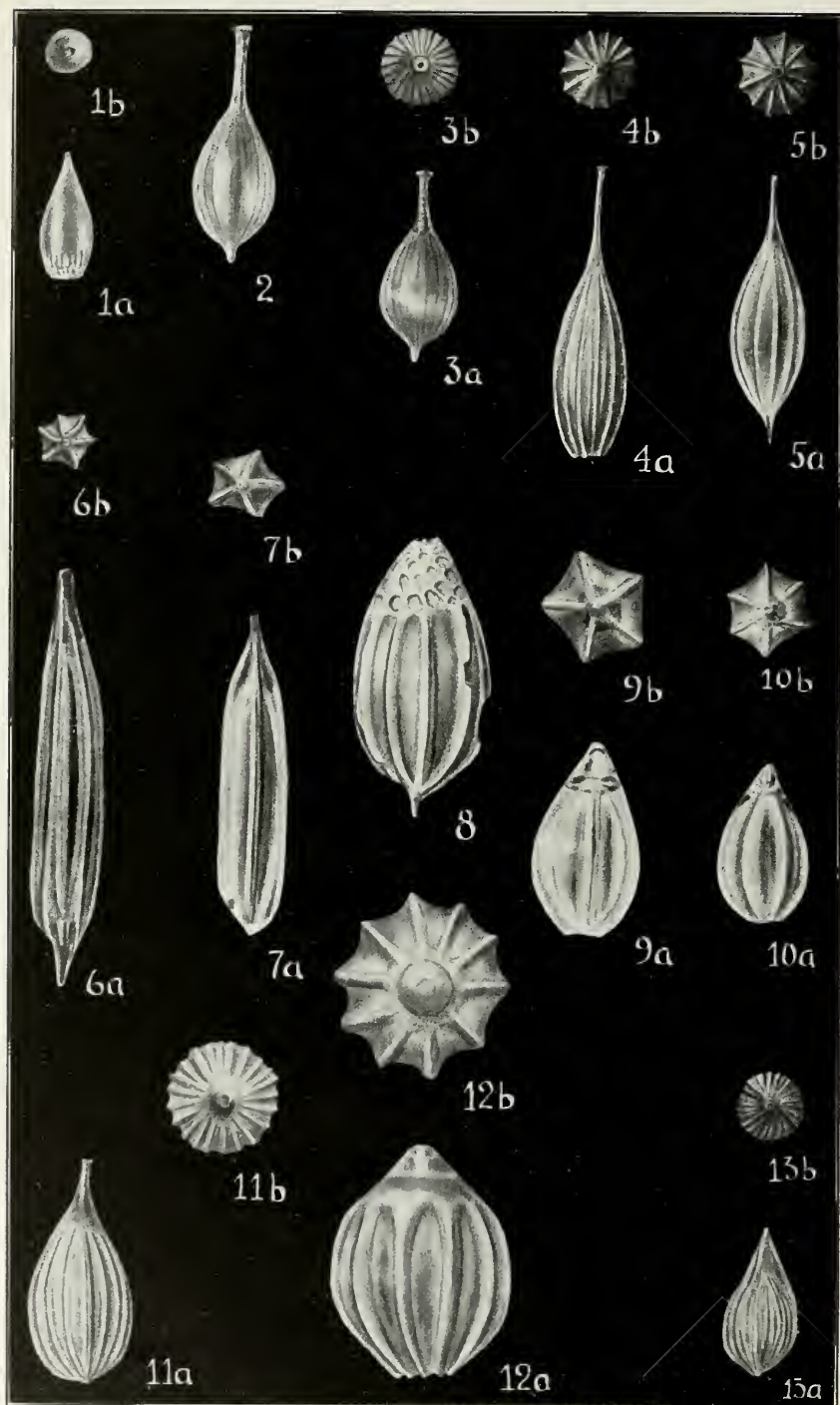
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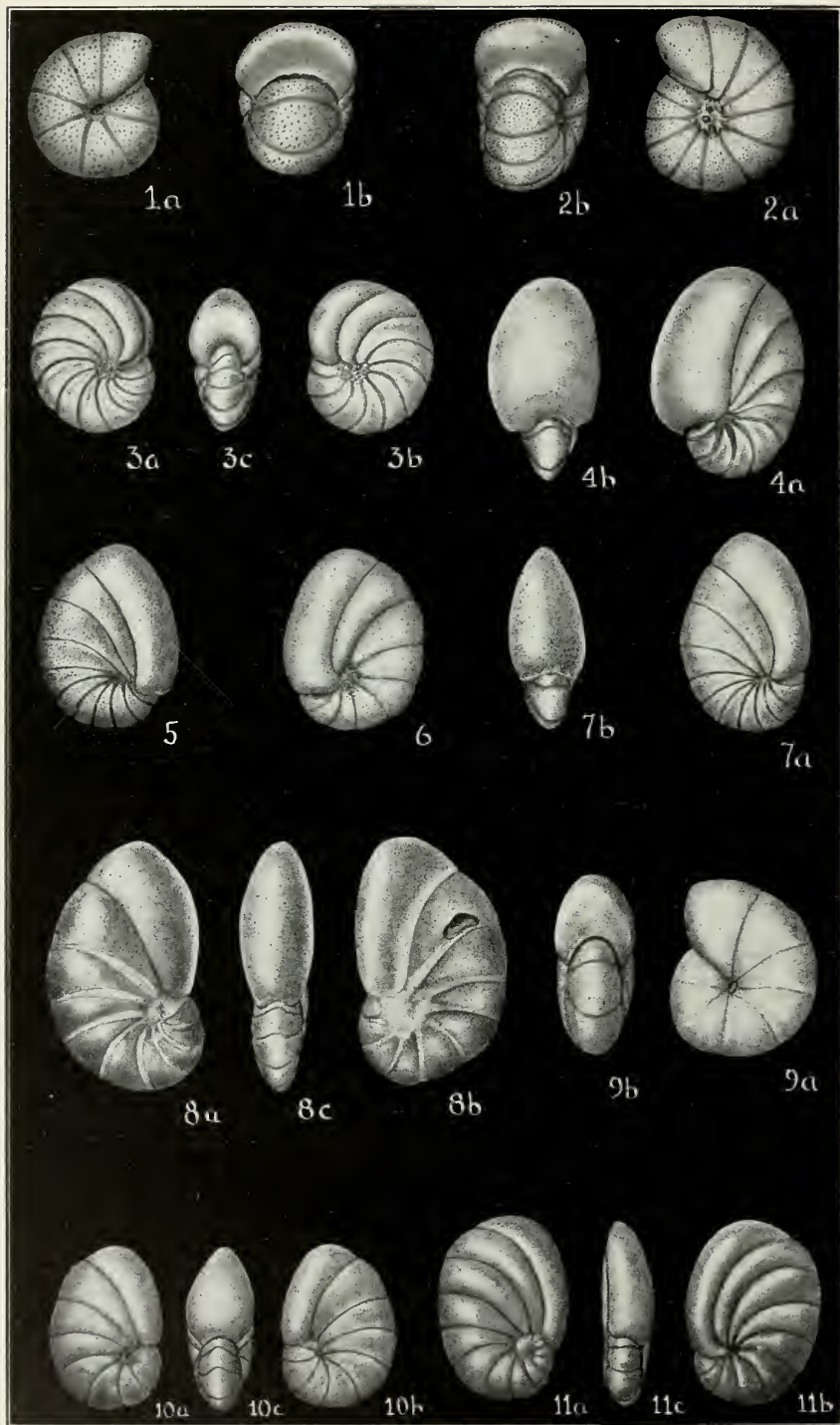


