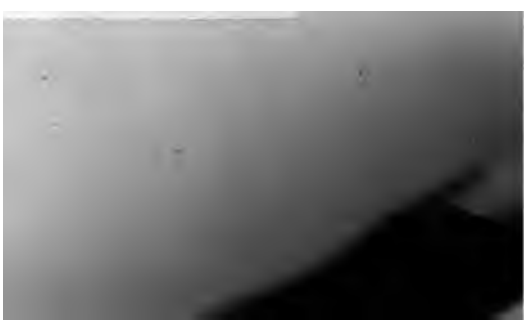

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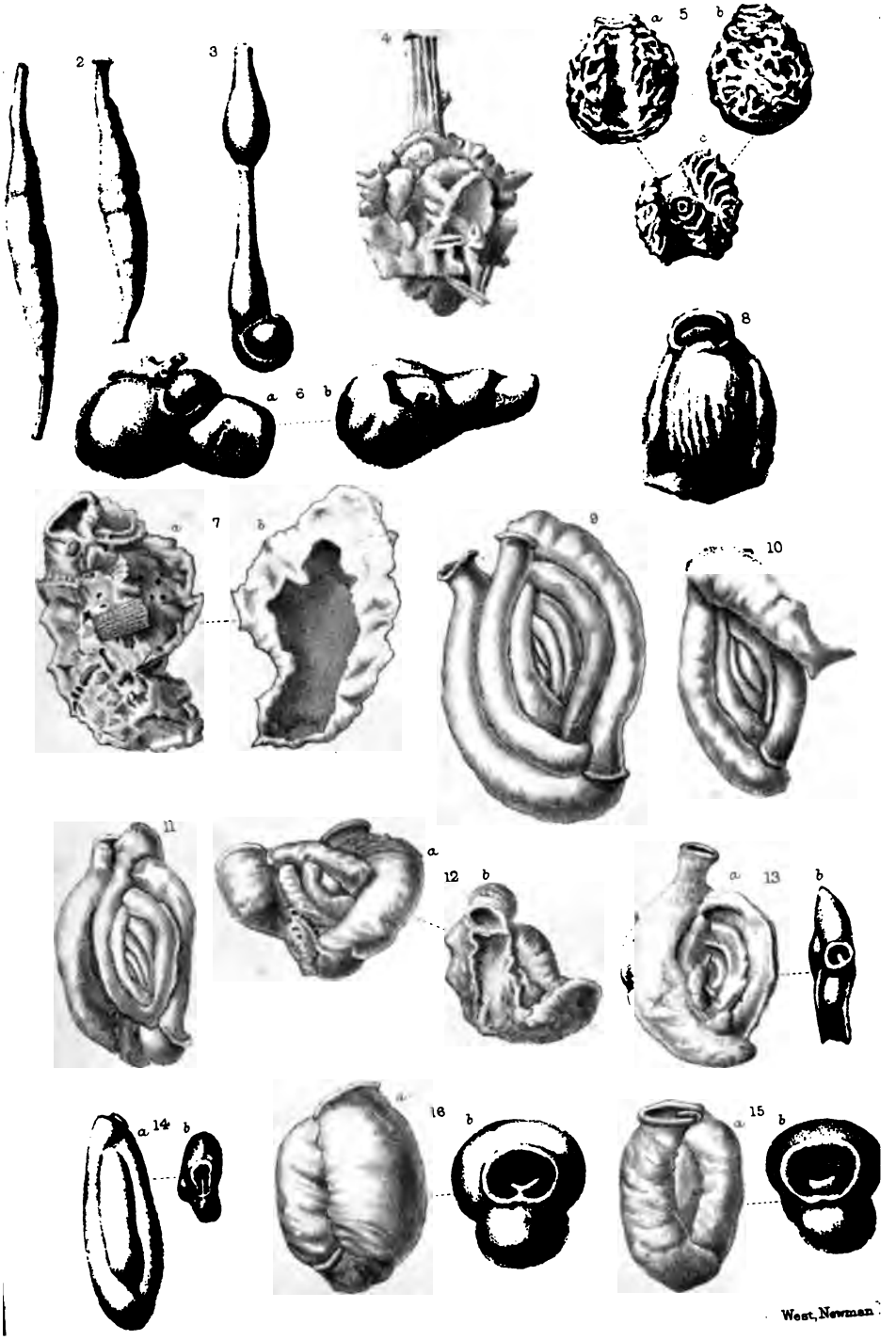

F. W. Millett del. ad nat.

West, Newman

Foraminifera of Malay Archipelago.

(Journ. R. Micr. Soc., 1898, pp. 258–269.)

VI.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.*

By Fortescue William Millett, F.R.M.S.

(*Read 16th February*, 1898.)

Plates V. and VI.

Dealing with material from nearly thirty stations, which form an unbroken chain extending from the north coast of Australia to the Malay Peninsula, Mr. Durrand's collection is of great importance, and this not only from the extraordinary variety of the forms contained in it, and their deviation in many instances from the ordinary structure of the Foraminifera, but because the rhizopodal fauna of this great region has hitherto been much neglected.

Mr. Durrand's Area 1 was not touched by the 'Challenger' Expedition; and, although the 'Challenger' Stations 188 to 195A may be considered to come within Area 2, neither in Dr. H. B. Brady's

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EXPLANATION OF PLATES.

Plate V.

Fig. 1, 2.—*Nubecularia fusiformis* sp. n. × 75.
„ 3. „ *tibia* Jones and Parker. × 90.
„ 4. „ *divaricata* Brady. × 60.
„ 5. „ *dubia* sp. n. × 90.
„ 6. „ *Bradyi* nom. nov. × 60.
„ 7. „ *lucifuga* Defrance. × 60.
„ 8.—*Biloculina ringens* Lamarck sp. var. *striolata* Brady. × 90.
„ 9–12.—*Spiroloculina nitida* d'Orbigny. Figs. 9–11 × 40, fig. 12 × 45.
„ 13. „ „ var. × 40.
„ 14.—*Miliolina oblonga* Montagu sp. × 40.
„ 15. „ *rotunda* d'Orbigny sp. × 45.
„ 16. „ „ Biloculine form. × 45.

Plate VI.

Fig. 1.—*Miliolina Bosciana* d'Orbigny sp. × 75.
„ 2. „ „ Alveolate var. × 75.
„ 3. „ „ Costate var. × 75.
„ 4. „ „ Agglutinate var. × 75.
„ 5. „ *transversestriata* Brady. × 75.
„ 6.—*Biloculina coronata* sp. n. × 75.
„ 7.—*Miliolina Durrandii* sp. n. × 40.
„ 8. „ „ Biloculine form. × 40.
„ 9. „ „ „ „ × 60.
„ 10. „ „ „ „ From a specimen mounted in balsam. × 40.

N.B.—In this diagram the sutural lines and some other details have been omitted in order to show more clearly the form of the earlier chambers.

„ 11.—*Miliolina cultrata* Brady (passage form). × 40.
„ 12. „ „ × 40.
„ 13. „ *Rupertiana* Brady. × 40.

'Report on the Foraminifera,' * nor in the 'Summary of the Scientific Results' by Dr. John Murray,† is there to be found any detailed list of the Foraminifera of these stations. This is the more to be regretted, as a comparison of the deep-water forms of the 'Challenger' dredgings with the shallow-water forms of Mr. Durrand's collection would have been of great interest.

Of other researches in this region the following may be noted.

In 1863, Harting ‡ described and figured a few species of Foraminifera from a deep-sea sounding in the Banda Sea.

In 1872, F. W. O. Rymer Jones § reported on some interesting *Lagenæ* from a sounding (1080 fathoms) in the Java Seas, and alluded to some other genera of Foraminifera which accompanied them.

Ehrenberg has several scattered notes on Foraminifera from Singapore, Batavia, and other localities in or adjoining the Malay Archipelago.

In 1881, ‖ Prof. Otto Bütschli, in describing the geographical distribution of the Foraminifera, devotes a column of the table to the Malay Archipelago. Unfortunately the species are there represented only by numerals; but Prof. Bütschli has with great kindness allowed me the use of his manuscript notes which contain the key to these numerals, and I am therefore in a position to make use of the list.

About ten years ago Mr. W. H. Harris, then of Cardiff, obtained from the late Capt. Seabrook some dredgings from the Java Seas. These were distributed among various rhizopodists, and excited much interest from the number of remarkable forms contained in them. It was from these dredgings that Mr. Harris procured the specimens of the new genus *Seabrookia* which forms the subject of a paper by the late Dr. H. B. Brady, published in this Journal in the year 1890.

In 1893 appeared Dr. J. E. Egger's report on the Foraminifera contained in the soundings made by the German exploring ship 'Gazelle.' Some of the sounding stations were in or about Mr. Durrand's Area 1, and the results, as tabulated by Dr. Egger, are available for comparison.

To economise space it has been deemed inexpedient to give the full synonymy of each species. This has been so fully dealt with of late years by Goës, Brady, Rupert Jones, Fornasini, de Amicis, and others, in works easily accessible, that it will suffice here to give only

* H. B. Brady, 'Reports on the Scientific Results of the Voyage of H.M.S. Challenger,' vol. ix. (Zoology), 1884.

† John Murray, 'A Summary of the Scientific Results obtained at the Sounding, Dredging, and Trawling Stations of H.M.S. Challenger,' 1895.

‡ P. Harting, 'Bijdrage tot de Kennis der Mikroskopische fauna en flora van de Banda-Zee,' Verh. Koninkl. Akad. Wetensch., vol. x. 1864.

§ F. W. O. Rymer Jones, 'On some Recent Forms of Lagena from Deep-sea Soundings in the Java Seas,' Trans. Linn. Soc. London, vol. xxx. 1872.

‖ Otto Bütschli, in Bronn's 'Klassen und Ordnungen des Thier-Reichs,' vol. i. (Protozoa), 1880. 1881.

such synonyms as may be considered necessary for the elucidation of the species. At the same time attention will be called to the forms figured by authors under other names, when those forms have characters differing in some respects from those of the type.

In selecting synonyms, preference has been given to those works in which the species are illustrated by figures, as so many of the forms given by authors prove to be wrongly diagnosed, that a mere list of names must be always regarded with a certain amount of suspicion.

The well-known tendency of the various types of Foraminifera to gravitate towards one another from every direction, although setting at defiance all strict rules of classification, can yet be made useful by observing in any given locality or formation the direction in which the different types tend to vary. To take an illustration: *Discorbina turbo* may in one locality approach *D. rosacea*, and in another *Rotalia Beccarii*. Attention to these variations serves to indicate the particular facies of a locality, and to show its distinguishing characters in a way which attention to the type forms only would fail to express.

For much assistance in the determination of species I am indebted to Prof. T. Rupert Jones and Messrs. Chapman and Sherborn of London, Dr. Axel Goës of Sweden, and M. Schlumberger and the late M. Berthelin of Paris.

Sub-kingdom **PROTOZOA**.

Class RHIZOPODA.

Order FORAMINIFERA (RETICULARIA).

PORCELLANEA vel IMPERFORATA.

Family II. MILIOLIDÆ.

Sub-Family I. **Nubecularinæ**.

Nubecularia Defrance.

Nubecularia fusiformis sp. n., plate V. figs. 1 and 2.

Test free or (?) adherent, monothalamous, elongate, fusiform, more or less flexed, with a circular aperture at each extremity. Length 0·7 mm.

This is a porcellanous isomorph of *Lagena gracillima*, and bears the same relation to *N. tibia* that the *Lagenæ* bear to the *Nodosariæ*, but it does not seem necessary on that account to create a new genus for it. It shows no tendency to become jointed, but some specimens have a lateral supplementary aperture, and sometimes one of the terminal apertures has a thickened margin. It occurs sparingly in both areas.

Nubecularia tibia Jones and Parker, plate V. fig. 3.

Nubecularia tibia Jones and Parker, 1860, Quart. Journ. Geol. Soc., vol. xvi. p. 455, pl. xx. figs. 48–51. *N. tibia* Brady, 1884, Chall. Rept., p. 135, pl. i. figs. 1–4. *N. tibia* Chapman, 1892, Quart. Journ. Geol. Soc., vol. xlviii. p. 516, pl. xv. fig. 1.

The typical form is not numerously represented, and most of the Stations where it occurs are in Area 1. The figured specimen curiously resembles the restoration of the specimens as indicated by dotted lines in the figures given by Jones and Parker, *loc. cit.*, pl. xx. figs. 50, 51.

Nubecularia lucifuga Defrance, plate V. fig. 7.

Nubecularia lucifuga Defrance, 1825, Dict. Sci. Nat., vol. xxv. p. 210, Atlas Zooph., pl. xliv. fig. 3. *N. lucifuga* Brady, 1884, Chall. Rept., p. 134, pl. i. figs. 9–16. *N. lucifuga* Egger, 1893, Abhandl. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 250, pl. xxi. figs. 4–7.

Occurs in various forms, attached as well as free, but the spiral form is not represented. Most of the specimens are elongate, with a tendency to approach *N. tibia*. Egger has a somewhat similar form from near Kerguelen Island. The figured specimen (from Station 2) shows little signs of septation; the shell is thick, and has agglutinated to it grains of sand and organic matter. The species is most plentiful in Area 1.

Nubecularia divaricata Brady, plate V. fig. 4.

Sagrina divaricata Brady, 1879, Quart. Journ. Micr. Sci., vol. xix. n.s., p. 276, pl. viii. figs. 22–24. *N. divaricata* Brady, 1884, Chall. Rept., p. 136, pl. lxxvi. figs. 11–15.

This is a rare form, and has hitherto been recorded from only three 'Challenger' Stations, viz. Humboldt Bay, Papua; off Raine Island, Torres Strait; and off Tongatabu, Friendly Islands. It occurs but very sparingly at Mr. Durrand's Stations 2 and 14 in Area 1, and Station 22 in Area 2.

Nubecularia Bradyi nom. nov., plate V. fig. 6 *a*, *b*.

Nubecularia inflata Brady, 1884, Chall. Rept., p. 135, pl. i. figs. 5–8.

Occurs in the normal form at several stations, mostly in Area 1. From my friend Mr. H. Sidebottom I have many specimens dredged by Mr. C. H. Nevill in the Gulf of Ægina, where it seems to be abundant; and Mr. Nevill tells me it is common off the Island of Delos. Amongst published figures of fossil Foraminifera resembling this form, are *N. novorossica* type *nodula* Karrer and Sinzow,* and

* Sitz. k. Akad. Wiss. Wien, vol. lxxiv. 1876, p. 281, pl. figs. 16–18.

the form placed by Terquem * amongst the *Testæ incertæ sedis* and assigned provisionally to *Guttulina*. It should be mentioned, however, that Jones and Chapman † attribute the latter form to *Polymorphina*, and name it var. *circularis*. The specific name given by Brady is so appropriate that it is unfortunate that it should have to be given up, but priority must be given to Terquem who used the same name for a *Nubecularia* in 1876. ‡

Nubecularia dubia sp. n., plate V. fig. 5 *a–c*.

Test free, monothalamous, oviform, concave on two opposite sides which are smooth, the remaining sides being convex and wrinkled, aperture small, circular, situated in a cup-like depression at the apex of the test.

A doubtful form, which may be claimed by the algologists, and have to go the way of *Dactylopora*. Somewhat analogous forms, bearing a superficial resemblence to this, occur in the Eocene of the neighbourhood of Paris, and are usually considered to be unicellular calcareous algæ. In these, however, the cell-walls are thick and porous, whilst those of *N. dubia* are thin and imperforate. The specimens are remarkably uniform in size and shape. It is found only at Station 2, where it is not uncommon.

Sub-Family II. **Miliolininæ.**

Biloculina d'Orbigny.

Biloculina ringens Lamarck sp.

Miliolites ringens Lamarck, 1804, Ann. du Muséum, vol. v. p. 351; vol. ix. pl. xvii. fig. 1. *Biloculina ringens* Brady, 1884, Chall. Rept., p. 142, pl. ii. figs. 7, 8.

A few small specimens, normal, and generally distributed.

Biloculina ringens var. *denticulata* Brady.

Biloculina ringens var. *denticulata* Brady, 1884, Chall. Rept., p. 143, pl. iii. figs. 4, 5.

Found sparingly in Area 1.

Biloculina ringens var. *striolata* Brady, plate V. fig. 8.

Biloculina ringens var. *striolata* Brady, 1884, Chall. Rept., p. 143, pl. iii. figs. 7, 8.

Found only at Station 22 in Area 2. The specimens are small, and approach *B. elongata*, whilst those figured by Brady resemble *B. depressa*. Its geographical range is much restricted, as it was

* Mém. Soc. Géol. France, sér. 3, vol. i. 1878, p. 48, pl. ix. fig. 41.

† Journal Linnean Society (Zoology), vol. xxv. 1896, p. 505, fig. 24.

‡ 'Essai sur le Classement des Animaux qui vivent sur la plage et dans les environs de Dunkerque,' fasc. 2, 1876, p. 73.

found only at three or four 'Challenger' Stations, all off the southern shores of Papua.

Biloculina bulloides d'Orbigny.

Biloculina bulloides d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 297, No. 1, pl. xvi. figs. 1–4. *B. bulloides* (d'Orbigny) Brady, 1884, Chall. Rept., p. 142, pl. ii. figs. 5, 6.

Found only at Station 14, very rare. It occurs at only five 'Challenger' Stations, two of which are amongst the islands south of New Guinea. In the 'Gazelle' soundings it is recorded from Kerguelen Island and New Guinea, rare in both localities.

Biloculina elongata d'Orbigny.

Biloculina elongata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 298, No. 4. *B. elongata* (d'Orbigny) Brady, 1884, Chall. Rept., p. 144, pl. ii. fig. 9 *a*, *b*.

Found sparingly in both areas; specimens small, but characteristic.

Biloculina coronata sp. n., plate VI. fig. 6 *a–c*.

Test fusiform, chambers few and inflated, sutures depressed, aperture circular, surmounted by a series of incurved lamellæ, which approach or inosculate over the centre of the aperture. Shell substance thin, translucent, and much wrinkled. Length 0·58 mm.

Apertures of the same type, but of a more complex character, are to be found in some specimens of *Idalina antiqua* and *Lacazina compressa* Munier-Chalmas and Schlumberger.* It is very rare, being represented by a solitary specimen from Station 18.

Biloculina depressa d'Orbigny.

Biloculina depressa d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 298, No. 7. *B. depressa* (d'Orbigny) Brady, 1884, Chall. Rept., p. 145, pl. ii. figs. 12, 15–17; pl. iii. figs. 1, 2.

Occurs at Station 13, very rare. Found in New Guinea amongst other 'Gazelle' Stations.

Biloculina lævis Defrance sp.

Pyrgo lævis Defrance, 1824, Dict. Sci. Nat., vol. xxxii. p. 273, Atlas, pl. lxxxviii. fig. 2. *Biloculina lævis* (Defrance sp.) Brady, 1884, Chall. Rept., p. 146, pl. ii. figs. 13, 14. *B. lævis* (Defrance) Goës, 1894, Kongl. Svenska Vetenskaps-Akad. Handl., vol. xxv. p. 119, pl. xxiv. figs. 914–918.

A solitary specimen of the *depressa* type from Station 22 in Area 2. Occurs at three 'Challenger' Stations, one of which is at Humboldt Bay, Papua, shallow water. Found by Goës at Spitzbergen, in deep water.

* Bull. Soc. Géol. de France, sér. 3, vol. xiii. pp. 273 *et seq.*

Biloculina ventruosa Reuss. (See *Miliolina circularis.*)

Spiroloculina d'Orbigny.

Spiroloculina planulata Lamarck sp.

Miliolites planulata Lamarck, 1805, Ann. du Muséum, vol. v. p. 532, No. 4. *Spiroloculina planulata* (Lamarck sp.) Brady, 1884, Chall. Rept., p. 148, pl. ix. fig. 11 *a–b*. *S. planulata* (Lamarck), T. Rupert Jones, 1895, Palæontographical Soc., p. 103, pl. iii. figs. 37, 38; woodcut, fig. 1.

Spiroloculina excavata d'Orbigny.

Spiroloculina excavata d'Orbigny, 1846, For. Foss. Vienn., p. 271, pl. xvi. figs. 19–21. *S. excavata* (d'Orb.) Brady, Chall. Rept., p. 151, pl. ix. figs. 5, 6. *S. excavata* (d'Orb.) T. Rupert Jones, 1895, Pal. Soc., p. 106, pl. v. fig. 2; woodcuts, figs. 2*a*, 2*b*.

Spiroloculina dorsata Reuss.

Spiroloculina limbata Bornemann, 1855, Zeitschr. deutsch. geol. Gesell., vol. vii. p. 348, pl. xix. fig. 1. *S. dorsata* Reuss, 1866, Denk. k. Akad. Wiss. Wien, vol. xxv. p. 123. *S. limbata* (d'Orb.) Brady, 1884, Chall. Rept., p. 150, pl. ix. figs. 15–17; var. pl. x. figs. 1, 2. *S. dorsata* (Reuss) T. Rupert Jones, 1895, Pal. Soc., p. 110; woodcuts, figs. 4, 8*a*, 8*b*.

Spiroloculina impressa Terquem.

Spiroloculina impressa Terquem, 1878, Mém. Soc. Géol. Fr., sér. 3, vol. i. p. 53, pl. x. fig. 8. *S. impressa* (Terq.) Brady, 1864, Chall. Rept., p. 151, pl. x. figs, 3, 4.

These four forms, with the exception of *S. planulata*, are well represented, the specimens being large as well as numerous, and form an unbroken series from one to another. They are found in both areas. *S. planulata* appears in Bütschli's list of Foraminifera from the Malay Archipelago.

Spiroloculina acutimargo Brady.

Spiroloculina acutimargo Brady, 1884, Chall. Rept., p. 154, pl. x. figs. 12–15. *S. acutimargo* (Brady) Balkwill and Wright, 1885, Trans. Roy. Irish Acad., vol. xxviii. p. 323, fig. 1. *S. acutimargo* (Brady) Egger, 1893, Abhandl. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 222, pl. i. figs. 26–28.

A few small specimens from both Areas.

Spiroloculina tenuiseptata Brady.

Spiroloculina tenuiseptata Brady, 1884, Chall. Rept., p. 153, pl. x. figs. 5, 6. *S. tenuiseptata* (Brady) Egger, 1893, Abhandl. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 223, pl. i. figs. 48, 49.

Found only at Station 2, and there very rare and poorly developed. Brady has it from the Ki Islands and two other localities, all over 500 fathoms. Egger's rather doubtful form is from the West Coast of Africa, about 10° north of the equator, depth about 370 fathoms.

Spiroloculina crenata Karrer.

Spiroloculina crenata Karrer, 1868, Sitz. k. Akad. Wiss. Wien, vol. lviii. Abth. i. p. 135, pl. i. fig. 9. *S. crenata* (Karrer) Brady, 1884, Chall. Rept., p. 156, pl. x. figs. 24–26. *S. crenata* Murray and Renard, 1891, Chall. Rept., pl. xiv. fig. 2^{17}. *S. crenata* (Karrer) Egger, 1893, Abhandl. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 225, pl. i. figs. 42, 43.

Found in both Areas, but most abundantly in No. 1.

Spiroloculina nitida d'Orbigny, plate V. figs. 9–13 *a*, *b*.

Spiroloculina nitida d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 298, No. 4. *S. nitida* (d'Orb.) Brady, 1884, Chall. Rept., p. 149, pl. ix. figs. 9, 10. *S. complanata* Egger, 1893, Abhandl. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 225, pl. iii. figs. 7, 8. *S. nitida* (d'Orb.) T. Rupert Jones, 1895, Crag Foraminifera, Pal. Soc., p. 112, pl. v. fig. 3, and woodcut fig. 5.

One of the commonest forms; the shell is usually thin and translucent, and slightly rugose. It is a wild-growing form often deviating from the normal plan of growth, as shown by the figures on plate V. A form closely resembling the arenaceous *Ammodiscus gordialis* is represented by fig. 12. Terquem and Berthelin, in their Report on the Foraminifera of the Middle Lias of Essey-les-Nancy,* under the name of *S. longiscata*, *S. concentrica*, &c., and Terquem, in his Monograph of the Foraminifera from the Fuller's-Earth of Warsaw,† under the name of "Agathistègues irréguliers," figure a large number of wild-growing specimens, most of which may be assigned to this species. That a peculiarity of this character should have survived for so vast a period of time, is an interesting fact in biology.

Brady, in his 'Challenger' Report.‡ assigns to this species a form in which the peripheral margin of the last formed chamber is acute or carinate, whilst that of the penultimate is square or even slightly excavated. A similar form occurs at several of the Malay Stations,

* Mém. Soc. Géol. de France, sér. 2, vol. x. 1875, p. 78, pl. xvi. &c.
† Op. cit., sér. 3, vol. iv. 1886, p. 77, pls. xv, xvi.
‡ P. 149, pl. ix. figs. 9, 10.

but the test is thinner, and the chambers have not the inflation characteristic of *S. nitida*. It is associated with the thin form of *Spiroloculina* from the coast of Papua, which Brady, *loc. cit.*, describes as a variety of *S. limbata*,* and is distinguishable from it chiefly by the partially acute periphery. Prof. T. Rupert Jones says of Brady's form, "It is evidently a limbate sub-variety of *nitida* d'Orb., which is a sub-type or variety of the type *Spiroloculina planulata* (Lamarck)." † The *S. nitida* of the same monograph, pl. v. fig. 3, is carinate. It should be mentioned that the wildness of growth is confined to the form which has cylindrical chambers.

S. nitida when striate, is the *S. grata* of Terquem; when reticulate, the *S. foveolata* of Egger; and when arenaceous, the *S. asperula* of Karrer.

Spiroloculina nitida (Striate variety.)

Spiroloculina grata, Terquem, 1878, Mém. Soc. Géol. Fr., sér. 3, vol. i. p. 55, pl. x. figs. 14, 15. *S. grata* (Terquem) Brady, 1884, 'Challenger' Rept., p. 155, pl. x. figs. 16, 17, 22, 23. *S. grata* Terquem, Egger, 1893, Abhand. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 224, pl. i. fig. 39.

This common coral-reef species is found abundantly at most of the Stations in both areas. In a large proportion of the specimens the chambers are square in transverse section, like *S. planulata*.

Spiroloculina nitida (Reticulate variety).

Spiroloculina foveolata Egger, 1893, Abhandl. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 224, pl. i. figs. 33, 34.

This may be described as a large thick-shelled *S. nitida*, which has the surface markings of *Miliolina reticulata*. It attains its extreme development in the coral sands of the South Pacific. Egger's figured specimen was from the Mauritius, and is an immature example of the species. It occurs only at Station 1, and is very rare.

Spiroloculina (?) *convexiuscula* Brady.

Spiroloculina (?) *convexiuscula* Brady, 1884, 'Challenger' Rept., p. 155, pl. x. figs. 18–20.

Assigned by Brady, with some hesitation, to this genus, it is more probably an arrested form of *Articulina*. It is remarkable for its uniformity, specimens from all localities being almost identical in size and structure. It occurs only at two 'Challenger' Stations, both on the coast of Papua. In the Malay Archipelago it is common and widespread over Area 1, but rare in Area 2.

Spiroloculina (or *Hauerina*) *fragilissima* Brady. (See *Hauerina*.)

* P. 150, pl. x. figs. 1, 2. † Pal. Soc., 1895, p. 114.

Miliolina Williamson, 1858.

Group of *Miliolina oblonga.*

Aperture dentate.

Miliolina oblonga Montagu sp., pl. V. fig. 14 *a, b.*

Vermiculum oblongum Montagu, 1803, Test. Brit., p. 522, pl. xiv. fig. 9. *Miliolina oblonga* (Montagu) T. Rupert Jones, 1895, Pal. Soc., p. 120, pl. iii. figs. 31, 32, and pl. v. fig. 5.

The type is rather rare, but several varieties and passage forms are represented at most of the Stations.

Miliolina rotunda d'Orbigny sp., pl. V. figs. 15, 16.

Triloculina rotunda d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. No. 4, p. 299. *T. rotunda* (d'Orb.) Schlumberger, 1893, Mém. Soc. Zool. de France, vol. vi. p. 206, pl. i. figs. 48–50.

This is a variety of *M. oblonga* with inflated chambers and a large circular aperture. It is as common in the Biloculine as in the Triloculine condition, but the former is slightly the larger. Forms closely allied or identical are *Triloculina lævigata*, d'Orb., *Quinqueloculina vulgaris* d'Orb., *Miliolina anconensis* Schultze, and *M. cuneata*, Biloculine variety, Brady.* The form from Humboldt Bay, Papua, assigned by Brady to *M. gracilis*,† appears to be an elongate form of this variety, and is common in the Malay Archipelago. *M. rotunda* is recorded from several parts of the Mediterranean, and occurs plentifully in several of Mr. Durrand's Stations in both Areas. As a fossil it attains a large size in the Pliocene (?) clay of St. Erth, Cornwall. If the form ascribed by A. Silvestri to *M. cuneata* ‡ is identical, it also occurs of great size in the Pliocene of Siena, Italy.

Miliolina Bosciana d'Orbigny sp., plate VI. fig. 1.

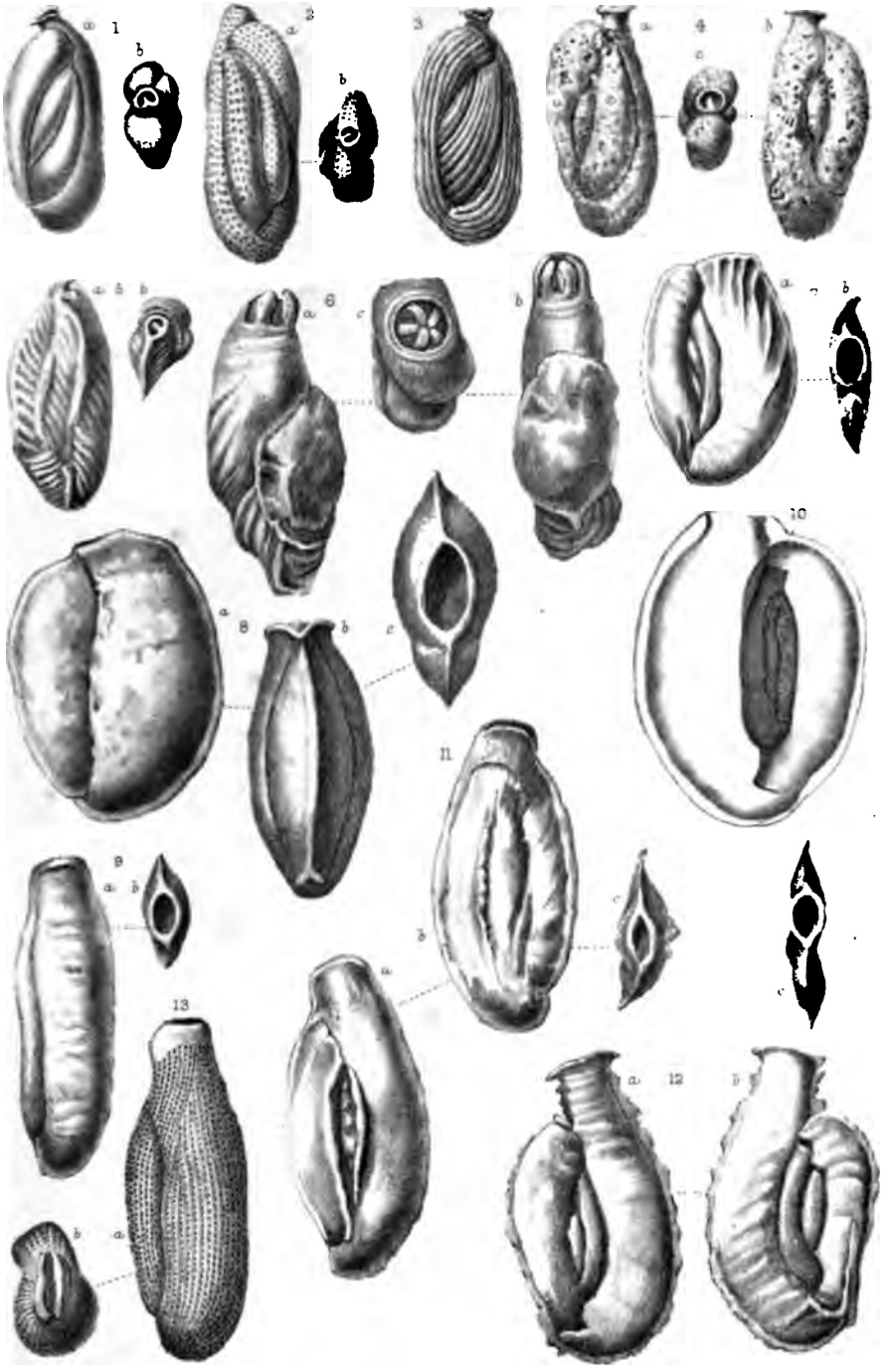
Quinqueloculina Bosciana d'Orbigny, 1839. De la Sagra, Hist. Physique de l'Ile de Cuba, Foraminifères, p. 191, pl. xi. figs. 22–24.

A form of *M. oblonga*, in which the chambers are more numerous and the sutures oblique. Worthy of notice from the diversity of its surface ornamentation.

Alveolate var., plate VI. fig. 2.

In this variety the aperture has not the thickened margin characteristic of the other forms, thus more nearly approaching d'Orbigny's specimens from the Antilles. The markings are very variable, ranging from a few scattered shallow depressions to striato-punctate as in *M. Rupertiana.*

* 'Challenger' Report, 1884, p. 139, pl. i. figs. 19, 20.
† Tom. cit., p. 160, pl. v. fig. 3.
‡ Mem. Pontif. Accad. dei Nuovi Lincei, vol. xii. 1896, p. 35, pl. i. fig. 12.



F.W. Millett del. ad nat. West, Newman lith.

Foraminifera of Malay Archipelago.

Costate var., plate VI. fig. 3.

In this form the markings are more uniform, varying only in size. Becoming more robust, it develops in the direction of *M. bicornis*.

Agglutinate var., plate VI. fig. 4.

Closely resembles *M. fusca*. The surface is beset with minute glittering scales and very small grains of sand attached to, but not enclosed within, the porcellanous shell-substance.

All the foregoing varieties are common and widespread in both areas.

Treating of the *Miliolinæ* with surface ornaments, Brady writes, "A few varieties may be disposed of by referring them to the smooth-shelled species having the same general contour." * Holding this opinion, Brady might with advantage have carried the process a little further than he did. Taking, for example, the species *M. tricarinata* and its varieties, the terms striate variety and reticulate variety are self-explanatory, whilst Brady's names for the same forms, *M. Terquemiana* and *M. Bertheliniana*, give no idea of their character and affinities.

In these Malay gatherings, so numerous are the transition forms that much light is thrown by them on the affinities of the *Miliolinæ*, although unfortunately not sufficient to enable us to link together the whole of the species.

Miliolina transversestriata Brady, plate VI. fig. 5.

Miliolina transversestriata Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 45. *M. transversestriata* Brady, 1884, Chall. Rept., p. 177, pl. iv. fig. 6.

Hitherto recorded only from the 'Challenger' dredgings, and in them in but two localities, Raine Island, Torres Strait, 155 fathoms, and in harbour-mud from Port Louis, Mauritius.

It is rather rare, but occurs at Stations in both Areas.

Aperture edentate.

Miliolina Durrandii sp. n., plate VI. figs. 7–10.

Test broadly elliptical, much depressed, chambers few, periphery acute or carinate, sutures slightly excavated, aperture large, elliptical or fusiform, surrounded by a thickened lip, edentate. Length 0·77 to 0·99 mm.

This is one of an interesting group in which the aperture is a large elliptical or fusiform opening without teeth. As in *M. rotunda*, the Biloculine form (figs. 8–10) is the larger. The costæ represented in fig. 7 are confined to the anterior portion of the test, and are

* 'Challenger' Report, 1884, p. 172.

remarkably uniform both in number and position. They are not present in all of the specimens, and are entirely wanting in the Biloculine form. The earlier chambers, as shown in fig. 10, are elongate, much resembling *M. Rupertiana* in contour. Elongate specimens of the Biloculine form as represented by fig. 9 are very common. Probably this is an arrested form which does not develop the final enclosing chambers.

Of the two forms, the Biloculine is the more numerous. The species is abundant at several Stations in both Areas.

Miliolina cultrata Brady, plate VI. figs. 11, 12.

Miliolina cultrata Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 45. *M. cultrata* Brady, 1884, Chall. Rept., p. 161, pl. v. figs. 1, 2. *M. cultrata* (Brady) Egger. 1893, Abhandl. d. k. bayer. Akad. d. Wiss., Cl. II. vol. xviii. p. 231, pl. ii. figs. 29–31.

This is an edentate form, although it is not so described by Brady or Egger. Its affinity with both *M. Durrandii* and *M. Rupertiana* is shown by the passage form fig. 11. Brady records it from two localities only, Papua, and off Calpentyn, Ceylon. Egger found it at three 'Gazelle' Stations, Mauritius, New Amsterdam, and West Australia.

In the Malay Archipelago its distribution is co-extensive with that of *M. Durrandii*, and it is just as abundant.

Miliolina Rupertiana Brady, plate VI. fig. 13.

Miliolina Rupertiana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 46. *M. Rupertiana* Brady, 1884, Chall. Rept., p. 178, pl. vii. figs. 7–12.

The carinate variety is not represented in this collection by anything nearer than the smooth passage form fig. 11, nor is there the variation of aperture figured by Brady.

The 'Challenger' specimens are from the islands off the south shores of Papua, west of Torres Strait; but Brady names a few other localities from which it has been procured.

It occurs at several Stations in both Areas, but only in very small numbers.

(To be continued.)

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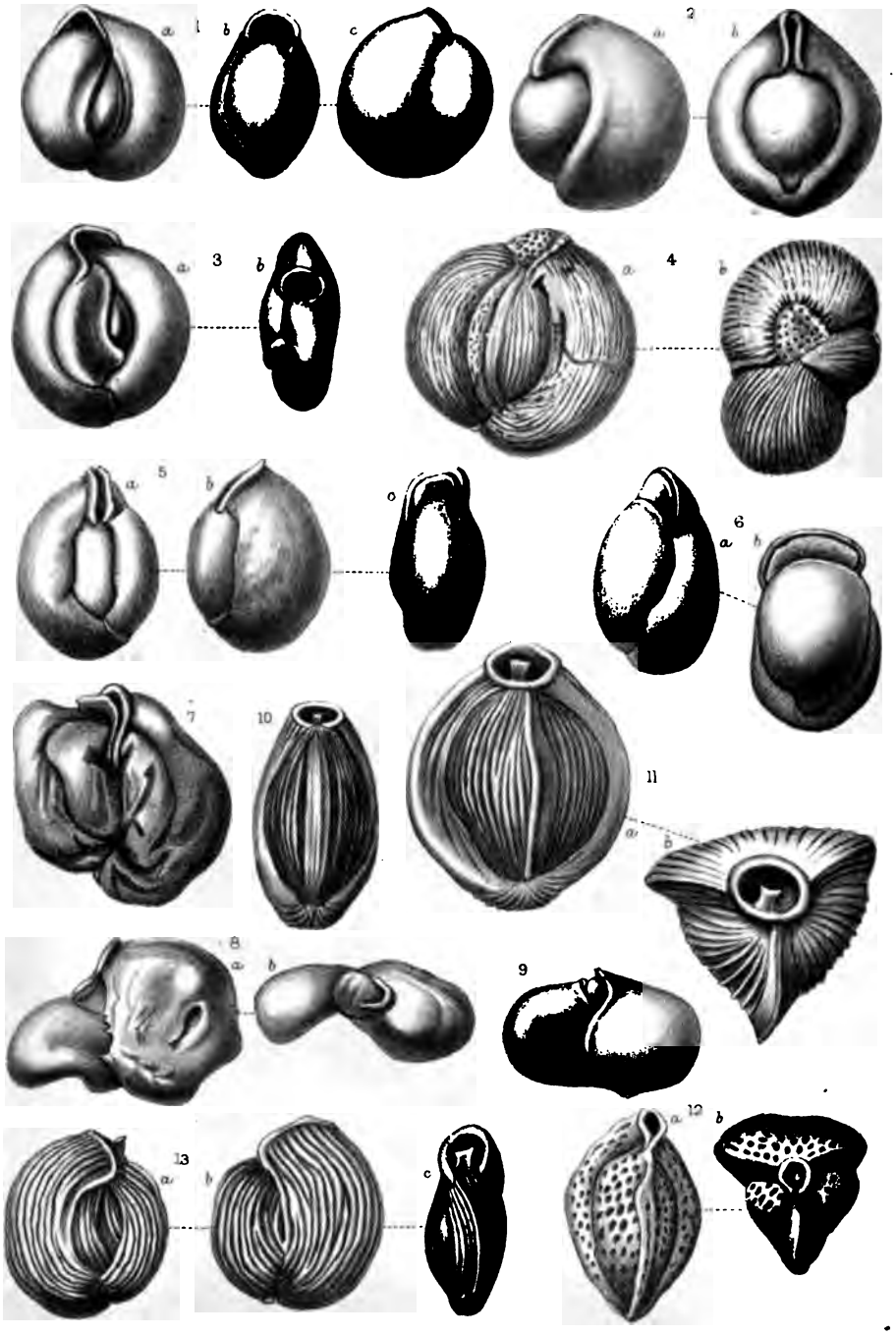


F W Millett del ad nat

West, Newman lith.

