

RECENT FORAMINIFERA FROM OFF NEW ZEALAND.

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The material sent me for study by the United States National Museum consisted of four slides with over 1,200 specimens, representing nearly 200 species. The material was sent to the National Museum by Miss Marjorie and Mr. R. L. Mestayer, of Wellington, New Zealand. The locality for the material is off the "Poor Knights" Islands, east coast of New Zealand, latitude $35^{\circ} 30' S.$; longitude $174^{\circ} 43' E.$, dredged by H. M. S. *Hinemoa*.

This material contains a few specimens which belong evidently to new species and varieties, and others which are especially interesting as representing rare species previously dredged in this region by the *Challenger*, and described by Brady, such as *Technitella raphanus* and *Frondicularia compta*. This material has been compared with that dredged by the *Challenger* at station 169 at a depth of 700 fathoms, also off New Zealand. It may be compared with Chapman's material from off Great Barrier Island, New Zealand, at a depth of 100 fathoms, and Sidebottom's material, dredged by the *Dart*, from off Australia, at 465 fathoms.

References are given in the synonymy to both Chapman's and Sidebottom's papers, as well as to other records for the region.

A study of this material shows that the general distribution is that of the Indo-Pacific region. Some specimens recorded by Heron-Allen and Earland from the Kerimba Archipelago are found as far to the south and east as this region. Others are the same as those already recorded from southern Japan, the Hawaiian Islands, the Philippines, the Malay Archipelago, etc.

In general this seems to be a very well defined faunal area and it is probable that many of the species found here are limited to this general region.

This New Zealand material contains a great number of Lagenidae which is similar to that of Chapman's and Sidebottom's material, as well as that which I have had from the Philippines in comparatively deep water. Heron-Allen and Earland, in their Kerimba material

have very few Lagenidae, probably on account of the shallow water from which most of their material came.

The species and varieties which have been found in the material follow in systematic sequence.

A few of the new or otherwise noteworthy species are figured in the two plates which accompany this paper.

Family ASTRORHIZIDAE.

Subfamily SACCAMMININAE.

Genus PSAMMOSPHAERA F. E. Schulze, 1875.

PSAMMOSPHAERA FUSCA F. E. Schulze.

Psammospheara fusca F. E. SCHULZE, II Jahre Comm. wiss. Unt. deutsch. Meer in Kiel, 1875, p. 113, pl. 2, figs. 8a-f.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 249, pl. 18, figs. 1, 5-8 (not 2-4).—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 35, figs. 25-28 (in text).

There are two specimens of small size, angular in shape, made up entirely of clear sand grains, broken sponge spicules, and little cement. This is not at all the usual form of test for this species. The general color is grayish white. They evidently correspond to the material noted by Sidebottom.

PSAMMOSPHAERA PARVA Flint.

Plate 75, fig. 3.

Psammospheara parva FLINT, Rep. U. S. Nat. Mus., 1897 (1899), p. 268, pl. 9, fig. 1.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 36, figs. 29 and 30 (in text).

There are a few specimens in the material which are attached to, or perforated by, one large acicular sponge spicule. The test itself, however, is not at all of the usual form, but is angular, made up of large rough sand grains and broken spicules. Occasionally pointed spicules extend out from the test. In one specimen more or less calcareous material is incorporated in the test.

Genus TECHNITELLA Norman, 1878.

TECHNITELLA RAPHANUS H. B. Brady.

Technitella raphanus H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 247, pl. 25, figs. 13, 14.—CHAPMAN, Zool. Results, *Endeavour*, pt. 3, 1912, p. 310; vol. 3, pt. 1, 1915, p. 319.—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1002.

There are three specimens that seem to belong to this very rare species. The shortest of these is about 5 mm. in length and the longest about 10 mm., which is much larger than the type specimen described by Brady. The form, however, is very much smaller than that of Brady's figured specimen. The test itself is composed entirely

of fragments of sponge spicules cemented in such a way that the free ends extend toward the small end of the test. The aperture is contracted and ends of the spicules brought in apparently to form a protection for the animal. The interior is rather smoothly finished and there seems to be no lining membrane. All the records for this species are in the South Pacific region. Brady's original specimens were from a *Challenger* station off Kandavu, Fiji Islands, in 210 fathoms. Chapman's specimens come from latitude $42^{\circ} 17' S.$; longitude $148^{\circ} 51' E.$, in 1,122 fathoms, east of Tasmania. Pearcey records two or three specimens in the *Scotia* material from station 420, latitude $69^{\circ} 33' S.$; longitude $15^{\circ} 19' W.$, in 2,620 fathoms. This material is therefore from the shallowest station yet recorded.

TECHNITELLA MESTAYERI, new species.

Plate 74, fig. 4.

Description.—Test elongate, slightly tapering, cylindrical, arcuate; wall composed of fine acicular sponge spicules, with a very little grayish cement; initial end broadly rounded; apertural end truncate with a slight lip; color grayish yellow; surface fairly smooth. Length, 3 mm.

Two specimens in this material are peculiar in their very small size, form, and general character of the test. They evidently represent a new species of this genus in the region. It is somewhat allied to *T. legumen* Norman, but is much longer, more nearly cylindrical than that species and the wall is differently built.

Type.—Cat. No. 14740, U.S.N.M.

Genus THOLOSINA Rhumbler, 1895.

THOLOSINA VESICULARIS (H. B. Brady).

Placopsilina vesicularis H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 51, pl. 5, fig. 2; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 316, pl. 35, figs. 18, 19.

* *Tholosina vesicularis* RHUMBLER, Arch. Prot., vol. 3, 1903, p. 227, fig. 53 (in text).—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 65.

There are three specimens which are here referred to this species, all attached to shell fragments. The wall is composed of broken sponge spicules and clear quartz fragments, some of them of fairly large size. Mixed with these are very fine sand grains and grayish cement. The periphery is even and extends out into straight cylindrical tubular extensions. There is no sign of branching of these in any of the specimens, and as a rule they stand out clear from the substratum and are not attached, except at their base. They correspond very closely in general appearance with the specimens figured by Brady (*Challenger*, pl. 35, fig. 19.)

Subfamily HYPERAMMININAE.

Genus HYPERAMMINA H. B. Brady, 1878.

HYPERAMMINA LAEVIGATA J. Wright.

Hyperammina elongata H. B. BRADY (part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 257, pl. 23, figs. 9, 10 (not 3, 7, 8).

Hyperammina elongata H. B. BRADY, var. *laevigata* J. WRIGHT, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 466, pl. 20, fig. 1.

Hyperammina laevigata CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 77, pl. 29, figs. 5, 6.

Two specimens of this species, showing the proloculum, and two others showing simply the tubular portion, are shown on the slides.

HYPERAMMINA MESTAYERI, new species.

Plate 74, fig. 3.

Description.—Test elongate, cylindrical, arcuate, varying little in diameter throughout its length; initial portion hardly, if at all, enlarged; apertural end contracted to form a circular opening; wall thick, composed of very short fragments of sponge spicules and a few quartz grains; the fragments of spicules are variously crossed, the free ends pointing backward; color light grayish brown.

Diameter 1.25 mm.; length up to 16 mm.

There are four specimens of this form, which is apparently microspheric, in which the proloculum is small and the length maximum. There are three other specimens which agree with these in all points of structure and in which the initial end is considerably greater, its diameter being 2 mm. or more, but gradually tapers toward the apertural end, and the longest of the three specimens is 5 mm in length. These apparently represent the megalospheric form of the same species. It is evidently related to *Hyperammina friabilis* H. B. Brady.

Type.—Cat. No. 14741, U.S.N.M.

HYPERAMMINA SUBNODOSA H. B. Brady (?).

Hyperammina subnodosa H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 259, pl. 23, figs. 11-14.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 63, fig. 80 (in text).

There are three specimens of large size, the largest being 10 mm. in length and nearly 2.5 mm. in breadth. These have a coarse rough wall, composed of sand and sponge spicules and are constricted at intervals. The apertural end of the best preserved specimen has the opening covered in by sponge spicules, leaving small openings between. The form in general is tapering and they may represent this species, although they also resemble *H. friabilis* H. B. Brady.

Genus TOLYPAMMINA Rhumbler, 1895.**TOLYPAMMINA HORRIDA, new species.**

Plate 74, fig. 5.

Description.—Test attached, under surface made up of a subglobular proloculum and elongate-cylindrical chamber; wall consisting of fine sponge spicules radiating from the surface; wall inside smoothly finished; aperture formed by the open end of the tube. This species resembles *Saccorhiza ramosa* H. B. Brady in the spicular character of the test, but is attached throughout its length, and has a subglobular proloculum, whereas typical *T. vagans* H. B. Brady has a smooth wall and elongate proloculum and is a much smaller species. The tubular portion of this species measures one-third mm. or more in diameter.

This seems to be a common species of the material. Four specimens are mounted and attached to shell fragments, all uniform in character. There is a specimen in Sidebottom's material¹ "almost white in color and attached to a fragment of a shell." This also may be the same as this species.

Type.—Cat. No. 14742, U.S.N.M.

Genus AMMOLAGENA Eimer and Fickert, 1899.**AMMOLAGENA CLAVATA (Parker and Jones).**

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

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

Ammolagena clavata EIMER and FICKERT, Zeitschr. wiss. Zool., vol. 65, 1899, p. 673.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 69, figs. 86-88.

There is a single specimen which may be referred to this species, but it is not typical. It consists of what seems to be a double-chambered proloculum with the tubular portion broken away.

Subfamily AMMODISCINAE.**Genus AMMODISCUS Reuss, 1861.****AMMODISCUS MESTAYERI, new species.**

Plate 74, figs. 1, 2.

Description.—Test large, in the microspheric form consisting of an elongate ovoid proloculum with three or four coils; central portion depressed; megalospheric form with large subglobular proloculum followed by one and one-half coils; test thickest in the central portion; wall composed of fine angular sand grains with whitish or light brown cement; exterior smoothly finished.

Diameter.—Microspheric, 4.5 mm.; megalospheric form, 2.5 mm. The proloculum of the megalospheric form is nearly 1 mm. in length, and of the microspheric about one-fourth that size.

¹ Journ. Roy. Micr. Soc., 1918, p. 11.

This is a peculiar species in the few coils of the test; especially in the megalospheric form, and with its very protuberant center it is nearly one-third again as wide in the center as in the outer portion. In the microspheric form the whole test is of even color except the border of each coil and the end of the last-formed coil, which are lighter colored. In the megalospheric form the proloculum and the beginning of the first coil are dark reddish brown. This does not seem at all like any of the other species of *Ammodiscus* that I have seen from any part of the world. It is probably a species limited to the Australian or Indo-Pacific region. Chapman¹ records *Ammodiscus tenuis* H. B. Brady, from his station off New Zealand, which may possibly be the same as this described here.

Type.—Cat. No. 14745, U.S.N.M.

Family LITUOLIDAE.

Subfamily REOPHACINAE.

Genus REOPHAX Montfort, 1808.

REOPHAX SPICULIFERA H. B. Brady.

Reophax spiculifera H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 54, pl. 4, figs. 10, 11; Rep. Voy. *Challenger*, Zoology vol. 9, 1884, p. 295, pl. 31, figs. 16, 17.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 92.

There are numerous specimens in the material which can be referred to this species. They are made entirely of elongate sponge spicules, very neatly cemented; occasionally the end of the spicules extends backward from the chamber, as in Brady's figure. The specimens, however, are much larger.

REOPHAX SPICULIFERA H. B. Brady, var. PSEUDODISTANS, new variety.

Plate 75, fig. 1.

Description.—Among the material are specimens in shape very close to *R. distans*, but the entire test is made up of sponge spicules and are evidently related to *R. spiculifera* H. B. Brady. The test is easily broken and numerous single chambers are found in the material.

Type.—Cat. No. 14743, U.S.N.M.

REOPHAX SCORPIURUS (?) Montfort.

Reophax scorpiurus MONTFORT, Conch. Syst., vol. 1, 1808, p. 330, 83me genre.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 291, pl. 30, figs. 12–17.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 83, figs. 114, and 116 (in text).

Some specimens in the material have the general form of this species as figured by Brady. They are made up of sponge spicules

¹ Trans. New Zealand Instit., vol. 38, 1905, p. 85.

and sand grains combined, and have a very irregular shape. It is a question if they really have anything to do with *R. scorpiurus*. Sidebottom records this¹. His material is fragmentary, consisting of single chambers, and may possibly belong to the variety described here.

REOPHAX ADVENA, new species.

Plate 75, fig. 2.

Description.—Test elongate, thick; walls composed of very large, mostly clear, sand grains angularly cemented with a pale yellowish cement, in which are embedded very fine fragments; surface of the cement smooth and fragments of the test standing out as angular projections; chambers usually three or four, increasing gradually in size, the last formed one being the largest.

Length up to 5 mm.

This is apparently the same species that Sidebottom² had. He records this under the name *R. pilulifera* H. B. Brady, and gives the following notes: "Two fragments. The tests are much more roughly built-up than the *Challenger* specimens. The pale yellowish-cement used is plainly shown." This is somewhat like the large robust species which Pearcey has described from the Antarctic, but seems to be different from that species. In general form it is somewhat like *R. pilulifera* H. B. Brady, but is much larger and a more coarsely built species than that.