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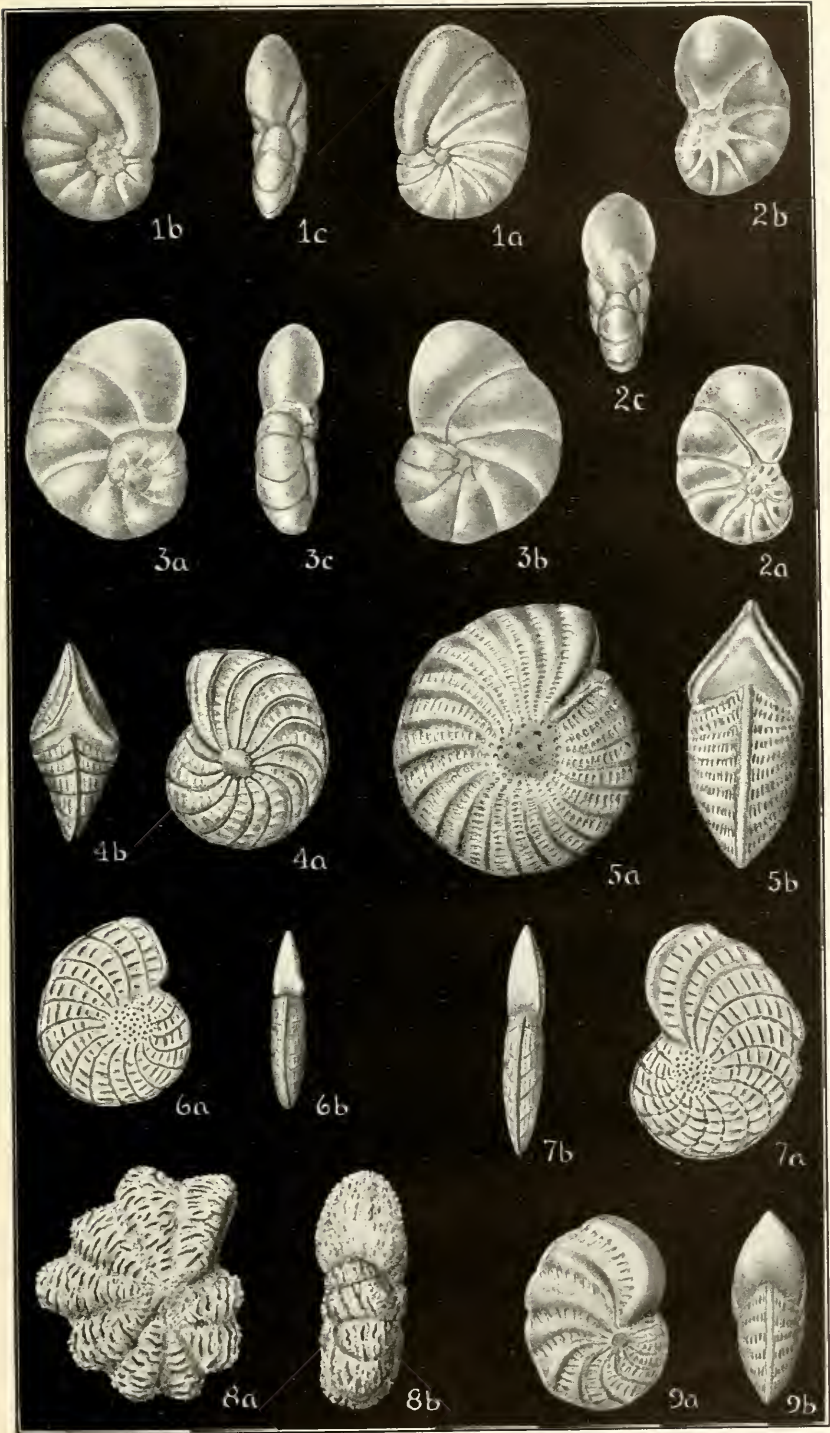
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