Foraminifera of Malay Archipelago.

(Journ. R. Micr. Soc., 1898, pp. 499–513.)

XIV.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part II.*

By Fortescue William Millett, F.R.M.S.

(*Read 15th June*, 1898.)

Plates XI. and XII.

Group of *Miliolina circularis* Bornemann sp.

Miliolina circularis Bornemann sp., plate XI. figs. 1–3.

Triloculina circularis Bornemann, 1855, Zeitschr. d. Deutsch. Geol. Gesell., vol. vii. p. 349, pl. xix. fig. 4. *T. enoplostoma* var.

EXPLANATION OF PLATES.

Plate XI.

Fig. 1.—*Miliolina circularis* Bornemann sp., Triloculine form. × 75.
„ 2. „ „ „ Biloculine form. × 90.
„ 3. „ „ „ Quinqueloculine form. × 60.
„ 4. „ „ var. *sublineata* Brady. × 60.
„ 5. „ *valvularis* Reuss sp., Triloculine form. × 60.
„ 6. „ „ „ Biloculine form. × 90.
„ 7. „ „ „ Quinqueloculine form. × 60.
„ 8, 9. „ *labiosa* d'Orbigny sp. Fig. 8 × 60, fig. 9 × 90.
„ 10, 11. „ *tricarinata* d'Orbigny sp., striate form = *M. Terquemiana* Brady. Fig. 10 × 90, fig. 11 × 40.
„ 12. „ „ d'Orbigny sp., reticulated form = *M. Bertheliniana* Brady. × 90.
„ 13. „ *suborbicularis* d'Orbigny sp. × 90.

Plate XII.

Fig. 1 *a*, *b*, *c*.—*Miliolina Parisiensis* d'Orbigny sp. × 55.
„ 2 *a*, *b*. „ *Cuvieriana* d'Orbigny sp. × 30.
„ 3 *a*, *b*, *c*. „ *cristata* sp. n. × 135.
„ 4 *a*, *b*. „ *Parkeri* Brady. × 30.
„ 5 *a*, *b*, *c*. „ *undosa* Karrer sp. × 75.
„ 6 *a*, *b*. „ *Ferussacii* d'Orbigny sp. × 60.
„ 7 *a*, *b*, *c*. „ „ „ var. × 60.
„ 8 *a*, *b*.—*Articulina lineata* Brady, smooth var. × 90.
„ 9, 10 *a*, *b*, *c*. „ *conico-articulata* Batsch sp. Fig. 9 × 60, fig. 10 × 90.
„ 11. „ *funalis* var. *inornata* Brady. × 60.

grammostomum Reuss, 1867, Sitzungsb. k. Akad. Wiss. Wien, vol. lv. Abth. i. p. 72, pl. ii. fig. 5. *Biloculina ventruosa* Reuss, 1867, ibid., p. 69, pl. i. fig. 9. *Miliolina circularis* (Born.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. Abth. ii. p. 235, pl. ii. figs. 61–63. *M. circularis* (Born.) Jones, 1895, Palæontographical Soc., p. 121, pl. v. fig. 4.

Continuing with the forms which typically have the chambers round or crescentiform in cross section, by imperceptible degrees changing into those in which the chambers become angular or carinate, we have now to treat of the short robust forms, in which the long straight chambers characteristic of *M. oblonga* are replaced by short ones, more or less curved.

M. subrotunda would almost as well have served for the type; but on the whole *M. circularis* appears to possess a larger number of the characters common to the group. As shown by the figures on plate XI., it exists in the Biloculine, Triloculine, and Quinqueloculine forms, all of which are edentate and have an aperture formed simply by a tent-like fold of the last added chamber, leaving the surface of the penultimate chamber exposed.

The Biloculine form, fig. 2, appears to be the *B. ventruosa* of Reuss. Although the specimen selected for illustration approaches *Biloculina sphæra* d'Orbigny, there are many others which are identical with *B. ventruosa* as figured by Reuss. Fig. 1 is the *Triloculina circularis* of Reuss, whilst the Quinqueloculine form, fig. 3, is scarcely separable from *Miliolina subrotunda* Montagu. The admirable researches of MM. Schlumberger and Munier-Chalmas show that individuals of the Miliolinæ in various stages of growth assume Biloculine, Triloculine, and Quinqueloculine characters. In the examination of a large series of specimens it is scarcely practicable to apply Schlumberger's laborious method of research; but there are on the exterior of the test certain characters, too subtle for scientific definition and appreciable only by a faculty we all possess which is somewhat akin to instinct—the kind of faculty which, to use a common illustration, enables the shepherd to identify each individual member of his flock, although at the same time he is totally incapable of defining the minute differences which serve to distinguish one from the others. By the exercise of some such quality of the mind, we arrive at the conclusion that the three forms in question can be no other than variations of *M. circularis*. Speaking of *M. procera*, Dr. Axel Goës says,* "It seems to be clearly allied to *M. circularis* (Bornem.) Br., the chief difference being its quinqueloculine arrangement of the chambers." Dr. Goës has thoroughly studied the subject, and his opinion is of great value; still, although fig. 3 is Quinqueloculine, it possesses too many of the characters of *M. circularis* to be separated from it with advantage.

* Bull. Mus. Comp. Zoology at Harvard College, vol. xxix. No. 1, 1896, p. 82.

The Biloculine form has been found only at Stations 14 and 22. The other forms occur at most of the Stations, the Quinqueloculine being the most numerous of the three.

'Challenger' Stations are Prince Edward's Island, Kerguelen Islands, and Bass Straits. Amongst other localities Dr. Egger records it from two 'Gazelle' Stations off the coast of Australia.

Miliolina circularis var. *sublineata* Brady, plate XI. fig. 4.

Miliolina circularis var. *sublineata* Brady, 1884, Chall. Rept., p. 169, pl. iv. fig. 7. *M. circularis* var. *sublineata* Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. Abth. ii. p. 237, pl. ii. figs. 78, 79.

This rare variety differs from the 'Challenger' and 'Gazelle' forms in having a cribrate aperture. The shell is thin and subtranslucent, as in the 'Challenger' specimens. In size it considerably exceeds the specimens of *M. circularis* with which it is associated in the Malay Archipelago.

It is rather plentiful at several stations in both areas.

Brady gives but one locality, "off the Admiralty Islands on the north coast of New Guinea"; and the sole 'Gazelle' station is off the coast of Mauritius.

Miliolina valvularis Reuss sp., plate XI. figs. 5–7.

Triloculina valvularis Reuss, 1851, Zeitschr. Deutsch. Geol. Gesell., vol. iii. p. 85, pl. vii. fig. 56. ?*Miliolina valvularis* (Reuss) Brady, Chall. Rept., p. 161, pl. iv. figs. 4, 5. *Miliolina valvularis* (Brady) Goës, 1894, Kongl. Svenska Vet.-Akad. Handl., vol. xxv. p. 115, pl. xxii. fig. 871.

Whilst the aperture of this species, in general form, is similar to that of *M. circularis*, it differs in being provided with a tooth or valve which varies in size and form from a mere tubercule on the penultimate chamber to a large valve covering the whole of the aperture with the exception of a narrow semicircular slit at the margin. Speaking of *M. valvularis*, Brady says,* "The species is one of the few that may rank with *Miliolina trigonula* and *Miliolina tricarinata* as a true *Triloculina*"; but in the Malay Archipelago it occurs also in the Biloculine and Quinqueloculine forms, and the figures by Goës above referred to represent it as having but two chambers visible externally; however, these have not the symmetry characteristic of *Biloculina*, and the arrangement of the earlier chambers is Triloculine or Quadriloculine.

The *Quinqueloculina dilatata* d'Orb., from the Gulf of Marseilles, figured by Schlumberger,† resembles the wild growing forms of *M. valvularis*. Biloculine forms similar to this species, if not identical,

* 'Challenger' Report, 1884, p. 161.

† Mém. Soc. Zool. France, vol. vi. 1893, p. 217, fig. 30 and pl. iii. figs. 73, 74.

are *B. globulus* Bornemann, *B. Grinzingensis* Karrer, and *B. ringens* var. Balkwill and Wright.

In the Malay Archipelago the distribution is similar to that of *M. circularis*, but it is less abundant.

The 'Challenger' specimens were obtained on the north-east coast of New Zealand. Those described by Dr. Goës were from the North Atlantic, from deep water in both instances.

Miliolina labiosa d'Orbigny sp., plate XI. figs. 8, 9.

Triloculina labiosa d'Orb., Foram. Cuba, p. 178, pl. x. figs. 12–14. *Miliolina labiosa* (d'Orb. sp.) Brady, 1884, Chall. Rept., p. 170, pl. vi. figs. 3–5.

This very unsatisfactory species occurs at only a few of the Stations, and never in great abundance. In form it ranges from *Nubecularia Bradyi* to *Miliolina valvularis*, the specimen figured being one of the most symmetrical.

D'Orbigny describes it as tolerably numerous in the sands of Cuba, and it is recorded from numerous 'Challenger' Stations.

Miliolina subrotunda Montagu sp.

"Serpula subrotunda dorso elevato," Walker and Boys (1784), Test. Min., p. 2, pl. i. fig. 4. *Vermiculum subrotundum* Montagu, 1803, Test. Brit., part ii. p. 521. *Miliolina subrotunda* (Walk. and Boys) Goës, 1894 Kongl. Svenska Vet.-Akad. Handl., vol. xxv. p. 109, pl. xix. figs. 846, 847. *Miliolina subrotunda* Jones, 1895, Palæontographical Soc., p. 120, woodcut, fig. 9.

In the Malay Archipelago typical forms of this ubiquitous species are not common, most of the specimens possessing some of the characters of *M. circularis* and *M. valvularis*.

It appears in Prof. Bütschli's list of Foraminifera from the Malay Archipelago.

Miliolina suborbicularis d'Orbigny sp., plate XI. fig. 13.

Quinqueloculina suborbicularis (d'Orb.) Schlumberger, 1893, Mém. Soc. Zool. France, vol. vi. p. 73, plate ii. figs. 63, 64, pl. iii. fig. 67, and woodcuts, figs. 26–28.

The Malay specimens, as will be seen from the illustrations, closely resemble those from the Gulf of Marseilles figured by Schlumberger.

It is moderately abundant at a few of the Stations.

Under the name of *M. Fichteliana*, Brady records it from Madagascar, the Inland Sea of Japan, and the Chinese Seas.

Miliolina tricarinata d'Orbigny sp.

Triloculina tricarinata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 299, No. 7. *Miliolina* (*Triloculina*) *tricarinata* (d'Orb.) Egger,

1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. Abth. II. p. 234, pl. ii. figs. 35–37. *M. tricarinata* (d'Orb.) de Amicis, 1893, Boll. Soc. Geol. Ital., vol. xii. fasc. 3, p. 30, pl. iii. fig. 2. *M. tricarinata* (d'Orb.) Goës, 1894, Kongl. Svenska Vet.-Akad. Handl., vol. xxv. p. 114, pl. xxi. figs. 866–869. *M. tricarinata* (d'Orb.) Jones, 1895, Palæontographical Soc., p. 119.

This very common species is well represented, being found at most Stations in both areas. It appears in Prof. Bütschli's list of Foraminifera from the Malay Archipelago.

Miliolina tricarinata, striate var., plate XI. figs. 10, 11.

Miliolina Terquemiana Brady, 1884, Chall. Rept., p. 166, pl. cxiv. fig. 1.

This striate variety is not uncommon in the Malay Archipelago, and is most abundant in Area 1. Its characters are distinctly those of *M. tricarinata*, and there are no passage forms towards *M. trigonula*. Brady writes,* "*Miliolina terquemiana* is exceedingly rare. Hitherto I have only seen specimens from two localities, namely, in shallow-water sand, dredged off Calpentyn, Ceylon, and in littoral sand from the east coast of Madagascar."

Miliolina tricarinata, reticulated var., plate XI. fig. 12.

Miliolina Bertheliniana Brady, 1884, Chall. Rept., p. 166, pl. cxiv. fig. 2.

This variety is very rare in the Malay Archipelago, being represented by one specimen only from Station 2. Its form is that of *M. tricarinata*, but approaching that of *M. trigonula*. Brady gives four localities: "Off Ascension Island, 7 fathoms; off Calpentyn, Ceylon, 2 fathoms; and in the shore-sands collected by Mr. Kitching near Tamatavé, Madagascar, and near Port Elizabeth, Algoa Bay."

Miliolina trigonula Lamarck sp.

Miliolites trigonula Lamarck, 1804, Ann. du Mus., vol. v. p. 351, No. 3. *Miliolina trigonula* (Lam.) Sherborn and Chapman, 1889, Journ. Roy. Micr. Soc., p. 484, pl. xi. fig. 1. *M. trigonula* (Lam.) Terrigi, 1891, Mem. R. Com. Geol. Ital., vol. iv. part i. p. 66, pl. i. fig. 4. *M. trigonula* (Lam.) Goës, 1894, Kongl. Svenska Vet.-Akad. Handl., vol. xxv. p. 115, pl. xxii. fig. 870.

This form, like *M. tricarinata*, is represented at most of the Stations in both areas, but is not quite so abundant.

Miliolina trigonula, striate var.

Miliolina insignis Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. N.S. p. 45. *Miliolina insignis* Brady, 1884, Chall. Rept., p. 165, pl. iv. figs. 8, 10.

* 'Challenger' Report, 1884, p. 166.

This variety is rare in the Malay Archipelago, although it occurs at three Stations.

Brady gives several localities, amongst them Bass Straits and the coast of Java.

Miliolina Parisiensis d'Orbigny sp., plate XII. fig. 1, *a*, *b*, *c*.

Quinqueloculina Parisiensis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 301, No. 5 (not described). *Q. Parisiensis* d'Orbigny, 'Planches Inédites,' pl. i. fig. 1. *Q. Parisiensis* d'Orbigny, 1850, 'Prodrome de Paléontologie,' vol. ii. p. 409. *Q. Parisiensis* (d'Orb.) Terquem, 1882, Mém. Soc. Géol. France, sér. 3, vol. ii. p. 181, pl. xix. fig. 21.

Although the Malay specimens of this pretty little form do not accord in all respects with the figures given and referred to by Terquem, yet so many of the characters are similar that there need be no difficulty in referring them to the same species.

D'Orbigny's references are to the figures in the 'Planches Inédites,' and his only published description is in the Prodrome, "Espèce renflée et striée." Thanks to the kindness of Signor Fornasini of Bologna, I am in possession of a tracing of the figure in the 'Planches Inédites'; this represents an elongate Quinqueloculine shell, with fine striæ and an edentate circular aperture at the extremity of a short prolongation of the anterior portion of the last formed chamber.

The unnamed and undescribed figures in 'Description des Coquilles fossiles des environs de Paris,' by Deshayes, referred to by Terquem, represent tests with simple longitudinal striæ; whilst Terquem describes his specimens as having longitudinal costæ with the intervals marked by a series of perforations. In the Malay specimens, as shown by the figure, the sculpture consists of transverse costæ crossed at right angles by larger longitudinal ribs. The aperture has three or more lobes, with sometimes traces of an obscure tooth. The test is Triloculine, and the shell substance thin and fragile.

It occurs only at Station 2, and there very sparingly.

Miliolina reticulata d'Orbigny sp.

Triloculina reticulata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 299, No. 9. *Miliolina* (*Triloculina*) *reticulata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 239, pl. ii. figs. 83, 84. *Quinqueloculina reticulata* (d'Orb.) Schlumberger, 1893, Mém. Soc. Zool. France, vol. vi. p. 214, fig. 25 and pl. ii. fig. 62.

In this common species the Quinqueloculine form usually has the chambers circular in transverse section, whilst in the Triloculine form they are generally more or less angular.

It is common at several Stations, mostly in Area 1.

Group of *Miliolina seminulum*.

Miliolina seminulum Linné sp.

Serpula seminulum Linné, 1767, Syst. Nat., 12th ed., p. 1264, No. 791. *Miliolina seminulum* (Linné) Jones, 1895, Pal. Soc., p. 116, pl. iii. figs. 35, 36.

Although this grouping of the *Miliolinæ* is far from natural, as indeed any system must be which aims at linking together the different forms in a linear series, it serves to bring together forms which the profusion of intermediate specimens in this collection shows to be nearly related.

In this group, chambers with the rounded transverse section cease to be the rule, and in most of the forms the chambers are angular or carinate.

M. seminulum occurs so abundantly in all seas and at all depths, that it is needless to specify localities. In the Malay Archipelago it is as numerous and as widely distributed as elsewhere.

Miliolina Auberiana d'Orbigny sp.

Quinqueloculina Auberiana d'Orbigny, 1839, Foram. Cuba, p. 167, pl. xii. figs. 1–3. *M. Auberiana* (d'Orb.) Goës, 1894, Kongl. Svenska Vet.-Akad. Handl., vol. xxv. p. 109, pl. xix. fig. 844, *a–d*.

This stout angular variety is not common in the Malay Archipelago, and does not appear to have been hitherto recorded from this region, although Bütschli in his list gives *M. triangularis*, which is a closely allied variety, differing in little more that the amount of acuteness of the periphery. A. Silvestri * records it from two localities in the Adriatic.

Miliolina Cuvieriana d'Orbigny sp., plate XII. fig. 2 *a*, *b*.

Quinqueloculina Cuvieriana d'Orbigny, 1839, Foram. Cuba, p. 190, pl. xi. figs. 19–21. *Miliolina Cuvieriana* (d'Orb.), Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., p. 234, pl. ii. figs. 47–49 and pl. iv. figs. 22–24. *M. Cuvieriana* (d'Orb.) Jones, 1895, Pal. Soc., p. 119, pl. vi. fig. 4 *a*, *b*.

In his description of this species d'Orbigny states that two or three longitudinal striæ accompany the keel on each side of it. In the figure in the Cuba Memoir these striæ are represented, but they do not appear in any other of the figures ascribed to this species. The *Q. Schroekingerii* var. *Calabra* Seguenza † has the peripheral edges of the chambers flattened and striate. The *Q. seminuda* of Reuss ‡ has the periphery rounded and striate; whilst Terquem,§ regardless of

* Atti e Rendic. d. Accad. Sci. Lett. e Arti d. Zelanti e PP. dello Studio di Acireale, vol. viii. 1896–7, p. 15.

† R. Accad. dei Lincei, 1880, p. 154, pl. xiv. fig. 13.

‡ Denkschr. k. Akad. Wiss. Wien, vol. xxv. 1865, p. 125, pl. i. fig. 11.

§ Mém. Soc. Géol. France, sér. 3, vol. i. 1878, p. 76, pl. xiv. fig. 8.

priority of nomenclature, names a form *Q. seminuda* in which the peripheral striæ are replaced by costæ. Brady,* Egger, and T. Rupert Jones all figure the species without striæ or costæ, and specimens of this kind occur in the Malay Archipelago, but not so abundantly as the costate form figured. The proportion of the peripheral margin marked by costæ varies in different specimens, the tendency always being to develop in the direction of *M. bicornis*.

It is most abundant and attains its greatest size at Station 14, but it occurs at a few other Stations.

Miliolina cristata sp. n., plate XII. fig. 3 *a*, *b*, *c*.

Test nearly circular, unequally biconvex, chambers triangular in cross-section, peripheral margin acute, that of the last formed chamber boldly serrated, aperture with a thickened margin, dentate. Length 0·20 mm.

This description will serve to identify a minute form whose zoological position appears to be between *M. Cuvieriana* d'Orbigny and *M. venusta* Karrer. It may possibly be allied to *M. excisa* Brady, Parker, and Jones,† from the Abrolhos Bank.

The solitary specimen is from Station 22.

Miliolina venusta Karrer sp.

Quinqueloculina venusta Karrer, 1868, Sitzungsb. k. Akad. Wiss. Wien, vol. lviii. p. 147, pl. ii. fig. 6. *Miliolina venusta* (Karrer) Sherborn and Chapman, 1889, Journ. Roy. Micr. Soc., p. 2, pl. xi. figs. 2, 3. *M. venusta* (Karrer) Chapman, 1891, Journ. Roy. Micr. Soc., p. 573, pl. ix. figs. 5, 6. *M. venusta* (Karrer) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 235, pl. ii. figs. 56–58.

As might be expected of this essentially deep-water species, it is but scantily represented in the anchor-mud from the Malay Archipelago, although it occurs at several of the Stations.

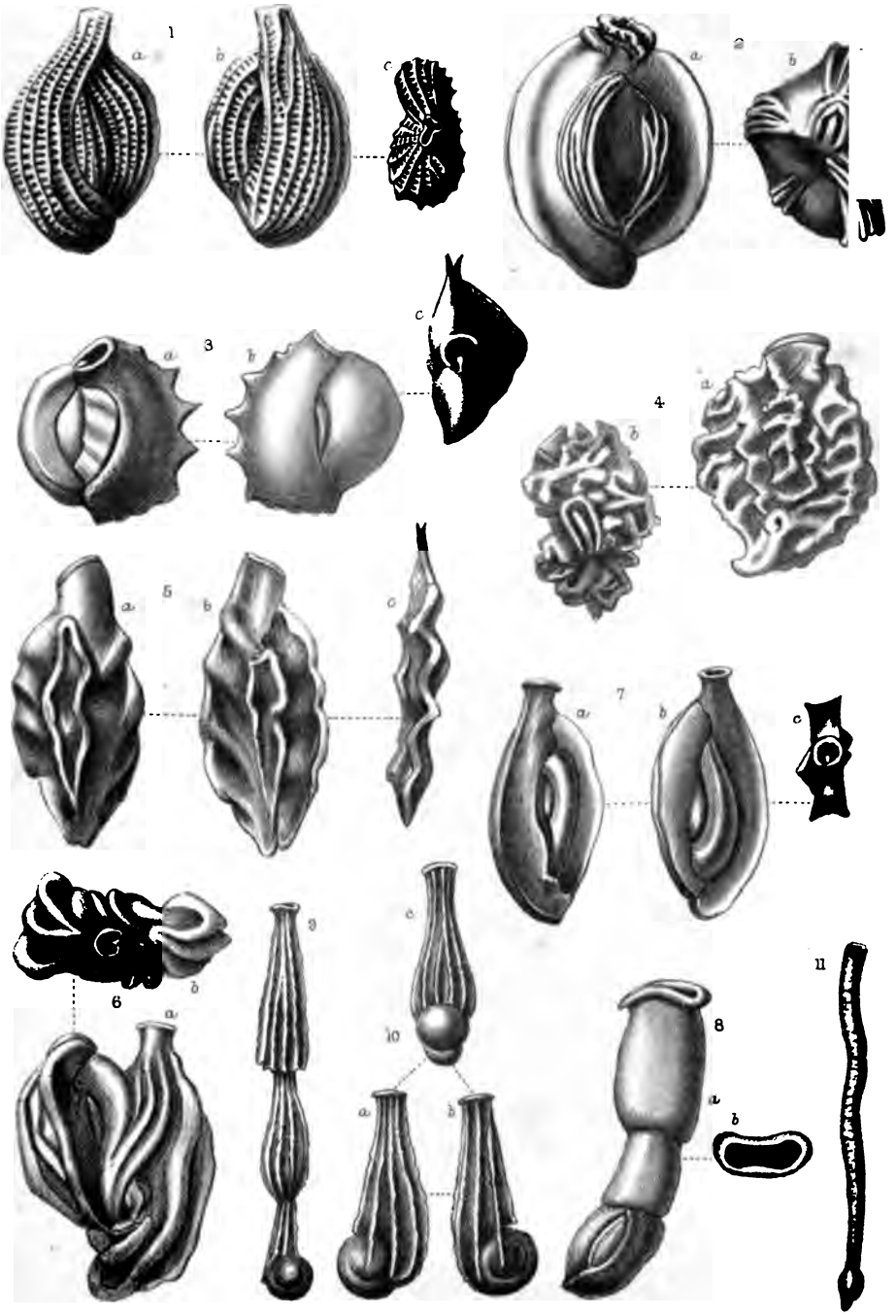
One of the 'Gazelle' Stations is Western Australia; and under the name of *M. Candeiana*, Dr. Goës‡ records it from the North Atlantic.

Miliolina undosa Karrer sp., plate XII. fig. 5 *a–c*.

Quinqueloculina undosa Karrer, 1867, Sitzungsb. k. Akad. Wiss. Wien, vol. lv. p. 361, pl. iii. fig. 3. *Miliolina undosa* (Karrer) Egger, 1893, Abhandl. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 237, pl. ii. figs. 41, 42.

Brady remarks,§ "this is a Quinqueloculine variety, somewhat of the '*Ferussacii*' type." Of the specimens figured by Brady on

* 'Challenger' Report, 1884, p. 162, pl. v. fig. 12.
† Trans. Zool. Soc., vol. xii. 1888, p. 215, pl. xl. fig. 33.
‡ K. Svenska Vet.-Akad. Handl., vol. xxv. No. 9, 1894, p. 109, pl. xix. fig. 845.
§ 'Challenger' Report, 1884, p. 176.



F.W.Millett del. et nat.

West, Newman lith.

Foraminifera of Malay Archipelago.

pl. vi., figs. 6 and 7 resemble *M. bicornis* in general contour, whilst figs. 8 *a*, *b* appear to be more nearly related to *M. Ferussacii*. The Malay specimens, as shown by the figures, approach still more closely to the thin elongate forms of *M. Ferussacii*, and Egger's specimens seem to be of the same character. The *Quinqueloculina signata* of Reuss* combines the characters of *M. undosa* and of *M. Ferussacii*, and is of much interest as an instructive intermediate form. Judging from external appearances, *Q. undulata* d'Orbigny, described and figured by Schlumberger,† pl. i. figs. 53, 54, differs from *M. undosa* in having traces of longitudinal costæ, whilst pl. ii. figs. 60, 61, resembles the typical *M. bicornis* as figured by many authors.

It occurs at Stations in both Areas, but is not very abundant.

The localities given by Brady are "Challenger Station 162, off East Moncœur Island, Bass Strait, 38 fathoms; but it occurs also on the coral reefs of the Sandwich Islands, 40 fathoms; on the south coast of Papua, Flinders Passage, 7 fathoms; and off Ascension Island, 7 fathoms." Egger records it only from Mauritius. A. Silvestri has found it in the Adriatic. Schlumberger's specimens of *Q. undulata* are from the Gulf of Marseilles.

Miliolina Parkeri Brady, plate XII. fig. 4 *a*, *b*.

"*Quinqueloculina* with oblique ridges," Parker, 1858, Trans. Micr. Soc. London, N.S., vol. vi. p. 53, pl. v. fig. 10. *Miliolina Parkeri* Brady, 1881, Quart. Journ. Micr. Sci., N.S., vol. xxi. p. 46. *M. Parkeri* Brady, 1884, Chall. Rept., p. 177, pl. vii. fig. 14.

This species seems to be nothing more than a robust and complex form of *M. undosa*. The passage-forms are numerous and varied, making a complete series from the one to the other. The Malay specimens are large and well developed, and are less triangular, that is to say, more rounded at the periphery, than those figured by Brady.

It is most abundant and at its best at Station 22, but is found at all other Stations in both Areas. Parker's specimens were from the East Indian Seas. Brady says of it, "essentially a coral-reef species. It occurs at seven 'Challenger' Stations amongst the islands of the Pacific, and with one exception (off Tahiti, 420 fathoms), always in shallow water. It has been found in sand dredged off the Seychelles (E. P. Wright), off Java (Robertson), and in the Red Sea.'

Miliolina Ferussacii d'Orbigny sp., plate XII. figs. 6 *a*, *b*, 7 *a*, *b*, *c*.

Quinqueloculina Ferussacii d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 301, No. 18; Modèle No. 32. *Miliolina Ferussacii* (d'Orb.) var. Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 325, pl. xii. figs. 10–12. *M. Ferussacii* (d'Orb.)

* Denkschr. k. Akad. Wiss. Wien, vol. i. 1850, pl. l. fig. 11.

† Mém. Soc. Zool. France, vol. vi. 1893, p. 213, figs. 23, 24, and pl. i. figs. 53, 54, and pl. ii. figs. 60, 61.

Sherborn and Chapman, 1886, Journ. R. Micr. Soc., p. 742, plate xiv. fig 5. *M. Ferussacii* (d'Orb.) Chapman, 1891, Journ. R. Micr. Soc., 1891, p. 574, pl. ix. fig. 8. *M. contorta* (D'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 111, pl. xx. figs. 851, 852. *M. contorta* (d'Orb.) var. Goës, 1896, Bull. Mus. Comp. Zool. at Harvard College, vol. xxix. p. 82, pl. vii. figs. 10–12; pl. viii. figs. 1–7.

This species is represented by numerous varieties, from the smooth eeble form fig. 6 to the strongly costate fig. 7; but here, as in most other regions, the variety *M. contorta* is the most abundant of them all, especially the rugose form resembling *Q. bidentata* d'Orbigny * and *Q. sclerotica* Karrer.† A considerable proportion of the specimens of the strongly costate variety show a tendency to wildness of growth, some of the later chambers deviating from the normal plan of aggregation, as in *M. separans* Brady, and in *Triloculina nodosaroides* Karrer.

This species and its varieties are common at most of the Stations in both Areas.

Its distribution in the northern hemisphere is very wide, but according to Brady, in the southern hemisphere it has only been noted at two or three points on the coast of Australia, one of which is Raine Island, Torres Strait.

Miliolina agglutinans d'Orbigny sp.

Quinqueloculina agglutinans d'Orbigny, 1839, Foram. Cuba, p. 168, pl. xii. figs. 11–13. *Miliolina agglutinans* (d'Orb.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 355, pl. xiii. figs. 1–3. *M. agglutinans* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 215, pl. xl. figs. 34, 35. *M. agglutinans* (d'Orb.) Chapman, 1891, Journ. R. Micr. Soc., p. 574, pl. ix. fig. 7. *M. agglutinans* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 239, pl. ii. fig. 55. *M. agglutinans* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 110, pl. xix. fig. 848 and pl. xx. fig. 849.

Included in this so-called species are the agglutinate forms of *M. Ferussacii* and *M. seminulum*. To the former of these belong the *Quinqueloculina agglutinans* and *Q. enoplostoma* of the Cuba Memoir, these having the contour of *M. contorta*, which again, when it has a rough surface, is the *M. sclerotica* of Karrer, and this form sometimes agglutinates sand-grains, or incorporates them sparingly into its shell-substance. The specimens figured by Brady, Balkwill, and Wright, Brady, Parker, and Jones, Chapman and Egger, are of the *seminulum* type, as are also some of those figured by Goës, whilst others have the form of *M. contorta* and *M. Cuvieriana*.

* Foram. Cuba, 1839, p. 197, pl. xii. figs. 18–20.
† Sitzungsb. k. Akad. Wiss. Wien, 1868, p. 152, pl. iii. fig. 5.

The Malay specimens are all of the *seminulum* type; they occur at several Stations in both Areas, but are nowhere abundant.

Miliolina pulchella d'Orbigny sp.

Quinqueloculina pulchella d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 303, No. 42. *M. pulchella* (d'Orb.) Jones, 1895, Pal. Soc., p. 123, pl. vi. fig. 3. *M. pulchella* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 114, pl. xxi. figs. 862–864.

This species, whose surface ornament often combines the fine striæ of *M. bicornis* with the strong costæ of *M. Ferussacii*, is here represented only by a few feeble specimens.

Miliolina Linnæana d'Orbigny sp.

Triloculina Linneiana d'Orbigny, 1839, Foram. Cuba, p. 172, pl. ix. figs. 11–13. *Miliolina Linnæana* (d'Orb.) Brady, 1884, Chall. Rep., p. 174, pl. vi. figs. 15–20. ?*Miliolina* (*Triloculina*) *Linnæana* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii p. 239, pl. ii. figs. 80, 81.

The Malay specimens resemble those figured by Brady, the costæ being irregular and sometimes interrupted or bifurcate.

It occurs sparingly at a few Stations.

The localities named by Brady are West Indies, Madagascar, and eight 'Challenger' Stations in the neighbourhood of the coral islands of the Pacific, within the tropical zone. Egger's rather doubtful example is from Mauritius.

Miliolina bicornis Walker and Jacob sp.

Serpula bicornis ventricosa Walker and Boys, 1784, Test. Min., p. 1, pl. i. fig. 2. *Miliolina bicornis* (Walker) Williamson, 1858, Rec. Foram. Great Britain, p. 87, pl. vii. figs. 190–195. *Adelosina bicornis* (W. and J.) Schlumberger, 1886, Bull. Soc. Zool. France, vol. xi. p. 546, figs. 1–5, and pl. xvi. figs. 10–15. *M. bicornis* (W. and J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 237, pl. ii. figs. 73, 74. *M. elegans* (Williamson) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 112, pl. xx. fig. 857. *M. bicornis* (W. and J.) Goës, ibid., p. 113, pl. xxi. figs. 860, 861. *M. bicornis* (W. and J.) Madsen, 1895, Meddelelser fra Dansk Geol. Forening, No. 2, p. 180, pl. fig. 1.

This species is most numerously represented by its elongate form, which, as before mentioned, merges into the costate variety of *M. Bosciana*.

It is abundant in Area 1, but occurs also in Area 2.

The 'Gazelle' specimen figured by Egger is of the elongate variety, and closely resembles the *M. bicornis* var. *elegans* of Williamson. It is from Mauritius, the only Station named for the species.

Miliolina Boueana d'Orbigny sp.

Quinqueloculina Boueana d'Orbigny, 1846, Foram. Foss. Vienne, p. 293, pl. xix. figs. 7–9. *M. Boueana* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 114, pl. xxi. fig. 865.

This form is not well represented, and the specimens might almost with as much reason have been included in the *Miliolina oblonga* group.

It occurs at a few Stations in both Areas.

Miliolina alveoliniformis Brady.

M. alveoliniformis Brady, 1879, Quart. Journ. Micr. Sci., N.S., vol. xix. p. 54. *Schlumbergerina areniphora* Munier-Chalmas, 1882, Bull. Soc. Géol. France, sér. 3, vol. x. p. 425, figure. *M. alveoliniformis* (Brady) Brady, 1884, Chall. Rept., p. 181, pl. viii. figs. 15–20. *M. alveoliniformis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 232, pl. ii. figs. 17–19.

This abnormal form of *Miliolina* is tolerably common and well developed at Station 22 in Area 2. All the specimens have the porous aperture as represented by Brady and Munier-Chalmas, thus differing from the example figured by Egger. In my cabinet are specimens from 'Challenger' Station 172, Nukualofa, Tongatabu, which are more regular in form, are entirely porcellanous, and the aperture resembles that of *M. circularis*.

Brady speaks of it as being essentially a coral reef species, and as having a wide range. The localities given by Munier-Chalmas for *Schlumbergerina areniphora* are the coast of Madagascar and the Gaboon and Torres Strait. The 'Gazelle' Stations are, off the Cape of Good Hope and Mauritius.

Sub-Family **Hauerininæ.**

Articulina d'Orbigny.

Articulina sulcata Reuss.

Articulina sulcata Reuss, 1850, Denkschr. k. Akad. Wiss., vol. i. p. 383, pl. xlix. figs. 13–17. *A. sulcata* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. pt. vii. p. 215, pl. xl. fig. 11. *A. sulcata* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 243, pl. ii. fig. 5.

The specimens of this species are neither numerous nor widely distributed. They are of the form figured by Brady and by Egger, which differs slightly from those figured by other authors.

Brady records four 'Challenger' Stations, one of which is Raine Island, Torres Strait. The 'Gazelle' Stations are West Africa and Mauritius.

Articulina Sagra d'Orbigny.

Articulina Sagra d'Orbigny, 1839, Foram. Cuba, p. 183, pl. ix. figs. 23–26. *A. Sagra* (d'Orb.) Brady, 1884, Chall. Rept., p. 184, pl. xii. figs. 22–24.

None of the Malay specimens have the extreme development of the *Vertebralina mucronata* of d'Orbigny,* nor of the *A. Sagra* as figured by Brady, but they form a series extending from the Cuba specimens of the latter form to the *A. lineata* of Brady; the decoration varying from costate to striate.

It is pretty evenly distributed, although not common.

Articulina lineata Brady.

Articulina lineata Brady, 1884, Chall. Rept., p. 183, pl. xii. figs. 19–21.

As before stated, this variety is connected with *A. Sagra*, and it would perhaps be better to include it in that species. None of the Malay specimens however have the margin "thin and sharp," as have some of the 'Challenger' examples.

It occurs at the same Stations as *A. Sagra*, and is rather more abundant.

It has been found at four 'Challenger' Stations, one of which is Raine Island, Torres Strait. There seems to be no other record of its occurrence.

Articulina lineata Brady, smooth variety, plate XII. fig. 8.

This form occurs in company with *A. lineata*, and is rather more abundant. In differs only in the absence of the striations. Length 0·50 mm.

Articulina conico-articulata Batsch sp., plate XII. figs. 9, 10.

Nautilus conico-articulatus Batsch, 1791, Conch. Seesandes, p. 3, pl. iii. fig. 11. *Vertebralina conico-articulata* (Batsch) Goës, 1882, K. Svenska Vet.-Akad. Handl., vol. xix. No. 4, p. 121, pl. ix. fig. 317. *A conico-articulata* (Batsch) Brady, 1884, Chall. Rept., p. 185, pl. xii. figs. 17, 18, and pl. xiii. figs. 1, 2. *A. conico-articulata* (Batsch) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 216, pl. xl. figs. 7–9. *Articulina* sp.? Wisniowski, 1888, Jahrb. k. k. Geol. Reichs., vol. xxxviii. p. 694, pl. xiii. fig. 62. *A. conico-articulata* (Batsch) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 224, pl. iii. fig. 2. *A. extensa* Egger, 1893, ibid., p. 242, pl. iii. fig. 3.

It is unfortunate that the figure of this species given by Batsch should have been taken from a specimen in which the initial chambers are wanting, seeing that this cylindrical *Articulina* is found in two distinct forms. In one of these the earlier chambers are arranged on

* Foram. Cuba, 1839, p. 52, pl. vii. figs. 16–19.

the Milioline plan as in *A. nitida* d'Orbigny, whilst in the other the initial portion consists of a spherical primordial with circumambient chamber as in the genus *Orbitolites*. Speaking of *Vertebralina conico-articulata*, Goes remarks,* "Its most singular form is that in which the primordial chamber is flask-formed, and the subsequent chamber develops itself from the top of its neck and so on, one chamber after the other in *Nodosarina* fashion; thus its usual *Miliolina* formed stage is passed over altogether." All the Malay specimens are of this form, and are extremely attenuated. It will be noticed that the *Nubecularia tibia* (pl. v. fig. 3) has the initial chambers of this character, and it becomes a question if this species should not be removed to the genus *Articulina*. Jones and Parker remark,† "From the Clam-shells of the East Indian Seas, and from the *Strombus gigas* of the West Indies, we get minute rectilinear individuals of *Nubecularia*, with a spiral commencement (*N. tibia* var. nov.)." And again (p. 456), "Of the straight specimens (*N. tibia*) we have only fragments, the spiral portion being absent." Brady also writes,‡ "Owing perhaps to the thinness of the walls and the slenderness of the stoloniferous tubes, specimens are scarcely ever found with more than three segments." A glance at the published figures of *N. tibia* will suggest that nearly all of them represent imperfect examples, and it might reasonably be assumed that the earlier chambers were of the same character as those of the Malay specimens. In these latter the shell substance of *N. tibia* is dense and opaque, whilst that of *A. conico-articulata* is thin and somewhat translucent. It must be left to subsequent researches to prove whether *N. tibia* is a distinct species, or if it is only a smooth form of *A. conico-articulata*.