Type.—Cat. No. 14744, U.S.N.M.

Subfamily TROCHAMMININAE.

Genus HAPLOPHRAGMOIDES Cushman, 1910.

HAPLOPHRAGMOIDES GRANDIFORMIS Cushman.

Haplophragmoides grandiformis CUSHMAN, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 440, fig. 11 (in text).

There are four specimens of smaller size than the type, but agreeing very well in general characteristics. The wall is composed of sand grains and yellowish-gray cement; on the whole rather neatly finished. Chapman³ mentions specimens of *H. canariense* in which the texture is coarsely arenaceous and all of a ruddy brown color. These may be the same species.

HAPLOPHRAGMOIDES cf. ROTULATUM H. B. Brady.

A single specimen seems nearer to this species than any other described one.

¹ Journ. Roy. Micr. Soc., 1918, p. 13.

² Trans. New Zealand Instit., vol. 38, 1905, p. 84.

³ Idem, p. 12.

Genus AMMOBACULITES Cushman, 1910.**AMMOBACULITES AGGLUTINANS (d'Orbigny).**

Spirolina agglutinans D'ORBIGNY, Foram. Foss. Vienne, 1846, p. 137, pl. 7, figs. 10-12.

Haplophragmium agglutinans H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 301, pl. 32, figs. 19-26.

Ammobaculites agglutinans CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 115, fig. 176 (in text).

Five specimens seem to be referable to this species. They are not typical but are like the specimen figured on page 115,¹ the coiled portion not being very distinct from the later uncoiled portion. This same characteristic has been noted in the Philippine and other Pacific specimens, and they represent a different form from that described by d'Orbigny.

Genus TROCHAMMINA Parker and Jones, 1860.**TROCHAMMINA cf. NANA H. B. Brady.**

There are three specimens in this material which are very close to this species as figured by Brady. The wall is very smooth, composed of an abundance of cement and scattered clear sand grains. Side-bottom² records this species.

TROCHAMMINA SQUAMATA Parker and Jones (?).

There are several specimens attached to shell fragments which are probably this species. The wall is made of sponge spicules, small angular quartz grains and fine, nearly white, cement. The surface is smoothly finished. Heron-Allen and Earland record this species from the Kerimba Archipelago, speaking of it as "nearly white in color." This is probably the same species as theirs from that region. Most of the specimens are surrounded by a considerable amount of amorphous material.

Genus AMMOSPHAEROIDINA Cushman, 1910.**AMMOSPHAEROIDINA SPHAEROIDINIFORMIS (H. B. Brady).**

Haplophragmium sphaeroidiniformis H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 313.

Ammosphaeroidina sphaeroidiniformis CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 128, fig. 202 (in text).

A single specimen, evidently this species, occurs among the mounted material.

¹ Bull. 71, U. S. Nat. Mus., pt. 1, 1910.

² Journ. Roy. Micr. Soc., 1918, p. 15.

Genus NOURIA Heron-Allen and Earland, 1913.**NOURIA POLYMORPHINOIDES Heron-Allen and Earland.**

Plate 75, figs. 4, 5.

Nouria polymorphinoides HERON-ALLEN and EARLAND, Trans. Zool. Soc., London, vol. 20, 1915, p. 376, pl. 37, figs. 1-15, also p. 615.

Part of the original material described by Heron-Allen and Earland came from this same station, material having been sent them by Mr. Mestayer.

There are four specimens of this very interesting species in the mounted material which I have.

Family TEXTULARIIDAE.**Subfamily TEXTULARIINAE.****Genus TEXTULARIA Defrance, 1824.****TEXTULARIA SAGITTULA Defrance.**

Textularia sagittula DEFRANCE, Chapman, Trans. New Zealand Instit., vol. 38, 1905, p. 87.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 361, pl. 42, figs. 17, 18.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 5, figs. 2-5 (in text).

There are four specimens of the typical form of this species, very close to that figured by Brady¹. These are elongate and increase but little in width as new chambers are added.

TEXTULARIA SAGITTULA Defrance, var. FISTULOSA H. B. Brady.

Textularia sagittula DEFRANCE, var. *fistulosa* H. B. BRADY, 1884, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 362, pl. 13, figs. 19-22.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 87, pl. 3, fig. 4.

There are five specimens apparently representing this variety described by Brady, mounted on the slide. Chapman records it from off Great Barrier Island, in 110 fathoms.

TEXTULARIA SAGITTULA Defrance, var. ATRATA Cushman.

Textularia sagittula DEFRANCE, var. *atrata* Cushman, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 7, figs. 2-5 (in text).

There are three specimens which have the characters of this variety, which I described from the North Pacific. The sutures are covered with a dark-colored material, which forms a central band in addition.

TEXTULARIA RUGOSA (Reuss.)

Plecanium rugosum REUSS, Sitz. Akad. Wiss. Wien, vol. 59, 1869, p. 453, pl. 1, figs. 3a-b.

Textularia rugosa H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 363, pl. 42, figs. 23 and 24.

There are several specimens in different stages of growth, all of which probably belong to this species. None of them, however, are

¹ Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 42, fig. 17.

as well developed as the elongate specimen figured by Brady¹, which are so common in the Philippine region farther north. Neither Chapman nor Sidebottom record this species from this region.

TEXTULARIA STRICTA Cushman.

Textularia stricta CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 11, fig. 13 (in text).—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 20.

There are several specimens which are apparently the same as the species described from southern Japan. Sidebottom has recorded this species from his material from Australia, and has suggested that Chapman's material figured from Great Barrier Island, New Zealand, under the names *Spiroplecta sagittula* (Defrance), and *S. sagittula*, var. *fistulosa* Brady² is this same species. This material from New Zealand that I have had confirms this view. The largest specimens have between 30 and 40 chambers. The early portion suggests a spiroplectine condition, and although the other chambers can not be made out, the specimens are apparently microspheric.

TEXTULARIA GOËSI Cushman.

Textularia sagittula DEFRANCE, var. GOËS, Königl. Svensk. Vet. Akad. Handl., vol. 19, No. 4, 1882, pl. 5, figs. 150-158.

Textularia trochus H. B. BRADY (part), Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 366, pl. 43, fig. 17 (not 15, 16, 18, 19); pl. 44, figs. 1-3 (not *T. trochus* d'Orbigny).

Textularia goësi CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 15, fig. 24 (in text).

There are several specimens on the slide evidently belonging to this species. The largest of these is very close to the figure given by Brady³ which he refers to *T. trochus* d'Orbigny. I have already called attention to the fact that this is not the same as D'Orbigny's species from the Cretaceous. This is apparently a species of the coral reef regions in the Indo-Pacific. Chapman records *T. trochus* from Great Barrier Island.

TEXTULARIA ABBREVIATA d'Orbigny.

Textularia abbreviata D'ORBIGNY, For. Foss. Vienne, 1846, p. 249, pl. 15, figs. 9-12 (7-12).—H. B. BRADY, PARKER, and JONES, Trans. Zool. Soc. London, vol. 12, 1888, p. 219, pl. 42, figs. 4, 5.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 14, fig. 20 (in text).

There are a few specimens evidently belonging to this species. They are somewhat like *T. conica*, but are much more compressed. Sidebottom records this species from the east coast of Australia.

¹ Challenger Report, pl. 42, fig. 24.

² Chapman, 1906, Trans. N. Zealand Instit., vol. 38, 1905, p. 87, pl. 3, fig. 4.

³ Challenger Report, pl. 43, fig. 17.

TEXTULARIA APERTURALIS Cushman.

Textularia solita (Schwager), var. *inflata* Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 42, pl. 5, figs. 1-3.

Textularia aperturalis CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 20, figs. 34-35.

There are several specimens which at first glance might be assigned to *T. concava* Karrer, but in the largest of these there is the characteristic inflated portion with high chambers and a divided aperture. The smaller, younger specimens have a simple aperture and they have developed only to the stage where the inflated condition is beginning to be apparent. If it were not for the only adult specimen they might be taken for *T. concava* var. *heterostoma* Fornasini. Sidebottom¹ records a single specimen which he refers to this variety. The type specimen of this species was from the west coast of America, recorded by Goës.

Genus BIGENERINA d'Orbigny, 1826.

BIGENERINA NODOSARIA d'Orbigny.

Bigennerina nodosaria D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 261, pl. 11, figs. 9-11.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 369, pl. 44, figs. 14-18.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 27, figs. 46-48 (in text).

There are two specimens of this typical coral reef species. Neither Chapman nor Sidebottom record this from this region.

Genus BOLIVINA d'Orbigny, 1839.

BOLIVINA DILATATA (?) Reuss.

There are several specimens which may be referred to this species, but they are not typical. One or two of them suggest *B. robusta* of Brady (especially *Challenger*, pl. 53, fig. 7). Others are more like *B. dilatata*. Chapman records *B. robusta* from off Great Barrier Island and mentions that these specimens are smaller than usual for this species.

BOLIVINA KARRERIANA H. B. Brady.

Bolivina karreriana H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 58; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 424, pl. 53, figs. 19-21.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 40, fig. 65 (in text).

There are on the slide seven very typical specimens. This species is recorded by Chapman from off Great Barrier Island, and Sidebottom, from the east coast of Australia. It is one of the characteristic species from the Indo-Pacific region.

¹ Journ. Roy. Micr. Soc., 1918, p. 20.

BOLIVINA NOBILIS Hantken.

Bolivina nobilis HANTKEN, Magy. kir. földt. int. évkönyve, vol. 4, 1875 (1876), p. 56, pl. 15, fig. 4; Mitth. Jahrb. Ung. geol. Anstalt, vol. 4, 1875 (1881), p. 65, pl. 15, fig. 4.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 424, pl. 53, figs. 14, 15.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 39, fig. 64 (in text).

There are two specimens that are evidently this species, although the recent material is referred by Brady to this species of Hantken from fossil beds of Hungary. It may be questionable whether this reference is correct. All the records for the recent occurrence of the species seem to be limited closely to the Indo-Pacific region, and it seems likely that the recent form is a valid species.

Genus VALVULINA d'Orbigny, 1826.**VALVULINA FUSCA** (Williamson).

Rotalina fusca WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 55, pl. 5, figs. 114, 115.

Valvulina fusca M. SARS, Vid. Selsk. Forh., 1868, p. 249.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 392, pl. 49, figs. 13, 14.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 59, figs. 94-95 (in text).

There is a single specimen which may be referred to this species. The chambers, however, are more inflated and distinct from one another, as characteristic of the species elsewhere. It may not belong here.

Genus GAUDRYINA d'Orbigny, 1839.**GAUDRYINA QUADRANGULARIS** Bagg.

Gaudryina quadrangularis BAGG, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 133, pl. 5, fig. 1.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 64, fig. 103 (in text).

A single specimen seems very characteristic of this species described by Bagg from the Hawaiian Islands. It is very close to the specimen I have figured.¹

GAUDRYINA TRIANGULARIS Cushman.

Gaudryina triangularis CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 65, figs. 103-104 (in text).

Numerous specimens are close to this species described from the Hawaiian Islands. They are perhaps more regular in form than the figured specimens, and are close to those given by Brady as *G. rugosa*.

Genus CLAVULINA d'Orbigny, 1826.**CLAVULINA cf. COMMUNIS** d'Orbigny.

There are two specimens mounted which apparently may belong to this species. They are elongate, tapering, widest at the apertural end; the initial portion is somewhat angular and not in the

¹ Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 65, fig. 103.

same line as the later chambers. They are not closely like any of the figures given by Brady in the *Challenger* report.

CLAVULINA BRADYI Cushman.

Clavulina cylindrica H. B. BRADY (not *C. cylindrica* d'Orbigny, 1826), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 396, pl. 48, figs. 32-38.

Clavulina soldanii CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 88.

Clavulina bradyi CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 73, figs. 118-119 (in text).

There are four specimens which are very evidently this species. Chapman records it from off Great Barrier Island, and our specimens show an exerted aperture very much like that shown by Brady in the *Challenger* report, but more strongly marked. The neck itself, however, has a definite labyrinthic opening, except for the smallest specimens, which are valvuline. I, however, do not think that all specimens referred to *Haplostiche soldanii* and *H. dubia* should belong to *Clavulina*, for in the Philippine region especially the two are very distinct. *Haplostiche* has no elongate aperture, and the labyrinthic opening is much more complex than in this species.

Subfamily BULIMININAE.

Genus BULIMINA d'Orbigny, 1826.

BULIMINA OVATA d'Orbigny.

Bulimina ovata D'ORBIGNY, For. Foss. Vienne, 1846, p. 185, pl. 11, figs. 13, 14.—

H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 400, pl. 50, figs.

13a, b.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 77, fig. 125 (in text).

There are a few specimens of this species on the slide.

BULIMINA PYRULA d'Orbigny.

Bulimina pyrula D'ORBIGNY, For. Foss. Vienne, 1846, p. 184, pl. 11, figs. 9, 10.—

H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 399, pl. 50, figs.

7-10.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 78, fig. 126 (in text).

Specimens like those figured by Brady occur in the material.

BULIMINA MARGINATA d'Orbigny.

Bulimina marginata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 269, No. 4, pl. 12,

figs. 10-12.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 405,

pl. 51, figs. 3-5.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 83, fig. 136 (in text).