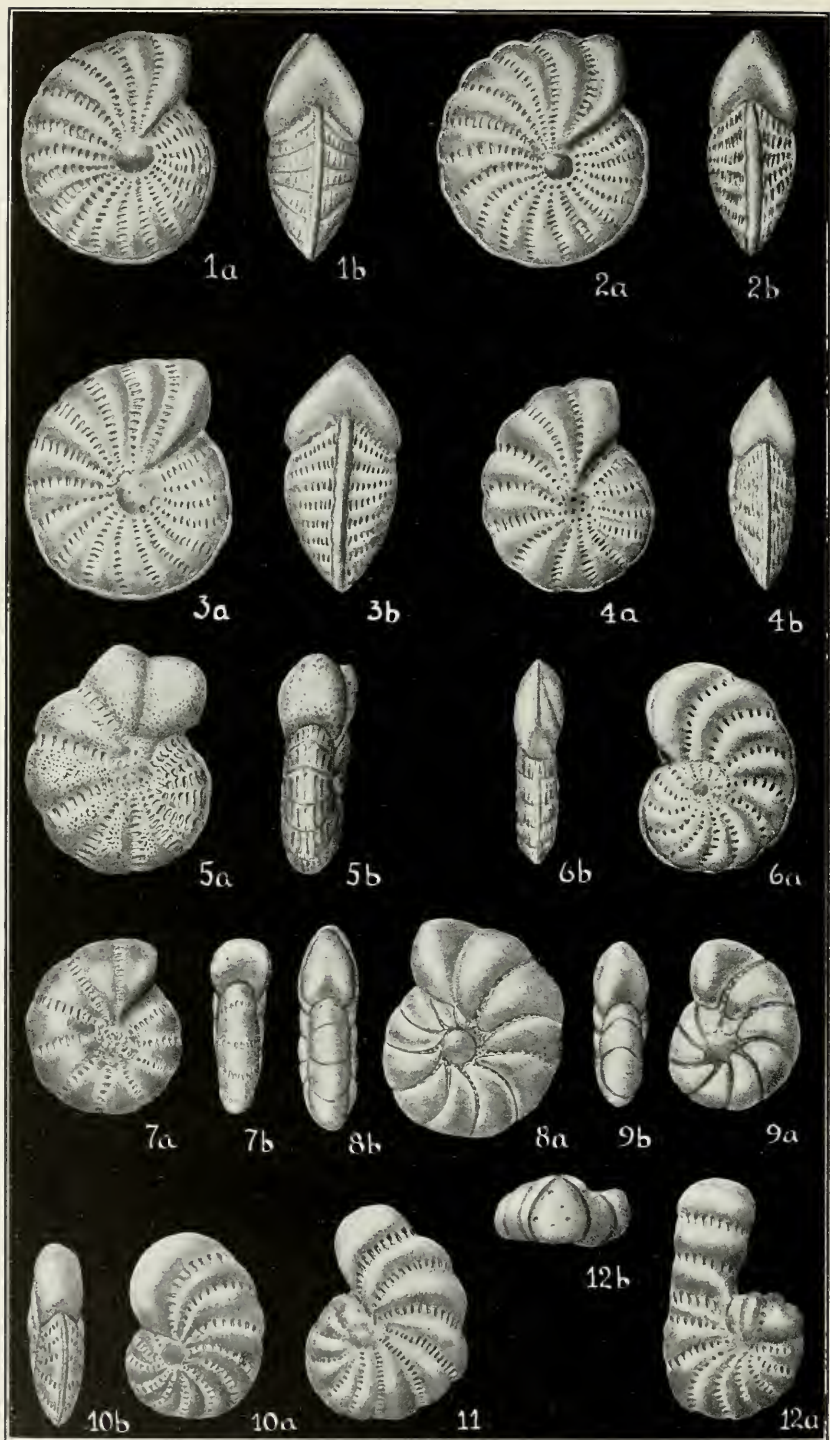
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