As for the latter, it may be convenient to assume that Batsch's species, as indeed the contour of the figure suggests, had the initial chambers of the *Orbitolites*-form, whilst d'Orbigny's *A. nitida* with the Milioline commencement may be treated as a distinct species.

Acting on this assumption, it may be stated that *A. nitida* is not represented in the gatherings by Goës from the Caribbean Sea, nor in Mr. Durrand's anchor mud; that, allowing for errors of interpretation, they both occur in the 'Challenger' and Abrolhos Bank collections; and that, supposing Egger's *A. extensa* to be equal to *A. conico-articulata*, they are both represented in the 'Gazelle' soundings.

For *A. conico-articulata* Egger's Stations are Mauritius and West Australia, and for *A. extensa* (which he considers a variety of *A. funalis*) Mauritius only.

In the Malay Archipelago the *Orbitolites*-form is very abundant, and occurs at nearly all the Stations in both areas.

* K. Svenska Vet.-Akad. Handl., vol. xix. 1882, p. 121.
† Quart. Journ. Geol. Soc., vol. xvi. 1860, p. 455.
‡ 'Challenger' Report, p. 135.

Articulina funalis Brady.

Articulina funalis Brady, 1884, Chall. Rept., p. 185, pl. xiii. figs. 6–11. *A. funalis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 242, pl. iii. fig. 1.

Fragments of this species occur at a few Stations in both areas, but the initial club-shaped portion is always wanting.

'Challenger' Stations are, Kerguelen Island, off Prince Edward's Island, and Humboldt Bay on the north coast of Papua.

What appears to be a fragment of this species is represented in 'The Foraminifera of the Abrolhos Bank,' Brady, Parker, and Jones, 1888, pl. xl. fig. 7, and figs. 5 and 6 of the same plate may represent the striate and smooth forms of the like species.

Articulina funalis var. *inornata* Brady, plate XII. fig. 11.

Articulina funalis var. *inornata* Brady, 1884, Chall. Rept., p. 186, pl. xiii. figs. 3–5. *A. inornata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 242, pl. iii. fig. 4.

Occurs at the same Stations as the typical form, and is somewhat more abundant.

The only 'Challenger' Station is Prince Edward's Island, and the only 'Gazelle' Station Mauritius; rare in both localities.

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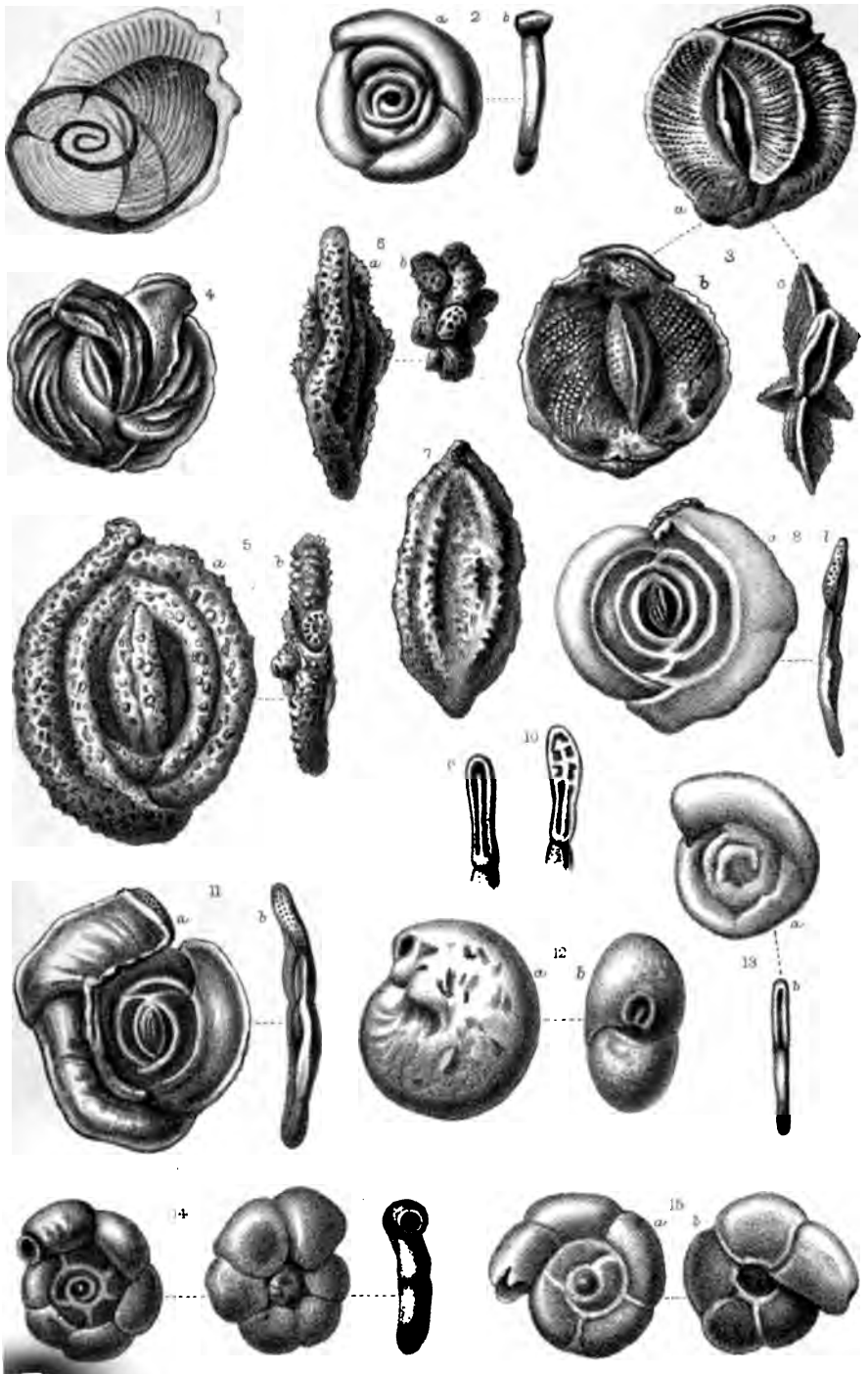

West, Newman lith.

Foraminifera of Malay Archipelago.

(Journ. R. Micr. Soc., 1898, pp. 607–614.)

XV.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part III.*

By Fortescue William Millett, F.R.M.S.

(*Read 19th October*, 1898.)

Plate XIII.

Vertebralina d'Orbigny.

Vertebralina striata d'Orb., plate XIII. fig. 1.

Vertebralina striata d'Orb., 1826, Ann. Sci. Nat., vol. vii. p. 283, No. 1; Modèle, No. 81. *V. striata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 243, pl. iii. figs. 33, 34.

The majority of the Malay specimens have the peripheral margin angular or carinate, as in *V. insignis* Brady, but in all the test is inequilateral, and one lip of the aperture protrudes beyond the other. Thus, although most of the specimens combine certain of the characters of the two species, the typical *V. insignis* is not represented. As will be seen from the figure, which is drawn as viewed by transmitted light, the test commences with a planospiral chamber.

It occurs at several Stations, but the specimens are small and feeble.

EXPLANATION OF PLATE XIII.

Fig. 1.—*Vertebralina striata* d'Orbigny. × 90.
„ 2.—*Ophthalmidium tumidulum* Brady. × 90.
„ 3.—*Massilina secans* d'Orbigny. × 40.
„ 4. „ „ var. *macilenta* Brady. × 40.
„ 5, 6, 7. „ *alveoliniformis* sp. n. × 30.
„ 8.—*Hauerina fragilissima* Brady sp. × 45.
„ 9, 10. „ „ various forms of aperture. × 90
„ 11. „ *compressa* d'Orbigny. × 40.
„ 12.—*Planispirina contraria* d'Orbigny sp. × 45.
„ 13. „ *exigua* Brady. × 45.
„ 14, 15.—*Fischerina pellucida* sp. n. × 90.

Miliolina Boueana d'Orbigny sp.

Quinqueloculina Boueana d'Orbigny, 1846, Foram. Foss. Vienne, p. 293, pl. xix. figs. 7–9. *M. Boueana* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 114, pl. xxi. fig. 865.

This form is not well represented, and the specimens might almost with as much reason have been included in the *Miliolina oblonga* group.

It occurs at a few Stations in both Areas.

Miliolina alveoliniformis Brady.

M. alveoliniformis Brady, 1879, Quart. Journ. Micr. Sci., N.S., vol. xix. p. 54. *Schlumbergerina areniphora* Munier-Chalmas, 1882, Bull. Soc. Géol. France, sér. 3, vol. x. p. 425, figure. *M. alveoliniformis* (Brady) Brady, 1884, Chall. Rept., p. 181, pl. viii. figs. 15–20. *M. alveoliniformis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 232, pl. ii. figs. 17–19.

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It is pretty evenly distributed, although not common.

Articulina lineata Brady.

Articulina lineata Brady, 1884, Chall. Rept., p. 183, pl. xii. figs. 19–21.

As before stated, this variety is connected with *A. Sagra*, and it would perhaps be better to include it in that species. None of the Malay specimens however have the margin "thin and sharp," as have some of the 'Challenger' examples.

It occurs at the same Stations as *A. Sagra*, and is rather more abundant.

It has been found at four 'Challenger' Stations, one of which is Raine Island, Torres Strait. There seems to be no other record of its occurrence.

Articulina lineata Brady, smooth variety, plate XII. fig. 8.

This form occurs in company with *A. lineata*, and is rather more abundant. In differs only in the absence of the striations. Length 0·50 mm.

Articulina conico-articulata Batsch sp., plate XII. figs. 9, 10.

Nautilus conico-articulatus Batsch, 1791, Conch. Seesandes, p. 3, pl. iii. fig. 11. *Vertebralina conico-articulata* (Batsch) Goës, 1882, K. Svenska Vet.-Akad. Handl., vol. xix. No. 4, p. 121, pl. ix. fig. 317. *A conico-articulata* (Batsch) Brady, 1884, Chall. Rept., p. 185, pl. xii. figs. 17, 18, and pl. xiii. figs. 1, 2. *A. conico-articulata* (Batsch) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 216, pl. xl. figs. 7–9. *Articulina* sp.? Wisniowski, 1888, Jahrb. k. k. Geol. Reichs., vol. xxxviii. p. 694, pl. xiii. fig. 62. *A. conico-articulata* (Batsch) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 224, pl. iii. fig. 2. *A. extensa* Egger, 1893, ibid., p. 242, pl. iii. fig. 3.

It is unfortunate that the figure of this species given by Batsch should have been taken from a specimen in which the initial chambers are wanting, seeing that this cylindrical *Articulina* is found in two distinct forms. In one of these the earlier chambers are arranged on

* Foram. Cuba, 1839, p. 52, pl. vii. figs. 16–19.

the Milioline plan as in *A. nitida* d'Orbigny, whilst in the other the initial portion consists of a spherical primordial with circumambient chamber as in the genus *Orbitolites*. Speaking of *Vertebralina conico-articulata*, Goes remarks,* "Its most singular form is that in which the primordial chamber is flask-formed, and the subsequent chamber develops itself from the top of its neck and so on, one chamber after the other in *Nodosarina* fashion; thus its usual *Miliolina* formed stage is passed over altogether." All the Malay specimens are of this form, and are extremely attenuated. It will be noticed that the *Nubecularia tibia* (pl. v. fig. 3) has the initial chambers of this character, and it becomes a question if this species should not be removed to the genus *Articulina*. Jones and Parker remark,† "From the Clam-shells of the East Indian Seas, and from the *Strombus gigas* of the West Indies, we get minute rectilinear individuals of *Nubecularia*, with a spiral commencement (*N. tibia* var. nov.)." And again (p. 456), "Of the straight specimens (*N. tibia*) we have only fragments, the spiral portion being absent." Brady also writes,‡ "Owing perhaps to the thinness of the walls and the slenderness of the stoloniferous tubes, specimens are scarcely ever found with more than three segments." A glance at the published figures of *N. tibia* will suggest that nearly all of them represent imperfect examples, and it might reasonably be assumed that the earlier chambers were of the same character as those of the Malay specimens. In these latter the shell substance of *N. tibia* is dense and opaque, whilst that of *A. conico-articulata* is thin and somewhat translucent. It must be left to subsequent researches to prove whether *N. tibia* is a distinct species, or if it is only a smooth form of *A. conico-articulata*.

As for the latter, it may be convenient to assume that Batsch's species, as indeed the contour of the figure suggests, had the initial chambers of the *Orbitolites*-form, whilst d'Orbigny's *A. nitida* with the Milioline commencement may be treated as a distinct species.

Acting on this assumption, it may be stated that *A. nitida* is not represented in the gatherings by Goës from the Caribbean Sea, nor in Mr. Durrand's anchor mud; that, allowing for errors of interpretation, they both occur in the 'Challenger' and Abrolhos Bank collections; and that, supposing Egger's *A. extensa* to be equal to *A. conico-articulata*, they are both represented in the 'Gazelle' soundings.

For *A. conico-articulata* Egger's Stations are Mauritius and West Australia, and for *A. extensa* (which he considers a variety of *A. funalis*) Mauritius only.

In the Malay Archipelago the *Orbitolites*-form is very abundant, and occurs at nearly all the Stations in both areas.

* K. Svenska Vet.-Akad. Handl., vol. xix. 1882, p. 121.
† Quart. Journ. Geol. Soc., vol. xvi. 1860, p. 455.
‡ 'Challenger' Report, p. 135.

Articulina funalis Brady.

Articulina funalis Brady, 1884, Chall. Rept., p. 185, pl. xiii. figs. 6–11. *A. funalis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 242, pl. iii. fig. 1.

Fragments of this species occur at a few Stations in both areas, but the initial club-shaped portion is always wanting.

'Challenger' Stations are, Kerguelen Island, off Prince Edward's Island, and Humboldt Bay on the north coast of Papua.

What appears to be a fragment of this species is represented in 'The Foraminifera of the Abrolhos Bank,' Brady, Parker, and Jones, 1888, pl. xl. fig. 7, and figs. 5 and 6 of the same plate may represent the striate and smooth forms of the like species.

Articulina funalis var. *inornata* Brady, plate XII. fig. 11.

Articulina funalis var. *inornata* Brady, 1884, Chall. Rept., p. 186, pl. xiii. figs. 3–5. *A. inornata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 242, pl. iii. fig. 4.

Occurs at the same Stations as the typical form, and is somewhat more abundant.

The only 'Challenger' Station is Prince Edward's Island, and the only 'Gazelle' Station Mauritius; rare in both localities.

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West, Newman lith.

Foraminifera of Malay Archipelago.

(Journ. R. Micr. Soc., 1898, pp. 607–614.)

XV.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part III.*

By Fortescue William Millett, F.R.M.S.

(*Read 19th October*, 1898.)

Plate XIII.

Vertebralina d'Orbigny.

Vertebralina striata d'Orb., plate XIII. fig. 1.

Vertebralina striata d'Orb., 1826, Ann. Sci. Nat., vol. vii. p. 283, No. 1; Modèle, No. 81. *V. striata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 243, pl. iii. figs. 33, 34.

The majority of the Malay specimens have the peripheral margin angular or carinate, as in *V. insignis* Brady, but in all the test is inequilateral, and one lip of the aperture protrudes beyond the other. Thus, although most of the specimens combine certain of the characters of the two species, the typical *V. insignis* is not represented. As will be seen from the figure, which is drawn as viewed by transmitted light, the test commences with a planospiral chamber.

It occurs at several Stations, but the specimens are small and feeble.

EXPLANATION OF PLATE XIII.

Fig. 1.—*Vertebralina striata* d'Orbigny. × 90.
„ 2.—*Ophthalmidium tumidulum* Brady. × 90.
„ 3.—*Massilina secans* d'Orbigny. × 40.
„ 4. „ „ var. *macilenta* Brady. × 40.
„ 5, 6, 7. „ *alveoliniformis* sp. n. × 30.
„ 8.—*Hauerina fragilissima* Brady sp. × 45.
„ 9, 10. „ „ various forms of aperture. × 90
„ 11. „ *compressa* d'Orbigny. × 40.
„ 12.—*Planispirina contraria* d'Orbigny sp. × 45.
„ 13. „ *exigua* Brady. × 45.
„ 14, 15.—*Fischerina pellucida* sp. n. × 90.

Ophthalmidium Kübler.

Ophthalmidium inconstans Brady.

Hauerina inconstans Brady, 1879, Quart. Journ. Micr. Sci., vol. xix. n.s. p. 54. *O. inconstans* Brady, 1884, Chall. Rept., p. 189, pl. xii. figs. 5, 7, 8. *O. inconstans* (Brady) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 216, pl. xl. figs. 12, 13. *O. inconstans* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 244, pl. iii. figs. 6, 49.

The Malay specimens are few in number, and are mostly of the Spiroloculine form from the Abrolhos Bank, figured by Brady, Parker, and Jones. Brady writes of the species, "Specimens of *Ophthalmidium inconstans* in their fullest development partake more or less of the characters of *Cornuspira*, *Spiroculina*, and *Hauerina*." *

Found only at Stations 2 and 17. The 'Gazelle' Stations are West Australia and Amboyna.

Ophthalmidium tumidulum Brady, plate XIII. fig. 2.

O. tumidulum Brady, 1884, Chall. Rept., p. 189, pl. xii. fig. 6.

A solitary specimen from Station 25. It is rather more angular than Brady's figure, and has three segments to each of the later convolutions. The surface has indications of faint oblique striæ.

Brady names but one 'Challenger' Station, "off Cubebra Island, West Indies," but says it is found in a few other localities.

Massilina Schlumberger.

In all the *Miliolidæ* which at certain stages change their plan of growth, there are two well-defined groups. In one of these the first stage is planospiral, consequently they may be regarded as dimorphic forms of *Cornuspira*. This arrangement prevails in the genera *Vertebralina*, *Ophthalmidium*, and *Planispirina*. In the other group the earlier chambers are aggregated on one or other of the Milioline plans, as in *Articulina*, *Massilina*, and *Hauerina*.

The genus *Massilina*, as constituted by Schlumberger, contains those forms which, commencing as *Miliolina*, subsequently change to *Spiroloculina*. Undoubtedly the accepted classification of this family stands greatly in need of improvement, but at present there is hardly sufficient material available to warrant the proposal of a new system.

Massilina secans d'Orbigny sp., plate XIII. fig. 3.

Quinqueloculina secans d'Orb., 1826, Ann. Sci. Nat., vol. vii. p. 303, No. 43; Modèle, No. 96. *Miliolina secans* (d'Orb.) Sherborn and Chapman, 1886, Journ. Roy. Micr. Soc., p. 742, pl. xiv. fig. 4. *Sigmoilina secans* (d'Orb.) var. *obliquistriata* Halkyard, 1889, Trans.

* Brady, 'Challenger' Report, 1884, p. 189.

Manchester Micr. Soc., p. 61, pl. i. fig. 7. *Massilina secans* (d'Orb.) Schlumberger, 1893, Mém. Soc. Zool. de France, vol. vi. p. 218, w.c. figs. 31–34 and pl. iv. figs. 82, 83. *Miliolina secans* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 112, pl. xx. fig. 856.

This species is very abundant and occurs in various forms, some with the surface smooth, others covered with papillæ arranged in irregular curved lines, as shown in the figure, which is taken from one of the most aberrant forms of the species, the earlier chambers being large in proportion, and unusually angular and protruding.

It occurs at Stations in both areas, but mostly in Area 2.

Massilina secans var. *macilenta* Brady, plate XIII. fig. 4.

Miliolina macilenta Brady, 1884, Chall. Rept., p. 167, pl. vii. figs. 5, 6.

The Malay specimens confirm Brady's suspicion that this is but a costate variety of *M. secans*, and it is scarcely possible to separate the two forms.

M. macilenta is more widely diffused than the type, but occurs in less abundance.

The 'Challenger' Stations are Nares Harbour, Admiralty Islands; Humboldt Bay, Papua; and off Honolulu, Sandwich Islands.

There appears to be no other record of its occurrence.

Massilina alveoliniformis sp. n., plate XIII. figs. 5, 6, 7.

Test elliptical, chambers tubular, the earlier ones arranged irregularly around the long axis, the later ones in a Spiroloculine series, periphery rounded, aperture terminal, radiate or cribrate, obscured by sand-grains. Texture arenaceous. Length 1·40 mm.

This species in some respects resembles *Sigmoilina tenuis*, but differs from it in the composition of the test and the character of the aperture. It may be regarded as a dimorphous form of *Miliolina alveoliniformis*, the earlier chambers, as shown by fig. 6, having all the characters of that species. *Quinqueloculina fabularoides* Karrer * has a similar aperture, and the arrangement of the chambers is not unlike.

It has been observed at Stations 2, 13, and 22, but the specimens are not numerous.

Hauerina d'Orbigny.

As represented by the Malay specimens, this genus has the earlier chambers arranged after the fashion of *Miliolina alveoliniformis*. These are succeeded by a series on the Spiroloculine plan, and these again by the arrangement characteristic of the genus, in which there are three or more segments in each convolution. The aperture is invariably much compressed, but is not always cribrate.

* Sitzber. k. Akad. Wiss. Wien, vol. l. Abth. i. 1864, p. 704, pl. i. fig. 3.

Hauerina fragilissima Brady sp. n., plate XIII. figs. 8, 9, 10.

Spiroloculina fragilissima Brady, 1884, Chall. Rept., p. 149, pl. ix. figs. 12–14.

The 'Challenger' specimens of this form, as stated by Brady, might be assigned either to *Spiroloculina* or to *Hauerina*, but there is in the Malay gatherings a much compressed variety of *Hauerina compressa*, which in all but the final development of the three segments to a convolution, is the exact counterpart of *S. fragilissima*. In this latter form the aperture is sometimes cribrate, sometimes has an elongated tooth, and frequently the dentate and cribrate forms of aperture are combined in the same specimens. Various forms of aperture are figured on plate XIII. It is a very interesting and instructive passage form combining the characters of the genera *Spiroloculina*, *Massilina*, and *Hauerina*.

It is moderately abundant at several Stations in both Areas.

S. fragilissima occurs at seven 'Challenger' Stations, four of which are off the coast of Papua.

Hauerina compressa d'Orbigny, plate XIII. fig. 11.

H. compressa d'Orb., 1846, For. Foss. Vienne, p. 119, pl. v. figs. 25–27. *H. compressa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 244, pl. iii. figs. 9, 10, 23, 24.

This rare species occurs both in the compressed form represented by Brady and in the more robust form figured by Egger. Usually it is only in the outermost convolution that there are more than two segments. The earlier chambers are indistinguishable from those of *H. fragilissima*.

In the Malay Archipelago it is found rather sparingly at a few Stations in both Areas.

Brady writes, "So far as can be gathered from the 'Challenger' material, the present distribution of *Hauerina compressa* is restricted to a very small area. It occurs in two dredgings in the narrow sea between the northernmost part of Australia and the island of New Guinea, namely off Booby Island, 6 to 8 fathoms, and off Raine Island, 155 fathoms, and a few small and doubtful specimens have been found in an adjoining locality; but beyond these limits it has not been observed."* The 'Gazelle' specimens were from Mauritius.

Hauerina ornatissima Karrer sp.

Quinqueloculina ornatissima Karrer, 1868, Sitzber. k. Akad. Wiss. Wien, vol. lviii. Abth. I. p. 151, pl. iii. fig. 2. *Hauerina ornatissima* Brady, 1884. Chall. Rept., p. 192, pl. vii. figs. 15–22.

This handsome species, so commonly found in coral sand and so seldom recorded, occurs sparingly at several Stations in both areas. The specimens, although not very large, are characteristic.

* 'Challenger' Report, 1884, p. 191.

Planispirina Seguenza.

Planispirina contraria d'Orbigny sp., plate XIII. fig. 12.

Biloculina contraria d'Orb., 1848, For. Foss. Vienne, p. 266, pl. xvi. figs. 4–6. *Planispirina contraria* Brady, 1884, Chall. Rept., p. 195, pl. xi. figs. 10, 11 and woodcut fig. 5 *a*.

From Station 27 there is a single specimen of this rather rare although widely distributed species.

It is recorded from six 'Challenger' Stations, amongst them being north of Papua and off Amboyna. A somewhat doubtful example appears on pl. iii. figs. 35, 36 of Egger's 'Gazelle' Report, but there is no reference to it in the text.

Planispirina exigua Brady, plate XIII. fig. 13.

Hauerina exigua Brady, 1879, Quart. Journ. Micr. Sci., vol. xix. n.s., p. 53. *P. exigua* Brady, 1884, Chall. Rept., p. 196, pl. xii. figs. 1–4 and woodcut fig. 5 *b*. *P. exigua* (Brady) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 216, pl. xl. fig. 4. *P. exigua* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 245, pl. iii. figs. 11, 12.

This common tropical shallow water species occurs in considerable abundance, and is widely distributed in both areas. The specimens exhibit remarkable persistency of form.

Sub-Family **Fischerininæ.**

Test free; segments numerous, arranged on a Rotaliform or inæquilaterally planospiral plan; aperture large, terminal.

This sub-family, unique amongst the Porcellanea in having the chambers arranged in a more or less Rotaliform manner, embraces the genera *Fischerina* of Terquem and *Ceratina* of Goës.

The genus *Fischerina* was instituted by Terquem in 1878 to accommodate a rare aberrant form from the Upper Pliocene of the Island of Rhodes. As usual with him, taking no notice of the shell structure, he assigned it a place between *Rotalina* and *Nonionina*, and named the species *F. Rhodiensis*.*

In 1894, Goës † described a porcellanous species from the Azores, which in form resembles *Trochammina proteus* Karrer. To this form he gave the name of *Ceratina trochamminoides*, remarking that through lack of specimens he was unable thoroughly to investigate the genus. Its affinities with *Fischerina* are, however, tolerably well marked, and it may be assigned provisionally to the same sub-family.

Fischerina Terquem.

Fischerina pellucida sp. n., plate XIII. figs. 14, 15.

Test Rotaliform, depressed, consisting of about three convolutions, each containing five or six chambers, which are all visible on the

* Mém. Soc. Géol. France, sér. 3, vol. i. 1878, p. 80, pl. xiv. fig. 25.

† K. Svenska Vet.-Akad. Handl., vol. xxv. p. 122, pl. xxv. fig. 930.

superior face. Inferior face excavated at the umbilicus, periphery rounded, slightly lobulated; sutures sunk. Aperture circular, with an everted margin. Shell smooth and translucent. Length 0·25 mm.

This interesting little form is widely distributed in the Malay Archipelago, and is by no means rare. It differs from *F. Rhodiensis* in the inflation of the chambers, in the lesser exposure of the convolutions on the inferior face of the test, and in the form of the aperture.

Sub-Family Peneroplidinæ.

Cornuspira Schultze.

Cornuspira foliacea Philippi sp.

Orbis foliaceus Philippi, 1844, Enum. Moll. Siciliæ, vol. ii. p. 147, pl. xxiv. fig. 26. *Cornuspira foliacea* (Phil.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 326, pl. xii. fig. 1. *C. foliacea* (Phil.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 247, pl. iii. figs. 20, 21. *C. foliacea* (Phil.) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 431, pl. i. fig. 4. *C. foliacea* (Phil.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 106, pl. xviii. fig. 834. *C. foliacea* (Phil.) Morton, 1897, Proc. Portland Soc. Nat. Hist., vol. ii. p. 114, pl. i. fig. 16.

Although tolerably abundant and widely diffused, the specimens are feeble, none of them exhibiting the rapid increase in size of the outer convolution which is characteristic of the species.

Cornuspira involvens Reuss.

Operculina involvens Reuss, 1850, Denkschr. k. Akad. Wiss. Wien, vol. i. p. 370, pl. xlvi. fig. 20. *Cornuspira involvens* Reuss, 1863, Sitzber. k. Akad. Wiss. Wien, vol. xlviii. p. 39, pl. i. fig. 2. *C. involvens* (Reuss) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 327, pl. xii. fig. 2. *C. involvens* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 216, pl. xl. figs. 1–3. *C. involvens* (Reuss) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 484, pl. xi. figs. 4, 5. *C. cretacea* (Reuss) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 552, pl. viii. fig. 6. *C. involvens* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 246, pl. iii. figs. 18, 19. *C. involvens* (Reuss) T. Rupert Jones, 1895, Pal. Soc., p. 128, pl. iii. figs. 52–54 and woodcuts figs. 11 *a*, 11 *b*.

Is more abundant than *C. foliacea*, and occurs in two forms; in one of these the tube is very small at the commencement, and the convolutions numerous; in the other the whorls are few, and the tube, having its origin in a spherical chamber, increases but little in size. This latter is the more abundant.

Probably these represent the *Microspheric* and *Megalospheric*

forms of the species. Both are figured on plate xl. of the Memoir on the Foraminifera of the Abrolhos Bank, by Brady, Parker, and Jones, referred to above.

Peneroplis Montfort.

Peneroplis pertusus Forskål sp.

Var. *a. planatus* Fichtel and Moll sp.
„ *b. pertusus* Forskål sp.
„ *c. arietinus* Batsch sp.
„ *d. cylindraceus* Lamarck sp.
„ *e. lituus* Gmelin sp.
„ *f. carinatus* d'Orbigny.

Accepting Brady's convenient arrangement of the forms composing this genus,* the above mentioned varieties are found in moderate numbers at most of the Malay Stations, but are most abundant in Area 1.

The specimens as a rule are not large, and call for little mention; it may however be observed, that although there are numerous examples of the fragile form *P. lituus*, not one of them possesses the initial chambers.

Orbitolites Lamarck.

Orbitolites marginalis Lamarck sp.

Orbulites marginalis Lamarck, 1816, Hist. Nat. Anim. sans Vert., vol. ii. p. 196, No. 1. *Orbitolites marginalis* Carpenter, 1883, Phil. Trans., vol. clxxiv. p. 559, fig. 1.

This simple form occurs in some abundance at several Stations in both areas, but the specimens are small.

Orbitolites complanata Lamarck.

Orbitolites complanata Lamarck, 1801, Syst. Anim. sans Vert., p. 376. *O. complanata* (Lam.) Egger, 1893, Abhandl. k. bayer. Akad., Cl. II., vol. xviii. p. 249, pl. iii. fig. 40. *O. complanata* (Lam.) T. Rupert Jones, 1895, Pal. Soc., p. 136, pl. iii. figs. 45–47. *O. complanata* (Lam.) Lister, 1895, Phil. Trans., vol. clxxxvi. p. 431, pl. ix. figs. 41–51.

Distribution similar to that of *O. marginalis*, and some of the specimens attain a considerable size.

Alveolina d'Orbigny.

Alveolina Boscii Defrance sp.

Oryzaria boscii Defrance, 1820, Dict. Sci. Nat., vol. xvi. p. 106. *Alveolina Boscii* (Defr.) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 306, No. 5; Modèle No. 50. *A. longa* (Czjzek) Egger, 1893, Abhandl. k. bayer. Akad., Cl. II., vol. xviii. p. 249, pl. iii. fig. 32.

* 'Challenger' Report, 1884, p. 204.

Occurs at a few Stations in both areas. The specimens are moderate in size.

The 'Gazelle' examples are from Mauritius.

Alveolina melo Fichtel and Moll. sp.

Nautilus melo Fichtel and Moll, 1798, Testac. Micr., p. 118, pl. xxiv. *Alveolina melo* (F. and M.) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 306, No. 5. *A. melo* (Brady) Egger, 1893, Abhandl. k. bayer. Akad., Cl. II., vol. xviii. p. 249, pl. iii. fig. 31.

This species is very rare in the Malay Archipelago and has been found only at Stations 2 and 22.

The 'Gazelle' Stations are Mauritius and West Australia.

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FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1899, pp. 249–255.)

V.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part IV.*

By Fortescue William Millett, F.R.M.S.

(*Read 15th February*, 1899.)

Plate IV.

ARENACEA.

Family ASTRORHIZIDÆ.

Sub-Family **Astrorhizinæ.**

Pelosina Brady.

Pelosina rotundata Brady, plate IV. fig. 1.

Pelosina rotundata, Brady, 1878, Quart. Journ. Micr. Sci., vol. xix. n.s. p. 31, pl. iii. figs. 4, 5. *P. rotundata* Brady, 1884, Chall. Rept., p. 236, pl. xxv. figs. 18–20. *P. rotundata* (Brady) Egger, 1893,

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EXPLANATION OF PLATE IV.

Fig. 1.—*Pelosina rotundata* Brady. × 60.
„ 1, *b*. „ „ The same specimen laid open.
„ 2.—*Crithionina mamilla* Goës. × 40.
„ 2, *b*. „ „ The same specimen laid open.
„ 3. „ *pisum* Goës. × 40.
„ 4.—*Technitella legumen* Norman var. × 75.
„ 5, 6.—*Aschemonella catenata* Norman sp. × 90.
„ 7.—(?) *Jaculella* or *Rhabdammina*. × 40.
„ 8.—*Reophax difflugiformis* Brady var. *lagenarium* Bertholin. × 90.
„ 9. „ *ampullacea* Brady. × 70.
„ 10, 10* „ *pleurostomelloides* sp. n. × 135.
„ 11. „ *fusiformis* Williamson sp. × 40.
„ 12. „ *bacillaris* Brady. × 60.
„ 13. „ *Scottii* Chaster. × 75.
„ 14. „ *membranacea* Brady. × 75.

Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 254, pl. xi. figs. 59, 60.

The solitary specimen, from Station 6, resembles that figured by Egger, being more fusiform than the 'Challenger' examples. The shell-wall is very thick and the internal cavity small. It is essentially a deep-water species.

'Challenger' Stations are: in the North Atlantic, south of Rockall Bank, and west of the Azores; in the South Atlantic, south of Pernambuco; and at a single Station in the North Pacific. Reported by Egger from West Australia.

Sub-Family **Saccamminin**æ.

Crithionina Goës.

Crithionina mamilla Goës, plate IV. fig. 2.

Crithionina mamilla Goës, 1894, Kongl. Svenska Vet.-Akad. Handl., vol. xxv. p. 15, pl. iii. figs. 34–36.

The specimens are all free, with the form symmetrical. The walls are very thick, and the cavity irregular in shape, smooth and polished. It is not abundant, but occurs at several of the Malay Stations.

Found by Goës at Koster Island, in the Skagerack; 106 metres.

Crithionina pisum Goës, plate IV. fig. 3.

Crithionina pisum Goës, 1896, Bull. Mus. Comp. Zool. Harvard College, vol. xxix. No. 1, p. 24, pl. ii. figs. 1, 2.

A few of the specimens may be assigned to this species, the shell-wall being much thinner and the cavity larger and not so smooth as in *C. mamilla*. It occurs at the same Stations as the latter, but is more rare.

Goës quotes it from the Gulf of Mexico; 940 fathoms.

Whilst engaged in writing these lines, there reaches me an announcement of the death of Dr. Goës. In a letter dated 27th May, 1896, referring to his last-named work, he writes, "my small essay, very probably the last of that line during my remaining life." This unfortunately proved prophetic. Although he had relinquished the study of the Foraminifera, his loss will be deplored by all Rhizopodists. A genial correspondent, he was always ready to advise and impart information to his fellow-workers. Painstaking as well as acute in his observations, his writings will endure as a lasting monument of work well and faithfully rendered.

In grateful remembrance of many kindnesses received from him, I cannot let this opportunity pass without offering a sincere tribute to his memory.

Sub-Family **Pilulininæ.**

Technitella Norman.

Technitella legumen Norman, plate IV. fig. 4.

T. legumen Norman, 1878, Ann. and Mag. Nat. Hist., ser. 5, vol. i. p. 279, pl. xvi. figs. 3, 4. *T. legumen* (Norman) Goës, 1894, Kongl. Svenska Vet.-Akad. Handl., vol. xxv. p. 14, pl. iii. figs. 20–27.

Much has been written on the subject of the powers possessed by the Foraminifera of selecting not only the material for the construction of their test, but also the size and form of the different particles. Typically, the test of *Technitella* should be a dense mass of spicules felted together and mixed with fine grains of sand, as is well shown in the figures by Goës. In all the Malay Archipelago specimens the test is constructed on a different plan, being simply a single layer of spicules cemented together side by side in parallel series, forming patches in which the direction of the spicules with regard to the axis of the test varies in different portions of the shell. The Marquis de Folin has figured numerous interesting examples of this form of construction, and has assigned to them the generic names of *Dioxeia*, *Trioxeia*, *Rhabdaminella*, and *Hyperaminella*. The affinity of this form with *Reophax* is very close, and is especially apparent when considered in relation to specimens of *R. ampullacea*, formed of thin laminæ, which occur in its company. In the Malay specimens the test is slightly compressed, and the general colour a light reddish brown.

It is found abundantly at several Stations in both Areas.

Sub-Family **Saccamminæ.**

Psammosphæra Schulze.

Psammosphæra fusca F. E. Schulze.

P. fusca Schulze, 1875, II. Jahresb. Komm. Untersuch. deutsch. Meere in Kiel, p. 113, pl. ii. fig. 8. *P. fusca* (Schulze) Haeusler, 1883, Neues Jahrbuch für Min., vol. i. p. 57, pl. iii. fig. 1. *P.* (Indet.) de Folin, 1887, Le Naturaliste, p. 127, fig. 13. *P. fusca* (Schulze) de Folin, 1888, Ibid., p. 110, figs. 4, 5. *P. fusca* (Schulze) Haeusler, 1890, Abhandl. schweiz. paläont. Gesell., vol. xvii. p. 15, pl. i. figs. 1–3. *P. fusca* (Schulze) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 14, pl. iii. fig. 19. *P. fusca* (Schulze) Grzybowski, 1896, Rozpr. Wydz. mat.-przy. Akad. Umiej w. Krakowic, vol. xxx. p. 274, pl. viii. fig. 14.

The specimens as usual vary considerably in size, but in all the test is composed of minute grains of sand.

It is very generally distributed in both Areas.

Sub-Family **Rhabdamminin**æ.

Aschemonella Brady.

Aschemonella catenata Norman sp., plate IV. figs. 5, 6.

Astrorhiza catenata Norman, 1876, Proc. Roy. Soc., vol. xxv. p. 213. *Astrorhiza catenata* (Norman) Brady, 1879, Quart. Journ. Micr. Sci., vol. xix. n.s., p 42, pl. iv. figs. 12, 13. *Aschemonella scabra* Brady, Ibid., p. 44, pl. iii. figs. 6, 7. *Aschemonella catenata* (Norman) Brady, 1884, Chall. Rept., p. 271, pl. xxvii. figs. 1–11, and pl. xxvii. A, figs. 1–3. ? *Reophax armatus* Goës, 1896, Bull. Mus. Comp. Zool. Harvard Coll., vol. xxix. p. 29, pl. i. fig. 1.

Of this very variable deep-water species two specimens occur from Station 6. They partake of the characters of the form first described by Brady as *A. scabra*, the test being void of spicules and characteristically thin. To the other form, which in 1879 Brady ascribed to *Astrorhiza catenata*, may probably be assigned the *Reophax armatus* of Goës, both of them having the test largely composed of spicules. Goës found the species in the Pacific, 1879 fathoms (one example only), and at 463 fathoms in the Caribbean Sea.

To this sub-family, and probably to the genus *Jaculella*, belongs a neat tapering cylindrical form without segments, of which there are several fragments, one of which is represented by pl. IV. fig. 7. The test is extremely thin, composed of sand-grains neatly fitted together and cemented after the fashion of a mosaic. Sometimes the test is curved.

Family LITUOLIDÆ.

Sub-Family **Lituolin**æ.

Reophax Montfort.

Reophax difflugiformis Brady.

R. difflugiformis Brady, 1879, Quart. Journ. Micr. Sci., vol. xix. n.s., p. 51, pl. iv. fig. 3. *R. difflugiformis* (Brady) Haeusler, 1885, Neues Jahrb. für Min., Beil.-Bd. iv. Heft 1, p. 9, pl. i. fig. 1. *R. difflugiformis* (Brady) Ibid., 1890, Abhandl. schweiz. paläont. Gesell., vol. xvii. p. 26, pl. iii. figs. 1–3 and pl. v. figs. 25–27. *R. difflugiformis* (Brady) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 26, pl. vi. figs. 196–198. *R. difflugiformis* (Brady) Chapman, 1895, Ann. and Mag. Nat. Hist., ser. 6, vol. xvi. p. 313, pl. xi. fig. 1.