This seems to be the most common species of the material, and the specimens are very characteristic for the most part. Some of them, however, have spines at the base which make them tend toward *B. aculeata* in this respect. No typical *aculeata* were found, however. Sidebottom records all three of these species, and Chapman records *B. pyrula* and *B. marginata*; the latter is abundant off Great Barrier Island.

Genus BULIMINELLA Cushman, 1911.**BULIMINELLA ELEGANTISSIMA d'Orbigny.**

Buliminella elegantissima D'ORBIGNY, Foram. Amer. Merid., 1839, p. 51, pl. 7, figs. 13, 14.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 402, pl. 50, figs. 20–22.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, pt. 2, p. 122.

There are three specimens of this very definite species. Brady mentions in the *Challenger* report this species from Australia and the South Pacific and that it is widely scattered elsewhere. Chapman does not record it from Great Barrier Island, but Sidebottom records a single specimen from the east coast of Australia. All specimens are typical rather than like the variety described by Sidebottom.

Genus VIRGULINA d'Orbigny, 1826.**VIRGULINA SUBSQUAMOSA Egger.**

Virgulina subsquamosa EGGER, Neues Jahrb., 1857, p. 295, pl. 12, figs. 19–21.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 415, pl. 52, figs. 9–11.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 92, figs. 145–146 (in text).

There are four specimens on the slide which are very close to the figures of this species given by Brady,¹ but not like the other figures given. It may be possible that Brady has several species under this one name. In the *Challenger* report Brady mentions that the finest specimens of this species occur amongst the islands of the Pacific, and it is quite probable that these specimens from New Zealand represent one of the species which Brady refers to. These range from Tahiti to the south coast of Japan, which is the range of so many of these species found in the Philippines, and southward to Australia.

Subfamily CASSIDULININAE.**Genus CASSIDULINA d'Orbigny, 1826.****CASSIDULINA SUBGLOBOSA H. B. Brady.**

Cassidulina subglobosa H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 60; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 430, pl. 54, figs. 17, *a-c*.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 98, fig. 152 (in text).

Characteristic specimens of this species are on the slides. It is characteristic of deeper waters in most of the oceans, this being rather less than the usual depth for its occurrence. Both Chapman and Sidebottom record this species in their papers.

CASSIDULINA BRADYI Norman.

Cassidulina bradyi (Norman, MS.) WRIGHT, Proc. Belfast Nat. Field Club, App., 1880, p. 152.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 431, pl. 54, figs. 6–10.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 99, fig. 153 (in text).

There are several fine specimens which can be referred to this species. There seems, however, to be a distinction between the

¹ *Challenger* Report, pl. 52, fig. 9.

species found in the South Pacific and those in the North Atlantic. All these New Zealand specimens are much compressed, and, except that the adult ones are somewhat elongate, are of the type figured by Brady.¹ Sidebottom and Chapman both record this species, and it is possible that the compressed Pacific form should be distinguished from the more inflated Atlantic one.

Genus EHRENBURGIA Reuss, 1850.

EHRENBURGIA SERRATA Reuss, variety.

There are several mounted specimens in the collection which are uniform in character. They are much more compressed than is generally the case in this species, and the center portion where the angles of the sutures come together instead of being angled and projected is flattened. This is constant in all the specimens and may represent a distinct variety of the species. Sidebottom records this species from Australia, but makes no mention of any peculiarity of this sort.

Family LAGENIDAE.

Subfamily LAGENINAE.

Genus LAGENA Walker and Boys, 1784.

LAGENA GLOBOSA (Montagu).

Vermiculum globosum MONTAGU, Test. Brit., 1803, p. 523.

Lagena globosa BROWN, Illus. Rec., Conch. Great Britain and Ireland, ed. 1, 1827, pl. 1, fig. 37.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 452, pl. 56, figs. 1-3.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 3, pl. 4, fig. 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 129.

There are several specimens of this common species, showing little variation except in the thickness of the test.

LAGENA LAEVIS (Montagu).

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

Lagena laevis WILLIAMSON, Ann. Mag. Nat. Hist., ser. 2, vol. 1, 1848, p. 12, pl. 1, figs. 1, 2.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 455.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 5, pl. 1, fig. 3; pl. 38, fig. 5.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

A single specimen, nearly spherical in shape, evidently belongs here.

LAGENA LAEVIGATA (Reuss).

Fissurina laevigata REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1849, p. 366, pl. 46, fig. 1.

Lagena laevigata TERRIGI, Atti Accad. Pont. Nuovi Lincei, vol. 33, 1880, p. 177, pl. 1, fig. 6.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 473, pl. 114, figs. 8a, b.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 7, pl. 2, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

There are several specimens of this species, very close to the form which I have figured.²

¹ *Challenger* Report, pl. 54, fig. 10.

² Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 7, pl. 2, fig. 1.

LAGENA ELONGATA (Ehrenberg).

Miliola elongata EHRENBURG, Ber. preuss. Akad. Wiss. Berlin, 1844, p. 274; 1845, p. 371.

Lagena elongata TATE and BLAKE, Yorkshire Lias, 1876, p. 454, pl. 18, figs. 9, 9a.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 457, pl. 56, fig. 29.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 91.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 12, pl. 1, fig. 5.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

There are two specimens of this species, very elongate in form, and they have a definite phialine lip.

LAGENA APICULATA (Reuss).

Oolina apiculata REUSS, in Haidinger's Nat. Abhandl., vol. 4, 1850, p. 22, pl. 1, fig. 1.

Lagena apiculata REUSS, Sitz. Akad. Wiss. Wien, vol. 46, 1862 (1863), p. 319, pl. 1, figs. 4-8, 10, 11.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 453, pl. 56, figs. 4, 15-18.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 13.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 129.

There are several specimens showing very little variation.

LAGENA HISPIDA Reuss.

Lagena hispida REUSS, Zeitschr. deutsch. geol. Ges., vol. 10, 1858, p. 43; Sitz. Akad. Wiss. Wien., vol. 46, 1863, p. 335, pl. 6, figs. 77-79.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 459, pl. 57, figs. 1-4.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 91.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 13, pl. 4, figs. 4, 5; pl. 5, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

There are numerous specimens, all of one form, with a nearly spherical chamber; neck slender, exceeding the diameter of the test; somewhat similar to *Challenger* (pl. 57, fig. 2).

LAGENA SQUAMOSA (Montagu).

Vermiculum squamosum MONTAGU, Test. Brit., 1803, p. 526, pl. 14, fig. 2.

Lagena squamosa BROWN, Ill. Rec. Conch. Great Britain, 1827, pl. 1, fig. 32.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 471, pl. 58, figs. 28-31.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 16, pl. 6, fig. 1.

This species seems to be much more common than the following one, and can easily be distinguished from it by its ornamentation, even although of similar size.

LAGENA HEXAGONA (Williamson).

Entosolenia squamosa MONTAGU, var. *hexagona* WILLIAMSON, Ann. Mag. Nat. Hist., ser. 2, vol. 1, 1848, p. 20, pl. 2, fig. 23.

Lagena hexagona SIDDALL, Cat. Brit. Rec. For., 1879, p. 6.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 472, pl. 58, figs. 32, 33.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 92.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 17, pl. 6, figs. 2, 3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

There are several specimens of very constant size and shape.

LAGENA STRIATA (d'Orbigny).

Oolina striata D'ORBIGNY, Foram. Amer. Merid., 1839, p. 21, pl. 5, fig. 12.

Lagena striata REUSS, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862, (1863) p. 327, pl. 3, figs. 44, 45; pl. 4, figs. 46, 47.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 460, pl. 57, figs. 22, 24.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 91.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 19, pl. 7, figs. 4, 5.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

There are numerous specimens of the usual form, which has a spherical or slightly elongate body, with a conical tapering neck, sometimes with the striae continued out on to it, often in a spiral form. They are very common in the material.

LAGENA DESMOPHORA Rymer-Jones.

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

Lagena desmophora H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 468, pl. 58, figs. 42, 43.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 27, pl. 12, fig. 5; pl. 13, fig. 3.

There is a single specimen which apparently belongs to this species. It is very close to the specimen figured by Chapman,¹ as *L. quadrilata* Brady. Rymer-Jones describes this species from off Java, and Sidebottom's records are from the southwest Pacific.

LAGENA SULCATA (Walker and Jacob).

Serpula (Lagena) sulcata WALKER and JACOB, Adams' Essays, Kanmacher's ed., 1798, p. 634, pl. 14, fig. 5.

Lagena sulcata PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 351.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 462, pl. 57, figs. 23, 26, 33, 34.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 91.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 22, pl. 9, fig. 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

There are a few very typical specimens; the body spherical and the neck tapering conical, costae of the surface continued lengthwise on the neck.

LAGENA SULCATA (Walker and Jacob) var. APICULATA Cushman.

Lagena sulcata, apiculate forms, H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 58, figs. 4, 17 (?).—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

Lagena sulcata (WALKER and JACOB) var. *apiculata* CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 23, pl. 9, figs. 3, 4.

Numerous specimens occur with the apical end spinose, very similar to the type in Bulletin 71 (pt. 3, pl. 9, fig. 3).

¹ Journ. Linn. Soc. Zool., vol. 30, 1910, pl. 55, fig. 10.

LAGENA ACUTICOSTA Reuss.

Lagena acuticosta REUSS, Sitz. Akad. Wiss. Wien, vol. 44, pt. 1, 1861 (1862), p. 305, pl. 1, fig. 4.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 464, pl. 57, figs. 31, 32; pl. 58, figs. 20 (?), 21.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 23, pl. 8, figs 9, 10; pl. 23, fig. 2.

Two specimens occur which are very typical.

LAGENA SEMISTRIATA Williamson.

Lagena striata, var. *semistriata* WILLIAMSON, Ann. Mag. Nat. Hist., ser. 2, vol. 1, 1884, p. 14, pl. 1, figs. 9, 10.

Lagena semistriata JONES and PARKER, Monogr. Foram. Crag., 1866, p. 34, pl. 4, fig. 6.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 465, pl. 57, figs. 14, 16, 17.

There are six specimens of this species on the slide, very constant in their character, and close to *Challenger* (pl. 57, fig. 14).

LAGENA MARGINATA (Walker and Boys).

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

Lagena marginata BROWN, Illus. Conch. Great Britain, 1827, pl. 1, figs. 30, 31.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 476, pl. 59, figs. 21-23.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 37, pl. 22, figs. 1-7.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 130.

There is a single specimen with a wide keel.

LAGENA ORBIGNYANA (Seguenza).

Entosolenia marginata WILLIAMSON (part) (not *L. marginata* (WALKER and BOYS)), Rec. Foram. Great Britain, 1858, p. 9, pl. 1, figs. 19, 20.

Fissurina orbignyana SEGUENZA, Foram. monotal. Mioc. Messina, 1862, p. 66, pl. 2, figs. 24, 26.

Lagena orbignyana H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 484, pl. 59, figs. 1, 18, 24, 26.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 42, pl. 19, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 131.

This occurs, as usual, in several forms. Two of the commoner forms are those figured by Sidebottom¹ and by Cushman.²

Subfamily NODOSARIINAE.**Genus NODOSARIA Lamarck, 1812.****NODOSARIA (GLANDULINA) LAEVIGATA d'Orbigny.**

Nodosaria (Glandulina) laevigata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 252, pl. 10, figs. 1-3.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 490, pl. 61, figs. 20-22.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 47, pl. 24, figs. 1, 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 131.

Several specimens occur and are very typical in all their characters.

¹ Journ. Quekett Micr. Club, vol. 12, 1913, pl. 17, fig. 10.

² Bull. 71, U. S. Nat. Mus., pt. 3, 1913, pl. 19, fig. 1.

NODOSARIA PYRULA d'Orbigny.

Nodosaria pyrula D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 253, No. 13.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 497, pl. 62, figs. 10-12.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 49, pl. 26, figs. 1-3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 132.

There are several specimens of this species which show the proloculum of the form which I have figured.¹

NODOSARIA PROXIMA Silvestri.

Nodosaria proxima SILVESTRI, Atti Accad. Gioenia, Catania, ser. 3, vol. 7, 1872, p. 63, pl. 6, figs. 138-147.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 511, pl. 64, fig. 15.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 52.

There are two specimens, each formed of two chambers, in general like those figured for this species, but with the costae more prominent than those figured by Brady. In general form and character, the specimens are close to those figured by Silvestri.

NODOSARIA RADICULA (Linnaeus).

Nautilus radicula LINNAEUS, Syst. Nat., ed. 12, 1767, pp. 1164, 285.
Nodosaria radicula D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 252, No. 3.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 495, pl. 61, figs. 28-31.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 52.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 131, pl. 3, figs. 23-25.

A single specimen in the material is very close to this species, as figured by Brady, but lacks the apical spine.

NODOSARIA SOLUTA (Reuss).

Dentalina soluta REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 60, pl. 3, figs. 4a, b.
Nodosaria soluta BORNEMANN, Zeitschr. deutsch. geol. Ges., vol. 7, 1855, p. 322, pl. 12, fig. 12.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 503, pl. 62, figs. 13-16; pl. 64, fig. 28.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 93.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 53, pl. 26, figs. 9-11.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 133.

There are a few rather immature specimens which can be referred to this species, but they are not typical.