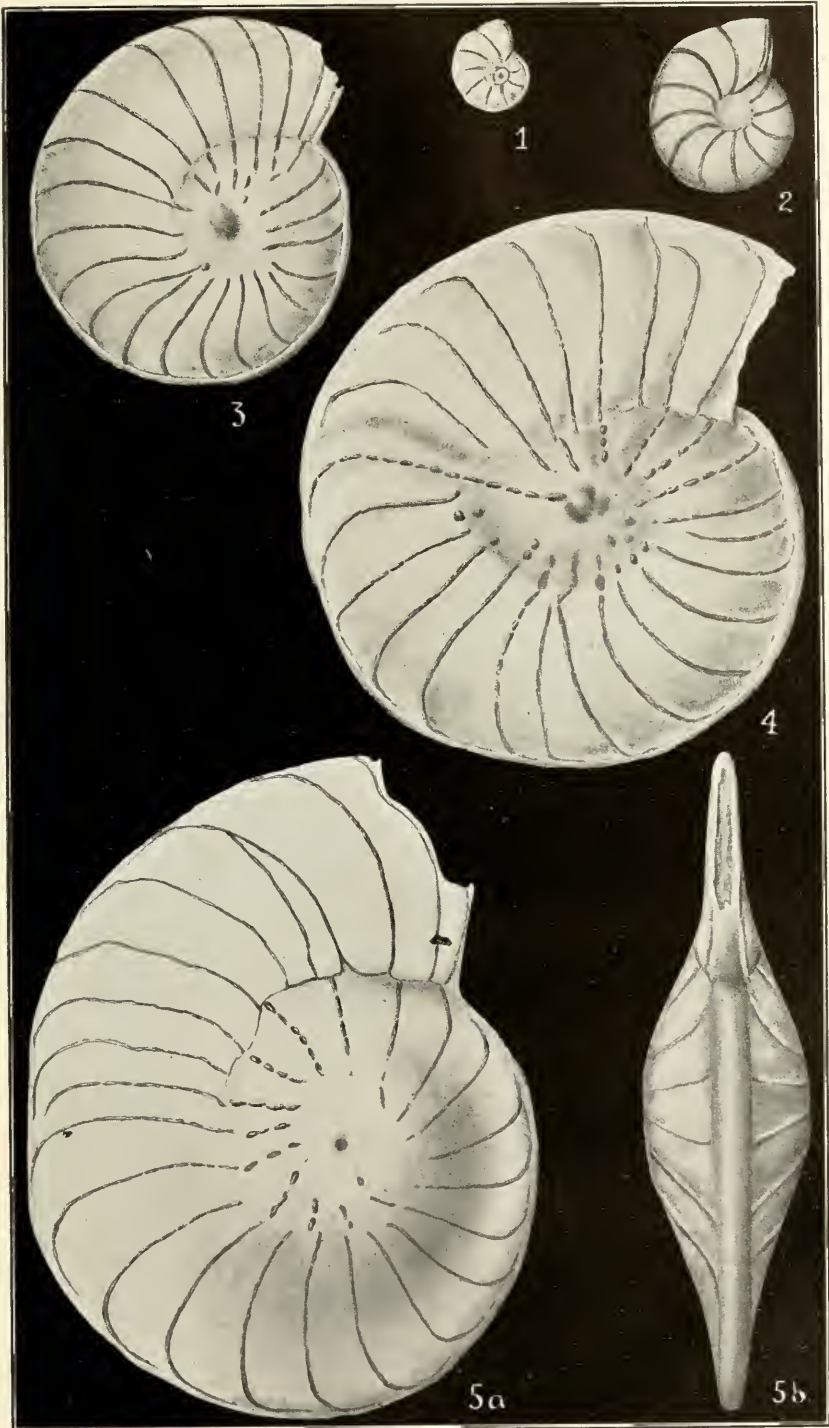
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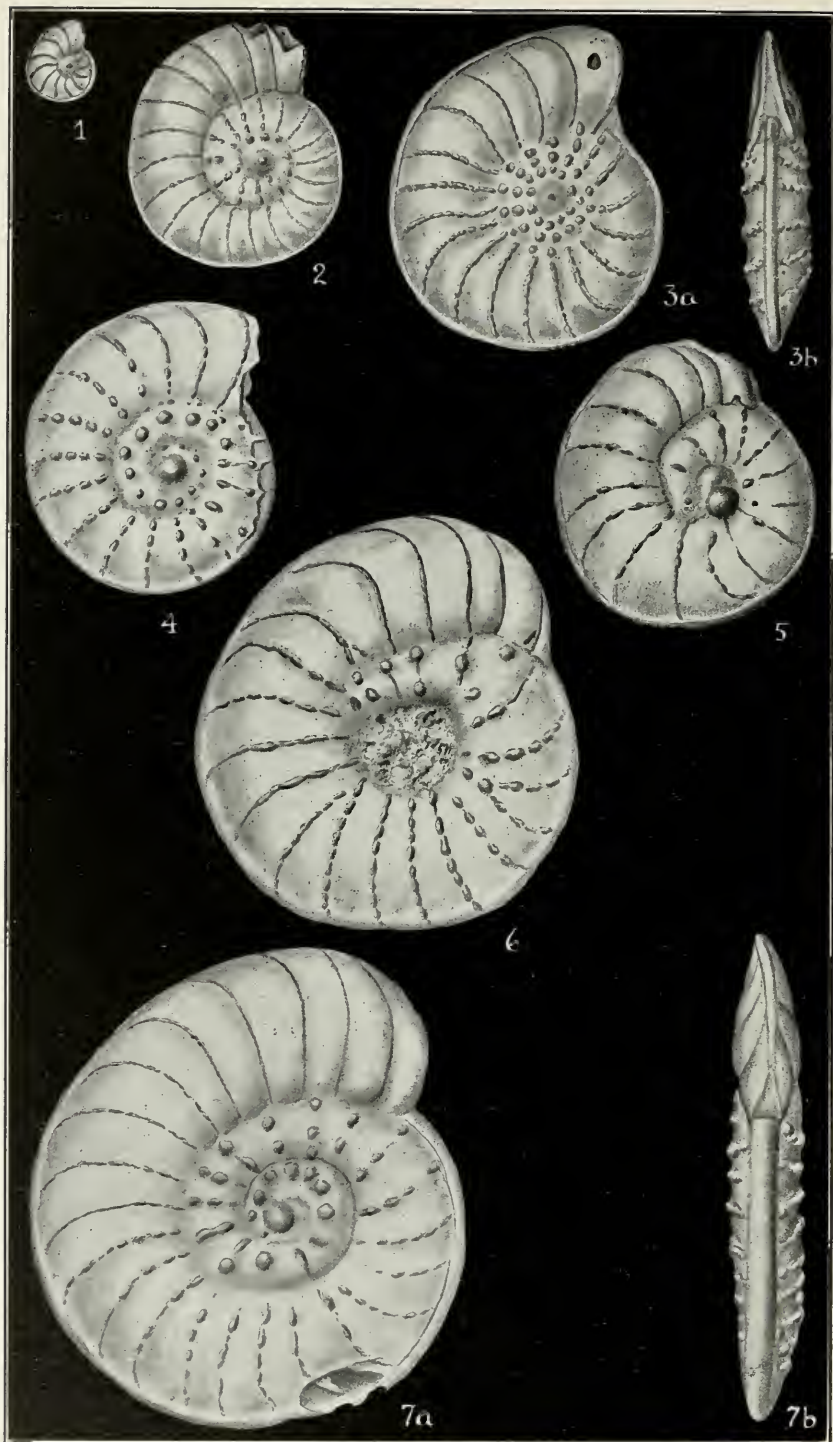