The typical form with globose body and distinct neck, is but poorly represented both in size and number, although it is found at several Stations in both Areas.

Reophax difflugiformis var. *lagenarium* Berthelin, plate IV. fig. 8.

Haplophragmium lagenarium Berthelin, 1880, Mém. Soc. Géol. Fr., ser. 3, vol. i. p. 21, pl. xxiv. fig. 2. *Reophax difflugiformis* Brady, 1884, Chall. Rept., p. 289, pl. xxx. figs. 1, 5.

This variety, which tapers regularly from the base to the apex without a distinct neck, is so persistent, both geologically and geographically, that it seems worthy of being treated separately. It is rather more abundant than the type, and occurs at the same Stations. The test is usually of a looser structure than that of the globose form.

Reophax ampullacea Brady, plate IV. fig. 9.

R. ampullacea Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 49. *R. ampullacea* (Brady) Chapman, 1892, Journ. R. Micr. Soc., p. 320, pl. v. fig. 2.

In all the specimens the shell-wall is very thin, being composed of little more than a single layer of broad flakes from the shells of Mollusca and other organisms, cemented together at or near their edges. It is very abundant at several of the Stations.

Elsewhere the species is of extreme rarity, the only 'Challenger' Station being off Christmas Harbour, Kerguelen Islands, 120 fathoms. Chapman records it from the Gault of Folkestone, and says, "It occurs frequently in one stratum only, in zone xi., 12 ft. from the top."

Reophax pleurostomelloides sp. n., plate IV. figs. 10 and 10*.

Test free, monothalamous, oval; shell-wall thin and finely arenaceous; aperture a large crescent-shaped opening in a lateral depression of the test near the apex. Length, 0·20 mm.

This is an interesting isomorph of the genus *Pleurostomella*. The lateral depression varies considerably in size, sometimes occupying but a small space near the apex, at other times reaching almost to the base of the shell. Being monothalamous, with a single aperture, this species is assigned provisionally to the genus *Reophax*, from which, however, it differs in not having the aperture terminal. In regarding such forms as this and *Nubecularia dubia*, it must be felt that, in the absence of any knowledge of the character of the cell-contents, great uncertainty must exist as to their real position in nature.

It is not very abundant, but is found at several Stations in both Areas.

Reophax fusiformis Williamson sp., plate IV. fig. 11.

Proteonina fusiformis Williamson, 1858, Rec. For. Gt. Br., p. 1, pl. i. fig. 1. *Reophax fusiformis* (Will.) Brady, 1884, Chall. Rept., p. 290, pl. xxx. figs. 7–11. *R. fusiformis* (Will.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 217, pl. xli. fig. 18. *R. fusiformis* (Will.?) Haeusler, 1890, Abhandl. schweiz. paläont.

Gesell., vol. xvii. p. 27, pl. v. fig. 22. *R. fusiformis* (Will.) Chapman, 1892, Journ. R. Micr. Soc., p. 320, pl. v. fig. 3.

The specimens are large, and the test is formed of very coarse grains of sand; most of them have the small initial chamber which marks the transition to *R. scorpiurus*. It is tolerably plentiful, but the range is rather restricted.

Reophax scorpiurus Montfort.

R. scorpiurus Montfort, 1808, Conch. Syst., vol. i. p. 331, 83e genre. *R. scorpiurus* (Montf.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 328, pl. xiii. fig. 5. *R. scorpiurus* (Montf.) Haeusler, 1885, Neues Jahrb. für Min., Beil.-Bd., iv. Heft 1, p. 9, pl. i. figs. 14, 15. *R. scorpiurus* (Montf.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 217, pl. xli. fig. 10. *R. scorpiurus* (Montf.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 328, pl. xiii. fig. 5. *R. scorpiurus* (Montf.) Haeusler, 1890, Abhandl. schweiz. paläont. Gesell., vol. xvii. p. 27, pl. v. figs. 23, 24. *R. scorpiurus* (Montf.) Chapman, 1892, Journ. R. Micr. Soc., p. 320, pl. v. figs. 4, 5. *R. scorpiurus* (Montf.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 257, pl. iv. fig. 18 and pl. v. figs. 45, 46. *R. scorpiurus* (Montf.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 24, pl. v. figs. 158–169.

Most of the specimens have the test composed of rough grains of sand, but in a few it is built up of thin flakes derived from organisms of various kinds. The figures by Goës, above referred to, show well the relationship of this form with *R. fusiformis*.

It is common, and widely distributed.

Reophax bacillaris Brady, plate IV. fig. 12.

R. bacillaris Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 49. *R. bacillaris* Brady, 1894, Chall. Rept., p. 293, pl. xxx. figs. 23, 24. *R. bacillaris* (Brady) de Amicis, 1895, Naturalista Siciliana, anno xiv. p. 72, pl. i. fig. 17. *R. bacillaris* (Brady) Goës, 1896, Bull. Mus. Comp. Zool. Harvard Coll., vol. xxix. p. 27.

A rare deep-water species, represented by a very few examples from Stations 5 and 6. The specimens are, however, highly characteristic.

Found at only one 'Challenger' Station, on the north coast of Papua, 1070 fathoms. Goës reports it from the Pacific, 1132–1201 fathoms.

Reophax dentaliniformis Brady.

R. dentaliniformis Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 49. *R. dentaliniformis* Brady, 1884, Chall. Rept., p. 293, pl. xxx. figs. 21, 22. *R. dentaliniformis* (Brady) Goës, 1894,

K. Svenska Vet.-Akad. Handl., vol. xxv. p. 25, pl. vi. figs. 172–175. *R. dentaliniformis* (Brady) Goës, 1896, Bull. Mus. Comp. Zool. Harvard Coll., vol. xxix. p. 27.

Another rare deep-water species, occurring a little more frequently than the preceding.

Recorded by Goës from the Skagerack, Baltic, Pacific, and Caribbean Sea.

Reophax Scottii Chaster, plate IV. fig. 13.

R. Scottii Chaster, 1892, First Rep. of the Southport Soc. of Nat. Sci., p. 57, pl. i. fig. 1.

A delicate flexible species which, when moist, can be bent into a curved or serpentine form, retaining the shape when dry. The *R. flexibilis* of Schlumberger, from the Russian Arctic Seas,* has precisely the same character, and closely resembles this form in other respects.

It has been recorded from Scotland, Ireland, and Malta, as well as from the Southport district. In the Malay Archipelago it is very rare.

Reophax membranacea Brady, plate IV. fig. 14.

R. membranacea Brady, 1879, Quart. Journ. Micr. Sci., vol. xxix. n.s., p. 53, pl. iv. fig. 9.

The examples of this species are few and fragmentary. None of them show the transverse wrinkles mentioned by Brady, and the form of the chambers indicates an affinity with *R. Scottii*.

It occurs at a few Stations, but is very rare.

* Mém. Soc. Zool. France, vol. vii. 1894, p. 258, pl. iii. fig. 10.

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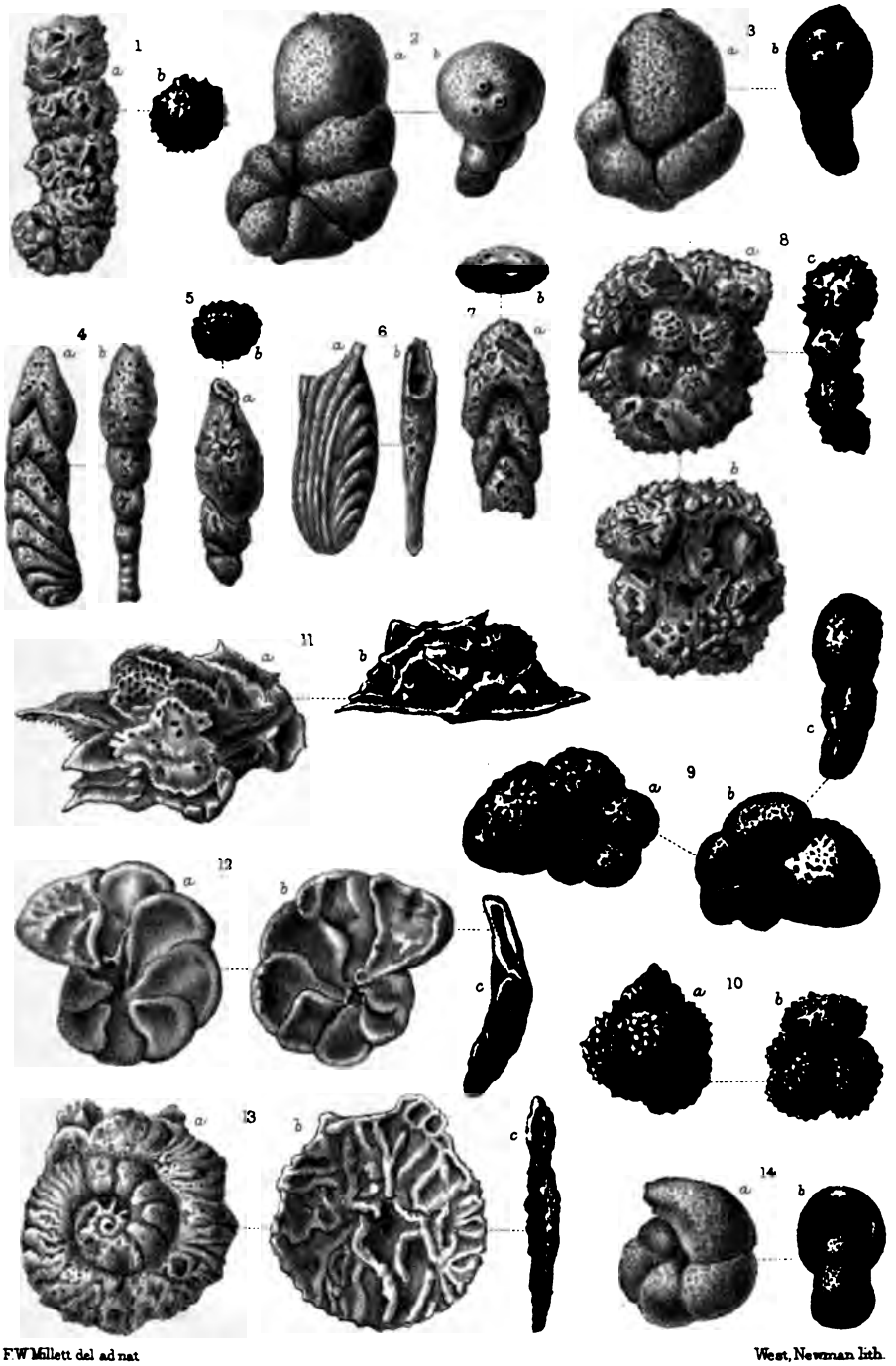

F.W.Millett del ad nat

West, Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1899, pp. 357–365.)

VII.—*Report on the Recent Foraminifera of the Malay Archipelago, collected by Mr. A. Durrand, F.R.M.S.—Part V.*

By Fortescue William Millett, F.R.M.S.

(*Read 15th March*, 1899.)

Plate V.

Haplophragmium Reuss.

Haplophragmium agglutinans d'Orbigny sp., plate V. fig. 1.

Spirolina agglutinans d'Orbigny, 1846, For. Foss. Vienne, p. 137, pl. vii. figs. 10–12. *Haplophragmium agglutinans* (d'Orb.) Brady, 1884, Chall. Rept., p. 301, pl. xxxii. figs. 19–26. *H. agglutinans* (d'Orb.) Haeusler, 1885, Neues Jahrb. für Min., Beil. Bd. iv. p. 13, pl. i. figs. 22, 23, and pl. ii. figs. 3, 4. *H. agglutinans* (d'Orb.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 330, pl. xiii. figs. 18–20. *H. agglutinans* (d'Orb.) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 484, pl. xi. fig. 8. *H. agglutinans* (d'Orb.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 32, pl. iii. figs. 32, 36, and pl. iv. figs. 5, 6, 18. *H. agglutinans* (d'Orb.) Fornasini, 1891, Foraminiferi Pliocenici del Ponticello di Savena, pl. ii. fig. 5. *H. agglutinans* (d'Orb.) Chapman, 1892, Journ. R. Micr. Soc., p. 324, pl. v. fig. 14. *H. agglutinans* (d'Orb.)

EXPLANATION OF PLATE V.

Fig. 1.—*Haplophragmium agglutinans* d'Orbigny sp. × 90.
„ 2, 3. „ „ var. *triperforata* var. n. × 90.
„ 4–6. „ *cassis* Parker sp. × 90.
„ 7. „ „ or ? *Reophax*. × 60.
„ 8. „ *compressum* Goës. × 60.
„ 9. „ *nanum* Brady. × 90.
„ 10. „ *anceps* Brady. × 90.
„ 11.—*Placopsilina bulla* Brady. × 45.
„ 12.—*Trochammina ochracea* Williamson sp. × 60.
„ 13. „ *plicata* Terquem sp. × 135.
„ 14. „ *ringens* Brady. × 90.

Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 260, pl. iv. figs. 16, 36. *H. agglutinans* Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 23, pl. v. figs. 140, 141. *H. agglutinans* (d'Orb.) Chapman, 1895, Ann. and Mag. Nat. Hist., ser. vi. vol. xvi. p. 313, pl. xi. fig. 2.

The specimens are all minute, and although they occur at most of the Stations, are not very numerous.

Haplophragmium agglutinans var. *triperforata* var. n., plate V. figs. 2, 3.

Having the general form of the type, this varies in two respects; the shell wall, instead of being rough through the coarseness of the incorporated sand-grains, is smooth as in the genus *Trochammina*; this smoothness however does not arise from an excess of cement, but from the fineness of the material employed. In place of the simple aperture there are always three perforations with raised borders, arranged in the form of a triangle. As shown by fig. 3, these perforations exist in the spiral as well as in the uniserial chambers. The interior is quite smooth and not at all labyrinthic; hence its affinities seem to be with *Haplophragmium* rather than with *Lituola*. It is not uncommon at Station 9, and occurs also, but very sparingly, at Station 5.

Its nearest ally appears to be the *H. lituolinoideum* of Goës from the Gulf of Mexico.*

Haplophragmium pseudospirale Williamson sp.

Proteonina pseudospiralis Williamson, 1858, Rec. Foram. Gt. Britain, p. 2, pl. i. figs. 2, 3. *Haplophragmium pseudospirale* (Will.) Siddall, 1879, Catal. Brit. Rec. Foram., p. 4. *H. pseudospirale* (Will.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 330, pl. xiii. figs. 6–8. *H. pseudospirale* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 260, pl. v. figs. 41, 42. *H. pseudospiralis* (Will.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 23, pl. v. figs. 142–151. *H. pseudospirale* (Will.) de Amicis, 1895, Naturalista Siciliano, Anno xiv. p. 9, pl. i. fig. 11.

The typical form with obscure segmentation is rare, but at several of the Stations there are numerous examples which have the sutures well marked, and which differ from *H. agglutinans* only in the compression of the test. Of the figures by Goës referred to above, 148 and 149 represent this form.

In the 'Challenger' Report the only localities given by Brady for this species are about the coasts of the British Isles; but in the 'Summary of the Scientific Results' it is reported from Station 172A (Tongatabu). The Gazelle Station is off West Australia.

* Bull. Mus. Comp. Zool. Harvard Coll., vol. xxix. 1896, p. 32, pl. iii. figs. 17–20.

Haplophragmium cassis Parker sp., plate V. figs. 4–6 and ? 7.

Lituola cassis Parker, 1870, Canadian Naturalist n.s., vol. v. p. 177, fig. 3. *Haplophragmium cassis* (Parker) Brady, 1884, Chall. Rept., p. 304, pl. xxxiii. figs. 17–19. *H. cassis* (Parker) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 261, pl. v. figs. 55, 56. *H. cassis* (Parker) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 24, pl. v. figs. 152–157.

The Malay specimens of this species are very variable in form, some of them being extremely compressed, and composed of numerous chambers.

Fig. 3 represents one of numerous fragments which have precisely the shell structure of *H. cassis*, and may be the final chambers of an abnormal form. An inclination to this rectilinear arrangement of the chambers is observable in fig. 4. On the other hand, it may be a species of *Reophax*, with the plan of growth and chevron-shaped chambers of a *Frondicularia*.

This and the typical form occur only at Station 9, where they are not uncommon.

The species is not represented in the 'Challenger' dredgings. Egger's specimens were procured from the West Coast of Africa, near the equator.

Haplophragmium compressum Goës, pl. V. fig. 8.

Lituolina irregularis var. *compressa* Goës, 1882, K. Svenska Vet.-Akad. Handl., vol. xix. p. 141, pl. xii. figs. 421–423. *Haplophragmium emaciatum* Brady, 1884, Chall. Rept., p. 305, pl. xxxiii. figs. 26–28. *H. emaciatum* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 262, pl. v. figs. 53, 54. *H. emaciatum* (Brady) Chapman, 1895, Ann. and Mag. Nat. Hist., ser. vi. vol. xvi. p. 315, pl. xi. fig. 6. *H. compressum* (Goës) Goës, 1896, Bull. Mus. Comp. Zool. Harvard College, vol. xxix. p. 31.

There can be but little doubt that Goës is correct in associating Brady's *H. emaciatum* with his own previously described *H. compressum*, and he is probably right in considering the form a variety of the *H. fontinense* of Terquem.

The Malay specimens are unusually robust and well developed, but their range is very limited.

Haplophragmium canariense d'Orbigny sp.

Nonionina canariensis d'Orbigny, 1839, Foram. Canaries, p. 128, pl. ii. figs. 33, 34. *Haplophragmium canariense* (d'Orb.) Siddall, 1879, Catal. Rec. Brit. Foram., p. 4. *Nonionina* (*Lituola*) *canariensis* (d'Orb.) or *N. Jeffreysi* (Will.) Schlumberger, 1882, Feuille des Jeunes Naturalistes, Ann. xii. p. 39, pl. ii. figs. 6, 7. *H. canariense* (d'Orb.) Haeusler, 1885, Neues Jahrb. für Min., Beil. Bd. iv. p. 12, pl. i. figs. 17–20. Idem, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii.

p. 34, pl. iv. figs. 1–3. *H. canariense* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 261, pl. v. figs. 27–29. *H. canariense* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 20, pl. v. figs. 95–101. *H. canariense* (d'Orb.) Chapman, 1895, Ann. and Mag. Nat. Hist., ser. vi. vol. xvi. p. 314, pl. xi. fig. 5.

The examination of any considerable number of examples of this species will show that there is always going on a struggle to deviate from the nautiloid form and to become evolute, at the same time becoming more compressed and more or less acute at the margin, finally merging into such forms as *H. compressum* and *H. fontinense*.

The Malay specimens have the usual range of variation; they are very numerous, and are restricted almost entirely to Area 1.

Haplophragmium latidorsatum Bornemann sp.

Nonionina latidorsata Bornemann, 1855, Zeitschr. deutsch. geol. Gesell., vol. vii. p. 339, pl. xvi. fig. 4. *Lituolina irregularis* (Röm.) Goës, 1882, K. Svenska Vet.-Akad. Handl., vol. xix. p. 139, pl. xii. figs. 419, 420. *Haplophragmium latidorsatum* (Born.) Brady, 1884, Chall. Rept, p. 307, pl. xxxiv. figs. 7–10, 14. *H. latidorsatum* (Born.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xiv. p. 218, pl. xli. figs. 14, 22. *H. latidorsatum* (Born.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 35, pl. iii. figs. 37, 38. *H. latidorsatum* (Born.) Chapman, 1892, Journ. R. Micr. Soc., p. 323, pl. v. fig. 12. *H. latidorsatum* (Born.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 21, pl. v. figs. 102–120.

In all the specimens the shell structure is coarse and the aperture simple. Its range in the Malay Archipelago is very restricted, although where it occurs the individuals are numerous.

According to Brady it is one of the commonest deep-water species of arenaceous foraminifera. Goës records it from the Pacific and from the Caribbean Sea.

Haplophragmium nanum Brady, plate V. fig. 9.

H. nanum Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 50. Idem, 1881, Ann. and Mag. Nat. Hist., ser. v. vol. viii. p. 406, pl. xxi. fig. 1. *H. nanum* (Brady) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xiv. p. 218, pl. xli. fig. 20. *H. nanum* (Brady) Chapman, 1892, Journ. R. Micr. Soc., p. 324, pl. v. fig. 15. *H. nanum* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 262, pl. v. figs. 13–15. *H. nanum* (Brady) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 22, pl. v. figs. 124–127.

The specimens are all characteristic, with little or no tendency to variation. It is most abundant in Area 1.

The 'Gazelle' Stations are West Africa, Mauritius, and New

Guinea. Goës reports it from the North Atlantic and from the Arctic regions.

Haplophragmium globigeriniforme Parker and Jones.

(?) *Globigerina bulloides* (d'Orb.) Williamson, 1858, Rec. Foram. Gt. Britain, p. 56, pl. v. figs. 116–118. *Lituola nautiloidea* var. *globigeriniformis* Parker and Jones, 1865, Phil. Trans., vol. clv. p. 407, pl. xv. figs. 46, 47, and pl. xvii. figs. 96–98. *H. globigeriniforme* (P. & J.) Siddall, 1879, Catal. Brit. Rec. For., p. 64. *H. globigeriniforme* (P. & J.) Balkwill and Millett, 1884, Journ. Microscopy and Nat. Sci., vol. iii. p. 25, pl. i. fig. 5. *H. globigeriniforme* (P. & J.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 36, pl. iv. figs. 13, 16, 17. *H. globigeriniforme* (P. & J.) Terrigi, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 68, pl. i. fig. 7. *H. globigeriniforme* (P. & J.) Chapman, 1892, Journ. R. Micr. Soc., p. 324, pl. v. fig. 16. *H. globigeriniforme* (P. & J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 260, pl. v. figs. 30, 31. *H. globigeriniforme* (P. & J.) Goes, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 22, pl. v. figs. 128–133.

Williamson's description of *Globigerina bulloides* is "Texture arenaceous, granular. Hue yellowish grey." This is correct for the present species, but not for *G. bulloides*; and according to the rules of nomenclature the species should be described as *H. bulloides* Williamson sp.; but sometimes the rule is more honoured in the breach than in the observance, and it may be excusable in the present instance to assume that Williamson had wrongly diagnosed the texture of the test.

It is abundant at a few of the Stations in both Areas, but the specimens are very small.

Haplophragmium anceps Brady, plate V. fig. 10.

H. anceps Brady, 1884, Chall. Rept., p. 313, pl. xxxv. figs. 12–15. *H. anceps* (Brady) Chaster, 1892, First Rept. Southport Soc. Nat. Sci., 1890–91, p. 57, pl. i. fig. 2.

The specimens are numerous and well distributed; although very small they are quite characteristic and, as may be inferred from Brady's remarks, resemble both *H. globigeriniforme* and *Verneuilina propinqua*.

It is one of the exceedingly interesting forms added to the list of the British Foraminifera by Dr. Chaster.

Placopsilina d'Orbigny.

Placopsilina bulla Brady, plate V. fig. 11.

P. bulla Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s., p. 51. Idem, 1884, Chall. Rept., p. 315, pl. xxxv. figs. 16, 17.

P. bulla (Brady) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 28, pl. vi. figs. 211–215. *P. bulla* (Brady) Grzybowski, 1894, Rozpraw Wydz. mat. przyr. Akad. Umiej. Krakowie, vol. xxix. p. 186, pl. i. fig. 1. *P. bulla* (Brady) Goës (1894) K. Svenska Vet.-Akad. Handl., vol. xxv. p. 28, pl. v. figs. 211–215.

The solitary specimen, from Station 14, differs from the usual form in having the test composed of fragments of considerable size from various organisms, giving it the rough appearance shown in the figure. In other respects it is sufficiently characteristic, and has an aperture at each end. Some of the specimens figured by Goës indicate a relationship with *P. vesicularis*; they are from the Skagerack and Koster Island.

Sub-Family Trochammininæ.

Ammodiscus Reuss.

Ammodiscus incertus d'Orbigny sp.

Operculina incerta d'Orbigny, 1839, Foram. Cuba, p. 49, pl. vi. figs. 16, 17. *Ammodiscus incertus* (d'Orb.) Berthelin, 1878, Foram. Bourgneuf et Pornichet, p. 25. *Trochammina incerta* (d'Orb.) Deecke, 1886, Mém. Soc. Emul. Montbéliard, sér. iii. vol. xvi. p. (14), pl. i. fig. 9. *A. incertus* (d'Orb.) Mariani, 1889, Boll. Soc. Geol. Ital., vol. vii. p. 284, pl x. fig. 1. *A. incertus* Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 484, pl. xi. fig. 7. *A. incertus* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 552, pl. viii. fig. 8. *A. incertus* var. *gracilis* (Kübler and Zwingli) Wisniowski, 1890, Pamiet. Wydz. III, Ak. Umiej. Krakowie, vol. xvii. p. 10, pl. viii. fig. 11. *A. incertus* (d'Orb.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 55, pl. ix. figs. 1–21. *A. incertus* (d'Orb.) Crick and Sherborn, 1891, Journ. Northampton Nat. Hist. Soc., vol. vi. p. 209, pl. fig. 1. *A. incertus* (d'Orb.) Chapman, 1892, Journ. R. Micr. Soc., p. 326, pl. vi. fig. 11. (?) *A. infimus* (Strickland) Sellheim, 1893, Inaug. Diss. Friedr. Alex. Univ., p. 9, pl. fig. 1. *A. incertus* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 263, pl. v. figs. 35, 36. *A. incertus* (d'Orb.) Goës, 1895, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 31, pl. vi. figs. 238, 239. *A. incertus* (d'Orb.) Chapman, 1895, Ann. and Mag. Nat. Hist., ser. vi. vol. xvi. p 315, pl. xi. figs. 8, 9.

Specimens are small, ill-developed, and not numerous; it occurs however in both Areas.

Although found at many 'Challenger' Stations, only one of them was in the North Pacific. The sole 'Gazelle' Station is West Australia.

Trochammina Parker and Jones.

Trochammina squamata Jones and Parker.

T. squamata Jones and Parker, 1860, Quart. Journ. Geol. Soc., vol. xvi. p. 304. *T. squamata* (P. & J.) Parker and Jones, 1865,

Phil. Trans., vol. clv. p. 407, pl. xv. fig. 30. *T. squamata* (P. & J.) Haeusler, 1885, Neues Jahrb. für Min., Beil. Bd. iv. p. 29, pl iii. fig. 30. Idem, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 65, pl. x. figs. 27–29, 40. *T. squamata* (P. & J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 264, pl. v. figs. 4–6.

What may be called the inflated form of the species is the commonest of all the arenaceous foraminifera in the Malay Archipelago, and it occurs at most of the Stations. The specimens are small, but characteristic.

The 'Gazelle' Stations are Kerguelen and Mauritius.

Trochammina ochracea Williamson sp., plate V. fig. 12.

Rotalina ochracea Williamson, 1858, Rec. Foram. Gt. Britain, p. 55, pl. iv. fig. 112, and pl. v. fig. 113. *Trochammina squamata* (P. & J.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 407, pl. xv. fig. 31. *T. ochracea* (Williamson) Balkwill and Millett, 1884, Journ. Microscopy and Nat. Sci., vol. iii. p. 25, pl. i. fig. 7.

This form is very rare, and has been observed only at Station 3.

Hitherto it has been recorded only from the British Isles, from the Arctic Regions (Parker and Jones), and from the Channel Islands (Halkyard).

Trochammina plicata Terquem sp., plate V. fig. 13.

Patellina plicata Terquem, 1876, Anim. Plage de Dunkerque, 2me fasc., p. 72, pl. viii. fig. 9. *Trochammina plicata* (Terq.), Balkwill and Millett, 1884, Journ. Microscopy and Nat. Sci., vol. iii. p. 26, pl. i. fig. 8. *T. plicata* (Terq.) Halkyard, 1889, Trans. and Ann. Nat. Rept. Manchester Micr. Soc., p. (10) pl. i. fig. 11.

This delicate scale-like form occurs only at Station 25, and is there, as elsewhere, extremely rare.

Its general distribution is the same as that of *T. ochracea*.

Trochammina nitida Brady.

T. nitida Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s., p. 52. *T. nitida* Brady, 1884, Chall. Rept., p. 339, pl. xli. figs. 5, 6. *T. nitida* (Brady) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 30, pl. vi. figs. 225–230.

At Station 6 there are some fine typical examples of this rare form; but elsewhere, although the characteristic flatness of the superior face is apparent, there are fewer chambers in the convolutions, and the relationship with *T. inflata* is in many instances well marked. Goës, who reports it from Spitzbergen, describes it as an emaciated form of *T. inflata*, and gives the number of segments in the last convolution as 6–9. In the majority of the Malay specimens the number of segments to the convolution is six; the colour is always grey.

It is found in its restricted form, rather abundantly at a few Stations, mostly in Area 1.

Trochammina inflata Montagu sp.

Nautilus inflatus Montagu, 1808, Testac. Brit., Supplement, p. 81, pl. xviii. fig. 3. *Trochammina inflata* (Mont.) Carpenter, Parker, and Jones, 1862, Introd. Foram., p. 141, pl. xi. fig. 5. *T. inflata* (Mont.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 331, pl. xiii. figs. 11, 12. *T. inflata* (Mont.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 65, pl. x. figs. 25, 26. *T. inflata* (Mont.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 28, pl. D, fig. 31. *T. inflata* (Mont.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. pl. v. figs. 10–12, 16–18. *T. inflata* (Mont.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 29, pl. vi. figs. 222–224.

In abundance this species almost equals *T. squamata*, and is rather more widely distributed. The specimens, as usual, have the primary chambers of a dark colour.

There are but few records of the occurrence of this species outside the British Isles. Brady gives no 'Challenger' Stations, but in the 'Summary of the Scientific Results' it is reported from Stations 237 and 323. Berthelin reports it from Belgium, Cherbourg, and from Bourgneuf and other places in the Bay of Biscay. Robertson procured it from the coast of Spain, and Goës from the Baltic. The 'Gazelle' stations from which it was obtained are not named.

Trochammina inflata var. *macrescens* Brady.

T. inflata var. *macrescens* Brady, 1870, Ann. and Mag. Nat. Hist., ser. iv. vol. vi. p. 290, pl. xi. fig. 5.

This variety differs from the type not only in the indentation of the chambers, but also in its tendency to the nautiloid form of growth.

It occurs sparingly at a few Stations in the Malay Archipelago.

Trochammina trullissata Brady.

T. trullissata Brady, 1879, Quart. Journ. Micr. Sci., vol. xix. p. 56, pl. v. figs. 10, 11. *T. trullissata* (Brady) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 64, pl. x. figs. 9, 11. *T. trullissata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II, vol. xviii. p. 265, pl. v. figs. 25, 26.

This species is very abundant, and occurs at several Stations in both Areas. The punctation or reticulation of the interior surface is not apparent.

In the 'Gazelle' examples, which are from West Africa and West Australia, the aperture is porous. Goës reports it from the Pacific and the Caribbean Sea.

Trochammina ringens Brady, plate V. fig. 14.

T. ringens Brady, 1879, Quart. Journ. Micr. Sci., vol. xix. p. 57, pl. v. fig. 12.

Of this very rare deep-water form there are a few specimens from both Areas. They are characteristic, and are easily distinguishable from *T. trullissata*.

Brady says of this species, "Its area of distribution does not appear to extend beyond the Atlantic." Goës reports it from both sides of the Isthmus of Panama.

Carterina spiculotesta Carter sp.

Rotalia spiculotesta Carter, 1877, Ann. and Mag. Nat. Hist., ser. iv. vol. xx. p. 470, pl. xvi. figs. 1–3. *Carterina spiculotesta* (Carter) Brady, 1884, Chall. Rept., p. 346, pl. xli. figs. 7–10.

Of this interesting form there is but one specimen, and that is from Station 28. It is very regular in form, and, as in *Trochammina inflata*, the primary chambers are of a dark colour.

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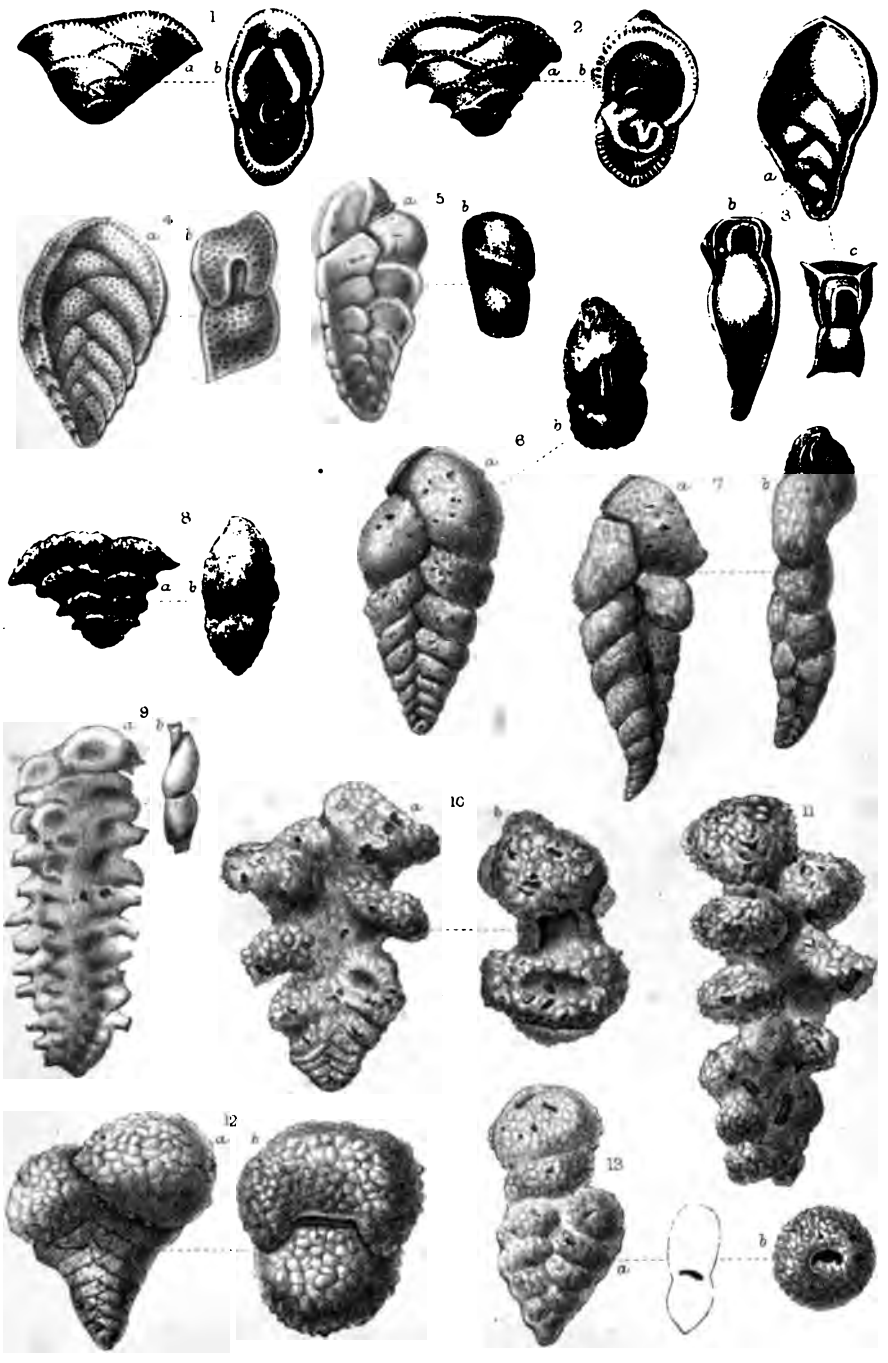

FW Millett del ad nat. West, Newman lith

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1899, pp. 557–564.)

X.—*Report on the Recent Foraminifera of the Malay Archipelago, collected by Mr. A. Durrand, F.R.M.S.—Part VI.*

By Fortescue William Millett, F.R.M.S.

(*Read 18th October*, 1899.)

Plate VII.

Family TEXTULARIDÆ.

Sub-Family **Textularinæ.**

Textularia Defrance.

Textularia inconspicua Brady, plate VII. fig. 1.

T. inconspicua Brady, 1884, Chall. Rept., p. 357, pl. xlii. fig. 6.

This is a feeble hyaline isomorph of *T. conica*, and occurs in two forms, one of them having the sutures limbate. Brady notes its resemblance to a small trochoid Rotalian; the Malay specimens are associated with a minute hyaline *Discorbina*, to which they bear a considerable resemblance.

It occurs sparingly at a few Stations in both areas, but the speci-

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EXPLANATION OF PLATE VII.

Fig. 1.—*Textularia inconspicua* Brady. × 90.
„ 2. „ „ var. *jugosa* Brady. × 90.
„ 3. „ *quadrilatera* Schwager. × 90.
„ 4. „ *rhomboidalis* sp. n. × 90.
„ 5. „ *concava* Karrer sp. × 60.
„ 6, 7. „ „ var. *heterostoma* Fornasini. Fig. 6 × 90, fig. 7 × 60.
„ 8. „ *sagittula* var. *jugosa* T. R. Jones. × 90.
„ 9. „ „ var. *fistulosa* Brady. × 90.
„ 10, 11. „ „ var. × 60.
„ 12. „ „ var. *Candeina* d'Orbigny. × 45.
„ 13.—*Bigenerina nodosaria* d'Orbigny. × 60.
a, Transverse section of the biserial portion of the test; *b*, oral aspect.

mens are sufficiently numerous to mark perfectly the transition from the normal to the limbate form.

Brady gives three 'Challenger' Stations, all in the Pacific, namely, off East Moncœur Island, Bass Straits; Nares Harbour, Admiralty Islands; and the *Hyalonema*-ground south of Japan.

Textularia inconspicua var. *jugosa* Brady, plate VII. fig. 2.

T. jugosa Brady, 1884, Chall. Rept., p. 358, pl. xlii. fig. 7. *T. jugosa* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 273, pl. vi. figs. 19–21.

"D'Orbigny has figured a specimen to all appearance belonging to this species (Foram. Canaries, pl. i. figs. 19–21) under the name of *Textularia sagittula*, and it is difficult to account for the apparent confusion of two forms so entirely distinct":—So wrote Brady (Chall. Rep., p. 358). In his 'Foraminifera of the Crag,' 1895, p. 145, Prof. T. Rupert Jones has no difficulty in associating as varieties of *T. sagittula* both d'Orbigny's and Brady's forms, and adds to them the heavy arenaceous limbate variety of *T. sagittula* found in the Crag and other deposits.

It is not stated by d'Orbigny nor by Brady if the shell-substance of their species is hyaline or arenaceous; the latter, however, remarks that the raised bands of *T. jugosa* are of clear shell-substance. From Raine Island ('Challenger' Station 185) I have some fine specimens of the last named form, and they are all distinctly hyaline, the limbations, moreover, being clearer than the other portions of the test. In Brady's figures, both of *T. inconspicua* and *T. jugosa*, there is shown a delicate striation of the margin of the oral face of the segments; this is conspicuous in all the specimens I have had an opportunity of examining; and in the large fossil specimens from Lucugnano figured by Costa* under the name of *T. sagittula* this feature is well shown.

Seeing that the relationship of *T. inconspicua* with *T. jugosa* is well indicated by the Malay specimens, and that the arenaceous form is also found in the same seas, it would appear convenient to treat the hyaline form as *T. inconspicua* var. *jugosa* Brady, and the arenaceous form as *T. sagittula* var. *jugosa* T. Rupert Jones. In the absence of a knowledge of the shell-substance of the limbate varieties of *T. sagittula* figured by Costa and by d'Orbigny, it is not clear to which of these varieties they should be assigned.

It is doubtful if the power possessed by certain forms of strengthening the secreted shell by the agglutination of extraneous particles of matter has any zoological value; that it has none as far as genera are concerned, is shown by such obsolete names as *Plecanium* and *Ataxophragmium*; but it appears to be of use in dealing with the characters

* Costa, Atti Accad. Pontaniana, vol. vii. fas. 2, 1856, p. 287, pl. xxiii. fig. 11.

of species and varieties, consequently it would not be wise to ignore it entirely.

Textularia jugosa was observed at only one 'Challenger' Station, off Raine Island, Torres Strait, but Brady quotes other localities where it has been found. The solitary 'Gazelle' Station is West Australia. In the Malay Archipelago it is more rare than the non-limbate form.