NODOSARIA COMMUNIS d'Orbigny.

Nodosaria (Dentalina) communis D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 254, No. 35.
Dentalina communis D'ORBIGNY, Mém. Soc. Géol. France, vol. 4, 1840, p. 13, pl. 1, fig. 4.
Nodosaria communis REUSS, Verst. Böhm. Kreid., pt. 1, 1845, p. 28, pl. 12, fig. 21.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 504, pl. 62, figs. 19-22.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 54, pl. 28, figs. 1, 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 133.

Specimens comparable to those figured by Brady are not uncommon.

¹ Bull. 71, U. S. Nat. Mus., pt. 3, 1913, pl. 26, fig. 2.

NODOSARIA FILIFORMIS d'Orbigny.

Nodosaria filiformis D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 253, No. 14.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 500, pl. 63, figs. 3-5.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 93, pl. 3, fig. 5.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 55, pl. 27, figs. 1-4.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 133.

One specimen, very close to that which I have figured,¹ occurs, but there are other specimens which show the proloculum similar to that of *N. pyrula*, but the chambers close set or oblique. These may be possibly microspheric and megalospheric forms of the same species, as the latter chambers are very similar.

NODOSARIA ROEMERI (Neugeboren).

Dentalina roemeri NEUGEBOREN, Denkschr. Akad. Wiss. Wien, vol. 12, 1856, p. 82, pl. 2, figs. 13-17.
Nodosaria roemeri REUSS, Sitz. Akad. Wiss. Wien, vol. 62, 1870, p. 475.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 505, pl. 63, fig. 1.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 94.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 55, pl. 24, figs. 4-6.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 134.

Very typical specimens occur, similar to that figured by Brady.

NODOSARIA CONSOBRINA (d'Orbigny), var. EMACIATA (Reuss).

Dentalina emaciata REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 63, pl. 3, fig. 9.
Nodosaria (D.) consobrina, var. *emaciata* REUSS, Denkschr. Akad. Wiss. Wien, vol. 25, 1865, p. 132, pl. 2, figs. 12, 13.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 502, pl. 62, figs. 25, 26.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 93.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 56, pl. 27, fig. 9.

Numerous specimens occur, similar to those figured in the *Challenger* report.

NODOSARIA MUCRONATA (Neugeboren).

Nodosaria (Dentalina) obliqua D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 254, No. 36.
Dentalina mucronata NEUGEBOREN, Denkschr. Akad. Wiss. Wien, vol. 12, 1856, p. 83, pl. 3, figs. 8-11.
Nodosaria mucronata REUSS, Sitz. Akad. Wiss. Wien, vol. 62, 1870, p. 475, No. 30.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 506, pl. 62, figs. 27-31.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 56, pl. 24, fig. 3; pl. 25, fig. 2; pl. 27, figs. 5-7; pl. 35, fig. 6.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 134.

There are several specimens evidently this species, with both apical and apertural ends acute, and the chambers overlapping to form the smooth surface.

¹ Bull. 71, U. S. Nat. Mus., pt. 3, 1913, pl. 27, figs. 1-2.

NODOSARIA SCALARIS (Batsch).

Nautilus (Orthoceras) scalaris BATSCH, Conch. des Seesandes, 1791, No. 4, pl. 2, figs. 4a, b.

Nodosaria scalaris PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 340, pl. 16, figs. 2a, b, c.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 510, pl. 63, figs. 28–31.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 58, pl. 24, fig. 7.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 134.

Two forms occur—one with the apical spine as figured by Brady¹ the other with the apical spine wanting, and a the costae of the surface extending over the apical end. These have the appearance of a test in which the first chamber has in some way become detached.

NODOSARIA VERTEBRALIS (Batsch).

Nautilus (Orthoceras) vertebralis BATSCH, Conch. des Seesandes, 1791, p. 3, No. 6, pl. 2, fig. 6a, b.

Nodosaria vertebralis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 514, pl. 63, fig. 35; pl. 64, figs. 11–14.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 60, pl. 32, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 134.

Nodosaria obliqua LINNAEUS, var. *vertebralis* CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 94, pl. 3, fig. 5.

This species seems to attain a large size in this material and may be compared to that found in the Philippine region.

NODOSARIA HIRSUTA d'Orbigny.

Nodosaria hirsuta D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 252, No. 7.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 60, pl. 28, fig. 3.

Nodosaria hispida D'ORBIGNY, For. Foss. Bass. Tert. Vienne, 1846, p. 35, pl. 1, figs. 24, 25.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 507, pl. 63, figs. 12–16.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 135.

There is a single specimen mounted which is very close in its character to that figured by Brady (*Challenger*, pl. 63, fig. 14).

Genus LINGULINA d'Orbigny, 1826.

LINGULINA CARINATA d'Orbigny (?).

Lingulina carinata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 257, No. 1.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 517, pl. 65, fig. (?)16.

There is a single specimen which is almost identical in all its characters with that figured by Brady² under this name. This is, however, evidently not *L. carinata* d'Orbigny. Brady mentions in his list of localities that he had material from the South Pacific, and this form figured by him may possibly be characteristic of this region. It is evidently a new species or variety, which should be described when more material is available.

¹ *Challenger* Report, pl. 63, figs. 28–31.

² *Challenger* Report, pl. 65, fig. 16.

LINGULINA GRANDIS Cushman.

Lingulina grandis CUSHMAN, Proc. U. S. Nat. Mus., vol. 51, 1917, p. 656.

There is a single specimen which is undoubtedly the same species which I described from the Philippines. This specimen is not as large as the type: it is between 3 and 4 mm. in length, and 1.2 mm. in width. This is another species which connects the foraminifere fauna of the Philippine region with that of New Zealand and Australia.

Genus CRISTELLARIA Lamarck, 1812.

CRISTELLARIA CULTRATA (Montfort).

Robulus cultratus MONTFORT, (?) Conch. Syst., vol. 1, 1808, p. 214, 54e genre.

Robulina cultrata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 287, No. 1.

Cristellaria cultrata PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 344, pls. 13, 17, 18; pl. 16, fig. 5.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 550, pl. 70, figs. 4, 5, 6.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 98.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 64, pl. 29, fig. 4.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 142.

Very typical material occurs, both adult and young specimens.

CRISTELLARIA ARTICULATA Reuss.

Robulina articulata REUSS, Sitz. Akad. Wiss. Wien, vol. 48, 1863, p. 53, pl. 5, fig. 62.

Cristellaria articulata REUSS, Sitz. Akad. Wiss. Wien, vol. 62, 1870, p. 483.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 547, pl. 69, figs. 10-12.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 97.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 65, pl. 31, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 141.

A few specimens with the characteristic apertural characters occur. They are close to the specimens figured by Brady,¹ but with the keel much more pronounced. In the general form of the chambers and keel they are somewhat similar to the figure of *C. nitida* as figured by Brady,² except in the apertural characters.

There is one specimen mounted on a separate slide from the others, which is one of the wild-growing forms mentioned and figured by Brady and is very similar to *Challenger*.³ Sidebottom⁴ had one specimen of this same form. From a comparison of the *Challenger* figures with the typical material, it is difficult to see what the two forms have in common. Our specimen is certainly like Brady's figure referred to, but is very unlike the typical specimens found in this same material.

CRISTELLARIA ROTULATA (Lamarck).

Lenticulites rotulata LAMARCK, Ann. Mus., vol. 5, 1804, p. 188, No. 3.

Cristellaria rotulata D'ORBIGNY, Mém. Soc. Géol. France, ser. 1, vol. 4, 1840, p. 26, pl. 2, figs. 16-18.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9,

¹ *Challenger* Report, pl. 69, figs. 11-12.

² *Idem*, pl. 70, fig. 2.

³ *Idem*, pl. 69, fig. 2.

⁴ Journ. Roy. Micr. Soc., 1918, p. 141.

1884, p. 547, pl. 69, figs. 13a, b.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 97.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 66, pl. 35, fig. 3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 142.

There are a very few typical specimens of this species representing both adult and early stages.

CRISTELLARIA ORBICULARIS (d'Orbigny).

Robulina orbicularis D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 288, pl. 15, figs. 8-9.

Cristellaria orbicularis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 549, pl. 69, fig. 17.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 97.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 67, pl. 36, figs. 4, 5.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 142.

There are characteristic specimens both of the young and the adult.

CRISTELLARIA GIBBA d'Orbigny.

Cristellaria gibba D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 63, pl. 7, figs. 20, 21.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 546, pl. 69, figs. 8, 9.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 69, pl. 35, fig. 1.

Material very close to that figured by Brady¹ occurs.

CRISTELLARIA VARIABILIS Reuss.

Cristellaria variabilis REUSS, Denschr. Akad. Wiss. Wien, vol. 1, 1849, p. 369, pl. 46, figs. 15, 16.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 541, pl. 68, figs. 11-16.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 70, pl. 36, figs. 1-3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 141, pl. 5, fig. 8.

There are numerous excellent specimens of this species.

CRISTELLARIA CREPIDULA (Fichtel and Moll).

Nautilus crepidula FICHTEL and MOLL, Test. Micr., 1803, p. 107, pl. 19, figs. g-i. *Cristellaria crepidula* D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 64, pl. 8, figs. 17-18.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 542, pl. 67, figs. 17, 19, 20; pl. 68, figs. 1-2.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 70, pl. 29, figs. 5, 6; pl. 31, figs. 2-5.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 140.

As usual, there is a considerable variation of the specimens representing this species, but all are typical in their general character. The variation is largely in length and the extent to which the chambers continue back on the ventral side.

CRISTELLARIA TRICARINELLA Reuss.

Cristellaria tricarinella REUSS, Sitz. Akad. Wiss. Wien, vol. 46, 1862, p. 68, pl. 7, fig. 9; pl. 12, figs. 2-4.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 540, pl. 68, figs. 3, 4.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 96.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 72, pl. 34, figs. 1, 2.

This species seems to be one of the most common in the material, as far as the mounted specimens show. They are very typical.

¹ *Challenger* Report, pl. 69, figs. 8-9.

Brady's *Challenger* records are from the Philippines, 95 fathoms; off Raine Island, Torres Strait, 155 fathoms, and off the west coast of New Zealand, 150 fathoms. I have had this species from off Japan, and it is evidently a species of the Indo-Pacific region. It may possibly be that it is not the same as the fossil species described by Reuss from the Cretaceous of Germany.

CRISTELLARIA TRICARINELLA Reuss, var. **SPINIPES** Cushman.

Cristellaria tricarinella REUSS, var. *spinipes* CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 72, pl. 33, fig. 2.

I described this variety from off Japan. That material differed from the typical *C. tricarinella* only in the addition of a large spine at the apical end of the test and with more limbate sutures. This material from New Zealand, while in general appearance like that of *C. tricarinella*, has several spines at the apical end; but the main difference is that the early portion is completely involute and quite different in appearance from that from Japan. The early stages are not at all like that of the numerous specimens of *C. tricarinella* which are mounted on the slide. It is an interesting form and may prove to be distinct.

CRISTELLARIA DENTICULIFERA Cushman.

Cristellaria cultrata H. B. BRADY (part) (not *C. cultrata* Montfort), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 550, pl. 70, figs. 7, 8.

Cristellaria denticulifera CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 75, pl. 37, fig. 1.

There is a single large specimen which is very close to this species as figured by Brady. The walls of the chambers are ornamented with longitudinal curved costae, and the denticulate borders with the raised sutures show it to be this species. The number of chambers is also similar to that in the figured specimen. The material I have had is from off Japan, but Brady's material is indefinite as to locality.

CRISTELLARIA SCHLOENBACHI Reuss.

Cristellaria schloenbachi REUSS, Sitz. Akad. Wiss. Wien, vol. 46, 1862, p. 65, pl. 6, figs. 14, 15.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 539, pl. 67, fig. 7.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 96.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 77, pl. 36, fig. 6.

Brady figures a single specimen which he refers to this species.¹ It is very close to this material. His records for this species include one station from this general region, off Raine Island, 155 fathoms. Chapman records a single specimen from off New Zealand.² It is also recorded by Millett from the Malay Archipelago. I have had it in some numbers from the Philippines. In the North Pacific

¹ *Challenger* Report, pl. 67, fig. 7.

² Trans. New Zealand Inst., vol. 38, 1905, p. 96.

material which I had it occurred as far north as Korea Strait, showing that it has a wide distribution in the Indo-Pacific region. This should be closely compared with the material from the Atlantic.

CRISTERLLARIA LATIFRONS H. B. Brady.

Cristellaria latifrons H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 544, pl. 68, fig. 19; pl. 113, figs. 11a, b.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 97.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 78, pl. 38, fig. 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 140.

Brady described this species from two widely separated regions—one off Culebra Island, West Indies, and the other from off New Zealand. This material from “Poor Knights Islands” is of the form figured by Brady.¹

Flint’s specimens from the Gulf of Mexico do not seem to be as typical as these from New Zealand, and it is to be suspected that Brady’s figure is that from his New Zealand locality. It may be that the two regions have distinct forms. It occurs in typical form in the Philippines, recorded by Sidebottom, and I have material in the *Albatross* and Philippine dredgings, so it is evidently a rather widespread species, at least in the Indo-Pacific regions.

CRISTELLARIA ITALICA (Defrance) (?).