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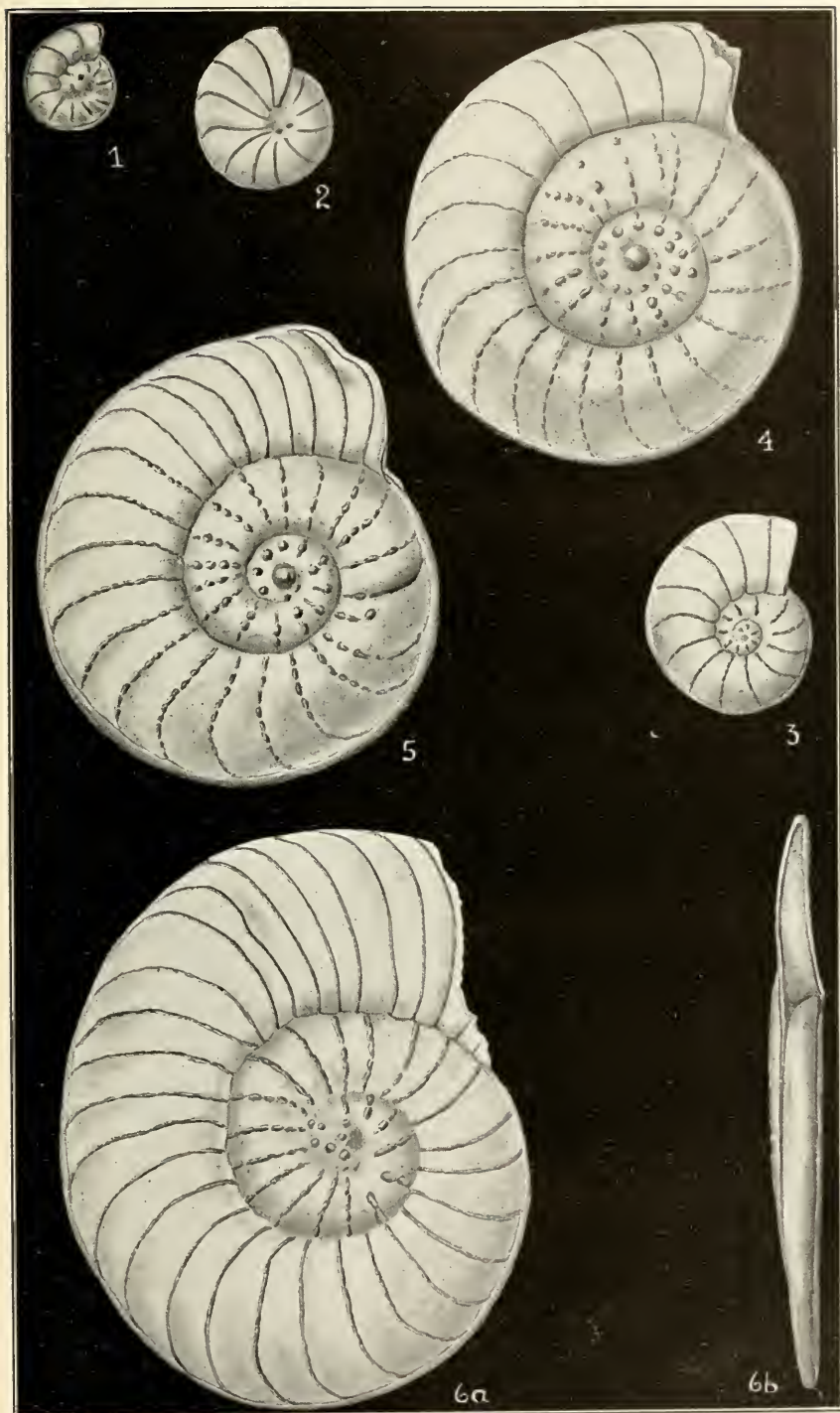


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