Textularia quadrilatera Schwager, plate VII. fig. 3.

T. quadrilatera Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 253, pl. vii. fig. 10. *T. quadrilatera* (Schwager) Brady, 1884, Chall. Rept., p. 358, pl. xlii. figs. 8–12.

The group of *Textulariæ* with abnormal apertures and other features indicating an affinity with the *Bolivinæ* is well represented in Mr. Durrand's collection, and affords opportunities of comparison which should prove of value to Rhizopodists. Prof. T. Rupert Jones in his 'Catalogue of the Fossil Foraminifera in the collection of the British Museum, 1882,' assigns the *Textularia obsoleta* of Eley to the genus *Bolivina*, and it is very doubtful if this species can be distinguished from *T. quadrilatera*.

In the Malay Archipelago this distinctly hyaline form is very rare, and has been observed only at Station 30.

It is recorded from several 'Challenger' Stations, both in the Atlantic and in the Pacific. As a fossil it occurs in the Pliocene of Kar Nicobar, and in the tertiary beds of St. Erth, Cornwall. To the kindness of Prof. Yokoyama I am indebted for some fine specimens from the tertiary of Hane, Prov. Tosa, in the Island of Sitkoku, Japan.

Textularia rhomboidalis sp. n., plate VII. fig. 4.

Test cuneiform, quadrilateral; the peripheral oblique to the lateral faces, making the transverse section of the test rhomboidal; sides slightly concave, margins rounded and lobulate, sutures curved and deeply excavated. Aperture an arched slit. Shell-substance hyaline and coarsely perforate. Length, 0·34 mm.

The rhomboidal section and hyaline test will serve to distinguish this from any other species of *Textularia*. A superficial resemblance to *Verneuilina spinulosa* may have caused it to be overlooked hitherto, as it is widely dispersed. It occurs at several of the Malay Stations in both areas. I have specimens from Raine Island ('Challenger' Station 185) and other localities in Torres Strait, and have examined fine examples from the Ægean Sea collected by C. H. Nevill, Esq.

Textularia concava Karrer sp., plate VII. fig. 5.

Plecanium concavum Karrer, 1868, Sitzungsb. k. Akad. Wiss. Wien, vol. lviii. Abth. I. p. 129, pl. i. fig. 3. *Textularia concava* (Karrer sp.) Brady, 1884, Chall. Rept., p. 360, pl. xlii. figs. 13, 14, and pl. xliii. fig. 11. *Textularia* (?) *concava* (Reuss) Egger, 1893,

Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 271, pl. vi. figs. 3, 4.

The typical form is represented only by a few examples from Station 6. The shell substance is composed of very small grains of sand, and the surface is smooth and of a light buff colour. There is a slight tendency to limbation of the sutures, or to a slight overlapping of the chambers.

It is reported from several 'Challenger' Stations in the Atlantic and in the South Pacific. Egger's rather doubtful examples are from West Africa, Mauritius, and between New Amsterdam and Australia.

Textularia concava var. *heterostoma* Fornasini, pl. VII. figs. 6, 7.

Sagrina affinis Fornasini, 1883, Boll. Soc. Geol. Ital., vol. ii. p. 189, pl. ii. fig. 10. *Sagraina affinis* Fornasini, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 45, pl. iii. fig. 1. *Textularia heterostoma* Fornasini, 1896, Mem. R. Accad. Sci. Istit. di Bologna, ser. 5, vol. vi. p. 4, pl. figs. 6, 12, 13.

This is one of the many interesting forms of *Textularia* from the Italian tertiaries described by Signor Fornasini. It differs from the type in the peripheral margin, which is less square, and also in the position of the aperture. In *T. concava* the aperture is a slit with a raised border situated at the inner margin of the terminal chamber and parallel to the suture. In *T. heterostomella* the aperture is similar in character, but varies in its position. In the Italian specimens it is usually remote from the suture and placed obliquely to it at various angles. In the Malay form it usually reaches to the suture and is perpendicular to it. In the Malay Archipelago this is one of the most abundant and widely distributed of the *Textulariæ*. It is more coarsely arenaceous than *T. concava*; and in one form (fig. 7) there is a considerable contortion of the test and a general resemblance to *T. crispata*.

The Italian specimens are from the pliocene of Ponticello di Savena, near Bologna.

Textularia sagittula Defrance.

"Polymorphum *sagittula*," Soldani, 1791, Testaceographiæ, vol. i. pt. 2, p. 120, pl. cxxxiii. fig. T. *Textularia sagittula* Defrance, 1824, Dict. Sci. Nat., vol. xxxii. p. 177; Atlas, Conch., pl. xiii. fig. 5. *T. sagittula* (Defrance) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 332, pl. xiii. figs. 15–17. *T. sagittula* (Defr.) Malagoli, 1887, Boll. Soc. Geol. Ital., vol. vi. p. 520, pl. xiii. fig. 1. *T. sagittula* (Defr.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xlii. fig. 1. *T. sagittula* (Defr.) Fornasini, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 46, pl. iii. figs. 2–4, *T. sagittula* (Defr.) Chapman, 1892, Journ. R. Micr. Soc., p. 328, pl. vi. fig. 16. *T. sagittula* (Defr.) Egger, 1893, Abhandl. k. bayer.

Akad. Wiss., Cl. II. vol. xviii. p. 271, pl. vi. figs. 8–10. *T. sagittula* (Defr.) Grzybowski, 1894, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej. Krakowie, vol. xxix. p. 187, pl. i. fig. 4. *T. sagittula* (Defr.) Jones, 1895, Palæont. Soc., p. 142, pl. v. figs. 15, 16, 18. *T. sagittula* (Defr.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 31, pl. ii. fig. 10.

There is nothing in the Malay specimens of this well known and ubiquitous species to call for remark. It is found at several Stations, and shows the usual variations of form and structure.

Textularia sagittula var. *jugosa* T. R. Jones, plate VII. fig. 8.

T. sagittula (Defr.) Fornasini, 1887, Boll. Soc. Geol. Ital., vol. vi. p. 374, pl. ix. figs. 1, 2. *T. sagittula* (Defr.) var. *jugosa* (Brady) T. R. Jones, 1895, Palæont. Soc., p. 145, pl. v. fig. 19. *T. rugosa* (Reuss) var. *marginata* Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 77, pl. ii. fig. 4.

This is the arenaceous form of *T. jugosa* before referred to. It has been found only at Station 13, and the specimens are neither numerous nor well developed. The only perfect example (the one figured) is short and triangular, but there are fragments which possess the characters of the forms figured by Fornasini and Prof. T. R. Jones.

It is a question if this arenaceous variety has previously been found recent; yet strangely enough, Prof. T. R. Jones, writing of the Crag specimen, remarks, "this is the first record of the variety in a fossil condition." * Fornasini's and Silvestri's examples are from the pliocene of Italy.

Textularia sagittula var. *fistulosa* Brady, plate VII. fig. 9.

T. sagittula var. *fistulosa* Brady, 1884, Chall. Rept., p. 362, pl. lxii. figs. 19–22. *T. fistulosa* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 271, pl. vi. figs. 15, 16.

This variety is very rare, and has been observed only at Station 2.

Brady considers the fistulose condition to be the result of redundant growth, and states that it is principally met with in specimens from tropical or sub-tropical latitudes. The only 'Gazelle' Station is Mauritius.

Textularia sagittula var., plate VII. figs. 10–12.

This is another form of the *sagittula* group. Essentially the initial portion of the test is much flattened with a more or less acute margin, and is formed of a great number of short broad segments. So far the characters of the test are constant, but the later chambers have a tendency to expand and become inflated in various manners. Sometimes each individual segment expands without regard to its

* Palæont. Soc., 1895, p. 146.

neighbours, as shown in figs. 10, 11; at other times they combine to form a symmetrical inflation of the test, as in fig. 12. In the Malay specimens these variations are very numerous, and afford materials for bringing together figures by various authors, the affinities of which have hitherto been very doubtful.

Of the figures in which the inflation of individual chambers occurs, the following may be mentioned:—*T. globigera* Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. pl. vii. fig. 100; *T. sagittula* var. *Soldanii* Fornasini, 1883, Boll. Soc. Geol. Ital., vol. ii. pl. ii. fig. 2; *T. Soldanii* Fornasini, 1887, Boll. Soc. Geol. Ital., vol. vi. pl. ix. figs. 3, 4; *T. conica* Chapman, 1892, Journ. R. Micr. Soc., pl. vi. fig. 20; *T. agglutinans* forma *jugosa* Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. pl. vii. figs. 297–299; and *T. luculenta* Brady, 1884, Chall. Rept., p. 364. The inflation in the last-mentioned form is not represented in Brady's figures, but I have specimens from 'Challenger' Station 24 (off Culebra Island) in which it is well shown. This variety is represented by figs. 10, 11, plate VII.

The figured specimens of the other form in which the later segments combine to form a club-shaped test are:—*T. Candeina* d'Orbigny, 1839, Foram. Cuba, pl. i. figs. 25–27; *Plecanium acuminatum* Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. vi. pl. x. fig. 5; *T. fungiformis* Fornasini, 1887, Boll. Soc. Geol. Ital., vol. vi. pl. x. fig. 1, and 1896, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vi. pl., 1–5; and *T. cordiformis* Terquem, 1883, Cinq. Mém. Foram. Oolithique, pl. xlv. fig. 5. The Malay form of this variety is represented by fig. 12, pl. VII.

The most numerous and regular, and therefore probably the most typical, form of this variety of *T. sagittula* closely resembles *T. aciculata* d'Orbigny in the shape and arrangement of the chambers forming the later portion of the test, but the margins are obtuse instead of being acute as in that species. This particular form is found at a considerable number of the Malay Stations; the inflated varieties are more rare and more local.

Textularia agglutinans d'Orbigny.

T. agglutinans d'Orbigny, 1839, Foram. Cuba, p. 144, pl. i. figs. 17, 18, 32. *T. agglutinans* (d'Orb.) Woodward and Thomas, 1885, Thirteenth Ann. Rept. Geol. Nat. Hist. Survey of Minnesota for 1884, p. 167, pl. iii. figs. 6, 7. *T. agglutinans* (d'Orb.) Vine, 1885, Proc. Yorkshire Geol. Polytech. Soc., n.s., vol. ix. p. 28, pl. ii. fig. 17. *T. agglutinans* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 742, pl. xiv. fig. 6. *T. agglutinans* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xli. figs. 17, 23, and pl. lii. figs. 2, 3. *T. agglutinans* (d'Orb.) Chapman, 1892, Journ. R. Micr. Soc., p. 329, pl. vi. fig. 21. *T. agglutinans* (d'Orb.) Woodward and Thomas, 1893, Final. Rept.

Geol. Nat. Hist. Survey of Minnesota, p. 30, pl. C, figs. 7, 8. *T. agglutinans* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 267, pl. vi. figs. 1, 2. *T. agglutinans* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 35, pl. vii. figs. 300–303. *T. agglutinans* (d'Orb.) T. R. Jones, 1895, Palæont. Soc., p. 147.

There is little to be said about this well-known species; the Malay specimens are not large, and are widely diffused throughout both areas.

Textularia gramen d'Orbigny.

T. gramen d'Orbigny, 1846, For. Foss. Vienne, p. 248, pl. xv. figs. 4–6. *T. gramen* (d'Orb.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 332, pl. xiii. figs. 13, 14. *T. gramen* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 109, pl. v. fig. 1. *T. gramen* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesellschaft, vol. xvii. p. 71, pl. xi. figs. 26, 27, 37. *T. gramen* (d'Orb.) Fornasini, 1891, Foram. Plioc. del Ponticello di Savena, pl. ii. fig. 6. *T. gramen* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 272, pl. vi. figs. 24–26.

The specimens are numerous and widely dispersed, but few of them are characteristic; in the majority the earlier formed portion of the test resembles *sagittula*, the later portion *agglutinans*.

Textularia conica d'Orbigny.

T. conica d'Orbigny, 1839, Foram. Cuba, p. 143, pl. i. figs. 19, 20. *T. conica* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesellschaft, vol. xvii. p. 72, pl. xi. figs. 40–42; 45, 46. *T. conica* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 273, pl. vi. figs. 34–36. *T. calix* Grzybowski, 1895, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej. Krakowie, vol. xxix. p. 287, pl. ix. fig. 17. *T. conica* (d'Orb.) T. R. Jones, 1895, Palæont. Soc., p. 152, pl. vii. fig. 24.

This species is well represented, the examples being numerous and widely distributed. The exterior of the test is arenaceous, and is rougher than is usual in this form. It is most abundant in Area 1.

Textularia trochus d'Orbigny.

T. trochus d'Orbigny, 1840, Mém. Soc. Géol. Fr., vol. iv. p. 45, pl. iv. figs. 25, 26. *T. trochus* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesell., vol. xvii. p. 72, pl. xi. figs. 43, 44. *T. trochus* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 553, pl. viii. fig. 14. *T. trochus* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 273, pl. vi. figs. 37, 38. *T. trochus* (d'Orb.) T. R. Jones, 1895, Palæont. Soc., p. 150.

The specimens are numerous and fine, and all, without exception, have the limbate sutures common in the recent, but rarely found in the fossil examples. It is restricted to Stations 2 and 22.

Bigenerina d'Orbigny.

Bigenerina nodosaria d'Orbigny, plate VII. fig. 13.

B. nodosaria d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 261, pl. xi. figs. 9–12; Modèle No. 57. *B. nodosaria* (d'Orb.) Fornasini, 1887, Atti Soc. Nat. Modena (Rendic.) ser. 3, vol. iii. p. 108, pl. i. figs. 3, 4. *B. nodosaria* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesell., vol. xvii. p. 73, pl. xii. figs. 1–4. *B. nodosaria* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 27, pl. vii. figs. 313–323; and *Clavulina textularioidea* p. 42, pl. viii. figs. 387–399. *B. agglutinans* (d'Orb.) Egger, 1895, Jahresber. XVI. naturhist. Ver. Passau, p. (8) pl. i. fig. 1. *Clavulina textularioidea* (Goës) Goës, 1896, Bull. Mus. Comp. Zool. Harvard Coll., vol. xxix. p. 37, pl. iv. figs. 26–38. *B. nodosaria* (d'Orb.) A. Silvestri, 1896, Mem. Pont. Accad. Nuovi Lincei, vol. xii. p. 81, pl. ii. figs. 5, 6.

The specimen figured possesses the characters of the species in an extreme degree; it is smoothly arenaceous, and in this form is very rare, having been noticed only at Station 10. Very common is the rough form equivalent to the *B. agglutinans* of D'Orbigny, which occurs at several Stations in both areas.

Clavulina textularioidea Goës seems to be nothing more than an aberrant form of this species.

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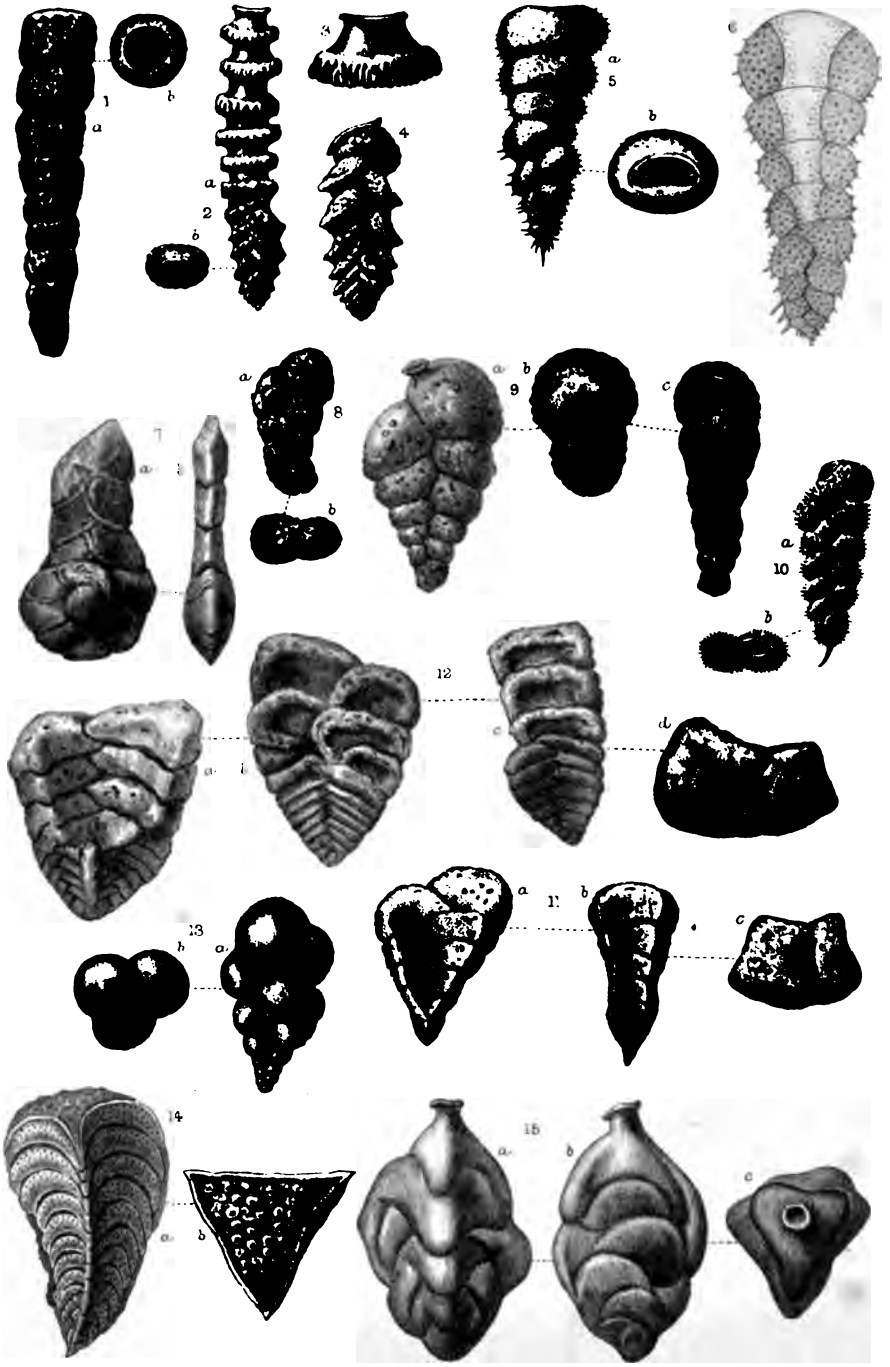

P.W.Millett del ad nat. West, Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1900, pp. 6–13.)

II.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part VII.*

By Fortescue William Millett, F.R.M.S.

(*Read 21st December*, 1899.)

Plate I.

Bigenerina digitata d'Orbigny var., plate I. fig. 1.

Bigenerina (*Gemmulina*) *digitata* d'Orb., 1826, Ann. Sci. Nat., vol. vii. p. 262, No. 4; Modèle No. 58. *B. digitata* (d'Orb.) Brady, 1864, Trans. Linn. Soc. London, vol. xxiv. p. 468, pl. xlviii. fig. 8. *B. arcuata* Haeusler, 1890, Abhandl. schweizer. Pal. Gesell., vol. xvii. p. 73, pl. xii. figs. 5–7. *B. digitata* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 38, pl. vii. figs. 324–341.

This species has hitherto been recorded only from Europe. The Malay variety is confined to Station 9, and the examples, although minute, are moderately abundant. The test is finely arenaceous and of the usual reddish-brown colour. The aperture is a large circular orifice occupying nearly the whole of the distal face. This appears to be the only feature in which it differs from the type.

Bigenerina fimbriata sp. n., plate I. figs. 2–4.

Test hyaline, elongate, straight, compressed. Chambers of the biserial portion numerous, having the outer margin projecting and the surface granular. Chambers of the linear series broad at the base, tapering towards the aperture; the base encircled by a fringed band. Aperture elliptical, with a bordered margin. Length 1·20 mm.

This form may be described as a dimorphous *Bolivina*, the biserial

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EXPLANATION OF PLATE.

Fig. 1.—*Bigenerina digitata* d'Orbigny var. × 135.
„ 2. „ *fimbriata* sp. n. × 40.
„ 3. „ „ One of the chambers of the linear series. × 80.
„ 4. „ „ Biserial portion, equal to *Bolivina lobata* Brady, changing to the dimorphous condition. × 75.
„ 5. „ (*Siphogenerina*) *Schlumbergerii* sp. n. × 75.
„ 6. „ „ „ By transmitted light showing the internal siphon. × 95.
„ 7.—*Spiroplecta annectens* Parker and Jones sp. × 100.
„ 8. „ *biformis* Parker and Jones sp. × 135.
„ 9.—*Gaudryina siphonella* Reuss. × 75.
„ 10. „ *hirta* sp. n. × 90.
„ 11. „ *Wrightiana* sp. n. × 90.
„ 12. „ „ Specimen with limbate sutures. × 100.
„ 13.—*Verneuilina pygmæa* Reuss. × 135.
„ 14.—*Chrysalidina dimorpha* Brady. × 60.
„ 15.—*Tritaxia lepida* Brady. × 135.

portion being identical in all points, even in magnitude, with *Bolivina lobata* Brady; whilst the chambers composing the linear series resemble *Lagena fimbriata* Brady.

It is found at several Stations in both Areas, but is nowhere abundant.

Bigenerina (*Siphogenerina*) *Schlumbergerii* sp. n.,
plate I. figs. 5, 6.

Test hyaline, thin, elongate, tapering, slightly compressed; biserial and uniserial chambers both inflated, and both having short spines scattered over the surface. Aperture large and curved. Throughout the uniserial chambers a tube connects the aperture of each chamber with that of the one preceding it. Length 0·46 mm.

The genera *Bigenerina* and *Sagrina* are superficially so much alike that it is difficult to distinguish one from the other by their external characters. The *Sagrinæ* have the test composed of the dense vitreous substance usually found in the family *Lagenidæ*; whilst in *Bigenerina* the test, when hyaline, is thinner and more porous. The internal siphon is common in the *Lagenidæ*, and also occurs, in a modified form, in many of the Malay species of the *Textularidæ*, as will be shown in due course; consequently it cannot be accepted as a feature distinguishing one family from the other. In M. Schlumberger's genus *Siphogenerina* are to be found arenaceous as well as hyaline forms. His *S. ocracea* from New Caledonia differs from *Bigenerina digitata* in little more than the possession of the internal siphon and the consequent alteration in the position of the aperture.

It may be observed that the aperture of *B. Schlumbergerii* closely resembles that of the *B. calcarata* of Berthelin,* as shown by his figures and also by that of Chapman from the Gault of Folkestone.†

From the characters of *B. Schlumbergerii* it seems to be more nearly allied to *Bigenerina* than to *Sagrina*, although there is here plenty of room for a difference of opinion.

Fig. 3 is from a drawing by the late M. Berthelin showing the test viewed by transmitted light.

The species is very common in the Malay Archipelago, and occurs at numerous Stations in both areas.

Pavonina d'Orbigny.

Pavonina flabelliformis d'Orbigny.

P. flabelliformis d'Orb., 1826, Ann. Sci. Nat., vol. vii. p. 260, pl. x. figs. 10–12; Modèle No. 56.

* Mém. Soc. Géol. France, sér. 3, vol. i. 1880, pl. xxiv. figs. 14–16, and pl. xxv. fig. 2.

† Journ. R. Micr. Soc., 1898, p. 15, pl. ii. fig. 14 (*Sagrina calcarata* Berthelin sp.).

Of this rare although widely diffused species there is a solitary example from Station 22. It is almost identical in form with the specimen figured by Brady in the Quarterly Journal of Microscopical Science, vol. xix. 1879, pl. viii. fig. 30.

Spiroplecta Ehrenberg.

Spiroplecta annectens Parker and Jones sp., plate I. fig. 7.

Textularia annectens Parker and Jones, 1863, Ann. and Mag. Nat. Hist., ser. 3, vol. xi. p. 92, woodcut fig. 1. *Spiroplecta annectens* (P. & J.) Brady, 1884, Chall. Rept., p. 376, pl. xlv. figs. 22, 23. *S. annectens* (P. & J.) Chapman, 1892, Journ. R. Micr. Soc., p. 750, pl. xi. fig. 3. *S. annectens* (P. & J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 275, pl. vi. fig. 14. *S. annectens* (P. & J.) Chapman, 1899, Ann. and Mag. Nat. Hist., ser. 7, vol. iii. p. 58, woodcut fig. 4.

Of this form there is a solitary specimen from Station 30.

Brady says that it had only been found at Raine Island, Torres Strait, and off a neighbouring locality, Ki Island. The 'Gazelle' specimens are from West Australia and New Guinea.

Fossil it is found in the Gault and Cambridge Greensand (Chapman).

Spiroplecta biformis Parker and Jones sp., plate I. fig. 8.

Textularia agglutinans var. *biformis* Parker and Jones, 1865, Phil. Trans., vol. clv. p. 370, pl. xv. figs. 23, 24. *Spiroplecta biformis* (P. & J.) Brady, 1884, Chall. Rept., p. 376, pl. xlv. figs. 25–27. *S. biformis* (P. & J.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. Sci., p. 333, pl. xiii. fig. 21 and woodcut fig. 2. *S. biformis* (P. & J.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 554, pl. viii. fig. 21. *S. biformis* (P. & J.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesell., vol. xvii. p. 74, pl. xi. figs. 48, 49–51. *S. biformis* (P. & J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 275, pl. vi. figs. 48–50. *S. biformis* (P. & J.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 38, pl. vii. figs. 308–312.

Of this arenaceous form a few specimens have been found at Station 9. They are very minute and of the usual rusty colour.

This species is most common in the Arctic regions. The 'Gazelle' examples, which are described as colourless, are from West Africa and West Australia.

Gaudryina d'Orbigny.

Gaudryina pupoides d'Orbigny.

Gaudryina pupoides d'Orbigny, 1840, Mém. Soc. Géol. France, vol. iv. p. 44, pl. iv. figs. 22–24. *Textularia pupoides* (d'Orb.) Goës,

1882, K. Svenska Vet.-Akad. Handl., vol. xix. p. 81, pl. vi. figs. 179, 180. *Gaudryina pupoides* (d'Orb.) Woodward and Thomas, 1885, 13th Ann. Rept. Geol. and Nat. Hist. Survey of Minnesota for 1884, p. 168, pl. iii. fig. 10. *G. pupoides* Sherborn and Chapman, 1886, Journ. R. Micr. Soc., vol. vi. p. 743, pl. xiv. fig. 7. *G. pupoides* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xlii. figs. 7, 8. *G. pupoides* (d'Orb.) Fornasini, 1889, Boll. Soc. Geol. Ital., vol. v. (p. 25) pl. i. fig. 7. *G. pupoides* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 554, pl. viii. fig. 22. *G. pupoides* (d'Orb.) Chapman, 1892, Ibid., p. 752, pl. xi. fig. 8. *G. pupoides* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 278, pl. vii. figs. 1–3, 49–51. *G. pupoides* (d'Orb.) Woodward and Thomas, 1893, Final Rept. Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 31, pl. C, figs. 15, 16. *G. pupoides* (d'Orb.) Grzybowski, 1894, Rozprawy Wydz. mat.-Przyr. Akad. Umiej-Krakowie, vol. xxix. p. 188, pl. i. fig. 9. *G. pupoides* (d'Orb.) Egger, 1895, 16. Jahresbericht Naturhist. Ver. Passau (p. 9), pl. i. fig. 19. *G. pupoides* (d'Orb.) A. Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 85, pl. ii. fig. 7.

This species is represented by a very few feeble examples, and appears to be restricted to Area 1.

Gaudryina siphonella Reuss, plate I. fig. 9.

Gaudryina siphonella Reuss, 1851, Zeitschr. deutsch. Geol. Gesell., vol. iii. p. 78, pl. v. figs. 40–42.

Is represented by a solitary, although well-developed, example from Station 25.

Brady speaks of the species as being comparatively rare in the living condition, although widely distributed.

Gaudryina filiformis Berthelin.

Gaudryina filiformis Berthelin, 1880, Mém. Soc. Géol. France, ser. 3, vol. i. p. 25, pl. xxiv. fig. 8. *G. filiformis* (Berthelin) Wright, 1882, Proc. Belfast Nat. Field Club, 1880–1881, Appendix, p. 180, pl. viii. fig. 3. *G. filiformis* (Berthelin) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xlii. fig. 6. *G. filiformis* (Berthelin) Chapman, 1892, Journ. R. Micr. Soc., p. 752, pl. xi. fig. 7. *G. filiformis* (Berthelin) Perner, 1897, Česká Akad. Císare Františka Josefa (Palæont. Bohemica) No. 4, p. 17, pl. vii. fig. 10.

This species occurs at several Stations in both Areas, and in some of them is fairly abundant. The examples are stout, and well developed.

Found at only four 'Challenger' Stations, but occurs at several places on the coast of the United Kingdom. Brady, Parker, and Jones record a single specimen from the Abrolhos Bank.

Gaudryina hirta sp. n., plate I. fig. 10.

Test hyaline, elongate, tapering towards the aboral end, compressed; triserial portion small and obscure. Biserial chambers numerous and inflated. Aperture erect, oval, with a depressed margin. Surface of test covered with short spines. Length 0·29 mm.

In this species the biserial portion appears to be more Bulimine than Textularian, as well in the texture of the test as in the position of the aperture. In the *Gaudryinæ* there is admittedly considerable variation in these features, and it is not necessary to establish a new genus for the reception of this form. The specimens are remarkably uniform in size and structure, and in the number of chambers.

It is very abundant in the Malay Archipelago, and is found at most of the Stations.

This is one of the forms which illustrate the peculiarity of the Malay Region in containing numerous species, widely distributed and in vast profusion, which have not been recorded from any other locality.

Gaudryina rugosa d'Orbigny.

Gaudryina rugosa d'Orbigny, 1840, Mém. Soc. Géol. France, vol. iv. p. 44, pl. iv. figs. 20, 21. *G. rugosa* (d'Orb.) Chapman, 1892, Journ. R. Micr. Soc., p. 752, pl. xi. fig. 9. *G. rugosa* (d'Orb.) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 437, pl. i. fig. 9.

Is represented by a few feeble specimens from Station 13.

Brady names seven localities at which it has been found in the living condition. It seems to be at its best in Torres Strait.

Gaudryina Wrightiana sp. n., plate I. figs. 11, 12.

Gaudryina rugosa (d'Orb.) Beissel, 1891, Abhandl. k. Preuss. Geol. Landesanstalt, Heft 3, p. 69, pl. xiii. figs. 30–33.

Test wedge-shaped; triserial portion with flat faces and acute or carinate edges; biserial portion quadrilateral, one of the lateral faces convex, the other concave. Peripheral margins broad and flat, and inclined towards the concave lateral face. Length 0·30 mm.

This is an interesting form of the *G. rugosa* group, and is closely allied to *G. Jonesiana*-Wright, from which it differs in its length, and in having one of the lateral faces convex. The sutures of the biserial portion are sometimes limbate.

It is not uncommon at Station 13, and occurs also at Station 2.

The specimen figured by Beissel is from the chalk-marl of Aix-la-Chapelle.

Verneuilina d'Orbigny.

Verneuilina triquetra Münster sp.

Textularia triquetra Münster, 1838, Romer, Neues Jahrb. für Min., p. 384, pl. iii. fig. 19. *Verneuilina triquetra* (Münster) Parker

and Jones, 1863, Ann. and Mag. Nat. Hist., ser. 3, vol. xi. p. 92. *V. triquetra* (Münster) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 553, pl. viii. figs. 19, 20. *V. triquetra* (Münster) Chapman, 1892, Journ. R. Micr. Soc., p. 329, pl. vi. fig. 24. *V. triquetra* (Münster) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 280, pl. vii. figs. 12, 13.

This form, rather rare in the living condition, is represented by a somewhat feeble specimen from Station 30.

The Gazelle Stations are Mauritius and off the east coast of Patagonia.

Verneuilina spinulosa Reuss.

Verneuilina spinulosa Reuss, 1850, Denkschr. k. Akad. Wiss. Wien, vol. i. p. 374, pl. xlvii. fig. 12. *V. spinulosa* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xlii. fig. 15. *V. spinulosa* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 281, pl. vii. figs. 11, 14–16.

Occurs in great abundance, and with the usual variety of form at nearly all the Stations in both Areas.

Verneuilina pygmæa Egger sp., plate I. fig. 13.

Bulimina pygmæa Egger, 1857, Neues Jahrb. für Min., p. 284, pl. xii. figs. 10, 11. *Verneuilina pygmæa* (Egger) Parker and Jones, 1863, Ann. and Mag. Nat. Hist., ser. 3, vol. xi. p. 92. *V. pygmæa* (Egger) Woodward and Thomas, 1893, Final Rept. Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 32, pl. C, figs. 17, 18. *V. pygmæa* (Egger) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. p. 279, pl. vii. figs. 8–10. *V. pygmæa* (Egger) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 32, pl. vii. figs. 262, 263.

The arenaceous form of the species is not represented in the anchor mud from the Malay Archipelago, but the beautiful little hyaline form here figured is scattered all over the region. It is as transparent as glass, and as usual the aperture is not apparent. Of all the published figures of the species the one which most resembles it is that of *Textilaria triseriata* Terquem.* The arenaceous form is a common deep-water species, but there appears to be no previous record of the hyaline variety.

Verneuilina polystropha Reuss sp.

Bulimina polystropha Reuss, 1846, Verstein. böhm. Kreid., part 2, p. 109, pl. xxiv. fig. 53. *Verneuilina polystropha* (Reuss) Parker and Jones, 1862, Introd. Foram., Appendix, p. 311. *V.* sp. indet. Andreæ, 1884, Abhandl. geol. Special-Karte Elsass-Lothringen, vol. ii. p. 296, pl. vi. fig. 15. *Bulimina polystropha* (Reuss) Chapman, 1892, Journ. R. Micr. Soc., p. 756, pl. xii. fig. 11. *V. polystropha* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II.

* Mém. Soc. Géol. France, sér. 3, vol. ii. 1882, p. 145, pl. xxiii. fig. 10.

vol. xiii. p. 280, pl. vii. figs. 17, 18. *V. polystropha* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 32, pl. vii. figs. 247–255. *Bulimina polystropha* (Reuss) Chapman, 1894, Quart. Journ. Geol. Soc., vol. l. p. 701, pl. xxxiv. fig. 5.

All the Malay specimens of this species are roughly arenaceous and for the most part colourless. The aperture is more Textularian than Bulimine.

It is abundant at Stations 2 and 12, and is found sparingly at other Stations in both Areas.

Chrysalidina d'Orbigny.

Chrysalidina dimorpha Brady, plate I. fig. 14.

Chrysalidina dimorpha Brady, 1884, Chall. Rept., p. 388, pl. xlvi. figs. 20, 21. *C. dimorpha* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 274, pl. vi. figs. 47, 51, 52.

Rare at Station 14, less rare at Station 22. The examples are characteristic, but show a considerable variation in the proportion of the length to the breadth.

Of the five localities given by Brady, one is off Raine Island, Torres Strait. The 'Gazelle' Stations are Mauritius and West Australia.

Tritaxia Reuss.

Tritaxia lepida Brady, plate I. fig. 15.

Tritaxia lepida Brady, 1881, Quart. Journ. Micr. Sci., n.s. vol. xxi. p. 55. *T. lepida* (Brady) Brady, 1884, Chall. Rept., p. 389, pl. xlix. fig. 12.

Of this very rare form there is a solitary but typical example from Station 3.

The only 'Challenger' locality given by Brady is Station 45 off the coast of North America, a little south of the latitude of New York, 1240 fathoms, but I have found several specimens in the rich dredging from Station 185, off Raine Island, Torres Strait, 155 fathoms.

Clavulina d'Orbigny.

Clavulina communis d'Orbigny.

Clavulina communis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 268, No. 4. *C. communis* (d'Orb.) Fornasini, 1885, Boll. Soc. Geol. Ital., vol. iv. p. 106, pl. vi. figs. 1, 2. *C. communis* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., vol. vi. p. 743, pl. xv. fig. 1. *C. communis* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 220, pl. xlii. fig. 11. *C. communis* (d'Orb.) Fornasini, 1891, Foram. Plioc. del Ponticello di Savena, pl. ii. fig. 7. *C. communis* (d'Orb.) Murray and Renard, 1891, Chall. Rept., "On Deep-

Sea Deposits," pp. 101, 135, pl. xiv. fig. 2[26]. *C. communis* (d'Orb.) Mariani, 1891, Boll. Soc. Geol. Ital., vol. x. fasc. 2, p. 172, pl. vi. fig. 3. *C. communis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 275, pl. vi. figs. 42, 43. *C. communis* (d'Orb.) Fornasini, 1893, Mem. R. Accad. Sci. Istit. Bologna, ser 5, vol. iii. p. 436, pl. i. figs. 10–12; and 1894, vol. v. p. 14, pl. iv. fig. 3.

The genus *Valvulina* in its simple form is not represented in the gatherings from the Malay Archipelago; and of the dimorphous forms the examples are rare and local. *Clavulina communis* has been noticed only at Station 14.

Clavulina angularis d'Orbigny,

Clavulina angularis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 268, No. 2, pl. xii. fig. 7.

Has been found only at Station 2, and there very sparingly. The examples are however large and characteristic.

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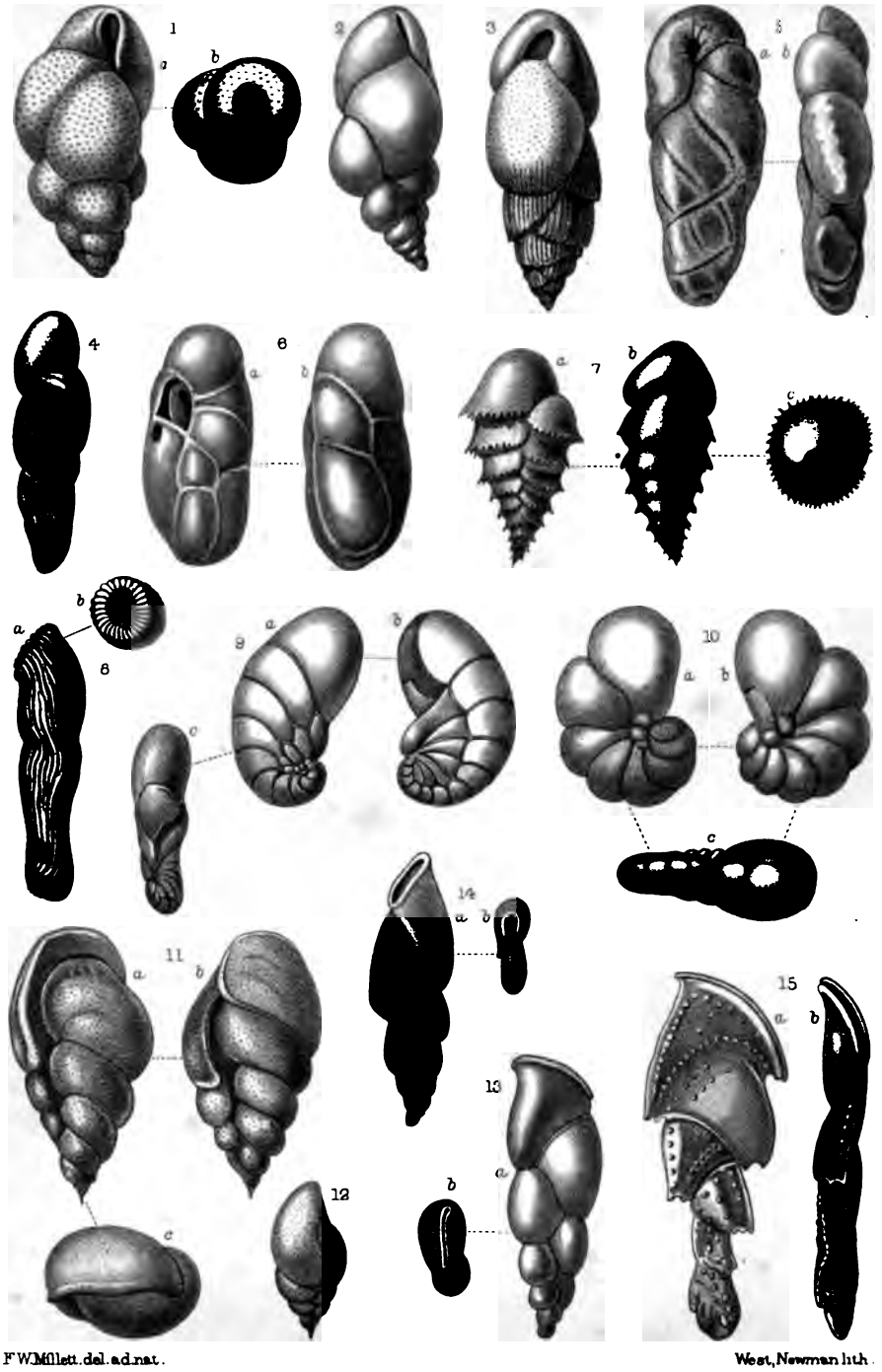

F.W.Millett. del. ad. nat.

West, Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1900, pp. 273–281.)

IV.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part VIII.*

By Fortescue William Millett, F.R.M.S.

(*Read 16th May*, 1900.)

Plate II.

Sub-family **Buliminin**æ.

Bulimina pupoides d'Orbigny.

Bulimina pupoides d'Orbigny, 1846, For. Foss. Vienne, p. 185, pl. xi. figs. 11, 12. *B. pupoides* (d'Orb.) Woodward and Thomas, 1885, 13th Ann. Rept. Geol. and Nat. Hist. Survey of Minnesota, p. 169, pl. iii. fig. 11. *B. pupoides* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 5, vol. vi. p. 110, pl. v. fig. 6. *B. pupoides* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 72, pl. i. fig. 22. *B. pupoides* (d'Orb.) Woodward and Thomas, 1893, vol. iii. Final Rept. Geol. and Nat. Hist. Survey of Minnesota, p. 32, pl. C, figs. 21–24. *B. pupoides* (d'Orb.) Egger, 1893, Abhandl.

EXPLANATION OF PLATE II.

Fig. 1.—*Bulimina elegans* d'Orbigny. × 100.
„ 2. „ *fusiformis* Williamson. × 90.
„ 3. „ *subornata* Brady. × 135.
„ 4. „ *elegantissima* d'Orbigny. × 115.
„ 5. „ „ var. *compressa* var. n. × 115.
„ 6. „ *subcylindrica* Brady. × 75.
„ 7. „ *marginata* d'Orbigny var. *biserialis* var. n. × 90.
„ 8. „ *Williamsoniana* Brady. × 60.
„ 9. „ *convoluta* Williamson. × 60.
„ 10. „ „ var. *nitida* var. n. × 60.
„ 11.—*Pleurostomella contorta* sp. n. × 75.
„ 12. „ „ young specimen. × 75.
„ 13.—*Virgulina Schreibersiana* Czjzek var. × 85.
„ 14. „ *squamosa* d'Orbigny. × 60.
„ 15.—*Bifarina Mackinnonii* sp. n. × 80.

k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 285, pl. viii. fig. 63. *B. pupoides* (d'Orb.) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 14, pl. iv. figs. 6–8. *B. pupoides* (d'Orb.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 290, pl. xxxvii. fig. 3. *B. pupoides* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 49, pl. xv. figs. 1, 2. *B. pupoides* (d'Orb.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 3.

Bulimina affinis d'Orbigny.

Bulimina affinis d'Orbigny, 1839, Foram. Cuba, p. 109, pl. ii. figs. 25, 26. *B. affinis* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., vol. vi. p. 743, pl. xvi. fig. 1. *B. affinis* (d'Orb.) Rzehak, 1886, Verh. Nat. Ver. Brünn, vol. xxiv. p. 80, pl. i. fig. 2. *B. affinis* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 554, pl. viii. fig. 23. *B. affinis* (d'Orb.) Chapman, 1892, Journ. R. Micr. Soc., p. 756, pl. xii. fig. 10. *B. affinis* (d'Orb.) Woodward and Thomas, 1893, vol. iii. Final Rept. Geol. and Nat. Hist. Survey of Minnesota, p. 32, pl. C, fig. 19. *B. affinis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 285, pl. viii. fig. 71. *B. affinis* (d'Orb.) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 14, pl. iv. figs. 4, 5. *B. affinis* (d'Orb.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 290, pl. xxxvii. fig. 2. *B. ovulum* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 50, pl. xv. fig. 46.

Bulimina elegans d'Orbigny, plate II. fig. 1.

Bulimina elegans d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 270, No. 10; Modèle, No. 9. *B. elegans* (d'Orb.) Parker, Jones, and Brady, 1865, Ann. and Mag. Nat. Hist., ser. 3, vol. xvi. p. 20, pl. ii. fig. 64. *B. elegans* (d'Orb.) Chapman, 1892, Quart. Journ. Geol. Soc., vol. xlviii. p. 516, pl. xv. fig. 9. *B. elegans* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 284, pl. viii. figs. 66, 67. *B. elegans* (d'Orb.) Jones, 1895, Palæont. Soc., p. 162, fig. 17. *B. elegans* (d'Orb.) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 16, pl. iii. fig. 9. *B. elegans* (d'Orb.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 294, pl. xxxvi. fig. 3. *B. elegans* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 50, pl. xv. fig. 44.

Of this group the central form is *B. elegans*, which is by far the most important in numbers as well as in distinctive characters. The aperture is always large and curiously contorted, suggesting a stage in the evolution of a complicated double aperture found in some allied species, a description of which will be given in due course. The *B. coprolithoides* of Andreae * has a somewhat similar aperture, and closely resembles this form in other respects. *B. pupoides* and

* Abhandl. Geol. Special-Karte Elsass-Loth., vol. ii. Heft 3, 1884, p. 305, pl. vi. fig. 4.

B. affinis are here variants of *B. elegans*, and are both represented by individuals feeble and few in number. In these the aperture is normal. They are all widely distributed in the Malay region, although, with the exception of *B. elegans*, they are nowhere abundant.

Bulimina elegans d'Orbigny var. *exilis* Brady.

Bulimina elegans var. *exilis* Brady, 1884, Chall. Rept., p. 399, pl. i. figs. 5, 6.

This variety has hitherto been found only in deep water, and is said by Brady to be not rare in the North Atlantic, and also to have been met with in the North and South Pacific. It does not appear to have been noticed by other observers.

In the Malay Archipelago it is very rare in its normal condition, but there are varieties of *Virgulina* closely resembling it, which are not uncommon.

Bulimina fusiformis Williamson, plate II. fig. 2.

Bulimina pupoides var. *fusiformis* Williamson, 1858, Rec. Foram. Gt. Britain, p. 63, pl. v. figs. 129, 130. *B. fusiformis* (Will.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 5.

Is found in more or less abundance on the coasts of Great Britain, and is stated by Joseph Wright to be "common" in the Post-Glacial beds of Cheshire.

The triserial specimen figured under this name by Terquem * can hardly be assigned to this species.

The Malay examples, although neither numerous nor widely distributed, are sufficiently characteristic, and as usual, indicate an affinity with the genus *Virgulina*.

Of its existence elsewhere either in the recent or the fossil condition, there is no evidence to record.

Bulimina ovata d'Orbigny.

Bulimina ovata d'Orbigny, 1846, For. Foss. Vienne, p. 185, pl. xi. figs. 13, 14. *B. ovata* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 72, pl. i. fig. 20. *B. ovata* (d'Orb.) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 15, pl. iii. fig. 11. *B. ovata* (d'Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 32, pl. ii. fig. 11. *B. ovata* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 49, pl. xv. fig. 45.

Is not well represented, the specimens being small and feeble as well as few in number. It appears to be restricted to Area 1.

Bulimina pyrula d'Orbigny.

Bulimina caudigera d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 270, No. 16; Modèle, No. 68. *B. pyrula* d'Orbigny, 1846, For.

* Ess. Plage Dunkerque, 1875, p. 37, pl. v. fig. 10.

Foss. Vienne, p. 184, pl. xi. figs. 9, 10. *B. pyrula* (d'Orb.) Terrigi, 1891, Mem. Com. Geol. d'Italia, vol. iv. p. 71, pl. i. figs. 18, 19. *B. pyrula* (d'Orb.) Chapman, 1892, Journ. R. Micr. Soc., p. 756, pl. xii. fig. 9. *B. pyrula* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 285, pl. viii. fig. 107. *B. cuspidata* Franzenau, 1894 (Soc. Hist. Nat. Croatia), p. 253, pl. i. fig. 23. *B. pyrula* (d'Orb.) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 16, pl. iv. fig. 1. *B. pyrula* (d'Orb.) Chapman, 1895, Ann. and Mag. Nat. Hist., ser. 6, vol. xvi. p. 326, pl. xii. fig. 11, *B. pyrula* (d'Orb.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 291, pl. xxxvi. figs. 4, 5.

The examples of this species are few, small, and ill-developed, but they are found scattered over the whole region. They vary in the direction of *B. subcylindrica.*

Bulimina subornata Brady, plate II. fig. 3.

Bulimina subornata Brady, 1884, Chall. Rept., p. 402, pl. li. fig. 6. *B. subornata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 286, pl. viii. fig. 79.

The examples agree with those of the 'Challenger' dredgings in having the shell-wall conspicuously foraminated, but are devoid of the aboral stout spine, and the chambers have a tendency to overlap, in this respect resembling those of *B. marginata.* Brady writes that it "is a rare species, occurring at only two of the 'Challenger' stations, both in the Pacific, namely, the *Hyalonema*-ground south of Japan, 345 fathoms, where it is tolerably plentiful, and off Aru Islands, 800 fathoms."

There are two 'Gazelle' stations at which it occurs, both off the West Coast of Australia.

It is common in the Malay Archipelago, and is found at many of the stations in both areas.

Bulimina elegantissima d'Orbigny, plate II. fig. 4.

Bulimina elegantissima d'Orbigny, 1839, Foram. Amér. Merid., p. 51, pl. vii. figs. 13, 14. *B. elegantissima* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss. Cl. II. vol. xviii. p. 289, pl. viii. figs. 101, 102. *B. elegantissima* (d'Orb.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 6.

This variable, but at the same time easily recognised species, is very abundant in the Malay Archipelago, and is widely diffused in both areas. It occurs in all its varieties, ranging from the compact build identical with that of the sandy *B. Presli* to the elongated form figured.

As an illustration of the persistency of this species in time, it may be mentioned that there would be little difficulty in selecting from the

Malay Archipelago material specimens to match most of the forms figured by Terquem * in his work on the Foraminifera of the Paris Eocene, under the names of *B. pulchra*, *B. turbinata*, *B. intorta*, *B. ovula*, and several others.

Bulimina elegantissima var. *compressa* var. n., plate II. fig. 5.

Differs from the type chiefly in being much compressed. It is a rare variety, and seems to be restricted to Area 1.

Bulimina subteres Brady.

Bulimina Presli var. *elegantissima* (d'Orb.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 374, pl. xv. figs. 12–17. *B. subteres* Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 55. *B. subteres* (Brady) Wright, 1882, Proc. Belfast Nat. Field Club, App. 1880–1881, p. 180, pl. viii. fig. 2. *B. subteres* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 289, pl. viii. figs. 73, 74. *B. subteres* (Brady) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 46, pl. ix. figs. 445–453.

Is not very abundant, although found at several Stations in both areas. The specimens are small, but have all the characters of the species.

Bulimina subcylindrica Brady, plate II. fig. 6.

Bulimina subcylindrica Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 56. *B. subcylindrica*, Brady, 1884, Chall. Rept., p. 404, pl. l. fig. 16. *B. subcylindrica* (Brady) Halkyard, 1889, Trans. and Ann. Rept. Manchester Micr. Soc., p. 64, pl. i. fig. 12. *B. subcylindrica* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 289, pl. viii. fig. 100.

This rare form is represented by a solitary specimen from Station 30 in Area 1. Some fine specimens in my cabinet from 'Challenger' Station 185, Raine Island, have the clear shell-substance mottled with opaque white patches, identical with those so commonly found in *Pulvinulina elegans*.

Brady names six 'Challenger' Stations, three of which are in the Atlantic, and three in the South Pacific. Halkyard records a few doubtful examples from Jersey and Guernsey. The only 'Gazelle' Station is off the West Coast of Africa, north of the Equator.

Bulimina marginata d'Orbigny.

Bulimina marginata d'Orbigny, 1826, Ann. Sci. Nat., vol vii. p. 269, No. 4, pl. xii. figs. 10–12. *B marginata* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 220, pl. xliii.

* Mém. Soc. Géol. France, sér. 3, vol. ii. 1882, pl. xx.

figs. 7, 10. *B. marginata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 287, pl. viii. figs. 69, 70. *B. marginata* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 46, pl. ix. figs. 439–444. *B. marginata* (d'Orb.) Jones, 1895, Palæont. Soc., p. 165, pl. iii. figs. 5, 6. *B. marginata* (d'Orb.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 4.

Of this well-known species there is little to be noted. It is abundant all over the Region, and the specimens exhibit the usual variations of form.

Bulimina marginata var. *biserialis* var. n., plate II. fig. 7.

Differs from the type in being biserial. It is also more symmetrical, tapering regularly from the oral to the aboral end. The crenulations of the free edge of the chambers often develope into spines. Its nearest representative amongst the triserial forms appears to be the *B. pulchella* of d'Orbigny.*

According to the definitions of the genera, this form should be placed amongst the Bolivinæ, but it is so manifestly a variety of *Bulimina marginata* that there need be no hesitation in associating it with that species.

It is less numerous and less widely distributed than the type, but occurs in both areas.

Bulimina aculeata d'Orbigny.

"Polymorpha *Pineiformia*" Soldani, 1791, Testaceographia, vol. i. part ii. p. 118, pl. cccxxvii. fig. ii., and pl. cxxx. figs. *v v*. *B. aculeata* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 269, No. 7. *B. aculeata* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 220, pl. xliii. fig. 8. *B. aculeata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 287, pl. viii. figs. 72, 78. *B. aculeata* (d'Orb.) Jones, 1895, Palæont. Soc., p. 163, pl. iii. figs. 1, 2. *B. aculeata* (Czjczek) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 17, pl. iii. figs. 8, 10, 13, 14. *B. aculeata* (d'Orb.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 291, pl. xxxvii. fig. 4. *B. aculeata* (Czjczek) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 53, pl. xv. figs. 5, 6, 21.

The examples all have the keeled or margined chambers characteristeric of *B. marginata*, and may therefore be considered varieties of that species. The form with globular chambers and spines at the base only, which is probably derived from *B. pupoides*, is not represented.

The species is less common in the Malay Archipelago anchor-mud than *B. marginata*, which may perhaps be owing to the fact that it is more of a deep-water species.

* Foram. Amér. Mérid., 1839, p. 50, pl. i. figs. 6, 7.

Bulimina inflata Seguenza.

Bulimina inflata Seguenza, 1862, Atti Accad. Gioenia Sci. Nat., ser. 2, vol. xviii. p. 109, pl. i. fig. 10. *B. inflata* (Seg.) Andreae, 1884, Abhandl. geol. Spezialkarte Elsass-Loth., vol. ii. pp. 211, 224, pl. ix. figs. 6, 7. *B. inflata* (Seg.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 220, pl. xliii. fig. 9. *B. inflata* (Seg.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 288, pl. viii. fig. 85. *B. inflata* (Seg.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e PP. dello Studio di Acireale, vol. v. p. 12, pl. v. figs. 68, 69. *B. inflata* (Seg.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 291, pl. xxxvii. fig. 5.

Is very rare in the Malay Archipelago, and has been observed only at Station 2 in Area 1.

Bulimina Williamsoniana Brady, plate II. fig. 8.

Bulimina Williamsoniana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n. s. p. 56; and 1884, Chall. Rept., p. 408, pl. li. figs. 16, 17.

This interesting species, although of well-marked characters, has been strangely overlooked by Rhizopodists, and all that is known about it seems to be comprised in the 'Challenger Report.' According to Brady it appears to be limited in its distribution to the South Pacific.

It is by no means uncommon in Torres Strait and at various places on the Australian coasts.

In the Malay Archipelago it is abundant at Station 2, and occurs also, but very sparingly, at Station 6. It has not been noted at other Stations more remote from the Australian region.

Bulimina convoluta Williamson, plate II. fig. 9.

Bulimina pupoides var. *convoluta* Williamson, 1858, Rec. Foram. Gt. Britain, p. 63, pl. v. figs. 132, 133. *B. convoluta* (Will.) Brady, 1884, Chall. Rept., p. 409, pl. cxiii. fig. 6. *B. convoluta* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 288, pl. viii. figs. 83, 84.

This admittedly abnormal form, although classed with the *Textularidæ*, does not possess the true Textularian plan of growth, inasmuch as the chambers do not alternate in the sense that each successive addition shifts the aperture from one side of the test to the other. The plan of growth is rather Rotaliform; a primary row of chambers having applied to it a secondary row analogous to the "asterigerine" flaps found in the genus *Discorbina*.

The aperture, which is not always apparent, consists sometimes of a horizontal slit, at other times of a small funnel-shaped depression, and is situated on the septal face of the primary chamber, at the

apex of the suture formed by the junction of the last added secondary chamber.

The typical form is very abundant at Station 13, and is found, though sparingly, at a few other Stations.

The only 'Challenger' Station is at Raine Island, Torres Strait. Dr. Egger records it from seven 'Gazelle' Stations extending from West Africa to West Australia; rare at all of them.

Bulimina convoluta var. *nitida* var. n., plate II. fig. 10.

This variety is almost purely Rotaliform, the secondary series of chambers being very small and often scarcely discernible. The aperture, like that of the type, is situated at the superior junction of the last added primary and secondary chambers, and is usually a straight horizontal slit as figured. The shell substance is opaque and lustrous, almost iridescent.

The two forms occur together, but one or the other always predominates: at Station 13 the type is abundant and the variety rare; at all the other Stations where they both occur, this is reversed.

Pleurostomella Reuss.

Pleurostomella contorta sp. n., plate II. figs. 11, 12.

Test conical, slightly compressed, rounded at the oral, pointed at the aboral extremity. Chambers short and inflated, arranged in two parallel series, each of which overlaps the other on one side; sutures oblique and depressed. Aperture a transverse fissure in the septal face of the terminal chamber, close to its junction with the last-formed chamber of the opposite series. Length 0·45 mm.

This is an anomalous species, and has little more than its flattened septal face to indicate its affinity with the genus. In the young condition, fig. 12, the characters are more marked than in the adult.

It is by no means uncommon in the Malay Archipelago, and is found at Stations in both Areas.

Virgulina d'Orbigny.

Virgulina Schreibersiana Czjzek.

Virgulina Schreibersiana Czjzek, 1848, Haidinger's Naturwiss. Abhandl., vol. ii. p. 147, pl. xiii. figs. 18–20. *V. Schreibersii* (Cz.) Malagoli, 1887, Atti Soc. Nat. Modena, ser. 3, vol. iii. p. 108, pl. i. fig. 5. *V. Schreibersiana* (Cz.) Egger, 1893, Abhandl. k. bayer. Ak. Wiss. Cl. II. vol. xviii. p. 290, pl. viii. figs. 93, 95. *V. Schreibersiana* (Cz.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 48, pl. xv. figs. 459, 461–472. *V. Schreibersiana* (Cz.) Fornasini, 1897, Rendic. Accad. Sci. Bologna, n.s. vol. ii. pl. ii. fig. 9. *V. Schreibersiana* (Cz.) Fornasini, 1898, Mem. R. Accad. Sci. Istit. di Bologna, ser. 5, vol. vii. p. 206, pl., fig. 6. *V. Schreibersiana* (Cz.)

Morton, 1897, Proc. Portland Nat. Hist. Soc., vol. ii. p. 115, pl. i. fig. 9. *V. Schreibersiana* (Cz.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 291, pl. xxxvii. fig. 6.

This species occurs in vast profusion and in great variety of form. The variety figured (plate II. fig. 13) is so numerous, so persistent in form, and so widely distributed in the Malay Archipelago, that it is deemed worthy of notice.

Virgulina squamosa d'Orbigny, plate II. fig. 14.

Virgulina squamosa d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 267, No. 1;—Modèle, No. 64. *V. squamosa* (d'Orb.) Goës, 1894. K. Svenska Vet.-Akad. Handl., vol. xxv. p. 47, pl. ix. figs. 454, 456, 460. *V. squamosa* (d'Orb.) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 19, pl. i. fig. 20.

This rather unsatisfactory form is represented by a few specimens from Station 13. In general appearance they bear some resemblance to *Bolivina nitida* Brady,* but the 'Challenger' form is more compact and less Virguline in character.

Bifarina Parker and Jones.

Bifarina Mackinnonii sp. n., plate II. fig. 15.

Test elongate, tapering towards the aboral extremity. Virguline chambers numerous and compressed into a cylindrical mass. Uniserial chambers triangular and much compressed, margins acute and carinate. Sutures limbate, forming a zigzag line. Aperture an elongated slit, terminal, and extending the full width of the chamber. Length 0·63 mm.

This interesting form is very rare. I have found a few poor specimens from the 'Challenger' dredgings from Station 185, Raine Island, and to Mr. A. Earland I am indebted for some good examples from Macassar Straits.

In the Malay Archipelago it has been noticed only at Station 22.

To the late Sir William Mackinnon, Chairman of the Board of Directors of the Netherlands India Steam Navigation Co., Mr. Durrand is indebted for the facilities afforded him for obtaining the material which forms the subject of this Report; and in recognition of this kindness, this species is respectfully dedicated to his memory.

* Chall. Rept., 1884, p. 420, pl. lii. fig. 30.

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Virgulina squamosa d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 267, No. 1;—Modèle, No. 64. *V. squamosa* (d'Orb.) Goës, 1894. K. Svenska Vet.-Akad. Handl., vol. xxv. p. 47, pl. ix. figs. 454, 456, 460. *V. squamosa* (d'Orb.) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 19, pl. i. fig. 20.

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F.W.Millett del. ad nat. West, Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1900, pp. 539–549.)

IX.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part IX.*

By Fortescue William Millett, F.R.M.S.

(*Read 17th October*, 1900.)

Plate IV.

Bifarina elongata sp. n., plate IV. figs. 1, 2.

Test elongate, straight, compressed, tapering gradually towards the aboral end. The earlier chambers small and biserial or irregularly agglomerated. The uniserial chambers inflated, with projecting margins causing the peripheral margin of the test to be lobulated; the earlier of these chambers are trilateral, the terminal ones quadrilateral. Sutures depressed. Surface ornamented with longitudinal lines of puncta. Aperture a long bordered slit at the apex of the chamber. Length 0·76 mm.

There is very little variation in this interesting form. The lines of perforations may be more or less distinct; and frequently a constriction of the cell-wall causes an inflated lobe to be formed at the projecting base of the uniserial chambers.

A stage in the transition from the biserial to the uniserial arrangement of the chambers is well indicated in the *Bolivina porrecta* of Brady, with its zigzag sutures and triangular chambers extending the full width of the test. This is carried a step further by the Malay allied examples, which in the later stages attain the true uniserial plan of growth, and serve to bind the whole together in a very natural group. Having thus to deal with dimorphous forms derived from both *Virgulina* and *Bolivina*, it is convenient

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EXPLANATION OF PLATE IV.

Fig. 1.—*Bifarina elongata* sp. n. × 75.
„ 2. „ „ „ A few of the uniserial chambers. × 75.
„ 3. „ *porrecta* Brady sp. × 90.
„ 4.—*Bolivina nobilis* Hantken. × 90.
„ 5. „ *textilarioides* Reuss. × 90.
„ 6. „ *convallaria* sp. n. × 100.
„ 7. „ *Durrandii* sp. n. × 100.
„ 8. „ *Karreriana* Brady var. *carinata* var. n. × 60.
„ 9. „ *Hantkeniana* Brady. × 55.
„ 10. „ *Schwageriana* Brady. × 65.
„ 11.—*Mimosina affinis* sp. n. × 90.
„ 12. „ *spinulosa* sp. n. × 75.
„ 13. „ „ „ var. × 90.
„ 14. „ *hystrix* sp. n. × 75.
„ 15. „ „ a portion of the cell-wall mounted in balsam and viewed by transmitted light. × 180.

to extend the subgenus *Bifarina* of Parker and Jones, so that it may include all the members of the series, and thus avoid the disadvantage of instituting a new name for forms which admittedly are scarcely separable.

In the genus *Pleurostomella* the triangular chambers with zigzag sutures are of common occurrence. Other figured forms of similar construction are *Textularia laminaris* Costa* and *Bolivina cylindracea* Schwager.† The single specimen from the North Atlantic, south-east of George's Bank, figured by Flint ‡ as *Bolivina porrecta* Brady, possesses the three different forms of chambers as in *Bifarina elongata*. It comes from a depth of 956 fathoms, and is much larger than the Malay examples, having a length of 1 mm.

Bifarina elongata is very common in the Malay Archipelago, and occurs at most of the Stations in both Areas.

Bifarina porrecta Brady sp., plate IV. fig. 3.

Bolivina porrecta Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 57. *B. porrecta* Brady, 1884, Chall. Rept., p. 418, pl. lii. fig. 22. *B. porrecta* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 300, pl. viii. figs. 7–9, 46, 47.

This is one of the commonest forms of the region, and occurs in abundance at nearly all the Stations. The walls are thin and clear, as stated by Brady of the 'Challenger' examples, but differ from them in being coarsely perforated. The aboral portion of the test is usually of a tawny colour, which becomes fainter and disappears when it reaches the triangular segments. In the specimens figured by Egger the change of form in the later chambers is not apparent.

Obtained at three 'Challenger' localities, namely:—Off Culebra Island, West Indies, 390 fathoms; off Tahiti, 420 fathoms; and in Humboldt Bay, north coast of Papua, 37 fathoms.

The 'Gazelle' Stations are Mauritius, 411 metres and 347 metres; and a rather doubtful locality, apparently on the western coast of New Guinea, "Galewostrasse" St. 104 *a*. 3 metres.

Bolivina d'Orbigny.

Bolivina punctata d'Orbigny.

Bolivina punctata d'Orbigny, 1843, Foram. Amér. Mérid., p. 63, pl. viii. figs. 6–12. *B. punctata* (d'Orb.) Woodward and Thomas, 1885, 13th Ann. Rept. Geol. and Nat. Hist. Survey of Minnesota for 1884, p. 169, pl. iii. fig. 12. *B. punctata* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., vol. vi. p. 743, pl. xiv. fig. 10. *B. punctata* (d'Orb.) Malagoli, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 375, pl. xiv. figs. 1–4. *B. punctata* (d'Orb.) Terrigi, 1891, Mem.

* Atti Accad. Pontaniana, vol. vii. fasc. 2, 1856, p. 290, pl. xxiii. fig. 15.
† Boll. R. Com. Geol. d'Italia, vol. ix. 1878, p. 528, pl. i. fig. 18.
‡ Rept. U.S. Nat. Mus. for 1897 (1899), p. 292, pl. xxxviii. fig. 2.

Com. Geol. d'Italia, vol. iv. p. 74, pl. i. figs. 26–28. *B. punctata* (d'Orb.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 34, pl. c. figs. 27, 28. *B. punctata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 298, pl. viii. figs. 1–3. *B. punctata* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 49, pl. ix. figs. 475–478, 480. *B. punctata* (d'Orb.) Egger, 1895, Jahresber. xvi. Naturhist. Ver. Passau (p. 12) pl. i. fig. 11; and *B. antiqua* (d'Orb.) p. 11, pl. i. figs. 13, 15. *B. punctata* (d'Orb.) Morton, 1897, Proc. Portland Nat. Hist. Soc., vol. ii. p. 115, pl. i. fig. 11. *B. elongata* (Hantk.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 14, pl. xvi. figs. 12, 13. *B. punctata* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897, p. 292, pl. xxxviii. fig. 1. *B. punctata* (d'Orb.) Wright, 1900, Geol. Mag., dec. iv. vol. vii. p. 100, pl. v. fig. 10.

This well known and widely diffused form is found in considerable abundance all over the Region, and exhibits the usual variations in length and breadth of the test, and in the number and form of the chambers. In one interesting variety there is on the surface of each chamber a clear patch quite free from puncta.

Bolivina nobilis Hantken, plate IV. fig. 4.

Bolivina nobilis Hantken, 1875 (1876), A magy. kir. földt. int. évkönyve, vol. iv. p. 56, pl. xv. fig. 4. *B. nobilis* (Hantk.) Chapman, 1892, Quart. Journ. Geol. Soc., vol. xlviii. p. 516, pl. xv. fig. 11. *B. nobilis* (Hantk.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 299, pl. viii. figs. 35–37.

This species, as instituted by von Hantken, seems to be nothing more nor less than a delicately striated variety of *B. punctata*; and the transition from one to the other, as far as surface ornamentation is concerned, is well shown in the specimen selected for illustration, as well as in that figured by Egger. In both of these the puncta, instead of being diffused equally over the whole of the surface, resolve themselves into longitudinal rows of dots. A tendency to become dimorphous is well shown by the figured specimen, in which the aperture of the last formed chamber is situated at the apex and remote from the suture. One of the examples figured by Brady* shows two uniserial following the biserial chambers. Chapman's figured specimen from the Gault, referred to above, appears to have the like peculiarity. This variation is however unusual in the species, and not normal, as in the forms here assigned to the genus *Bifarina*.

In the Malay Archipelago this species is abundant and widely distributed.

It is stated to have been found only in 'Challenger' dredgings from the South Pacific; but amongst the 'Gazelle' Stations there is one on the West Coast of Africa.

* Chall. Rept., 1884, pl. liii. fig. 14.

Bolivina textilarioides Reuss, plate IV. fig. 5.

Textularia variabilis var. *lævigata* Williamson, 1858, Rec. Foram. Gt. Britain, p. 77, pl. vi. fig. 168. *Bolivina textilarioides* Reuss, 1862 (1863), Sitzungsber. k. Akad. Wiss. Wien, vol. xlvi. p. 81, pl. x. fig. 1. *B. textilarioides* (Reuss) Terrigi, 1883, Atti Accad. Pontif. Nuovi Lincei, vol. xxxv. p. 191, pl. iii. fig. 32. *B. textilarioides* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 221, pl. xliii. fig. 1. *B. textularioides* (Reuss) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 554, pl. viii. fig. 25. *Bolivina textilarioides* Murray and Renard, 1891, Chall. Rept. 'On Deep-Sea Deposits,' pp. 110, 130, pl. xiii. fig. 3 [5, 22]. *B. textilarioides* (Reuss) Chapman, 1892, Journ. R. Micr. Soc., p. 757, pl. xii. fig. 12. *B. textularioides* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 297, pl. viii. figs. 13–16, 110–112. *B. textularioides* (Reuss) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 12, pl. i. fig. 8. *B. textularioides* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 41, pl. xvi. figs. 1–3.

This variable species is represented by two well marked forms, both of which are figured by Brady in the 'Challenger' Report. In the one which is here selected for illustration, the cell-walls are quite smooth and clear, with the exception of the sutures, which are covered with opaque granular matter. In the other form, which is well figured by Terrigi, the chambers are much inflated and the surface porous.

It is abundant in the Malay Archipelago, and is found, in greater or smaller quantities, at most of the Stations.

Bolivina dilatata Reuss.

Bolivina dilatata Reuss, 1850, Denkschr. k. Akad. Wiss. Wien, vol. i. p. 381, pl. xlviii. fig. 15. *Textularia variabilis* var. *spathulata* Williamson, 1858, Rec. Foram. Gt. Britain, p. 76, pl. vi. figs. 164, 165. *B. dilatata* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 221, pl. xliii. figs. 3, 6. *B. dilatata* (Reuss) Malagoli, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 376, pl. xiv. figs. 5–10. *B. dilatata* (Reuss) Terrigi, 1899, Mem. R. Acad. Lincei, ser. 4, vol. vi. p. 110, pl. v. fig. 7. *B. dilatata* Murray and Renard, 1891, Chall. Rept. 'On Deep-Sea Deposits,' p. 90, pl. xiii. fig. 2, 4. *B. dilatata* (Reuss) Terrigi, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 75, pl. i. fig. 29. *B. dilatata* (Reuss) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 33, pl. c. fig. 26. *B. dilatata* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 294, pl. viii. figs. 17–20. *B. dilatata* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 50, pl. ix. figs. 482–486, and pl. xiv. figs. 5–10. *B. dilatata* (Reuss) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 10, pl. 1, fig. 6.

The examples are few and small, but are distributed over both Areas.

According to Brady it is a North Atlantic species, but there are 'Gazelle' Stations in the Indian Ocean and in the South Pacific.

Bolivina tortuosa Brady.

Bolivina tortuosa Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi n.s. p. 57. *B. tortuosa* Brady, 1884, Chall. Rept., p. 420, pl. lii. figs. 31–34. *B. tortuosa* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 298, pl. viii. figs. 43, 44.

This form, which appears to be nothing more than a twisted variety of *B. dilatata*, is rare in the Malay Archipelago, although the specimens are characteristic and fine. It is most numerous in Area 1.

It is abundant at 'Challenger' Station No. 120, off Pernambuco, 675 fathoms. This locality is not mentioned by Brady in his Report, and the depth of water is greater than at any of the Stations recorded by him.

Bolivina robusta Brady.

Bolivina robusta Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 57. *B. robusta* Brady, 1884, Chall. Rept., p. 421, pl. liii. figs. 7–9. *B. robusta* (Brady) Egger, 1893, Abhandl. k. bayer. Ak. Wiss., Cl. II. vol. xviii. p. 294, pl. viii. figs. 31, 32.

This species, so widely distributed over the globe, yet so rarely recorded, occurs sparingly in the Malay Archipelago, at Stations in both Areas. The examples are rather feeble, and approach *B. dilatata*.

It is very abundant in the Tertiary clay of St. Erth.

Bolivina limbata Brady.

Bolivina limbata Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 57. *B. limbata* Brady, 1884, Chall. Rept., p. 419, pl. lii. figs. 26–28. *B. limbata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 300, pl. viii. figs. 10–12.

A few specimens occur in both Areas, but they are not quite typical, the margin being more rounded than usual.

The 'Gazelle' Stations are West Africa and Mauritius.

Bolivina lobata Brady, plate I. fig. 4.

Bolivina lobata Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 58. *B. lobata* Brady, 1884, Chall. Rept., p. 425, pl. liii. figs. 22, 23. *B. lobata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 300, pl. viii. figs. 55, 56.

In Part VII. of this Report, this species has already been figured and alluded to in relation to *Bigenerina fimbriata*.* It well illus-

* Possibly this form might as conveniently have been assigned to the genus *Bifarina*. See this Journal, *ante*, p. 6.

trates the difficulty of treating the dimorphous forms under the accepted system of classification, the simple and compound examples finding places in different genera.

It is by no means common in the Malay Archipelago.

There are four 'Challenger' Stations, all of which are near the Island of Papua. The 'Gazelle' localities are West Coast of Portugal, Mauritius, and West Australia.

Bolivina convallaria sp. n., plate IV. fig. 6.

Test elongate, straight, tapering towards the aboral end, peripheral edge lobulated; chambers numerous, inflated, with the peripheral margin rounded or acute; basal margin greatly projecting, reflected, and serrated. Sutures deeply sunk. Aperture large and variable in form. Length 0·47 mm.

This species varies greatly in the form and arrangement of the chambers and in the shape and size of the aperture. It may be described as resembling a much elongated *Bulimina marginata*, in which the chambers are loosely arranged biserially.

It is by no means common, but occurs at several Stations, mostly in Area 2.

Bolivina ænariensis Costa sp.

Brizalina ænariensis Costa, 1856, Atti Accad. Pontaniana, vol. vii. p. 297, pl. xv. fig. 1. *Bolivina ænariensis* Brady, 1882, Proc. R. Soc. Edin., vol. xi. p. 711—Table. *B. ænariensis* (Costa) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 221, pl. xliii. figs. 2–5. *B. ænariensis* (Costa) Malagoli, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 377, pl. xiv. figs. 11, 12. *B. nobilis* (Hantken) Terrigi, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 75, pl. i. fig. 30. *B. ænariensis* (Costa) Flint, 1899, Rept. U.S. Nat. Mus. for 1897, p. 292, pl. xxxvii. fig. 8.

In the Malay Archipelago typical specimens of this species are very rare, but passage forms related to both *B. robusta* and *B. nobilis* are common. In these the margin becomes more or less rounded and the striæ more numerous and irregular.

Bolivina Durrandii sp. n., plate IV. fig. 7.

Test elongate, lanceolate, compressed; peripheral margin acute and serrated; chambers slightly inflated, inferior margin acute and projecting; sutures deeply sunk and smooth; surface of chambers ornamented with broken irregular costæ. Aperture a long fusiform slit. Length 0·45 mm.

This species is closely allied to *B. lobata* Brady, and differs principally in being more compressed and in having the peripheral margin acute. In these respects also it differs from the *B. campanu-*

lata of Egger,* a minute form which he states may be the juvenile stage of *B. lobata*.

In one variety the test becomes longer and less compact in the arrangement of the chambers, which also become more inflated, thus showing a tendency to approach *B. convallaria*.

It is one of the commonest forms in the Malay Archipelago, and is found in abundance at most of the Stations.

Bolivina plicata d'Orbigny.

Bolivina plicata d'Orbigny, 1843, Foram. Amér. Mérid., p. 42, pl. viii. figs. 4–7. *B. plicata* (d'Orb.) Halkyard, 1889, Trans. and Ann. Rept. Manchester Micr. Soc., p. 35, pl. i. fig. 13. *B. plicata* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 51, pl. ix. figs. 487, 488. *B. plicata* (d'Orb.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 7.

It is difficult to reconcile, one with the other, d'Orbigny's figures of *B. plicata* and *B. costata*. In his 'Amérique Méridionale,' plate viii. fig. 4, is described as *B. plicata*, whilst in his 'Bassin Tertiaire de Vienne' a copy of this figure with the addition of a representation of its oral aspect, appears under the name of *B. costata*. In Carpenter's 'Introduction'† these figures are copied to illustrate *B. costata*.

B. plicata is very rare in the Malay Archipelago, and the few specimens found mostly resemble those from brackish water figured by Brady.‡

Bolivina costata d'Orbigny.

Bolivina costata d'Orbigny, 1843, Foram. Amér. Mérid., p. 62, pl. viii. figs. 8, 9. *B. costata* d'Orbigny, 1846, For. Foss. Vienne, p. 239, pl. xxi. figs. 44, 45. *B. costata* Brady, 1884, Chall. Rept., p. 426, pl. liii. figs. 26, 27.

The specimens are neither numerous nor in all respects characteristic. In contour they resemble those figured by Brady in the 'Challenger' Report, and as in them, the costæ are frequently interrupted and fail to bridge over the sutures. The aperture is however always without a thickened margin, which is, according to D'Orbigny, one of the characters of the species.

The 'Challenger' Stations are Raine Island, Torres Strait, 155 fathoms; Humboldt Bay, Papua, 37 fathoms; and off Amboyna, 15 to 20 fathoms. Goës records it from the Pacific, 730 fathoms.

Bolivina subangularis Brady.

Bolivina subangularis Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 59. *B. subangularis* Brady, 1884, Chall. Rept., p. 427, pl. liii. figs. 32, 33.

* Abhandl. k. bayer. Akad. Wiss., Cl. ii. vol. xviii. 1893, p. 301, pl. viii. figs. 53, 54.
† Page 196, pl. xii. fig. 22.
‡ Ann. and Mag. Nat. Hist., ser. 4, vol. vi. 1870, p. 302, pl. xii. fig. 7.

An unsatisfactory species at the best, and seemingly compounded of *B. plicata* and *B. costata*.

It occurs sparingly at a few Stations, mostly in Area 1.

'Challenger' Stations are, Philippine Islands, 95 fathoms; and off Raine Island, 155 fathoms.

Bolivina Hantkeniana Brady, plate IV. fig. 9.

Bolivina Hantkeniana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 58. *B. Hantkeniana* Brady, 1884, Chall. Rept., p. 424, pl. liii. figs. 16–18. *B. Hantkeniana* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 296, pl. viii. figs. 40–42.

The Malay examples of this species are very fine, and are subject to the usual variations of form and ornamentation, but they are mostly of the broadly oval modification, and are all more or less costate. The aperture is very large, and is provided with the tongue characteristic of the group.

The species occurs in considerable abundance at Station 2, and is found sparingly at some other Stations, but it is confined almost exclusively to Area 1.

'Challenger' Stations are Tahiti, 420 and 620 fathoms; off Kandavu, 210 and 255 fathoms; off New Hebrides, 130 fathoms; and off Aru Island, 800 fathoms.

The sole 'Gazelle' Station is West Australia, 359 metres.

Bolivina Karreriana Brady.