Saracenaria italica DEFRANCE, Dict. Sci. Nat., vol. 32, 1824, p. 177, vol. 47, 1827, p. 344.

Cristellaria (Saracenaria) italica D’ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 293, No. 26.

Cristellaria italica PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 3, vol. 16, 1865, pp. 21, 32, pl. 1, figs. 41, 42.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 544, pl. 68, figs. 17, 18, 20-23.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 78, pl. 33, fig. 3.

There is a species which seems to be common, which is much broader than *C. latifrons*, and yet is not the typical form of *C. italica*. The ventral base of the chamber in the adult is broadly triangular, much like that of *C. italica*, but it extends nearly to the base of the test. This is a form placed by some writers under *C. acutauricularis*.

Genus MARGINULINA d’Orbigny, 1826.

MARGINULINA GLABRA d’Orbigny.

Marginulina glabra D’ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 259, No. 6.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 527, pl. 65, figs. 5, 6.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 95.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 79, pl. 23, fig. 3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 138, pl. 4, figs. 26-31; pl. 5, figs. 1-3.

There are several typical specimens of this species.

¹ *Challenger* Report, pl. 68, fig. 19.

Genus VAGINULINA d'Orbigny, 1826.**VAGINULINA LEGUMEN (Linnaeus).**

Nautilus legumen LINNAEUS, Syst. Nat., ed. 10, 1758, p. 711, No. 248.

Vaginulina legumen D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 257, No. 2.—

H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 530, pl. 66, figs.

13-15.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 80, pl. 39, fig. 4.—

SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 139.

This seems to be a common species from the number of mounted specimens. They are close to the figures given by Brady for this species.

Genus FRONDICULARIA Defrance, 1824.**FRONDICULARIA COMPTA H. B. Brady.**

Frondicularia compta H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 57, pl. 8, fig. 6; Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 520, pl. 65, fig. 19.

Brady figures and describes a very peculiar specimen under this species name. It came from off East Moncoeur Island, Bass Strait, depth 38 fathoms. He also figures ¹ a specimen from off Raine Island which he refers to *F. archiaciana* d'Orbigny. In this material from New Zealand there are four specimens which should be referred to either one or the other of these figures given by Brady. These have from three to five chambers. One of them has somewhat the ornamentation shown in plate 114, figure 12. The others are more like the earlier chambers of *F. compta*, plate 65, figure 19. It seems quite likely that both the specimens which Brady had may be one species, in which case they probably should both be placed under Brady's species. At any rate the New Zealand specimens which are in this collection seem to belong to *F. compta*, which is evidently a very rare species, and should be looked for elsewhere in the Indo-Pacific region.

Subfamily POLYMORPHININAE.**Genus POLYMORPHINA d'Orbigny, 1826.****POLYMORPHINA GIBBA d'Orbigny.**

Polymorphia (Globulina) gibba D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 226, No. 20.

Polymorphina gibba H. B. BRADY, PARKER, and JONES (part), Trans. Linn. Soc. London, vol. 27, 1870, p. 216, pl. 39, figs. 2a-d.—H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 561, pl. 71, figs. 12a, b.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 85, pl. 41, fig. 4.

Both the typical form and two specimens of the fistulose form occur on the slides. They are very close to the figures given by Brady.

¹ Challenger Report, pl. 114, fig. 12.

POLYMORPHINA OBLONGA d'Orbigny.

Polymorphina oblonga D'ORBIGNY, For. Foss. Vienne, 1846, p. 232, pl. 12, figs. 29-31.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 569, pl. 73, figs. 2-4.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 88, pl. 37, fig. 6.

The specimens on the slide are very similar to the specimens figured by Brady.¹

POLYMORPHINA ELEGANTISSIMA Parker and Jones.

Polymorphina elegantissima PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 438.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 566, pl. 72, figs. 12-15.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 90, pl. 38, fig. 1.

There are two specimens on the slide which are evidently the young of this species, which is common in shallow water in the entire Indo-Pacific region.

POLYMORPHINA PROBLEMA d'Orbigny.

Polymorphina problema D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 266, No. 14.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 568, pl. 72, fig. 20; pl. 73, fig. 1.

There are numerous specimens in all stages, some of which are close to Brady's figure,² but the adults are, as a rule, broader than those specimens. Otherwise they are typical.

POLYMORPHINA REGINA H. B. Brady, Parker, and Jones.

Polymorphina regina H. B. BRADY, PARKER, and JONES, Trans. Linn. Soc. London, vol. 27, 1870, p. 241, pl. 41, figs. 32a, b.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 571, pl. 73, figs. 11-13.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 91, pl. 41, figs. 6, 7.

There are two small specimens with the characteristic ornamentation of this species.

Subfamily UVIGERININAE.

Genus UVIGERINA d'Orbigny, 1826.

UVIGERINA PYGMAEA d'Orbigny.

Uvigerina pigmea D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 269, pl. 12, figs. 8, 9.
Uvigerina pygmaea D'ORBIGNY, For. Foss. Bass. Tert. Vienne, 1846, p. 190, pl. 11, figs. 25, 26.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 575, pl. 74, figs. 11-14.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 99.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 96, pl. 42, fig. 1; pl. 44, fig. 5.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 146.

A few specimens may be referred to this common species.

¹ *Challenger* Report, pl. 73, fig. 2.

² *Idem*, pl. 73, fig. 1.

UVIGERINA AMPULLACEA H. B. Brady.

Uvigerina asperula CZIZEK, var. *ampullacea* H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 579, pl. 75, figs. 10, 11.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 146.

Uvigerina ampullacea EGGER, Abh. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 313, pl. 9, fig. 37.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 102, pl. 42, fig. 3.

A few specimens may be referred to this species, having the characteristic form of the last chambers.

UVIGERINA INTERRUPTA H. B. Brady.

Uvigerina interrupta H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 60, pl. 8, figs. 17, 18; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 580, pl. 75, figs. 12-14.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 103, pl. 44, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 147.

There are a few specimens of this species which are very similar to those figured by Brady.¹ It is evidently a species occurring in the Indo-Pacific region in shallow water. Brady's material is all from the South Pacific. Chapman records it from the Arabian Sea, and it is known as far east as off the Galapagos, and Juan Fernandez. Most of the records are in comparatively shallow water.

Genus SIPHOGENERINA Schlumberger, 1883.

SIPHOGENERINA BIFRONS, var. STRIATULA Cushman.

Siphogenerina bifrons, var. *striatula* CUSHMAN, Proc. U. S. Nat. Mus., vol. 51, 1917, p. 662.

There is a single specimen of this variety in the material. It is common in the Philippine region and extends its range very much to the south, showing that it is probably widely distributed in the Indo-Pacific.

Subfamily RAMULININAE.

Genus RAMULINA Rupert-Jones, 1875.

RAMULINA GLOBULIFERA H. B. Brady.

Ramulina globulifera H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 58, pl. 8, figs. 32, 33; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 587, pl. 76, figs. 22-28.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 99.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 3, p. 110, pl. 39, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 149.

There are one or two specimens which probably belong to this species, although they may be possibly very fistulose *Polymorphinae*. Both specimens, however, have a definite chamber, from which branch the numerous arms. Therefore they seem to be reasonably placed under *Ramulina*.

¹ *Challenger* Report, pl. 75, figs. 12-14.

Family CHILOSTOMELLIDAE.

Genus CHILOSTOMELLA Reuss, 1850.

CHILOSTOMELLA OVOIDEA Reuss.

Chilostomella ovoidea REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 380, pl. 48, fig. 12.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 436, pl. 55, figs. 12–23.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 2, pl. 1, figs. 1–5.

There are several specimens mounted on the slide which seem to show possibly both microspheric and megalospheric forms. There are two very distinct sizes: the larger specimen is evidently somewhat like *C. grandis* Cushman, described from the Philippines. It is however not as large as that species.

Family GLOBIGERINIDAE.

Genus GLOBIGERINA d'Orbigny, 1826.

GLOBIGERINA BULLOIDES d'Orbigny.

Globigerina bulloides D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 277, No. 1.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 593, pl. 77; pl. 79, figs. 3–7.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 100.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 5, pl. 2, figs. 7–9; pl. 9.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 149.

This seems to be a common species in the material from the number of specimens mounted.

GLOBIGERINA DUBIA Egger.

Globigerina dubia EGGER, Neues Jahrb. für Min., 1857, p. 281, pl. 9, figs. 7–9.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 595, pl. 79, figs. 17a–c.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 6, pl. 4, figs. 1–3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 149.

This form seems to be common from the number of specimens mounted. Chapman, however, does not record it in his material from New Zealand.

GLOBIGERINA RUBRA d'Orbigny.

Globigerina rubra D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, Foraminifères, p. 94, pl. 4, figs. 12–14.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 602, pl. 79, figs. 11–16.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 9, pl. 3, figs. 6–9.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 149.

There are but two specimens of this species. These have the characteristic form but not the color. Sidebottom's specimens show no color. This seems to be true of most specimens from the Indo-Pacific region. Very few have the red color characteristic of Atlantic specimens. Chapman does not record it from New Zealand.

GLOBIGERINA CONGLOBATA H. B. Brady.

Globigerina conglobata H. B. BRADY, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 72; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 603, pl. 80, figs. 1-5; pl. 82, fig. 5.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 10, pl. 3, figs. 3-5; pl. 10, figs. 1, 6.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 150.

There are numerous specimens of small size and fairly characteristic, but not as fully developed as those from other regions. Chapman does not record this from New Zealand, but Sidebottom mentions "fine specimens."

GLOBIGERINA SACCULIFERA H. B. Brady.

Globigerina helicina CARPENTER (not *G. helicina* d'Orbigny), Intr. Foram., 1862, pl. 12, fig. 11.

Globigerina sacculifera H. B. BRADY, Geol. Mag., dec. 2, vol. 4, 1877, p. 535; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 604, pl. 80, figs. 11-17; pl. 82, fig. 4.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 11, pl. 2, figs. 4-6; pl. 5; pl. 10, fig. 4.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 149.

Numerous typical specimens occur. Sidebottom also had the species, but Chapman did not.

GLOBIGERINA AEQUILATERALIS H. B. Brady var. INVOLUTA Cushman.

Globigerina aequilateralis H. B. BRADY, var. *involuta* CUSHMAN, Proc. U. S. Nat. Mus., vol. 51, 1917, p. 662.

All the specimens which can be referred to this species in this material are of the form described from the Philippines. In this the last-formed coil overlaps and largely covers the earlier portion. Both Chapman and Sidebottom record this species from this region.

Genus ORBULINA d'Orbigny, 1839.

ORBULINA UNIVERSA d'Orbigny.

Orbulina universa D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminiifères," p. 3, pl. 1, fig. 1.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 608, pl. 78; pl. 81, figs. 8-26; pl. 82, figs. 1-3.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 101.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 14, pl. 6; pl. 7; pl. 11, fig. 3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 151.

There are a few mounted specimens, hardly any of which are typical. Most of them have two visible chambers, and some more than two, evidently young stages in the development of the species. It may be that these were mounted especially on account of their interest and the typical material common, but not mounted.

Genus SPHAEROIDINA d'Orbigny, 1826.

SPHAEROIDINA BULLOIDES d'Orbigny.

Sphaeroidina bulloides D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 267, No. 1.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 620, pl. 84, figs. 1-7.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 101.—CUSHMAN,

Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 18, pl. 10, fig. 7; pl. 12, fig. 1.—SIDE-BOTTOM, Journ. Roy. Micr. Soc., 1918, p. 151.

There are numerous specimens of this species, which is recorded by Chapman and Sidebottom as rare.

SPHAEROIDINA DEHISCENS Parker and Jones.

Sphaeroidina dehiscens PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 369, pl. 19, fig. 5, *a, b*.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 621, pl. 84, figs. 8–11.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 19, pl. 10, fig. 2; pl. 13, fig. 1.

A few specimens evidently young of this species occur, but no well-developed ones. Chapman does not record it, and Sidebottom quotes it as "rare, but typical."

Genus PULLENIA Parker and Jones, 1862.

PULLENIA QUINQUELOBA (Reuss).

Nonionina quinqueloba REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 47, pl. 5, figs. 31*a, b*.

Pullenia quinqueloba H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 617, pl. 84, figs. 14, 15.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 101.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 21, pl. 13, fig. 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 151.

Very typical specimens occur which are characteristic in every way; they are well-developed adult specimens. Brady records this from the east coast of New Zealand, and Chapman and Sidebottom both record it. Sidebottom mentions that his specimens varied in the number of chambers and final whorl, there being from four to seven chambers. Our specimens have the characteristic five visible chambers.

PULLENIA OBLIQUILOCULATA Parker and Jones.

Pullenia obliquiloculata PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 368, pl. 19, figs. 4*a, b*.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 618, pl. 84, figs. 16–20.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 22, pl. 10, fig. 3; pl. 12, figs. 2, 3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 151.

This is the commonest species of this group and is typical in form and of full size. Sidebottom had the species from the east coast of Australia.

Family ROTALIIDAE.

Subfamily SPIRILLININAE.

Genus SPIRILLINA Ehrenberg, 1841.

SPIRILLINA VIVIPARA Ehrenberg.