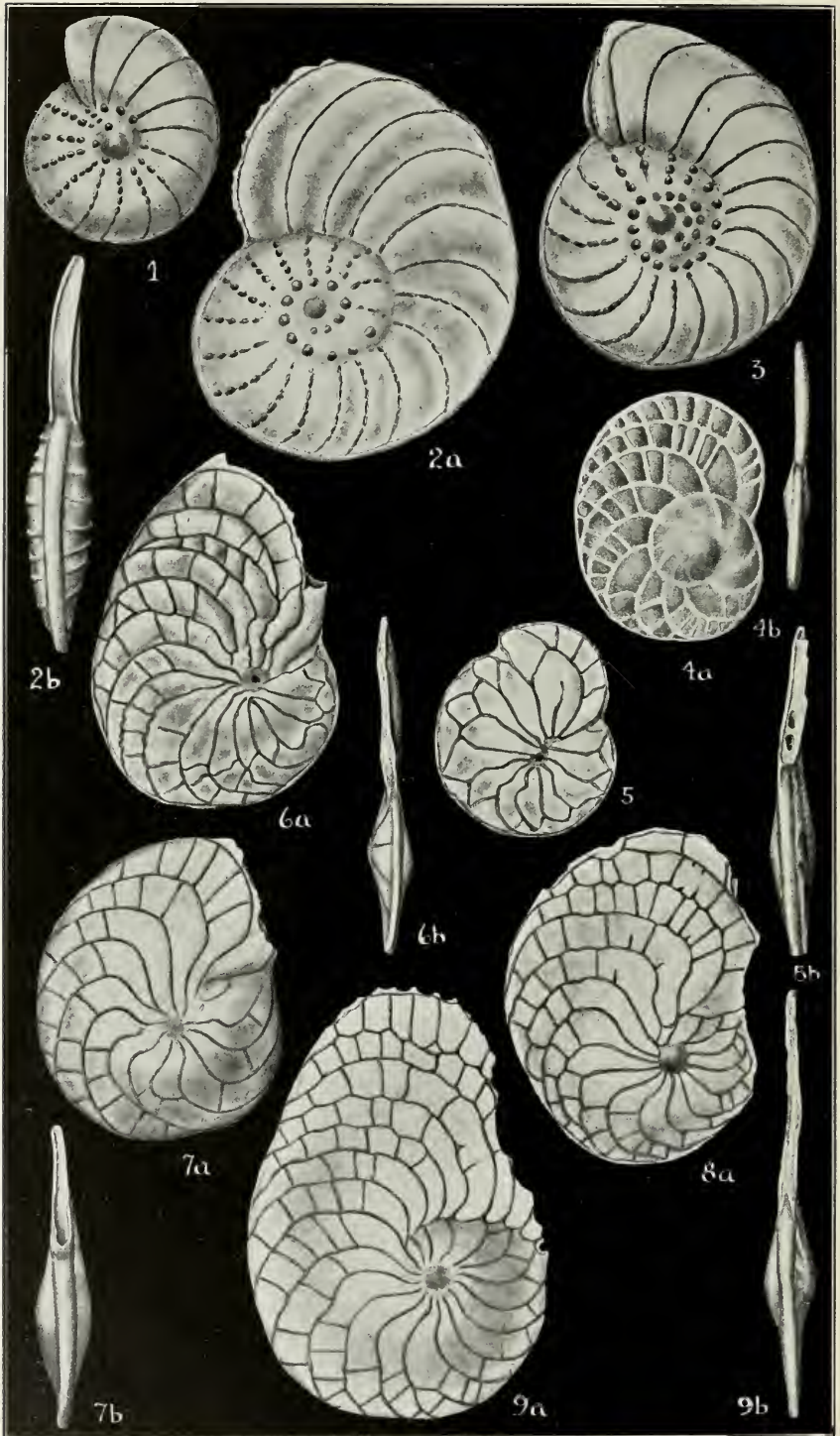


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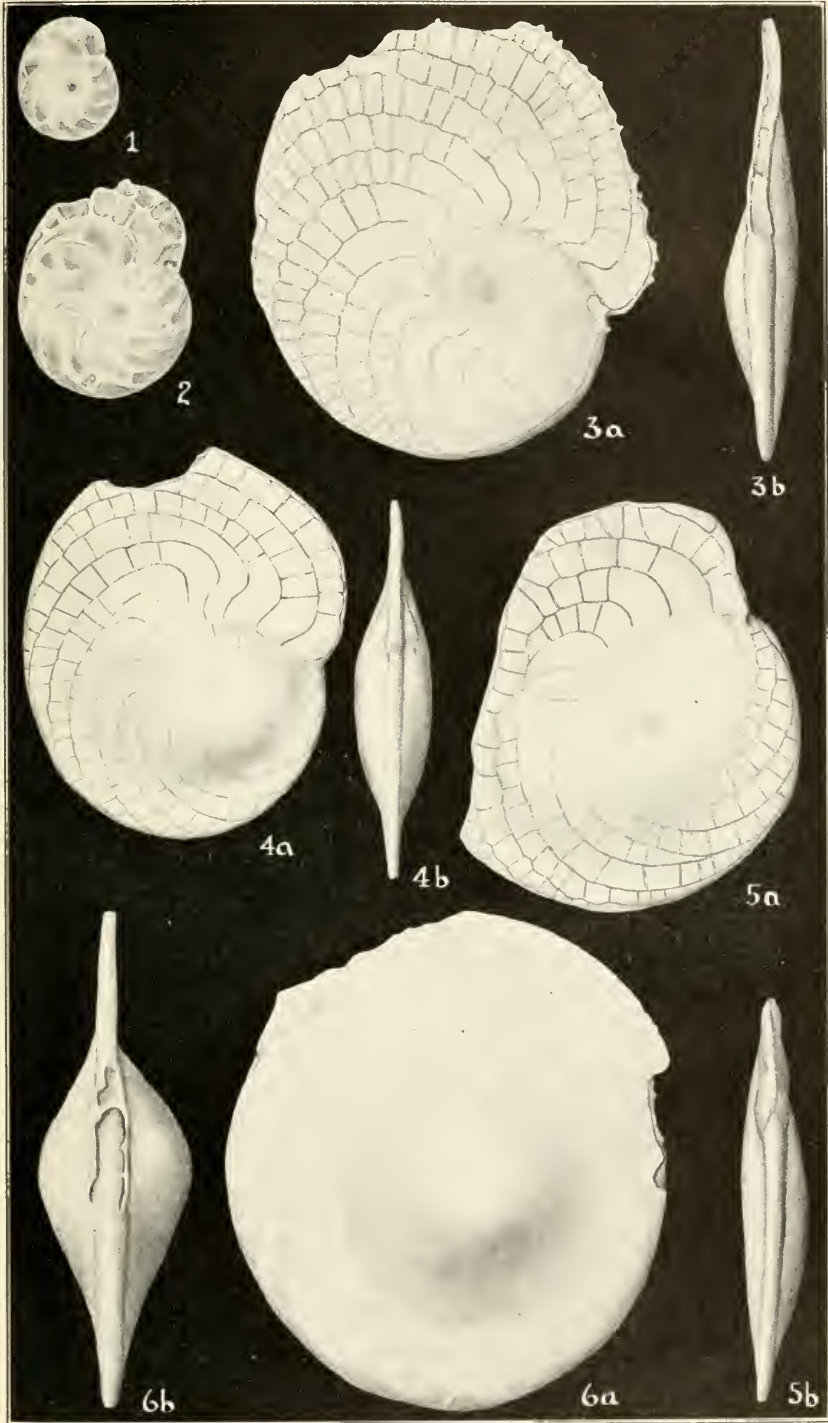