Bolivina Karreriana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 58. *B. Karreriana* Brady, 1884, Chall. Rept., p. 424, pl. liii. figs. 19–21. *B. Karreriana* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 299, pl. viii. figs. 38, 39.

In the Malay Archipelago the typical form of this species is very rare, although it occurs in both Areas.

With regard to its distribution, Brady writes, "This pretty species is abundant on the *Hyalonema*-ground, south of Japan, 345 fathoms. It occurs also in the South Pacific, at two points off Tahiti, 420 fathoms and 620 fathoms respectively; and in the South Atlantic, off Pernambuco, 675 fathoms."

'Gazelle' Stations are Mauritius, 411 metres; West Australia, 359 metres; and Fiji, 2432 metres.

Bolivina Karreriana var. *carinata* var. n., plate IV. fig. 8.

This variety differs from the type in having the peripheral margin acute or carinate, and the aperture is in every case provided with a more or less projecting tongue. It is much larger than the typical form. Length 0·80 mm.

Although described as a variety of *B. Karreriana*, it is equally allied to *B. Hantkeniana*, and may be treated as a passage form between the two.

It is by no means uncommon, and occurs at several Stations in both Areas.

Bolivina Schwageriana Brady, plate IV. fig. 10.

Bolivina Schwageriana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 58. *B. Schwageriana* Brady, 1884, Chall. Rept., p. 425, pl. liii. figs. 24, 25.

Of this very rare form, hitherto known only from the 'Challenger' examples, there are some fine specimens from Stations in both Areas. They differ from the type in possessing a few delicate costæ near the peripheral margin, but in all the aperture is provided with a projecting tongue.

All that is known of its distribution elsewhere may be summed up in Brady's words (Chall. Rept., p. 426): "The figured specimens were obtained, amongst others, from Humboldt Bay, Papua, 37 fathoms; besides which, a few somewhat doubtful examples have been found at Station 185, off Raine Island, Torres Strait, 155 fathoms."

Bolivina reticulata Hantken.

Bolivina reticulata Hantken, 1875 (1876), A magy. kir. földt. int. évkönyve, vol. iv. p. 56, pl. xv. fig. 6. *B. reticulata* (Hantken) Brady, 1884, Chall. Rept., p. 426, pl. liii. figs. 30, 31. *B. reticulata* (Hantken) Egger, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 295, pl. viii. figs. 33, 34.

This form is rather rare in the Malay Archipelago, although it occurs at Stations in both Areas. Some of the specimens have the peripheral margin rounded, as in the fossil examples; in others it is acute, as figured by Brady.

Mimosina gen. n.

Test typically spiral, conical or trochoid; chambers arranged bi- or tri-serially about the longitudinal axis. Aperture compound, consisting of two distinct orifices; one of them usually being a slit at the base of the inner wall of the final chamber; the other an opening varying in shape and situated near the apex of the chamber; the two orifices frequently being connected internally by means of a bent tube or septum. Shell-wall cellular or spongy.

This is a collection of forms which, but for certain characters they possess in common, might not only be assigned to the genera *Verneuilina*, *Bulimina*, and *Ehrenbergina*, but to recognised species in each of these genera. These distinguishing characters are the compound aperture and the cellular structure of the shell-wall. Something analogous to the first of these may be found in certain

members of the group of *Pulvinulina elegans* for which has been instituted the genus *Epistomina*; whilst something resembling the second may be found in the cell-walls of *Lagena Hertwigiana* and *Nodosaria intercellularis*.

Taken in the abstract these form a very natural group, and it becomes a question whether it is more convenient or even more zoologically accurate to treat them as a distinct genus, or to scatter them amongst already existing genera. It must be noted that they are not represented merely by a few obscure examples whose peculiarities might be ascribed to local influences, but all the forms here described are found in the greatest profusion all over the Malay Region. It is one of the problems of zoology that species so well marked and existing in such astonishing abundance should not hitherto have been observed in our existing oceans, nor in any of the geological formations.

Mimosina affinis sp. n., plate IV. fig. 11.

Test ovate; chambers globular, arranged tri-serially and rapidly increasing in size; sutures depressed. Sutural orifice a slit, usually cribrate; superior orifice a curved depression with the extremities rounded. Length 0·35 mm.

This is an isomorph of *Bulimina affinis* d'Orbigny, having little to distinguish it beyond the compound aperture and the structure of the shell-wall. The specimens are remarkably uniform in appearance, where there is any tendency to variation it is in the direction of *Mimosina spinulosa*.

It is the most abundant species of the genus, occurring in great profusion at nearly all the Stations in both Areas.

Mimosina spinulosa sp. n., plate IV. fig. 12.

Test elongate, trifacial, tapering towards the aboral end, margins acute; chambers slightly inflated, the marginal angle acute and slightly overlapping the preceding chambers, arranged tri-serially; sutures more or less depressed. Sutural orifice a narrow slit; superior orifice large and triangular or semilunar. Length 0·50 mm.

This is an isomorph of *Verneuilina*. It is very variable not only in length, but in the form and extent of inflation of the chambers, as well as in the degree of acuteness of the peripheral margins.

It is abundant, but less so than the other forms.

Mimosina spinulosa var., plate IV. fig. 13.

In this variety the marginal angles of the chambers are developed into lobes terminating in a spine. The chambers are more inflated and less regularly arranged, and the test is often contorted.

It is more abundant than the typical form, and the distribution is the same.

Mimosina hystrix sp. n., plate IV. fig. 14.

Test oblong ovate; tri-serial in the earlier stage, subsequently becoming bi-serial. Chambers inflated, those of the bi-serial portion provided with a spine at the rounded peripheral margin; sutures sunk. Aperture: both orifices circular or oval with a bordered margin. Length 0·50.

In some respects this form resembles *Ehrenbergina hystrix* Brady, but there is no real affinity. It differs from the other species in its dimorphous character as well as in the form and position of the sutural orifice.

It is abundant, but more local than the other species.

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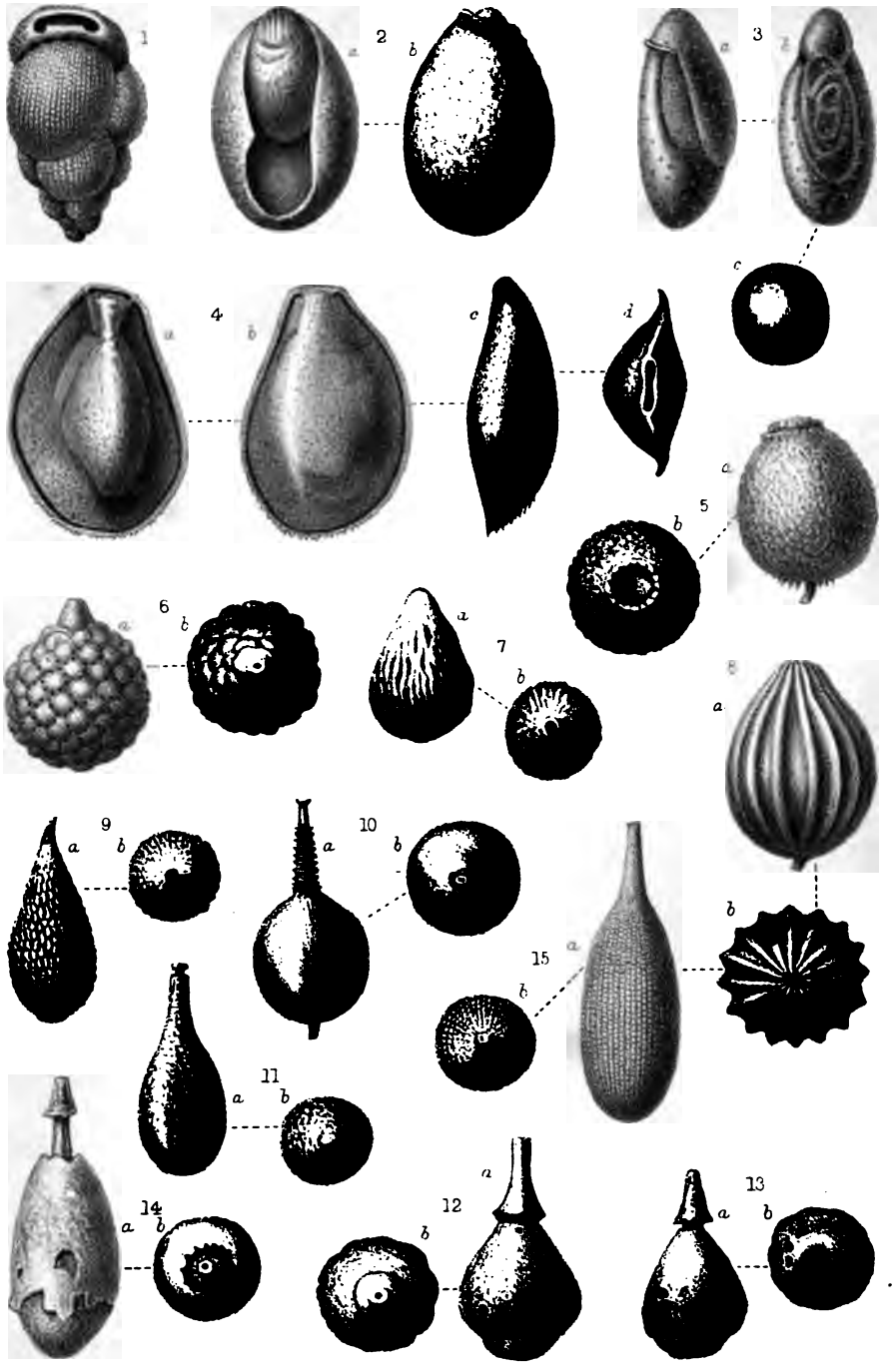

FWMillett del ad nat. West, Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1901, pp. 1–11.)

I.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part X.*

By Fortescue William Millett, F.R.M.S.

(*Read February 20th*, 1901.)

Plate I.

Sub-family **Cassidulininæ**.

Cassidulina d'Orbigny.

Cassidulina lævigata d'Orbigny.

Cassidulina lævigata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 282 (No. 1), pl. xv. figs. 4, 5;—Modèle No. 41. *C. lævigata* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 221, pl. xliii. fig. 11. *C. lævigata* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 111, pl. v. fig. 9. *C. lævigata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol.

EXPLANATION OF PLATE.

Fig. 1.—*Mimosina affinis* sp. n. × 90.
In fig. 11*a*, plate IV. the inferior aperture is wrongly depicted; the present figure is intended to correct it.
„ 2, 3.—*Chilostomella ovoidea* Reuss. Fig. 2 × 60; fig. 3 × 75.
„ 4.—*Seabrookia pellucida* Brady. × 135.
„ 5.—*Lagena ampulla-distoma* Ry. Jones. × 75.
„ 6. „ *rudis* Reuss. × 75.
„ 7. „ *variata* Brady. × 75.
„ 8. „ *costata* Williamson sp. var. × 100.
„ 9. „ *spumosa* sp. n. × 100.
„ 10. „ *lævis* Montagu sp., var. *distoma* Silvestri. × 100.
„ 11. „ *Chasteri* sp. n. × 100.
„ 12, 13. „ *pannosa* sp. n. Fig. 12 × 110; fig. 13 × 90.
„ 14. „ „ var. × 100.
„ 15. „ *foveolata* Reuss. × 100.

xviii. p. 302, pl. vii. figs. 47, 48, 54–56. *C. lævigata* (D'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 43, pl. viii. figs. 418–420. *C. lævigata* (d'Orb.) A. Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 103, pl. ii. fig. 10.

This is a very rare form in the Malay Archipelago, and has been observed only at Station 10, in Area 1.

Cassidulina crassa d'Orbigny.

Cassidulina crassa d'Orbigny, 1843, Foram. Amér. Mérid., p. 56, pl. vii. figs. 18–20. *C. crassa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 303, pl. vii. figs. 35, 36. *C. crassa* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 43, pl. viii. figs. 421, 422. *C. crassa* Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 19, pl. ix. fig. 19. *C. crassa* (d'Orb.) A. Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 104, pl. ii. figs. 11, 12. *C. crassa* (d'Orb.) Morton, 1897, Proc. Portland Nat. Hist. Soc., vol. ii. p. 116, pl. i. fig. 12. *C. crassa* (d'Orb.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897 (1899), p. 292, pl. xxxviii. fig. 3. *C. crassa* (d'Orb.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 11.

This is less rare than *C. lævigata*, and is found at Stations in both Areas.

Family *CHILOSTOMELLIDÆ.*

Chilostomella Reuss.

Chilostomella ovoidea Reuss, plate I. figs. 2, 3.

Chilostomella ovoidea Reuss, 1850, Denkschr. k. Akad. Wiss. Wien, vol. i. p. 380, pl. xlviii. fig. 12. *C. ovoidea* (Reuss) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 485, pl. xi. fig. 12. *C. ovoidea* (Reuss) Dreyer, 1891, Jenaische Zeitschr. für Naturwiss., vol. xxvi. p. 271. *C. ovoidea* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 305, pl. ix. figs. 1, 2. *C. ovoidea* (Reuss) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 201, pl. vi. fig. 2. *C. ovoidea* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 53, pl. ix. figs. 512–516.

In the robust form, fig. 2, the shell is dense and opaque, with a granular surface. The more attenuated specimens, fig. 3, are sufficiently transparent to allow of the internal chambers being seen, and the shell-wall is smooth, with a few opaque white dots scattered over its surface.

The principal variation is in the relative length of the successive chambers, and on this depends the comparative stoutness or attenuation of the contour of the test.

It is not uncommon at Station 25, in Area 2, but has not been observed at any other locality in the region.

Seabrookia Brady.

Seabrookia pellucida Brady, plate I. fig. 4.

Seabrookia pellucida Brady, 1890, Journ. R. Micr. Soc., p. 570, figs. 60, 1*a–c*, 2. *S. pellucida* (Brady) Wright, 1891, Proc. R. Irish Acad., ser. 3, vol. i. p. 476, pl. xx. fig. 5.

About twelve years ago Mr. W. H. Harris, then of Cardiff, obtained from the late Captain Seabrook some dredgings from the Java Seas. These were distributed amongst various rhizopodists, and excited much attention from the number of interesting forms contained in them. It was from these dredgings that Mr. Harris procured the specimens of the new genus *Seabrookia* which formed the subject of a paper by the late Dr. H. B. Brady, published in this Journal in the year 1890.

The differences between *Seabrookia* and *Chilostomella* are so slight that it is questionable if they are of generic value; quite as much variation exists amongst the forms assigned by common consent to the genus *Lagena*. The chief difference is in the form and position of the aperture; whilst in *Seabrookia* these are remarkably uniform, in *Chilostomella* they vary very much, as shown in the specimens figured by Sherborn and Chapman, Rzehak, Franzenau, and Silvestri. This is, however, a question which must be decided by future researches.

The Malay specimens vary so slightly that it is difficult to distinguish one individual from another.

It occurs at several Stations in both Areas, but is nowhere numerous.

The localities named by Brady and Joseph Wright are, off Cebu, 120 fathoms, Java Sea, 45 fathoms, and 'Challenger' material from Station 33, off Bermudas, 435 fathoms.

Family *LAGENIDÆ*.

Sub-family **Lageninæ**.

Lagena Walker and Boys.

Group of *Lagena globosa*.

Lagena globosa Montagu sp.

Serpula (*Lagena*) *lævis globosa* Walker and Boys, 1784, Test. Min., p. 3, pl. i. fig. 8. *Vermiculum globosum* Montagu, 1803, Test. Brit., p. 523. *Lagena globosa* (Montagu) Brown, 1844, Illustr. Rec. Conch. Gt. Brit., p. 126, pl. lvi. fig. 37. *L. globosa* var. *major* Uhlig, 1886, Jahrb. k. k. Geol. Reichs., vol. xxxvi. p. 167, fig. 1. *L. globosa*, (Montagu) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., p. 744,

pl. xiv. fig. 11. *L. globosa* (Montagu) Haeusler, 1887, Neues Jahrb. für Min., vol. i. p. 181, pl. iv. figs. 1–18. *L. globosa* (Montagu) Brady, 1888, Geol. Mag., dec. 3, vol. v. p. 481, pl. xiii. figs. 1–3. *L. globosa* (Montagu) Mariani, 1889, Boll. Soc. Geol. Italia, vol. vii. p. 285, pl. x. figs. 3, 4. *L. globosa* (Montagu) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 111, pl. v. fig. 10; pl. vi. figs. 4–6. *L. globosa* (Montagu) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 555, pl. ix. figs. 1, 4. *L. globosa* (Walker and Boys) Haeusler, 1890, Mém. Soc. Pal. Suisse, vol. xvii. p. 84, pl. xiii. figs. 5–9. *L. globosa* (Montagu) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 77, pl. ii. fig. 1. *L. globosa* (Montagu) Mariani, 1891, Boll. Soc. Geol. Italia, vol. x. p. 725, pl. xxi. fig. 7. *L. globosa* (Montagu) Chapman, 1893, Journ. R. Micr. Soc., p. 579, pl. viii. fig. 1. *L. globosa* (Montagu) Mariani, 1893, Ann. Istit. tecn. Udine, ser. 2, vol. xi. (p. 22) pl. i. fig. 7. *L. globosa* (Montagu) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 323, pl. x. fig. 69. *L. globosa* (Montagu) Haeusler, 1893, Abhandl. schweiz. pal. Gesell., vol. xx. p. 11, pl. i. figs. 1–13. *L. globosa* (Reuss) Grzybowski, 1894, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej-Krakowie, vol. xxix. p. 189, pl. i. fig. 15. *L. globosa* (W. and J.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 77, pl. xiii. fig. 741. *L. globosa* (Montagu) Jones, 1895, Paleont. Soc., p. 177, pl. i. fig. 32 (1866). *L. globosa* (Montagu) Perner, 1897, Česka Akad. Césare Františka Josefa (Paleont. Bohemica, No. 4) p. 19, pl. vii. figs. 4, 6, and fig. 17 in text. *L. globosa* (Montagu) Morton, 1897, Proc. Portland Sci. Nat. Hist., vol. ii. p. 116, pl. i. fig. 1. *L. globosa* (Montagu) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 102, pl. v. fig. 3. *L. globosa* (Montagu) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 306, pl. liii. fig. 4. *L. globosa* (W. and B.) Kiær, 1900, Rep. on Norwegian Fishery and Marine Investigation, vol. i. No. 7, p. 39, pl. fig. 17. *L. globosa* (Montagu) Silvestri, 1900, Mem. Pontif. Accad. Nuovi Lincei, vol. xvii. p. 244, pl. vi. figs. 30, 40.

Williamson, in his 'Recent Foraminifera of Great Britain,' having regard to the resemblance in contour of the tests, associates *L. lineata* with *L. globosa*; Brady, in his 'Challenger' Report on the Foraminifera, attaching greater importance to surface ornamentation, places it with *L. striata*. There are advantages and disadvantages connected with each method, but on the whole the *Lagenæ* seem to fall into more natural groups when arranged in accordance with the general shape of the test, than when the character of the surface is taken as the basis of classification.

There are usually assigned to *L. globosa* two distinct forms; in one of these the test is thin and inflated, inclined to be opaque, and possessing a well developed internal tube. In the other the test is very thick and transparent, the shape pyriform, and the aperture surrounded with radiating striæ. Amongst these latter are doubtless

included many specimens which are nothing more nor less than arrested growths of *Nodosaria* and *Polymorphina*.

Both forms are to be found in the Malay Archipelago, and they are evenly distributed over the whole of the region, although nowhere abundantly.

Lagena apiculata Reuss.

Oolina apiculata Reuss, 1851, Haidinger's Naturw. Abhandl., vol. iv. Abth. 1, p. 22, pl. i. fig. 1. *Lagena apiculata* Reuss, 1862, Sitzber. k. Akad. Wiss. Wien, vol. xlvi. (1863) p. 318, pl. i. figs. 1, 4–8, 10, 11. *L. apiculata* (Reuss) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., p. 744, pl. xiv. fig. 14. *L. apiculata* (Reuss) Haeusler, 1887, Neues Jahrb. für Min., vol. i. p. 182, pl. iv. figs. 19–30. *L. apiculata* (Reuss) Mariani, 1889, Boll. Soc. Geol. Ital., vol. vii. p. 285, pl. x. fig. 5. *L. globosa* (Montagu) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 554, pl. ix. fig. 2; and *L. apiculata* (Reuss), p. 555, pl. ix. figs. 6, 7, 9–11. *L. globosa* (Montagu) Haeusler, 1890, Mém. Soc. Pal. Suisse, vol. xvii. p. 84, pl. xiii. figs. 3–10; and *L. apiculata* (Reuss) p. 85, pl. xiii. figs. 11, 12, 14, and pl. xv. fig. 43. *L. apiculata* var. *odontostoma* de Amicis, 1893, Boll. Soc. Geol. Italia, vol. xii. p. 352, pl. iii. fig. 9. *L. apiculata* (Reuss) Haeusler, 1893, Abhandl. schweiz. pal. Gesell., vol. xx. p. 14, pl. i. figs. 25–27, 34, 35. *L. apiculata* (Reuss) Chapman, 1893, Journ. R. Micr. Soc., p. 581, pl. viii. figs. 2, 3. *L. apiculata* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 80, pl. xiii. fig. 747. *L. apiculata* (Reuss) Jones, 1895, Paleont. Soc., p. 179, pl. i. fig. 27 (1866). *L. apiculata* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 103, pl. v. fig. 32. *L. apiculata* (Reuss) Chapman, 1900, Quart. Journ. Geol. Soc., vol. lvi. p. 258, pl. xv. fig. 3.

Bearing in mind that most, if not all, of the *Lagenæ* have their apiculate condition, it seems unnecessary to endow each with a separate name; but pending an entire reform of the classification, it may cause less inconvenience for the present if these names be retained.

The form is rare in the Malay Archipelago, but is widely distributed.

Lagena ampulla-distoma Ry. Jones, plate I. fig. 5.

L. vulgaris var. *ampulla-distoma* Ry. Jones, 1872, Trans. Linn. Soc., vol. xxx. p. 63, pl. xix. fig. 52. *L. ampulla-distoma* (Ry. Jones) Brady, 1884, Chall. Rept., p. 458, pl. lvii. fig. 5.

This is a form of *L. globosa* which is not only apiculate, but roughened on the surface.

The process at the base of the acuminate *Lagenæ* may be either solid, or, as in the present instance, tubular. Whether or not the difference is worthy of varietal distinction is very doubtful.

It is by no means a rare form in the Malay Archipelago, and the

specimens are well developed. It occurs in considerable abundance all over the Region.

Rymer Jones procured it from ten miles south of Sandalwood Island, in the Java Seas, 1080 fathoms. The 'Challenger' Station is Raine Island, Torres Strait, 155 fathoms. There seems to be no other record of its occurrence.

Lagena hispida Reuss.

"Sphærulæ *hispidæ*" Soldani, 1798, Testaceographia, vol. ii. p. 53, pl. xvii. V, X. *Lagena hispida* Reuss, 1858, Zeitschr. deutsch. geol. Gesell., vol. x. p. 434. *L. hispida* (Reuss) Haeusler, 1887, Neues Jahrb. für Min., vol. i. p. 185, pl. v. fig. 7–11. *L. hispida* (Reuss) Haeusler, 1890, Mém. Soc. Pal. Suisse, vol. xvii. p. 88, pl. xiii. figs. 21–24. *L. hispida* (Reuss) Chapman, 1893, Journ. R. Micr. Soc., p. 582, pl. viii. figs. 9, 10. *L. hispida* (Reuss) Haeusler, 1893, Abhandl. schweiz. pal. Gesell, vol. xx. p. 16, pl. i. figs. 36–47. *L. hispida* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 307, pl. liii. fig. 8.

This variety occurs in considerable abundance, and is widely distributed in the Malay Archipelago. The specimens have all the usual variations of form and structure, and comprise hispid conditions of *L. globosa*, *L. acuminata*, and *L. lævis*.

Lagena aspera Reuss.

Lagena aspera Reuss, 1861, Sitzungsber. k. Akad. Wiss. Wien, vol. xliv. p. 305, pl. i. fig. 5. *L. aspera* (Reuss) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 78, pl. ii. fig. 1. *L. aspera* (Reuss) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 337, pl. xiv. figs. 10–12. *L. aspera* (Reuss) Haeusler, 1887, Neues Jahrb. für Min., vol. i. p. 185, pl. v. figs. 14–18. *L. aspera* (Reuss) Haeusler, 1890, Mém. Soc. Pal. Suisse, p. 89, pl. xiii. figs. 25, 26. *L. aspera* (Reuss) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 77, pl. ii. fig. 3. *L. aspera* (Reuss) Haeusler, 1893, Abhandl. schweiz. pal. Gesell., vol. xx. p. 15, pl. i. figs. 52–59. *L. aspera* (Reuss) Woodward and Thomas, 1893, Final Rept. Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 35, pl. D, fig. 1. *L. aspera* (Reuss) Chapman, 1893, Journ. R. Micr. Soc., p. 582, pl. viii. fig. 8. *L. aspera* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 106, pl. v. fig. 10.

This form is widely distributed in the Malay Archipelago, although more rare than *L. hispida*. The examples have the like variation of form, the most common being that of *L. lineata*.

Lagena rudis Reuss, pl. I. fig. 6.

Lagena rudis Reuss, 1863, Bull. Acad. Roy. Belgique, sér. 2, vol. xv. p. 145, pl. i. fig. 17. *L. rudis* Reuss, 1862, Sitzungsber. k.

Akad. Wiss. Wien, vol. xlvi. (1863) p. 336, pl. vi. fig. 82. *Entosolenia rudis* (Reuss) Möbius, 1880, Meersfauna Insel Mauritius, p. 90, pl. viii. fig. 10.

Viewed by reflected light the surface appears, as described by Reuss, to be bedecked with knobs, between which lie weak and irregular dimples. By transmitted light these dimples are resolved into a reticulate system, which is continued over the entire test beneath the protuberances.

It is a very rare form, and has been noticed only in Area 2.

Lagena variata Brady, plate I. fig. 7.

Lagena variata Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 61. *L. variata* Brady, 1884, Chall. Rept., p. 461, pl. lxi. fig. 1.

This variety is not uncommon at Station 22, and occurs also at Station 10. The examples are rather feeble.

The only 'Challenger' Station is off East Monceeur Island, Bass Strait, 38 fathoms.

Lagena lineata Williamson sp.

Entosolenia lineata Williamson, 1848, Ann. and Mag. Nat. Hist., ser. 2, vol. i. p. 18, pl. ii. fig. 18. *Lagena lineata* (Will.) Reuss, 1862, Sitzungsber. k. Akad. Wiss. Wien, vol. xlvi. p. 328, pl. iv. fig. 48. *L. caudata* (d'Orb.) Balkwill and Millett, 1884, Journ. Micr. vol. iii. p. 78, pl. i. fig. 9. *L. lineata* (Will.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 336, pl. xiv. figs. 13–16. *L. lineata* (Will.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 222, pl. xliv. fig. 33. *L. lineata* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 326, pl. x. figs. 29, 30.

The examples of this variety are typical, and are widely distributed in the Malay Archipelago, but are nowhere abundant.

Besides various localities on the west coast of Europe, it has been recorded from the Abrolhos Bank, Tristan d'Acunha, Kerguelen Island, and West Australia.

Lagena costata Williamson sp., plate I. fig. 8.

Entosolenia costata Williamson, 1858, Rec. Foram. Gt. Britain, p. 9, pl. i. fig. 18. *E. costata* (Will.) Dawson, 1859, Canad. Nat., vol. iv. p. 29, figs. 6, 7. *Lagena costata* (Will.) Reuss, 1862, Sitzungsber. k. Akad. Wiss. Wien, vol. xlvi. (1863) p. 329, pl. iv. fig. 54. *L. costata* (Will.) Wright, 1877, Proc. Belfast Field Club (App.), p. 103, pl. iv. figs. 11–13. *L. costata* (Will.) Terquem, 1882, Mém. Soc. Géol. Fr., sér. 3, vol. ii. p. 27, pl. ix. fig. 11. *L. costata* (Will.) Balkwill and Wright, 1885, Trans. R. Irish Acad. vol. xxviii. (Sci.) p. 338, pl. xiv. figs. 3–5. *L. costata* (Will.) Haeusler, 1887, Neues Jahrb. für Min., vol. i. p. 184, pl. v. fig. 5; and *L. striata* (d'Orb.)

p. 184, pl. v. fig. 6. *L. costata* (Will.) Haeusler, 1890, Mém. Soc. Pal. Suisse, vol. xvii. p. 88, pl. xv. fig. 42. *L. gracilis* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 328, pl. x. fig. 33.

This form varies very much in the character of the sculpture of its surface. The figured specimen resembles the *L. mucronulata* of Reuss.*

It is not very numerous in the Malay Archipelago, but occurs at several Stations in both Areas.

Lagena acuticosta Reuss.

L. acuticosta Reuss, 1861, Sitzungsber. k. Akad. Wiss. Wien, vol. xliv. p. 305, pl. i. fig. 4. *L. sulcata* var. *acuticosta* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 222, pl. xiiv. figs. 26, 31. *L. acuticosta* (Reuss) Chapman, 1893, Journ. R. Micr. Soc., p. 583, pl. viii. fig. 11. *L. acuticosta* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 329, pl. x. figs. 47, 48, 82, 83. *L. acuticosta* (Reuss) Jones, 1895, Paleont. Soc., p. 188, pl. i. figs. 42, 43 (1866). *L. acuticosta* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 106, pl. vi. fig. 62.

This variety, which can hardly be separated from *L. costata*, has in the Malay Archipelago the same distribution, and occurs in about equal quantities.

Lagena melo d'Orbigny sp.

Oolina melo d'Orbigny, 1843, Foram. Amér. Mérid., p. 20, pl. v. fig. 9. *Lagena melo* (d'Orb.) Jones, Parker, and Brady, 1866, Paleont. Soc., p. 38, pl. i. fig. 35. *L. melo* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., p. 222, pl. xliv. figs. 21, 24. *L. melo* (d Orb.) Jones, 1895, Paleont. Soc., p. 192, fig. 20.

This variety is but poorly represented, the examples being few and insignificant.

Lagena hexagona Williamson.

Entosolenia squamosa var. *hexagona* Williamson, 1848, Ann. and Mag. Nat. Hist., ser. 2, vol. i. p. 20, pl. ii. fig. 23. *Lagena hexagona* (Will.) Jones, 1895, Paleont. Soc., p. 193, pl. vi. fig. 7, and w.c. fig. 21. *L. hexagona* (Will.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 15.

In the Malay Archipelago this is the best represented of the reticulated forms. The specimens are well grown, abundant, and are distributed all over the Region.

Lagena reticulata Macgillivray sp.

Lagenula reticulata Macgillivray, 1843, Hist. Moll. Animal. Aberdeen, &c., p. 38. *Lagena reticulata* (Macgill.) Reuss, 1862,

* Sitzungsber. k. Akad. Wiss. Wien, vol. xlvi. 1862 (1863) p. 329, pl. iv. fig. 52.

Sitzungsber. k. Akad. Wiss. Wien, vol. xliv. p. 335, pl. v. figs. 67, 68. *L. hexagona*? (Will.) var. Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 79, pl. i. fig. 10. *Entosolenia squamosa* (Montagu) Dawson, 1886, Handb. Zool., p. 44, fig. 33. *L. hexagona* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 326, pl. x. fig. 60. *L. hexagona* (Will.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol., xxv. p. 80, pl. xiii. fig. 746. *L. reticulata* (Macgill.) Jones, 1895, Paleont. Soc., p. 195, pl. iv. fig. 7 (1866). *L. hexagona* (Will.) Silvestri, 1896, Mem. Pontif. Acad. Nuovi Lincei, vol. xii. p. 117, pl. ii. fig. 19.

This variety, distinguished by the irregularity of its meshes, is very rare in the Malay Archipelago, and the examples are by no means well developed.

Lagena squamosa Montagu sp.

Vermiculum squamosum Montagu, 1803, Test. Brit., p. 526, pl. xiv. fig. 2. *Lagena squamosa* (Montagu) Brown, 1827, Illustr. Rec. Conch. Gt. Brit., pl. i. fig. 32. *L. squamosa* (Montagu) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 340, pl. xiv. fig. 9. *L. squamosa* (Montagu) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 326, pl. x. figs. 58, 59. *L. squamosa* (Montagu) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 79, pl. xiii. fig. 745. *L. squamosa* (Montagu) Jones, 1895, Paleont. Soc., p. 196, w.c. fig. 19.

Although not abundant, the examples are pretty evenly distributed over the whole of the Region, and have all the characters of the species, with little or no variation.

Lagena spumosa sp. n. plate I. fig. 9.

Test pyriform; shell substance a thick covering of vesicular matter overlying a dense internal layer. Aperture a conical transparent tube situated at the apex of the test. Length 0·25 mm.

This is a very interesting form, having the shell substance in two distinct layers, and differing from all the other species of the genus in its spongy outer coating.

It is very rare, and has been found only at Station 25 in Area 2.

Group of *Lagena lævis*.

Lagena lævis Montagu sp.

"Serpula (*Lagena*) lævis ovalis" Walker and Boys, 1784, Test. Min., p. 3, pl. i. fig. 9. *Vermiculum læve* (W. & B.) Montagu, 1803, Test. Brit., p. 524. *Lagena lævis* (W. & J.) Williamson, 1848, Ann. and Mag. Nat. Hist., ser. ii. vol. i. p. 12, pl. i. figs. 1, 2. *L. lævis* (W. & J.) Jones, 1884, Quart. Journ. Geol. Soc., vol. xi. p. 769, pl.

xxxiv. fig. 3. *L. vulgaris* Gümbel, 1885, Geol. Bayern, Th. 1, Lief. 2, p. 422, fig. 266[6]. *L. lævis* (Montagu) Haeusler, 1887, Neues Jahrb. für Min., p. 181, pl. iv. figs. 31–38. *L. lævis* (Montagu) Malagoli, 1887, Atti Soc. Nat. Modena (Rend.), ser. 3, vol. iii. p. 109, pl. i. fig. 7. *L. lævis* (Montagu) Brady, 1888, Geol. Mag., dec. 3, vol. v. p. 482, pl. xiii. figs. 6–10. *L. lævis* (Montagu) Fornasini, 1889, Minute forme Rizopod. Retic., pl. fig. 8. *L. lævis* (Montagu) Haeusler, 1890, Mém. Soc. Pal. Suisse, vol. xvii. p. 86, pl. xiii. fig. 20. *L. lævis* (Montagu) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4, vol. x. p. 466, pl. fig. 1. *L. lævis* (Montagu) Mariani, 1891, Boll. Soc. Geol. Italia, vol. x. p. 725, pl. xxi. fig. 9. *L. lævis* (Montagu) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 431, pl. ii. fig. 1. *L. tubulifera* Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xviii. p. 324, pl. x. figs. 6, 7. *L. lævis* (Montagu) Mariani, 1893, Ann. R. Ist. Udine, ser. 2, vol. xi. p. 22, pl. i. fig. 8. *L. lævis* (Montagu) Chapman, 1893, Journ. R. Micr. Soc., p. 581, pl. viii. fig. 5. *L. lævis* (Montagu) Haeusler, 1893, Mém. Soc. Pal. Suisse, vol. xx. p. 13, pl. i. figs. 14–16. *L. lævis* (Montagu) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 74, pl. xiii. figs. 719–722. *L. lævis* (Montagu) Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 24, pl. ii. fig. 11. *L. lævis* (Montagu) Jones, 1895, Paleont. Soc., p. 181, pl. i. fig. 28 (1866). *L. lævis* (Montagu) Fornasini, 1898, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 210, pl. fig. 19. *L. lævis* (Montagu) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 102, pl. v. fig. 2; and *L. clavata* (d'Orb.) p. 103, pl. v. fig. 16. *L. lævis* (Montagu) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 306, pl. liii. fig. 6. *L. lævis* (Montagu) Chapman, 1900, Quart. Journ. Geol. Soc., vol. lvi. p. 258, pl. xv. fig. 2. *L. lævis* (Montagu) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 12. *L. lævis* (Montagu) Silvestri, 1900, Mem. Pontif. Accad. Nuovi Lincei, vol. xvii. p. 244, pl. vi. fig. 56.

This ubiquitous form occurs in great profusion at nearly all the Stations, and exhibits the usual variations of form between *L. globosa* and *L. apiculata*.

Lagena lævis var. *distoma* Silvestri, plate I. fig. 10.

Lagena lævis (Montagu) Silvestri, 1900, Mem. Pontif. Accad. Nuovi Lincei, vol. xvii. p. 244, pl. vi. figs. 74, 75.

This apiculate variety is by no means uncommon at Station 25, and has been observed at other Stations. Some of the examples are very finely striated, indicating an affinity with *L.* (*Amphorina*) *Lyellii* Seguenza.*

Prof. Silvestri's examples are from a neogene deposit, supposed to be miocene, in the Alta Valle Tiberina.

* Foram. Monotal. Mioc. Messina, 1862, p. 52, pl. i. fig. 40.

Lagena Chasteri sp. n., plate I. fig. 11.

Test flask-shaped; rounded at the base. Shell substance consisting of a mass of vesicular matter enclosed between two layers of dense clear substance. Surface smooth and polished. Length 0·28 mm.

That this is closely allied to *L. spumosa* is shown by the tendency of the two forms to coalesce.

The vesicular matter sparkling through the transparent outer layer causes the test to resemble the mineral avanturine.

It has been observed only at Station 25, where it is not uncommon.

Lagena pannosa sp. n., plate I. figs. 12–14.

Test flask- or decanter-shaped, with usually a constriction at the place where the neck joins the body. Shell substance composed of an inner layer of hard matter, on which rests a thick coating of opaque granular substance, which exhibits a strong tendency to disintegrate. Between the middle and base of the body are two zones of irregular indentations. Length 0·30 mm.

This interesting member of the compound-wall series is well marked by the tendency of the granular portion to disintegrate and expose portions of the internal layer; to a less extent this feature is apparent also in *L. spumosa*.

In the variety fig. 14 the disintegration is more irregular, and the zones are not produced.

The *L. tubifero-squamosa* Parker and Jones,* fossil from Grignon, with its "decaying outer layers," appears to be a member of this group.

It occurs at many Stations in both Areas, but is most abundant at Station 25, which appears to be the headquarters of the compound-wall series.

Lagena foveolata Reuss, plate I. fig. 15.

Lagena foveolata Reuss, 1862 (1863) Sitzungsber. k. Akad. Wiss. Wien, vol. xlvi. p. 332, pl. v. fig. 65. *Lagena* No. 25, Von Schlicht, 1870, Foram. Septarienthones von Pietzpuhl, p. 10, pl. iii. fig. 25.

This is a very beautiful form, the minuteness and regularity of the sculpture causing the test to shine with great lustre.

The cells are smaller, and have less space between them than in the example figured by Reuss.

It occurs, very sparingly, at Station 25, and has not been observed elsewhere.

* Phil. Trans., 1862, p. 354, pl. xviii. fig. 7.

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STAMFORD STREET AND CHARING CROSS.

An unsatisfactory species at the best, and seemingly compounded of *B. plicata* and *B. costata*.

It occurs sparingly at a few Stations, mostly in Area 1.

'Challenger' Stations are, Philippine Islands, 95 fathoms; and off Raine Island, 155 fathoms.

Bolivina Hantkeniana Brady, plate IV. fig. 9.

Bolivina Hantkeniana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 58. *B. Hantkeniana* Brady, 1884, Chall. Rept., p. 424, pl. liii. figs. 16–18. *B. Hantkeniana* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 296, pl. viii. figs. 40–42.

The Malay examples of this species are very fine, and are subject to the usual variations of form and ornamentation, but they are mostly of the broadly oval modification, and are all more or less costate. The aperture is very large, and is provided with the tongue characteristic of the group.

The species occurs in considerable abundance at Station 2, and is found sparingly at some other Stations, but it is confined almost exclusively to Area 1.

'Challenger' Stations are Tahiti, 420 and 620 fathoms; off Kandavu, 210 and 255 fathoms; off New Hebrides, 130 fathoms; and off Aru Island, 800 fathoms.

The sole 'Gazelle' Station is West Australia, 359 metres.

Bolivina Karreriana Brady.

Bolivina Karreriana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 58. *B. Karreriana* Brady, 1884, Chall. Rept., p. 424, pl. liii. figs. 19–21. *B. Karreriana* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 299, pl. viii. figs. 38, 39.