Spirillina vivipara EHRENBURG, Abh. Akad. Wiss. Berlin, 1841, p. 442, pl. 3, fig. 41.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 630,

pl. 85, figs. 1-5.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 3, pl. 1, figs. 1, 2.—SIDEBOTTOM, Journ. Roy. Micr., Soc., 1918, p. 250.

There are five specimens on the slide, all of the same form and general characters. The test is very thin and transparent, and prominently, but finely perforate. The keels are more or less irregular, occasionally somewhat angled in places.

SPIRILLINA DECORATA H. B. Brady.

Spirillina decorata H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 633, pl. 85, figs. 22-25.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 7, pl. 5, figs. 1, 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 250.

There is a single specimen which is evidently this species. It, however, agrees with the two smaller tests mentioned by Sidebottom, resembling *S. limbata* var. *denticulata*.

SPIRILLINA LIMBATA H. B. Brady, var. DENTICULATA H. B. Brady.

Spirillina limbata H. B. BRADY, var. *denticulata* H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 632, pl. 85, fig. 17.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 5, pl. 3, figs. 1, 2.

There are two specimens very clearly this species. They are mounted with the typical form. Both of these specimens are broadest on the ventral side which is acutely angled.

Subfamily ROTALINAE.

Genus DISCORBIS Lamarck, 1804.

DISCORBIS TURBO (d'Orbigny).

Rotalia (Trochulina) turbo D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 274, No. 39; Modèles, No. 73.

Discorbina turbo CARPENTER, PARKER, and JONES, Introd. Foram., 1862, p. 200.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 642, pl. 87, figs. 8a-c.

Discorbis turbo CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 10, pl. 11, fig. 2.

A single very typical specimen is mounted. This species is not mentioned either by Chapman or Sidebottom, but was dredged by the *Challenger* off Australia in shallow water. I had the species from the Hawaiian Islands and Japan, showing that it has a wide range in this faunal area.

DISCORBIS ROSACEA (d'Orbigny).

Rotalia rosacea D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 273, No. 15.

Discorbina rosacea H. B. BRADY, Trans. Linn. Soc., vol. 24, 1864, p. 473, No. 69; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 644, pl. 87, figs. 1, 4.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 252.

Discorbis rosacea CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 13, fig. 13, (in text).

There are two sets of specimens mounted, one of which evidently represents dead shells without color; the other, live ones in which

the central chambers are the characteristic reddish brown. In form these are very similar to the specimens figured by Brady.¹

DISCORBIS VILARDEBOANA (d'Orbigny) (?).

There is a specimen which is very close to that figured by Brady under this name.² This is referred by Heron-Allen and Earland in their Clare Island Paper to *D. concinna* Brady. However, comparison of these two in the *Challenger* plates show that there are differences between them, which this specimen bears out. It is evidently not *D. vilardeboana* d'Orbigny. A similar form to this occurs in the Philippines and appears to be a definite species occurring in the Indo-Pacific region.

DISCORBIS PATELLIFORMIS (H. B. Brady).

Discorbina patelliformis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 647, pl. 88, figs. 3a-c; pl. 89, figs. 1a-c.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 254.

Discorbis patelliformis CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 17, pl. 5, fig. 5; fig. 19 (in text).

One very typical specimen is mounted. This seems to be a species known largely from the South Pacific. It is recorded as far north as Laysan Island by Rhumbler, and the Malay Archipelago by Millett, and as far west as Madagascar. There are records for it in the Mediterranean. It seems to occur mostly in comparatively shallow water.

DISCORBIS BERTHELOTI (d'Orbigny).

Rosalina bertheloti D'ORBIGNY, in Barker, Webb, and Berthelot, Hist. Nat. Isles Canaries, vol. 2, pt. 2, 1839, "Foraminifères," p. 135, pl. 1, figs. 28-30.

Discorbina bertheloti H. B. BRADY, Trans. Linn. Soc. London, vol. 24, 1864, p. 469, pl. 48, figs. 10a, b; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 650, pl. 89, figs. 10-12.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 253.

Discorbis bertheloti CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 20, pl. 7, fig. 3; fig. 23 (in text).

This seems to have been a common species from the material, as a large set is mounted. They are very typical.

DISCORBIS RARESCENS (H. B. Brady).

Discorbina rarescens H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 651, pl. 90, figs. 2, 3, and 4.—CHAPMAN, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1907, p. 136.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 253.

Discorbis rarescens CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 20, pl. 7, fig. 4; fig. 24 (in text).

There is a single specimen of this species with four visible chambers, and a thin narrow keel surrounding the entire test. It was described by Brady from off Raine Island and from the Philippines. Sidebottom had a few specimens from off Australia.

¹ *Challenger* Report, pl. 87, fig. 1.

² *Idem*, pl. 86, fig. 12.

DISCORBIS PILEOLUS (d'Orbigny.)

Valvulina pileolus D'ORBIGNY, Foram. Amer. Merid., 1839, p. 47, pl. 1, figs. 15-17.
Discorbina pileolus PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 385.

There are very numerous specimens of this species, most of which are plastogamic—a condition which appears to be common in this species. Most of the records for this species seem to be from the Indian and South Pacific Oceans. There is one specimen which has a border with a row of short spines which suggests a varietal character, but no name is given it as only one specimen occurs.

DISCORBIS BICONCAVA (Parker and Jones.)

Discorbina biconcava PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 422, pl. 19, fig. 10.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 653.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 255.

There are six specimens on one of the slides, which agree very closely with the *Challenger* figures. Almost all the records for this species are about Australia, except one from Siddall, from Great Britain. This is recorded as a very small form, and it may be questionable as to its really being identical with this species, especially since Sidebottom records a single small specimen from off Australia. Heron-Allen and Earland in their Clare Island Paper do not record this species.

DISCORBIS INCONSPICUA (H. B. Brady.)

Textularia inconspicua H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 357, pl. 42, figs. 6a-c.—MILLETT, Journ. Roy. Micr. Soc., 1899, p. 557, pl. 7, fig. 1.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 86.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 18.—HERON-ALLEN and EARLAND, Trans. Zool. Soc., vol. 20, 1915, p. 623, pl. 47, figs. 1-4.

In the material from this station there are six specimens of this species. These show the early chambers to be spiral; the walls are very thin and translucent, and distinctly perforated. Millett has already remarked that this species has certain characteristics, making it more like some of the Rotaliidae than the other species of *Textularia*, and Brady also observed this same resemblance. I have already noted (pt. 2, p. 19) that it might belong to *Discorbis*, but that "a study of the apical characters and the arrangement of the early chambers should determine this." This material now can be used for this study, and seems to determine definitely that it should be placed among the Rotaliidae. In some of its markings it resembles *Patellina*, and is here placed under *Discorbis*. It seems to be a species in which the chambers each make a half coil as added, and its resemblance to *Textularia* is only superficial. This seems to be clearly an Indo-Pacific species. The localities given by Brady are off Moncoeur Island, Bass Strait, 38 fathoms; Nares Harbor, Admi-

ralty Islands, 17 fathoms; and the *Hyalonema* ground, south of Japan, 345 fathoms. Millett records the species from the Malay Archipelago, and Chapman from off Great Barrier Island.

Genus PLANORBULINA d'Orbigny, 1826.

PLANORBULINA ACERVALIS H. B. Brady.

Planorbulina acervalis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 657, pl. 92, fig. 4.—MILLETT, Journ. Roy. Micr. Soc., 1904, p. 490.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 29, pl. 14, fig. 1; fig. 32 (in text).

There is a single specimen which is characteristic of this species.

Genus TRUNCATULINA d'Orbigny, 1826.

TRUNCATULINA LOBATULA (Walker and Jacob).

Nautilus lobatulus WALKER and JACOB, Adams' Essays, Kanmacher's ed., 1798, p. 642, pl. 14, fig. 36.

Truncatulina lobatula D'ORBIGNY, in Barker, Webb, and Berthelot, Hist. Nat. Isles Canaries, vol. 2, pt. 2, "Foraminifères," 1839, p. 134, pl. 2, figs. 22-24.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 660, pl. 92, fig. 10; pl. 93, figs. 1, 4, 5; pl. 95, figs. 4, 5.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 256.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 31, pl. 15, fig. 1; fig. 34 (in text).

There are numerous specimens which seem to be this species.

TRUNCATULINA VARIABILIS d'Orbigny.

Truncatulina variabilis D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 279, No. 8; in Barker, Webb, and Berthelot, Hist. Nat. Isles Canaries, vol. 2, pt. 2, "Foraminifères," 1839, p. 135, pl. 2, fig. 29.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 661, pl. 93, figs. 6-7.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 103.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 33, fig. 35 (in text).

There are numerous irregular specimens, some very elongate, like that figured,¹ and others more nearly circular in their general outline, all probably representing this species. The early chambers in the living coiled portion are brownish in color in the best preserved specimens.

TRUNCATULINA HAIDINGERII (d'Orbigny).

Rotalina haidingerii D'ORBIGNY, For. Foss. Bass. Tert. Vienne, 1846, p. 154, pl. 8, figs. 7-9.

Truncatulina haidingerii REUSS, Sitz. kais. Akad. Wiss. Wien, vol. 55, 1867, p. 28.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 663, pl. 95, fig. 7.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 104.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 35, pl. 13, fig. 5; pl. 28, fig. 1; fig. 37 (in text).—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 257.

There are a few specimens which seem to be similar to those figured by Brady, the only difference being in the angle of the tests, which seems to be more acute than our specimens.

¹ Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 33.

TRUNCATULINA UNGERIANA (d'Orbigny).

Rotalina ungeriana D'ORBIGNY, For. Foss. Bass. Tert. Vienne, 1846, p. 157, pl. 8, figs. 16-18.

Truncatulina ungeriana REUSS, Denkschr. Akad. Wiss. Wien, vol. 25, 1865, p. 161.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 664, pl. 94, figs. 9a-d.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 26, pl. 17, fig. 2; fig. 39 (in text).—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 256.

There are numerous very typical specimens of this species which seems to be a common one in the region from the published records.

TRUNCATULINA TENUIMARGO H. B. Brady.

Truncatulina tenuimargo H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 62, pl. 93, figs. 2-3.—EGGER, Abhandl. bay. Acad. Wiss. München, Cl. II, vol. 18, 1893, p. 399, pl. 16, figs. 7-9.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 102.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 257, pl. 6, figs. 20, 21.

There are two specimens mounted on the slide which are very close to Brady's figure.¹ This seems to be a rare species. There is no such development of the ventral surface as figured by Sidebottom, the extent of the elevation being similar to the figure quoted by Brady in the *Challenger* Report. This seems to be a species limited closely to the Australian region.

Genus SIPHONINA Reuss, 1849.**SIPHONINA RETICULATA (Czjzek).**

Rotalina reticulata CZJZEK, Haidinger's Nat. Abh., vol. 2, 1848, p. 145, pl. 13, figs. 7-9.

Siphonina reticulata BRONN, Lethaea Geognostica, ed. 3, vol. 3, 1853-1856, p. 227, pl. 35(?), figs. 23a-c.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 43, pl. 16, fig. 4; pl. 28, fig. 3; fig. 48 (in text).

Truncatulina reticulata H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 669, pl. 96, figs. 5-8.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 102.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 257.

There is a single specimen with a very crenulate margin, very similar in appearance to that figured by Brady.²

Genus ANOMALINA d'Orbigny, 1826.**ANOMALINA GROSSERUGOSA (Gümbel).**

Truncatulina grosserugosa GÜMBEL, Abh. kais. bay. Akad. Wiss., vol. 10, 1868, p. 660, pl. 2, fig. 104.

Anomalina grosserugosa H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 673, pl. 94, figs. 4, 5.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 45, pl. 20, fig. 1; fig. 50 (in text).

There are numerous specimens which seem to be this species, although neither Chapman or Sidebottom record it from this region.

¹ *Challenger* Report, pl. 93, fig. 2.

² *Idem*, pl. 96, figs 5, 6.

Chapman, however, records it from Funafuti, and it is known from numerous stations in the North Pacific.

Genus CARPENTERIA Gray, 1858.

CARPENTERIA PROTEIFORMIS Goës.

Carpenteria balaniformis, var. *proteiformis* Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 19, 1882, p. 94, pl. 6, figs. 208–214; pl. 7, figs. 215–219.

Carpenteria proteiformis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 679, pl. 97, figs. 8–14.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 49, pl. 20, fig. 2; pl. 21, fig. 1.

There are several very typical specimens of this species which is very common in the Indo-Pacific, and well developed in the Philippines and coral-reef regions. These typical specimens have the reticulate porous wall, as shown in the figures given by Goës and Brady. There are, however, other very interesting specimens mounted on the slide with these. These are not only different in form, but also in the structure of the test, and especially in the ornamentation. One series of these has the test very thin, and the pores small and close together. Some of the specimens are loosely joined in an irregular linear series. Others are irregularly piled, and while they have the same type of test, they have an addition of a superficial thickening of material which gives them a very different appearance. This consists of more or less regular bosses on the outside of the test already formed. These thickenings are circular or irregularly elongate and are distinguished between the pores of the test. This makes an entirely different looking test from the other. (In worn specimens, even in later chambers, this secondary thickening is lacking.) The apertures also are very different in character. Some of them, as shown by Goës, are elongate and tubular, while others are sunken and have numerous spines about the borders on the two or three adjacent chambers. Altogether this forms a very interesting series. The specimens are in considerable numbers, but not sufficient to determine whether these are definite varietal characters or not.