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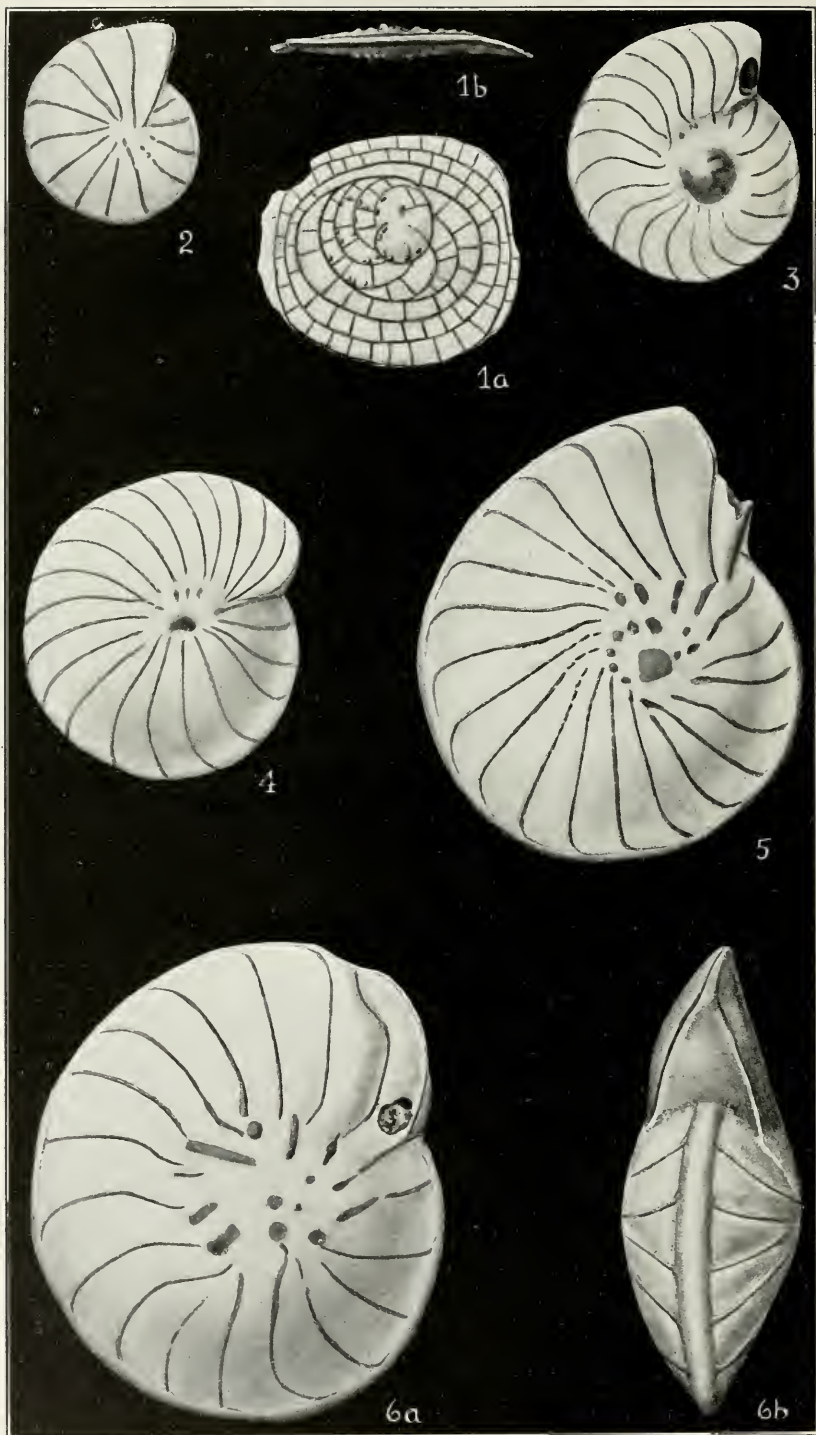