Genus PULVINULINA Parker and Jones, 1862.

PULVINULINA CONCENTRICA Parker and Jones.

Pulvinulina concentrica (Parker and Jones, MS.), H. B. BRADY, Trans. Linn. Soc., London, vol. 24, 1864, p. 470, pl. 48, fig. 14; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 686, pl. 105, fig. 1a–b.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 51, pl. 28, fig. 4.

There are several specimens representing both early stages and the adult of this species. This species is very widely spread and shows little variation in its characters. Neither Chapman or Sidebottom seem to record it from this region.

PULVINULINA OBLONGA (Williamson.)

Nautilus auricula, var. *a*, FICHTEL and MOLL, 1803, Test. Micr., p. 108, pl. 20, figs. *d*, *e*, *f*.

Rotalina oblonga WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 51, pl. 4, figs. 98-100.

Pulvinulina oblonga H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 688, pl. 106, figs. 4*a-c*.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 260.

There is a single typical specimen of this species which is common in the general region. Sidebottom records small specimens.

PULVINULINA cf. PATAGONICA d'Orbigny.

A single specimen may be referred to this species but it is not typical.

PULVINULINA CANARIENSIS (d'Orbigny).

Rotalina canariensis D'ORBIGNY, in Barker, Webb, and Berthelot, Hist. Nat. Isles Canaries, vol. 2, pt. 2, "Foraminifères," 1839, p. 130, pl. 1, figs. 34-36.

Pulvinulina canariensis OWEN, Journ. Linn. Soc. London, vol. 9, Zool., 1867, p. 148, pl. 5, fig. 21.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 692, pl. 103, figs. 8-10.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 105.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 56, pl. 23, fig 1; fig. 55 (in text).—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 259.

There are numerous typical specimens, which seem to be common in the region, being recorded both by Chapman and Sidebottom.

PULVINULINA TRUNCATULINOIDES (d'Orbigny).

Rotalina truncatulinoides D'ORBIGNY, in Barker, Webb, and Berthelot, Hist. Nat. Isles Canaries, vol. 2, pt. 2, "Foraminifères," 1839, p. 132, pl. 2, figs. 25-27.

Pulvinulina truncatulinoides PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 398, pl. 16, figs. 41-43.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 105.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 59, pl. 23, fig. 4.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 259.

Pulvinulina micheliniana H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 694, pl. 104, figs. 1, 2.

There are several typical specimens of this widely spread pelagic form.

PULVINULINA SCHREIBERSII (d'Orbigny).

Rotalina schreibersii D'ORBIGNY, For. Foss. Bass. Tert. Vienne, 1846, p. 154, pl. 8, figs. 4-6.

Pulvinulina schreibersii PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 393.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 697, pl. 115, fig. 1*a-c*.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 106.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 62, fig. 59 (in text).

There are several typical specimens of this species which seems to be characteristic of the Indo-Pacific. Most of the *Challenger* material comes from this region, and I have found it to be very abundant in the Philippines. It extends as far eastward as the Hawaiian Islands and as far westward as the Red Sea and the Mediterranean.

PULVINULINA CRASSA (d'Orbigny).

Rotalina crassa D'ORBIGNY, Mém. Soc. Géol. France, vol. 4, 1840, p. 32, pl. 3, figs. 7, 8.

Pulvinulina crassa OWEN, Journ. Linn. Soc. Zool. London, vol. 9, 1867, p. 148, pl. 5, fig. 8 (?), 9.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 694, pl. 103, figs. 11, 12.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 105.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 58, pl. 27, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 259.

There are several specimens of this common species.

PULVINULINA ELEGANS (d'Orbigny).

Rotalia (Turbinulina) elegans D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 276, No. 54.

Pulvinulina elegans JONES and PARKER, Geologist, vol. 7, 1864, p. 88.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 699, pl. 105, figs. 4-6.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 63, pl. 26, fig. 3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 260.

Typical specimens occur in various stages. The species is very common in this whole general region.

PULVINULINA AURICULA (Fichtel and Moll).

Nautilus auricula, var. *a* FICHTEL and MOLL, Test. Micr., 1803, p. 108, pl. 20, figs. *a-c*.

Pulvinulina auricula PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 393.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 688, pl. 105, figs. 5*a-c*.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 105.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 53, pl. 22, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 260.

Very large fine specimens are mounted on one of the slides. This is common in comparatively deep water in the general region. Brady records it off the Philippines, and I have found it in the same region.

Genus ROTALIA Lamarck, 1804.**ROTALIA SOLDANII d'Orbigny.**

Rotalia (Gyroidina) soldanii D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 278, No. 5.

Rotalia soldanii HANTKEN, Mitt. Jahrb. ung. geol. Anstalt., 1875, p. 80, pl. 9, figs. 7*a-c*.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 706, pl. 107, figs. 6, 7.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 106.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 71, pl. 29, fig. 1; pl. 31, fig. 4.

The mounted specimens are very typical.

Genus GYPSINA Carter, 1877.**GYPSINA INHAERENS (Schultze).**

Acervulina inhaerens SCHULTZE, Organ. der Polythal., 1854, p. 63, pl. 6, fig. 12.

Gypsina inhaerens H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 718, pl. 102, figs. 1-6.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 74, pl. 21, figs. 6, 7.

There is a single specimen, which seems to be this species.

GYPSINA VESICULARIS (Parker and Jones).

Orbitolina vesicularis PARKER and JONES, Ann. Mag. Nat. Hist., ser. 3, vol. 6, 1860, p. 31, No. 5.

Gypsina vesicularis CARTER, Ann. Mag. Nat. Hist., ser. 4, vol. 20, 1877, p. 173.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 718, pl. 101, figs. 9–12.

There are two specimens, small and poorly preserved, which may be this species. They are roughly conical in form, of light color, and similar to Brady's figures.

Genus POLYTREMA Risso, 1826.**POLYTREMA MINIACEUM (Linnaeus).**

Millepora miniacea LINNAEUS, Syst. Nat., ed. 13, (Gmelin's), vol. 1, pt. 6, 1788, p. 3784, No. 6.

Polytrema miniaceum BLAINVILLE, Dict. Sci. Nat., vol. 42, 1826, Atlas, Zooph., vol. 1, p. 17.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 721, pl. 100, figs. 5–9; pl. 101, fig. 1.—HICKSON, Trans. Linn. Soc. London, Zoology, vol. 14, 1911, pp. 444, 453, pl. 30, fig. 1; pl. 31, fig. 8; pl. 32, figs. 18, 23, 27, 31.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 75, pl. 18, fig. 6; pl. 20, fig. 4.

There are several specimens of this species; two of them are the characteristic pink color; the other two are grayish white.

Family NUMMULITIDAE.**Genus NONIONINA d'Orbigny, 1826.****NONIONINA UMBILICATULA (Montagu).**

Nautilus umbilicatus MONTAGU, Test. Brit., 1803, p. 191.

Nonionina umbilicatulula PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 242, pl. 12, fig. 157.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 726, pl. 109, figs. 8, 9.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 107.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 24, pl. 17, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 262.

There are numerous well-developed specimens of this species which seems to be common in the Indo-Pacific.

Genus POLYSTOMELLA Lamarck, 1822.**POLYSTOMELLA CRISPA (Linnaeus).**

Nautilus crispus LINNAEUS, Syst. Nat., ed. 12, 1767, p. 1162.

Polystomella crista LAMARCK, Anim. sans Vert., vol. 7, 1822, p. 625, No. 1.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 736, pl. 110, figs. 6, 7.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, pl. 18, fig. 1.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 263.

There is a single specimen apparently immature. Sidebottom records a few very small weak specimens.

POLYSTOMELLA MACELLA (Fichtel and Moll).

Nautilus macellus, var. *a*, FICHTEL and MOLL, Test. Micr., 1803, p. 66, pl. 10, figs. *e-g*.

Polystomella macella PARKER and JONES, Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 104, No. 8.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 737, pl. 110, figs. 8, 9, 11.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 33, pl. 18, fig. 3.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 263.

There are numerous finely developed specimens of this species which Sidebottom records as "two very small immature specimens."

POLYSTOMELLA MILLETTII Heron-Allen and Earland.

Polystomella verriculata MILLETT, Journ. Roy. Micr. Soc., 1904, p. 604, pl. 11, fig. 3.

Polystomella millettii HERON-ALLEN and EARLAND, Trans. Zool. Soc., p. 735, pl. 53, figs. 38-42.

There are five specimens which may be possibly referred to this species. They have a reticulate surface, the lines of which are oblique to the sutures. In the specimens from New Zealand, even in the last-formed chambers, there is not developed the angled condition shown by Heron-Allen and Earland in their type figures. These correspond fairly well with the figures of *P. hedleyi* figured by Jensen.¹ His specimens, however, have less of the angled pattern than is developed in our specimens, and ours are not very closely like those of Millett. From the various figures given of similar specimens of the Philippines and from this general region, there is either one very variable species or numerous varieties or species developed, and it should be carefully collected and studied in the regions to determine this.

Family MILIOLIDAE.**Subfamily CORNUSPIRININAE.****Genus CORNUSPIRA Schultze, 1854.****CORNUSPIRA FOLIACEA Costa, var. EXPANSA Chapman.**

Cornuspira carinata COSTA, var. *expansa* CHAPMAN, Biol. Res. *Endeavour*, vol. 3, 1915, p. 318, pl. 1, fig. 3.

There are several well-developed specimens which are very clearly this variety described by Chapman. Our specimens, however, are better developed than that figured by Chapman. It is very clear, both from these specimens and from abundant Philippine material, that this would be a variety of *C. foliacea*. Some of the specimens are very expanded and are nearly 4 mm. in length and nearly as much in breadth. There are slight traces of very fine longitudinal striae.

¹ Proc. Linn. Soc. New South Wales, vol. 29, 1905, p. 828, pl. 23, fig. 4.

CORNUSPIRA INVOLVENS (Reuss).

Operculina involvens REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1849, p. 370, pl. 45, fig. 20.

Cornuspira involvens REUSS, Sitz. Akad. Wiss. Wien, vol. 48, 1863, p. 39, pl. 1, fig. 2.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 200, pl. 11, figs. 1-3.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 25, pl. 1, fig. 2; pl. 2, fig. 2.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 11.

There is a single specimen which seems to be typical. It is microspheric.

CORNUSPIRA LACUNOSA H. B. Brady.

Cornuspira lacunosa H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 202, pl. 113, fig. 21.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 26, pl. 2, fig. 3.

There are two microspheric specimens of small size which, although not very irregular in surface pattern, resemble very closely the young of this species as seen in material from the Philippines and other portions of the North Pacific.

CORNUSPIRA, species (?).

There are two microspheric specimens on one of the slides which seem to be different from any described species of this genus. The earliest coils are smooth; the later ones are covered by longitudinal or oblique costae. These are usually distinct and do not run one into the other. The transverse lines of growth are also prominent in the later portions. In the largest of the two specimens the coils become somewhat expanded but not compressed, the test being at its greatest thickness in this portion. It is not at all like *C. striolata* H. B. Brady; in form it is somewhat similar to a specimen figured by Chapman¹ from the Tertiary of Australia. Chapman's figure does not show the surface markings as in our material, but the form is very suggestive. Except for the very broad later growth it resembles *C. lacunosa*. The material of *C. lacunosa* which I had from the North Pacific showed that the last coil loses its ornamentation largely. Otherwise this largest specimen is quite similar to that form.

Genus SPIROLOCULINA d'Orbigny, 1826.**SPIROLOCULINA GRATELOUPI d'Orbigny.**

Spiroloculina grateloupi D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 298.—TERQUEM, Mém. Soc. Geol. France, ser. 3, vol. 1, 1878, p. 52, pl. 5, figs. 5, 6.—WEISNER, Archiv. Prot., vol. 25, 1912, p. 208.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 31, pl. 4, figs. 4, 5.

Spiroloculina excavata H. B. BRADY (not d'Orbigny), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 151, pl. 9, figs. 5, 6.

There are several well-developed specimens of this species in various stages. The largest ones show adult characters very well.

¹ Journ. Linn. Soc. Zool, vol. 30, 1907, p. 24, pl. 3, fig. 48.

SPIROLOCULINA AFFIXA Terquem.

Spiroloculina affixa TERQUEM, Mém. Soc. Geol. France, ser. 3, vol. 1, 1878, p. 55, pl. 5 (10), fig. 13a-c.—HOWCHIN, Trans. Roy. Soc. South Australia, vol. 12, 1889, p. 2.—CHAPMAN, Journ. Linn. Soc. Zoology, vol. 30, 1907, p. 10, pl. 1, figs. 23-25.

Spiroloculina acutimargo H. B. BRADY (part), Rep. Voy. Challenger, Zoology, vol. 9, 1884, pl. 10, fig. 12 (not figs. 13-15).

Spiroloculina inaequilateralis SCHLUMBERGER, Mém. Soc. Zool. France, vol. 6, 1893, p. 201, pl. 4, figs. 84-86; fig. 3 (in text).—SIDEBOTTOM, Mem. and Proc. Manchester Lit. and Philos. Soc., vol. 54, No. 16, 1910, p. 2, pl. 1, fig. 2.

There are a number of specimens which are very evidently this species, and show little variation in form and general characters. Chapman and Howchin record this from the Tertiary of Australia. Terquem described the species from the Pliocene of the Isle of Rhodes; Schlumberger described his species, which is evidently the same as Terquem's, from the Gulf of Marseille.

Sidebottom had the same species from the Bay of Palermo, Sicily. The figure given by Brady referred to above seems to be this same species. From other material that I have had it seems to be widespread and of very constant characters in this general region.

SPIROLOCULINA ANTILLEA d'Orbigny, var. RETICOSA Chapman.

Spiroloculina grata TERQUEM, var. *reticosa* CHAPMAN, Biol. Res. Endeavour, vol. 3, 1915, p. 313, pl. 1, fig. 2.

There is a single specimen which is very clearly this variety described by Chapman from "forty miles south of Cape Wiles." It has the same peculiar surface markings as shown in the type figure, and probably has a widespread distribution about Australia and elsewhere.

Genus PLANISPIRINA Seguenza, 1880.

PLANISPIRINA SPHAERA (d'Orbigny).

Biloculina sphaera D'ORBIGNY, Voy. Amer. Merid., 1839, "Foraminifères," p. 66, pl. 8, figs. 13-16.—H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 141, pl. 2, figs. 4a, b.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 4.

Planispirina sphaera SCHLUMBERGER, Mém. Soc. Zool. France, 1891, p. 190, text figs. 45, 46.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 82.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 37, pl. 19, fig. 1.

There are a few specimens which have the typical V-shaped aperture.

Genus NUBECULARIA Defrance, 1825.

NUBECULARIA LUCIFUGA Defrance.

Nubecularia lucifuga DEFRANCE, Dict. Sci. Nat., vol. 25, 1825, p. 210, Atlas Zooph., pl. 44, fig. 3.—H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 134, pl. 1, figs. 9-16.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 41, pl. 8, fig. 6.

There are two specimens which are referred to this species. One represents several close-set chambers irregularly coiled. The other

represents an irregular linear series in which the chambers are pyriform, the basal portion being broad and rounded, the apertural end narrowed. These remind one very much of certain specimens of *Vitrewebbina*. Both specimens are attached to shell fragments.

NUBECULARIA BRADYI Millett.

Plate 75, fig. 6.

Nubecularia inflata H. B. BRADY, (not *Nubecularia inflata* TERQUEM), Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 135, pl. 1, figs. 5-8.

Nubecularia bradyi MILLETT, Journ. Roy. Micr. Soc., 1898, p. 261, pl. 5, fig. 6.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 41, pl. 8, figs. 4, 5.

There are numerous specimens, very irregular in shape and resembling in a general way those figured by Brady¹ and also a specimen figured by Millett. In spite of the fact of the irregularity of form, the general characters of this species seem to be well defined. The surface is smooth and polished and clear white in color.

Subfamily FISCHERININAE.

Genus FISCHERINA Terquem, 1878.

FISCHERINA PELLUCIDA Millett.

Plate 75, figs. 7, 8.

Fischerina pellucida MILLETT, Journ. Roy. Micr. Soc., 1898, p. 611, pl. 13, figs. 14-15.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, 1915, p. 591.

There are two very typical specimens from this station. Heron-Allen and Earland record it from the Keriinba Archipelago off the eastern coast of Africa. Millett's specimens are from the Malay Archipelago, and with this material from New Zealand, show that the species has a wide range in the Indo-Pacific region. Heron-Allen and Earland in the same paper (p. 592) record their species *F. helix* from material collected by Mr. R. L. Mestayer from the same dredging from which our material is mounted. This species has not occurred on the series of slides I have had from the United States National Museum.

Subfamily QUINQUELOCULININAE.

Genus QUINQUELOCULINA d'Orbigny, 1826.

QUINQUELOCULINA SCLEROTICA Karrer.

Quinqueloculina sclerotica KARRER, Sitz. Akad. Wiss. Wien, vol. 58, Abth. 1, 1868, p. 152, pl. 3, fig. 5.

¹ Challenger Report, pl. 1, figs. 5-8.

Milolina sclerotica BALKWILL and MILLETT, Journ. Micr., vol. 3, 1884, p. 24, pl. 1, fig. 2.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, 1915, p. 577, pl. 44, figs. 1-4.

Several specimens with an agglutinate test seem to belong to this species which Heron-Allen and Earland have found in the Kerimba Archipelago.

QUINQUELOCULINA POLYGONA d'Orbigny.

Quinqueloculina polygona D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 198, pl. 12, figs. 21-23.

There are several specimens with square-edged chambers, which seem very similar to this species described by d'Orbigny.

QUINQUELOCULINA VULGARIS d'Orbigny.

Quinqueloculina vulgaris D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 33.—SCHLUMBERGER, Mém. Soc. Zool. France, 1893, p. 207, text figs. 13, 14, pl. 2, figs. 65, 66.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 46, pl. 11, fig. 3. *Miliolina vulgaris* CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 81.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, 1915, p. 569.

There are several specimens which can be referred to this species, which I find to be common in shallow water about the Pacific, and from the Hawaiian Islands to Japan.

QUINQUELOCULINA BICOSTATA d'Orbigny.

Quinqueloculina bicostata D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, p. 195, pl. 12, figs. 8-10.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 47, pl. 13, fig. 1.

Miliolina bicostata HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, 1915, p. 572, pl. 42, figs. 42-45.

There are a few specimens which are evidently this species and close to those figured by Heron-Allen and Earland in the above reference.

QUINQUELOCULINA DISPARILIS d'Orbigny.

Quinqueloculina disparilis D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 21.—SCHLUMBERGER, Mém. Soc. Zool. France, vol. 6, 1893, p. 212, pl. 2, figs. 55-57, figs. 21, 22 (in text).—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 48, pl. 14, fig. 1.

This species, which is very characteristic of this whole region in shallow water, occurs in the mounted material. In the Philippines it is a very common and widely distributed species, and evidently typical of the Indo-Pacific.

QUINQUELOCULINA BRADYANA Cushman.

Miliolina undosa H. B. BRADY, (not *Quinqueloculina undosa* Karrer), Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 176, pl. 6, figs. 6-8.

Quinqueloculina bradyana CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 52, pl. 18, fig. 2.

A few specimens which are close to the figures of this species which I have given (pt. 6, 1917, pl. 18, fig. 2) are mounted. From Brady's

figures and the material I have had, it seems to be a species widely distributed in the Indo-Pacific.

Genus HAUERINA d'Orbigny, 1848.

HAUERINA FRAGILISSIMA (H. B. Brady).

Spiroloculina fragilissima H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 149, pl. 9, figs. 12-14.

Hauerina fragilissima MILLETT, Journ. Roy. Micr. Soc., 1898, p. 610, pl. 13, figs. 8-10.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 64, pl. 24, fig. 4.

There is a single specimen which is evidently the young of this species, although the aperture is not cribrate. The surface is very smooth and polished, very thin, and the edge rounded. The records for this species are all from this general region.

Genus TRILOCULINA d'Orbigny, 1826.

TRILOCULINA TRIGONULA (Lamarck).

Miliolites trigonula LAMARCK, Ann. du Mus., vol. 5, 1804, p. 351, No. 3.

Triloculina trigonula D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 299, No. 1, pl. 16, figs. 5-9.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 65, pl. 25, fig. 3.

Miliolina trigonula WILLIAMSON, Rec. Foram. Great Britain, 1858, p. 83, pl. 7, figs. 180-182.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 164, pl. 3, figs. 14-16.

There are a few specimens which are typical of this species.

TRILOCULINA TRICARINATA d'Orbigny.

Triloculina tricarinata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 299, No. 7.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 66, pl. 25, figs. 1, 2.

Miliolina tricarinata H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 165, pl. 3, fig. 17a, b.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 7.

There are two specimens of this species, of the broad short form, in which the breadth and the length are nearly equal.

TRILOCULINA CIRCULARIS Bornemann.

Triloculina circularis BORNEMANN, Zeitschr. deutsch. geol. Ges., vol. 7, 1855, p. 349, pl. 19, fig. 4.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 67, pl. 25, fig. 4; pl. 26, fig. 1.

Miliolina circularis H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 169, pl. 4, fig. 3a-c; pl. 5, figs. 13, 14.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 81.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 8.

One or two specimens among those mounted are quite definitely this species, which is common in shallow and warm waters.

TRILOCULINA OBLONGA (Montagu).

Vermiculum oblongum MONTAGU, Test. Brit., 1803, p. 522, pl. 14, fig. 9.

Triloculina oblonga D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 300, No. 16.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 69, pl. 26, fig. 3.

Miliolina oblonga H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 160, pl. 5, figs. 4a, b.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 7, pl. 1, figs. 15, 16.

There are four rather typical specimens of this species mounted on one of the slides.

TRILOCULINA LABIOSA d'Orbigny.

Triloculina labiosa D'ORBIGNY, in De La Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 157, pl. 10, figs. 12-14.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 70.

Miliolina labiosa H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 170, pl. 6, figs. 3-5.

There are several rather small and typical specimens which should be referred here. The specimens show about the same range of variation as those figured by Brady.

TRILOCULINA ROTUNDA d'Orbigny.

Triloculina rotunda D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 299, No. 4.—SCHLUMBERGER, Mém. Soc. Zool. France, vol. 6, 1893, p. 64, pl. 1, figs. 48-50; figs. 11, 12 (in text).

Miliolina rotunda MILLETT, Journ. Roy. Micr. Soc., 1898, p. 267, pl. 5, figs. 15, 16.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, 1915, p. 568, pl. 42, figs. 27-30.

There are numerous well-developed specimens of this species which, according to the records, must be widely spread in the Indo-Pacific, being recorded from the Kerimba Archipelago by Heron-Allen and Earland, from the Malay Archipelago by Millett, and from this material off New Zealand. It is also recorded from the Mediterranean and the Atlantic.

Genus BILOCULINA d'Orbigny, 1826.

BILOCULINA ANOMALA Schlumberger.

Biloculina anomala SCHLUMBERGER, Mém. Soc. Zool. France, vol. 4, 1891, p. 182, pl. 11, figs. 84-86; pl. 12, fig. 101, text figs. 32-34.—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 80.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 79, pl. 32, fig. 1.

Several specimens seem very close to the figures given by Schlumberger, and I have had the species from the Hawaiian Islands. Chapman records it from off Great Barrier Island. Schlumberger's type material is from the Mediterranean.

BILOCULINA PISUM Schlumberger.

Biloculina pisum SCHLUMBERGER, Mém. Soc. Zool. France, vol. 4, 1891, p. 569, pl. 11, figs. 81-83; fig. 31 (in text).—CHAPMAN, Trans. New Zealand Instit., vol. 38, 1905, p. 80.

There are several specimens, which, from their surface characters, might belong to either this species or *B. vespertilio* Schlumberger.

Chapman, however, has had material from this same general region which he has sectioned and determined as *B. pisum*; therefore probably these specimens belong to the same species.

BILOCULINA SARSII Schlumberger.

Biloculina ringens H. B. BRADY (not *B. ringens* Lamarck), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 142, pl. 2, fig. 7.

Biloculina sarsii SCHLUMBERGER, Mém. Soc. Zool. France, vol. 4, 1891, p. 166, pl. 9, figs. 55-59, text figs. 10-11.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 76, pl. 30, fig. 2.

There are fine large specimens which may be referred to this species that are mounted on one of the slides. I had material from the North Pacific, from the Hawaiian Islands, westward to Japan, and, from this material, it is evidently widespread in the Indo-Pacific.

BILOCULINA BRADYI Schlumberger.

Biloculina bradyi SCHLUMBERGER, Mém. Soc. Zool. France, vol. 4, 1891, p. 170, pl. 10, figs. 63-71; figs. 15-19 (in text).

This seems to be one of the commonest species of this genus in the material. The very broad flattened lip is very characteristic.

BILOCULINA COMATA H. B. Brady.

Biloculina comata H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 45; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 144, pl. 3, figs. 9a, b.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 81, pl. 34, fig. 1.

There are three specimens of a striate triloculine form which are close to the figures of *Miliolina insignis*, given by Brady in the *Challenger* Report. From other material I have seen in the Pacific. It seems that this may be the triloculine stage of *B. comata*.

EXPLANATION OF PLATES.

PLATE 74.

- FIG. 1. *Ammodiscus mestayeri*, megalospheric specimen $\times 25$.
2. *Ammodiscus mestayeri*, microspheric specimen $\times 25$.
3. *Hyperammia mestayeri*, microspheric specimen $\times 10$.
4. *Technitella mestayeri* $\times 40$.
5. *Tolypammia horrida* $\times 20$.

PLATE 75.

- FIG. 1. *Reophax spiculifera*, var. *pseudodistans* $\times 25$.
2. *Reophax advena* $\times 30$.
3. *Psammosphaera parva*? $\times 30$.
- 4, 5. *Nouria polymorphinoides* $\times 30$.
6. *Nubecularia bradyi* $\times 30$.
7. *Fischerina pellucida*, dorsal view $\times 30$.
8. *Fischerina pellucida*, ventral view of another specimen $\times 30$.



Cushman, Joseph A. 1919. "Recent Foraminifera from off New Zealand."
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