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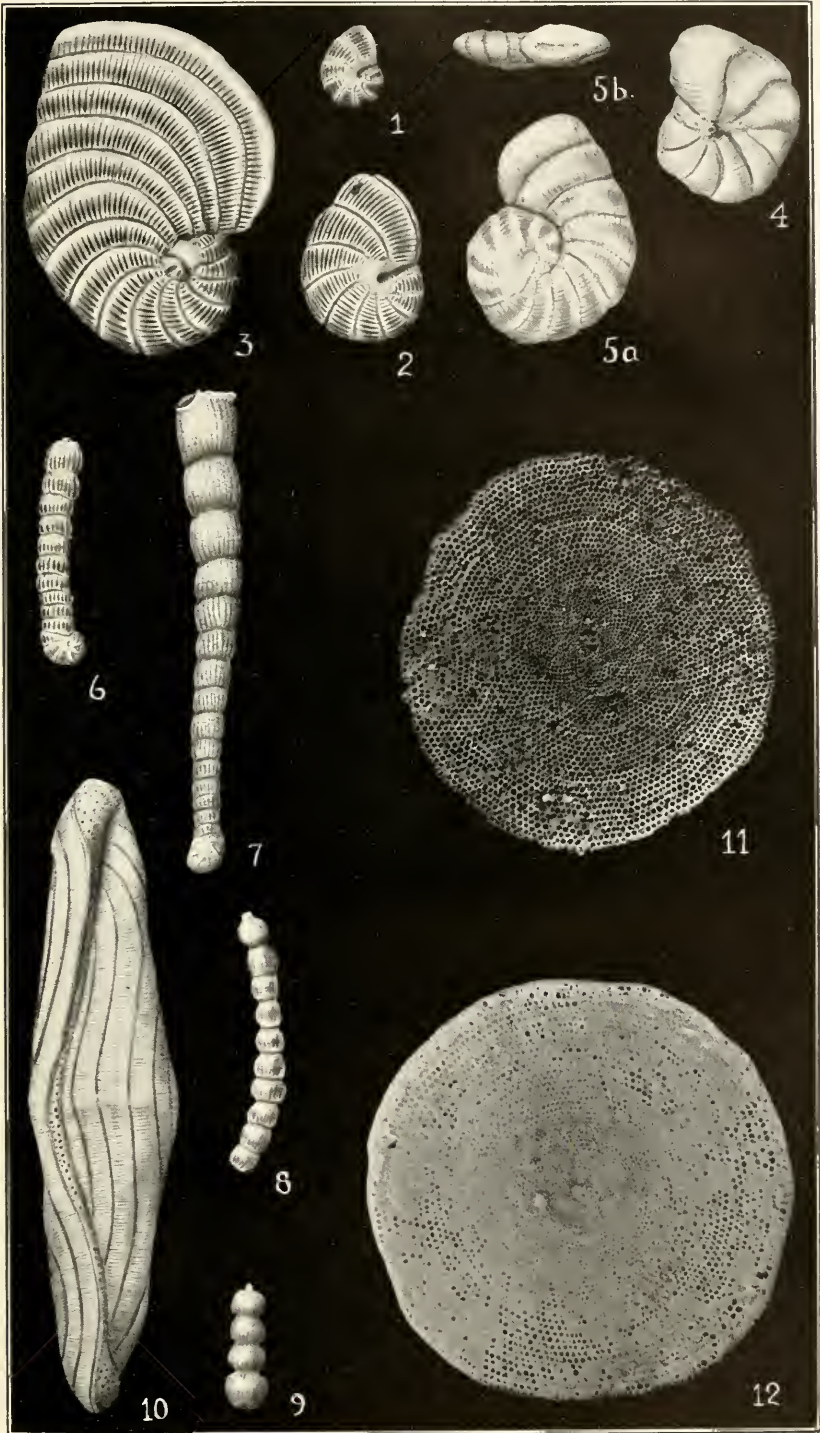
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