In the Malay Archipelago the typical form of this species is very rare, although it occurs in both Areas.

With regard to its distribution, Brady writes, "This pretty species is abundant on the *Hyalonema*-ground, south of Japan, 345 fathoms. It occurs also in the South Pacific, at two points off Tahiti, 420 fathoms and 620 fathoms respectively; and in the South Atlantic, off Pernambuco, 675 fathoms."

'Gazelle' Stations are Mauritius, 411 metres; West Australia, 359 metres; and Fiji, 2432 metres.

Bolivina Karreriana var. *carinata* var. n., plate IV. fig. 8.

This variety differs from the type in having the peripheral margin acute or carinate, and the aperture is in every case provided with a more or less projecting tongue. It is much larger than the typical form. Length 0·80 mm.

Although described as a variety of *B. Karreriana*, it is equally allied to *B. Hantkeniana*, and may be treated as a passage form between the two.

It is by no means uncommon, and occurs at several Stations in both Areas.

Bolivina Schwageriana Brady, plate IV. fig. 10.

Bolivina Schwageriana Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 58. *B. Schwageriana* Brady, 1884, Chall. Rept., p. 425, pl. liii. figs. 24, 25.

Of this very rare form, hitherto known only from the 'Challenger' examples, there are some fine specimens from Stations in both Areas. They differ from the type in possessing a few delicate costæ near the peripheral margin, but in all the aperture is provided with a projecting tongue.

All that is known of its distribution elsewhere may be summed up in Brady's words (Chall. Rept., p. 426): "The figured specimens were obtained, amongst others, from Humboldt Bay, Papua, 37 fathoms; besides which, a few somewhat doubtful examples have been found at Station 185, off Raine Island, Torres Strait, 155 fathoms."

Bolivina reticulata Hantken.

Bolivina reticulata Hantken, 1875 (1876), A magy. kir. földt. int. évkönyve, vol. iv. p. 56, pl. xv. fig. 6. *B. reticulata* (Hantken) Brady, 1884, Chall. Rept., p. 426, pl. liii. figs. 30, 31. *B. reticulata* (Hantken) Egger, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 295, pl. viii. figs. 33, 34.

This form is rather rare in the Malay Archipelago, although it occurs at Stations in both Areas. Some of the specimens have the peripheral margin rounded, as in the fossil examples; in others it is acute, as figured by Brady.

Mimosina gen. n.

Test typically spiral, conical or trochoid; chambers arranged bi- or tri-serially about the longitudinal axis. Aperture compound, consisting of two distinct orifices; one of them usually being a slit at the base of the inner wall of the final chamber; the other an opening varying in shape and situated near the apex of the chamber; the two orifices frequently being connected internally by means of a bent tube or septum. Shell-wall cellular or spongy.

This is a collection of forms which, but for certain characters they possess in common, might not only be assigned to the genera *Verneuilina*, *Bulimina*, and *Ehrenbergina*, but to recognised species in each of these genera. These distinguishing characters are the compound aperture and the cellular structure of the shell-wall. Something analogous to the first of these may be found in certain

members of the group of *Pulvinulina elegans* for which has been instituted the genus *Epistomina*; whilst something resembling the second may be found in the cell-walls of *Lagena Hertwigiana* and *Nodosaria intercellularis*.

Taken in the abstract these form a very natural group, and it becomes a question whether it is more convenient or even more zoologically accurate to treat them as a distinct genus, or to scatter them amongst already existing genera. It must be noted that they are not represented merely by a few obscure examples whose peculiarities might be ascribed to local influences, but all the forms here described are found in the greatest profusion all over the Malay Region. It is one of the problems of zoology that species so well marked and existing in such astonishing abundance should not hitherto have been observed in our existing oceans, nor in any of the geological formations.

Mimosina affinis sp. n., plate IV. fig. 11.

Test ovate; chambers globular, arranged tri-serially and rapidly increasing in size; sutures depressed. Sutural orifice a slit, usually cribrate; superior orifice a curved depression with the extremities rounded. Length 0·35 mm.

This is an isomorph of *Bulimina affinis* d'Orbigny, having little to distinguish it beyond the compound aperture and the structure of the shell-wall. The specimens are remarkably uniform in appearance, where there is any tendency to variation it is in the direction of *Mimosina spinulosa*.

It is the most abundant species of the genus, occurring in great profusion at nearly all the Stations in both Areas.

Mimosina spinulosa sp. n., plate IV. fig. 12.

Test elongate, trifacial, tapering towards the aboral end, margins acute; chambers slightly inflated, the marginal angle acute and slightly overlapping the preceding chambers, arranged tri-serially; sutures more or less depressed. Sutural orifice a narrow slit; superior orifice large and triangular or semilunar. Length 0·50 mm.

This is an isomorph of *Verneuilina*. It is very variable not only in length, but in the form and extent of inflation of the chambers, as well as in the degree of acuteness of the peripheral margins.

It is abundant, but less so than the other forms.

Mimosina spinulosa var., plate IV. fig. 13.

In this variety the marginal angles of the chambers are developed into lobes terminating in a spine. The chambers are more inflated and less regularly arranged, and the test is often contorted.

It is more abundant than the typical form, and the distribution is the same.

Mimosina hystrix sp. n., plate IV. fig. 14.

Test oblong ovate; tri-serial in the earlier stage, subsequently becoming bi-serial. Chambers inflated, those of the bi-serial portion provided with a spine at the rounded peripheral margin; sutures sunk. Aperture: both orifices circular or oval with a bordered margin. Length 0·50.

In some respects this form resembles *Ehrenbergina hystrix* Brady, but there is no real affinity. It differs from the other species in its dimorphous character as well as in the form and position of the sutural orifice.

It is abundant, but more local than the other species.

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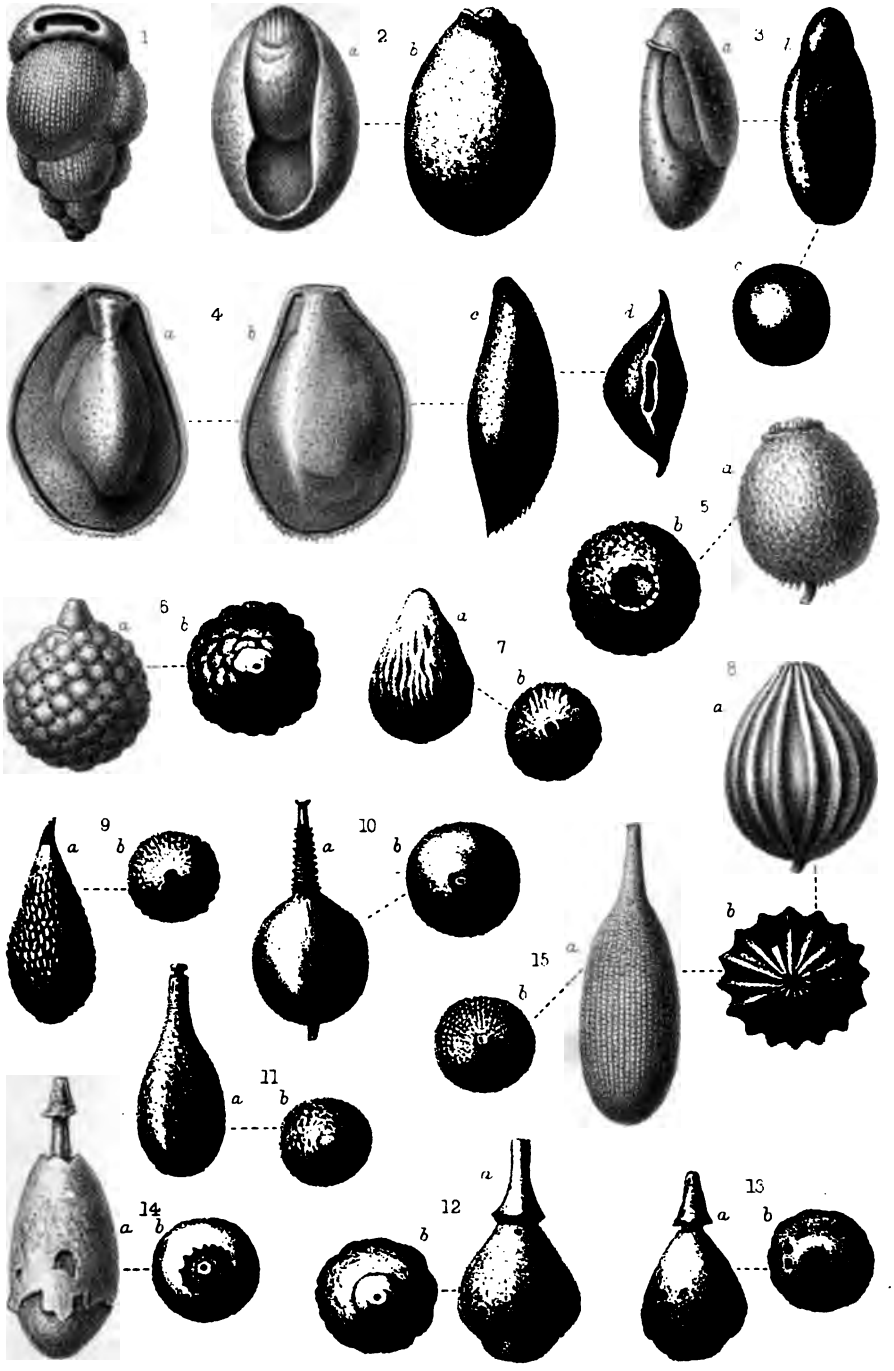

FW.Millett del.ad nat. West, Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1901, pp. 1–11.)

I.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part X.*

By Fortescue William Millett, F.R.M.S.

(*Read February 20th*, 1901.)

Plate I.

Sub-family **Cassidulininæ**.

Cassidulina d'Orbigny.

Cassidulina lævigata d'Orbigny.

Cassidulina lævigata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 282 (No. 1), pl. xv. figs. 4, 5;—Modèle No. 41. *C. lævigata* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 221, pl. xliii. fig. 11. *C. lævigata* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 111, pl. v. fig. 9. *C. lævigata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol.

EXPLANATION OF PLATE.

Fig. 1.—*Mimosina affinis* sp. n. × 90.
In fig. 11*a*, plate IV. the inferior aperture is wrongly depicted; the present figure is intended to correct it.
„ 2, 3.—*Chilostomella ovoidea* Reuss. Fig. 2 × 60; fig. 3 × 75.
„ 4.—*Seabrookia pellucida* Brady. × 135.
„ 5.—*Lagena ampulla-distoma* Ry. Jones. × 75.
„ 6. „ *rudis* Reuss. × 75.
„ 7. „ *variata* Brady. × 75.
„ 8. „ *costata* Williamson sp. var. × 100.
„ 9. „ *spumosa* sp. n. × 100.
„ 10. „ *lævis* Montagu sp., var. *distoma* Silvestri. × 100.
„ 11. „ *Chasteri* sp. n. × 100.
„ 12, 13. „ *pannosa* sp. n. Fig. 12 × 110; fig. 13 × 90.
„ 14. „ „ var. × 100.
„ 15. „ *foveolata* Reuss. × 100.

xviii. p. 302, pl. vii. figs. 47, 48, 54–56. *C. lævigata* (D'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 43, pl. viii. figs. 418–420. *C. lævigata* (d'Orb.) A. Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 103, pl. ii. fig. 10.

This is a very rare form in the Malay Archipelago, and has been observed only at Station 10, in Area 1.

Cassidulina crassa d'Orbigny.

Cassidulina crassa d'Orbigny, 1843, Foram. Amér. Mérid., p. 56, pl. vii. figs. 18–20. *C. crassa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 303, pl. vii. figs. 35, 36. *C. crassa* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 43, pl. viii. figs. 421, 422. *C. crassa* Egger, 1895, Jahresbericht xvi. Naturhist. Ver. Passau, p. 19, pl. ix. fig. 19. *C. crassa* (d'Orb.) A. Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 104, pl. ii. figs. 11, 12. *C. crassa* (d'Orb.) Morton, 1897, Proc. Portland Nat. Hist. Soc., vol. ii. p. 116, pl. i. fig. 12. *C. crassa* (d'Orb.) Flint, 1899, Rept. U.S. Nat. Mus. for 1897 (1899), p. 292, pl. xxxviii. fig. 3. *C. crassa* (d'Orb.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 11.

This is less rare than *C. lævigata*, and is found at Stations in both Areas.

Family *CHILOSTOMELLIDÆ.*

Chilostomella Reuss.

Chilostomella ovoidea Reuss, plate I. figs. 2, 3.

Chilostomella ovoidea Reuss, 1850, Denkschr. k. Akad. Wiss. Wien, vol. i. p. 380, pl. xlviii. fig. 12. *C. ovoidea* (Reuss) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 485, pl. xi. fig. 12. *C. ovoidea* (Reuss) Dreyer, 1891, Jenaische Zeitschr. für Naturwiss., vol. xxvi. p. 271. *C. ovoidea* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 305, pl. ix. figs. 1, 2. *C. ovoidea* (Reuss) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 201, pl. vi. fig. 2. *C. ovoidea* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 53, pl. ix. figs. 512–516.

In the robust form, fig. 2, the shell is dense and opaque, with a granular surface. The more attenuated specimens, fig. 3, are sufficiently transparent to allow of the internal chambers being seen, and the shell-wall is smooth, with a few opaque white dots scattered over its surface.

The principal variation is in the relative length of the successive chambers, and on this depends the comparative stoutness or attenuation of the contour of the test.

It is not uncommon at Station 25, in Area 2, but has not been observed at any other locality in the region.

Seabrookia Brady.

Seabrookia pellucida Brady, plate I. fig. 4.

Seabrookia pellucida Brady, 1890, Journ. R. Micr. Soc., p. 570, figs. 60, 1*a–c*, 2. *S. pellucida* (Brady) Wright, 1891, Proc. R. Irish Acad., ser. 3, vol. i. p. 476, pl. xx. fig. 5.

About twelve years ago Mr. W. H. Harris, then of Cardiff, obtained from the late Captain Seabrook some dredgings from the Java Seas. These were distributed amongst various rhizopodists, and excited much attention from the number of interesting forms contained in them. It was from these dredgings that Mr. Harris procured the specimens of the new genus *Seabrookia* which formed the subject of a paper by the late Dr. H. B. Brady, published in this Journal in the year 1890.

The differences between *Seabrookia* and *Chilostomella* are so slight that it is questionable if they are of generic value; quite as much variation exists amongst the forms assigned by common consent to the genus *Lagena*. The chief difference is in the form and position of the aperture; whilst in *Seabrookia* these are remarkably uniform, in *Chilostomella* they vary very much, as shown in the specimens figured by Sherborn and Chapman, Rzehak, Franzenau, and Silvestri. This is, however, a question which must be decided by future researches.

The Malay specimens vary so slightly that it is difficult to distinguish one individual from another.

It occurs at several Stations in both Areas, but is nowhere numerous.

The localities named by Brady and Joseph Wright are, off Cebu, 120 fathoms, Java Sea, 45 fathoms, and 'Challenger' material from Station 33, off Bermudas, 435 fathoms.

Family *LAGENIDÆ*.

Sub-family **Lageninæ**.

Lagena Walker and Boys.

Group of *Lagena globosa*.

Lagena globosa Montagu sp.

Serpula (*Lagena*) *lævis globosa* Walker and Boys, 1784, Test. Min., p. 3, pl. i. fig. 8. *Vermiculum globosum* Montagu, 1803, Test. Brit., p. 523. *Lagena globosa* (Montagu) Brown, 1844, Illustr. Rec. Conch. Gt. Brit., p. 126, pl. lvi. fig. 37. *L. globosa* var. *major* Uhlig, 1886, Jahrb. k. k. Geol. Reichs., vol. xxxvi. p. 167, fig. 1. *L. globosa*, (Montagu) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., p. 744,

Lagena elongata Ehrenberg sp., plate VIII. fig. 10.

Miliola elongata Ehrenberg, 1854, Mikrogeologie, pl. xxv. i. A, fig. 1. *Lagena gracillima* (Seg.) Fornasini, 1883, Boll. Soc. Geol. Ital., vol. ii. p. 185, pl. ii. fig. 5. *L. elongata* (Ehr.) Tate and Blake, 1876, Yorkshire Lias, p. 454, pl. xviii. fig. 9. *L. elongata* (Ehr.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 330, pl. x. fig. 14. *L. elongata* (Ehr.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 75, pl. xiii. fig. 731; and *L. gracillima* (Seg.) p. 75, pl. xiii. figs. 728, 730. *L. elongata* (Ehr.) Fornasini, 1895, Lagena elongata Ehr. sp.? p. two figures in text. *L. elongata* (Ehr.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 306, pl. liii. fig. 1.

This cylindrical variety of *L. gracillima* is abundant, and occurs at many of the Stations in both Areas. The striated form (*L. distoma*) is not represented.

Lagena botelliformis Brady, plate VIII. fig. 15.

Lagena botelliformis Brady, 1881, Quart. Journ. Micr. Sci., n.s., vol. xxi. p. 60. *L. botelliformis* Brady, 1884, Chall. Rept., p. 454, pl. lvi. fig. 6. *L. botelliformis* (Brady) Chaster, 1892, First Rept. of the Southport Soc. of Nat. Sci., 1890–1891 (1892), p. 60, pl. i. fig. 11.

It is difficult to make out the affinities of this peculiar form; it may be an elongated and curved *L. globosa*; but on the whole it seems more nearly allied to *L. elongata*, with which consequently it is here associated.

In the Malay Archipelago it is very rare, and has been found only at Station 5 in Area 1, and Station 25 in Area 2.

The 'Challenger' specimens were obtained from shallow water off the Cape de Verde Islands; in material from mid-ocean in the South Atlantic, 2350 fathoms; and from Station 302, south of Juan Fernandez, 1450 fathoms. Dr. Chaster obtained it from mud under Southport Pier.

Lagena gracilis Williamson, plate VIII. figs. 12–14.

Lagena gracilis Williamson, 1848, Ann. and Mag. Nat. Hist., ser. 2. vol. i. p. 13, pl. i. fig. 5. *L. williamsoni* var. near *striato-punctata* Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 78, pl. iv. fig. 4. *L. gracilis* (Will.) Chapman, 1893, Journ. R. Micr. Soc., p. 583, pl. viii. fig. 13. *L. gracilis* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 328, pl. x. figs. 25, 49; and *L. sulcata* (P. and J.), p. 328, pl. x. fig. 73. *L. gracilis* (Will.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv.

p. 77, pl. xvii. fig. 738. *L. gracilis* (Will.) Jones, 1895, Palæont. Soc., p. 189, pl. vii. fig. 6.

This is usually a striated variety of *L. clavata*, but it assumes many forms, as well illustrated by Brady in the 'Challenger' Report. In the Malay Archipelago the majority of the specimens have an affinity with the apiculata form of *L. striata* named by Seguenza *Amphorina Lyellii*,* and passage-forms exist in an unbroken series from the one to the other.

The examples figured show variations in the form of the test as well as in the character of the sculpture, which ranges from that of *L. striata* to that of *L. sulcata*.

It is abundant at Station 30, and occurs at a few other Stations in both Areas.

Lagena quinquelatera Brady, plate VIII. fig. 11.

Lagena quinquelatera Brady, 1881, Quart. Journ. Micr. Sci., n.s. vol. xxi. p. 60. *L. quinquelatera* Brady, 1884, Chall. Rept., p. 484, pl. lxi. figs. 15, 16. *L. quinquelatera* (Brady) var. *inflata* Chapman, 1893, Journ. R. Micr. Soc., p. 584, pl. vii. fig. 17.

This is a rare form in the Malay Archipelago, although it occurs at several Stations. The margins are subcarinate, and usually exhibit small cavities placed at regular intervals; some of the 'Challenger' specimens are faintly striate, and Chapman says of the gault variety "aboral extremity minutely denticulate."

Brady describes the species as being "compressed equally on five sides," and classes it with the compressed *Lagenæ*, although he also speaks of it as a modification of *L. lævis*.

The Malay Archipelago examples find their nearest affinities in *L. gracilis*, and might almost be described as a variety of that species.

The 'Challenger' localities are, South Pacific, north of the Society Islands, 2350 fathoms; and Southern Ocean, off Prince Edward's Island, 50–150 fathoms.

Compressed **Lagenæ**.

Group of *Lagena lævigata*.

Lagena lævigata Reuss sp.

Fissurina lævigata Reuss, 1850, Denkschr. k. Akad. Wiss. Wien, vol. i. p. 366, pl. xlvi. fig. 1. *Lagena lævigata* (Reuss) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 80, pl. ii. fig. 6; and trigonal form p. 81, pl. iii. fig. 6. *L. marginata* (Montagu) Haeusler, 1887, Neues Jahrb. für Min., p. 186, pl. iv. figs. 51, 52.

* Foram. monotal. Mioc. Messina, 1862, p. 52, pl. i. fig. 40.

L. lucida (Will.) Fornasini, 1888, Boll. Soc. Geol. Ital., p. 47, pl. iii. fig. 5. *L.* (*Fissurina*) *lævigata* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 330, pl. x. figs. 64, 65. *L. marginata* (Montagu) Haeusler, 1893, Abhandl. schweiz. Pal. Gesell., vol. xx. p. 18, pl. i. figs. 65, 66. *L. lævigata* (Reuss) Jones, 1895, Palæont. Soc., p. 197, pl. vii. fig. 14. *L. lævigata* (Reuss) Madsen, 1895, Meddelelser fra Dansk Geol. Forening, No. 2, pp. 74 and 195, pl. fig. 3. *L. lævigata* (Reuss) var. *calostoma* Fornasini, 1901, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. ix. p. 48, fig. 2 A B.

This widely distributed form is found in more or less abundance at nearly all of the Malay Archipelago Stations. It varies in the usual manner from globular to elongate, and is of various degrees of compression, but in all cases the margin is marked by a narrow band of clear shell-substance.

Lagena lævigata Reuss sp. var. *acuta* Reuss sp.,
plate VIII. fig. 16.

Entosolenia marginata var. *lucida* Williamson, 1858, Rec. Foram. Gt. Britain, p. 10, pl. i. fig. 23. *Fissurina acuta* Reuss, 1862, Sitzber. k. Akad. Wiss. Wien, vol. xlvi. p. 340, pl. vii. fig. 90, and *F. apiculata*, p. 339, pl. vi. fig. 85. *Lagena acuta* (Reuss) Fornasini, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 47, pl. iii. fig. 6. *L. acuta* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 332, pl. x. figs. 74, 75. *L. acuta* (Reuss) var. *sacculus* Fornasini, 1901, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. ix. p. 49, pl. fig. 3.

This occurs in two forms. In one of these, as in *L. lævigata*, the margin is rounded and marked by a band of clear shell-substance. The other is the variety described by Brady in the 'Challenger' Report,* and stated by him to be "not quite typical, and might with equal propriety be treated as a mucronate example of *Lagena marginata*."

In the Malay Archipelago the variety more nearly corresponding with *L. lævigata* is the more common and more generally distributed; the carinate variety is more restricted in its range, and is found most abundantly in Area 2.

Lagena lucida Williamson sp.

Entosolenia marginata var. *lucida* Williamson, 1848, Ann. and Mag. Nat. Hist., ser. 2, vol. i. p. 17, pl. ii. fig. 17. *Lagena lucida* (Will.) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 80, pl. ii. fig. 7, and pl. iii. figs. 4, 5.

* Chall. Rept., 1884, p. 474, pl. lix. fig. 6.

In this variety the clear shell-substance surrounding the aperture, besides forming the marginal band as in *L. lævigata*, is produced on the centre of each side into an oval or pear-shaped mass. Compared with *L. lævigata* the test is usually broader at the base and more angular, tapering towards the oral end. Many of the examples are, however, elongate, and some apiculate.

This form is by no means so common nor so widely distributed as *L. lævigata*, and has received but little notice from writers on the Foraminifera. It is very abundant in the Tertiary beds of St. Erth, and the difference in the shell-structure is there as well marked as in the recent specimens.

Lagena fasciata Egger sp. plate VIII. fig. 19.

Oolina fasciata Egger, 1857, Neues Jahrb. für Min., p. 270, pl. v. figs. 12–15. *Lagena fasciata* (Egger) Reuss, 1862, Sitzber. K. Akad. Wiss. Wien, vol. xlvi. p. 323, pl. ii. fig. 24. *Fissurina* Nos. 66 and 67 von Schlicht, 1870, Foram. Septar. Pietzpuhl, p. 12, pl. iv. figs. 25–30. *L. quadricostulata* Reuss, 1870, Sitzber. K. Akad. Wiss. Wien, vol. lxii. p. 469. *L. quadricostulata* (Reuss) Brady, 1884, Chall. Rept., p. 486, pl. lix. fig. 15.

Having traced the changes of form in the disposition of the clear and the opaque shell-substance in *L. lævigata* and *L. lucida*, it is now necessary to follow them through their further stages. Taking *L. annectens* Burrows and Holland,* two narrow curved bands appear on each side of the shell. In *L. faba* Balkwill and Millett these bands are slightly raised, whilst they become costæ in *L. quadricostulata* Reuss, *L. fasciata* Egger, and *L. Meyeriana* Chapman. ‡

These bands may or may not unite at the base of the shell; Dr. Egger's examples of *L. fasciata* show both conditions, whilst in the only known specimen of *L. Meyeriana* the costæ, although continuous, are recurved, and form a sinus at the aboral extremity.

In the Malay Archipelago *L. fasciata* is abundant and widely dispersed, and there is great variety not only in the form of the test, but in the strength and disposition of the costæ.

It is a common form in the Tertiary beds of St. Erth.

Lagena multicosta Karrer sp., plate VIII. fig. 17.

Fissurina multicosta Karrer, 1877, Abhandl. K. K. Geol. Reichsanstalt, vol. ix. p. 379, pl. xvi. *b* fig. 20, and *Fissurina Bouei* p. 378, pl. xvi. *b* fig. 19. *Lagena multicosta* (Karrer) Brady, 1884, Chall. Rept., p. 466, pl. lxi. fig. 4. *Lingulina costata* (d'Orb.) Fornasini, 1889, Mioc. di San Rufillo, pl. i. fig. 17.

* Palæont. Soc., 1895, p. 203, pl. vii. fig. 11.
† Journ. Micr., vol. iii. 1884, p. 81, pl. ii. fig. 10.
‡ Quart. Journ. Geol. Soc., vol. i. 1894, p. 706, pl. xxxiv. fig. 7.

This is another member of the group possessing the two different characters of shell-substance; and, as in *L. lævigata*, the clear shell-substance surrounding the aperture extends in a thin band round what may be called the margin of the test.

In the Malay Archipelago examples there is very little branching or other irregularity of the costæ, and they usually cover the entire surface of the test from the base to the prominence in which is situated the aperture.

The form is extremely abundant at several stations in Area 2, but is very rare in Area 1.

The only 'Challenger' station reported is No. 346, South Atlantic, a little south of the Equator, 2350 fathoms, but I have found it in the material from Station 185, Raine Island, Torres Strait, 155 fathoms.

Lagena quadrata Williamson sp., plate VIII. fig. 18.

Entosolenia marginata var. *quadrata* Williamson, 1858, Rec. Foram. Gt. Britain, p. 11, pl. i. fig. 27. *Lagena lucida* var. *quadrata* (Will.) Reuss, 1862, Sitzber. K. Akad. Wiss. Wien, vol. xlvi. p. 324, pl. ii. fig. 26. *L. quadrata* (Will.) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 81, pl. ii. fig. 8. *L. lævigata* var. *quadrata* (Will.) Wright, 1886, Proc. Belfast Nat. Field Club, 1884–5, App. ix. p. 324, pl. xxvi. fig. 9. *L. quadrata* (Will.) Egger, 1893, Abhandl. K. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 331, pl. x. figs. 78, 79; and *L. compressa*, p. 331, pl. x. figs. 1, 2. *L. quadrata* (Will.) var. Jones, 1895, Palæont. Soc., p. 198, pl. vii. fig. 9.

Here, as elsewhere, this species occurs in two forms; one of them with the margin rounded, and allied to *L. lævigata*; the other with a carinate margin, and differing but little from *L. marginata*.

It occurs at several Stations in the Malay Archipelago, but only in small numbers.

Group of *Lagena marginata*.

Lagena marginata Walker and Boys.

"Serpula (*Lagena*) marginata" Walker and Boys, 1784, Test. Min., p. 2, pl. i. fig. 7. *Lagena marginata* (W. and B.) Brown, 1827, Illustr. Conch. Gt. Brit., fly-leaf, pl. i. figs. 30, 31. *L. marginata* (W. and J.) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 81, pl iii. fig. 2. *L. marginata* (Montagu) Haeusler, 1887, Neues Jahrb. für Min., vol. i. p. 186, pl. iv. fig. 53. *L. marginata* (W. and B.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 222, pl. xliv. figs. 27, 29, 30, 32. *Fissurina alata* (Reuss) Franzenau, 1889, Math. termész. értesito, vol. vii. p. 249, pl. iii. fig. 4. *L. marginata* (Montagu) Haeusler, 1890, Abhandl. schweizer. Pal. Gesell., vol. xvii. p. 86, pl. xiii. fig. 112. *L. marginata* (W. and B.),

Chapman, 1893, Journ. R. Micr. Soc., p. 584, pl. viii. fig. 16. *L. marginata* (W. and B.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 332, pl. x. figs. 20, 66, 67, 96, 97. *L. marginata* (W. and B.) Goës, 1894, K. Svenska Vet. Akad. Handl., vol. xxv. p. 81, pl. xiii. fig. 748. *L. marginata* (W. and J.) Jones, 1895, Palæont. Soc., p. 199, fig. 22. *L. marginata* (W. and B.) Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 119, pl. iii. figs. 7–9. *L. marginata* (W. and B.) Perner, 1897, Česká Akad. Cisare Frantiska Josefa (Palæont. Bohemica) No. 4, p. 18, pl. vii. figs. 3, 5, 7. *L. marginata* (Walker) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 104, pl. v. fig. 5. *L. marginata* (W. and B.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897, (1899) p. 307, pl. liv. fig. 2. *L. marginata* (W. and B.) Silvestri, 1900, Mem. Pontif. Accad. Nuovi Lincei, vol. xvii. p. 243, pl. vi. figs. 51, 52. *L. marginata* (W. and B.) Fornasini, 1900, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. viii. p. 376, fig. 25. *L. marginata* (W. and B.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 17.

This usually common form is not very abundant in the Malay Archipelago, and although it is plentiful at a few Stations, at the others it occurs but sparingly.

It is best represented by its varieties, which are numerous and diversified.

Lagena marginata Walker and Boys var. plate VIII. fig. 20.

This variety is distinguished by its truncated contour, the test being almost semicircular, with the aperture situated in a depression at the apex of the shell. In form it closely resembles the *Fissurina aperta* of Seguenza* and the *Lagena faba* of Balkwill and Millett.†

It is very rare, and occurs only at a few Stations.

Lagena marginata Walker and Boys var. plate VIII. fig. 21.

This variety is also very rare. The recurved spines at the oral extremity of the elongated neck appear to have but little value as a criterion of species, as they have been found by F. W. O. Rymer Jones in *L. lævis*,‡ and by Dr. Chaster in a compressed form resembling *L. lævigata*.§

* Foram. monotal. Mioc. Messina, 1862, p. 60, pl. i. fig. 60.

† Journ. Micr., vol. iii. 1884, p. 81, pl. ii. fig. 10.

‡ *Lagena vulgaris* typica, Trans. Linn. Soc, vol. xxx. 1872, p. 51, pl. xix. fig. 13.

§ *Lagena falcata*, First Rept. of the Southport Soc. of Nat. Sci., 1892, p. 6, pl. i. fig. 7.

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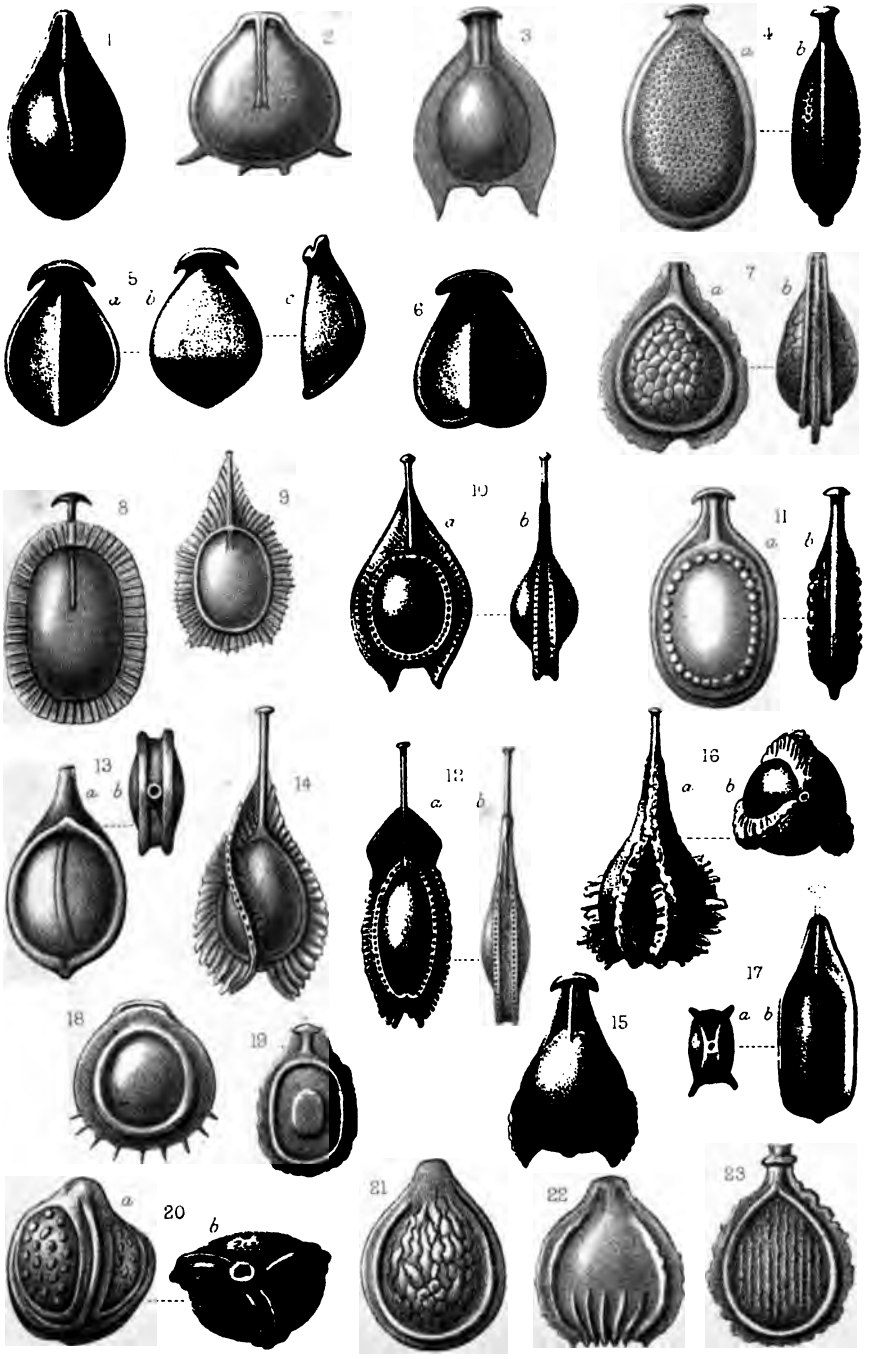

F.W.Millett del.ad nat. West,Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1901, pp. 619–628.)

X.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part XII.*

By Fortescue William Millett, F.R.M.S.

(*Read October 16th*, 1901.)

Plate XIV.

Lagena marginata var. *semimarginata* Reuss, plate XIV. fig. 1.

Lagena No. 64 Von Schlicht, 1870, Foram. Septarienthones von Pietzpuhl, p. 11, pl. iv. figs. 4–6; and No. 65, p. 11, pl. iv. figs. 10–12. *L. marginata* var. *semimarginata* Reuss, 1870, Sitzungsber. k. Akad. Wiss. Wien, vol. lxii. p. 468. *L. marginata* var. *semimarginata* (Reuss) Fornasini, 1891, Foram. Plioc. del Ponticello di Savena, pl. ii. fig. 11. *L. marginata* var. *semimarginata* (Reuss) Morton, 1897, Proc. Portland Soc. Nat. Hist., vol. ii. p. 117, pl. i. fig. 5.

In this form the curved spines of the foregoing variety are still more depressed, and extend inwardly, forming a broad keel on either side of the neck, which keel may or may not be continued in the shape of a narrow band around the periphery of the test.

It is not uncommon in Area 2; and as figured by Von Schlicht and F. W. O. Rymer Jones, some of the specimens are rounded at the base, whilst others are acuminate.

Lagena staphyllearia Schwager sp., plate XIV. fig. 2.

Fissurina staphyllearia Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 209, pl. v. fig. 24. *Lagena vulgaris* var. *spinicosto-*

EXPLANATION OF PLATE XIV.

Fig. 1. — *Lagena marginata* var. *semimarginata* Reuss. × 100.
„ 2. „ *staphyllearia* Schwager sp. × 100.
„ 3. „ *marginata* var. *seminiformis* Schwager. × 100.
„ 4. „ *marginato-perforata* Seguenza. × 100.
„ 5, 6. „ *Eleockiana* sp. n. × 135.
„ 7. „ *squamoso-marginata* Parker and Jones. × 100.
„ 8, 9. „ *lagenoides* Williamson sp × 100.
„ 10, 11, 12. „ *formosa* Schwager. × 100.
„ 13. „ *bicarinata* Terquem sp. × 100.
„ 14, 15, 16. „ *auriculata* Brady. × 135.
„ 17. „ *quadrangularis* Brady. × 100.
„ 18. „ *Orbignyana* var. *calcar* Millett. × 135.
„ 19. „ „ „ *Walleriana* Wright. × 100.
„ 20. „ „ „ *castrensis* Schwager. × 100.
„ 21. „ „ „ *pulchella* Brady. × 100.
„ 22. „ „ „ *variabilis* Wright. × 135.
„ 23. „ „ „ *clathrata* Brady. × 100.

marginata Rymer Jones, 1872, Trans. Linn. Soc., vol. xxx. p. 57, pl. xix. figs. 34, 35. *L. staphyllearia* (Schwager) Brady, 1884, Chall. Rept., p. 474, pl. lxix. figs. 8–11. *L. staphyllearia* (Schwager) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p 331, pl. x. figs. 50, 51, 99. *L. staphyllearia* (Schwager) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 307, pl. liv. fig. 1.

In the examples of this species described by Schwager, the periphery is rounded as in *L. lævigata*, but in most of the figures given by other authors, the margin is shown carinate as in *L. marginata*.

The Malay specimens, which are very few in number, and are found only in Area 2, are of the latter form.

Regarding the distribution of the species, Brady writes: "In the North and South Atlantic *L. staphyllearia* has only been observed at great depths, namely at four Stations, ranging from 2200 to 2750 fathoms; but in the Southern Ocean and the South Pacific it occurs also from time to time in shallow water near the coast-line."

Dr. Egger records it from various 'Gazelle' Stations ranging from the West Coast of Africa to New Guinea, and at depths varying from 57 to 1720 fathoms.

The 'Albatross' locality, according to Flint, is the Caribbean Sea near Aspinwall, 896 fathoms.

Lagena marginata var. *seminiformis* Schwager, plate XIV. fig. 3.

Miliola stiligera (?) Ehrenberg, 1854, Mikrogeologie, pl. xxxi. fig. 6. *Lagena seminiformis* Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 208, pl. v. fig. 21. *Entosolenia marginata* (?) Chimmo, 1878, Nat. Hist. Euplectella, p. 21, pl. vi. fig. 20. *Fissurina diptera* Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. vi. p. 332, pl. xvii. fig. 37. *L. seminiformis* (Schwager) Jones, 1895, Palæont. Soc., p. 200, pl. vii. fig. 10.

In this variety the apertural curved spines are still further developed, and form a broad wing which embraces usually the whole of the peripheral margin of the test.

It is a marked peculiarity of the Malay Archipelago forms of *L. marginata* that they show a strong tendency to a duplication of the marginal carina, the space between the two keels being either void or filled up with cellular matter. This, under ordinary circumstances, might be considered a valid reason for treating the two forms as distinct species; but seeing that the arrangement prevails in nearly every form of *L. marginata* and its allies, it may be looked upon in the present instance as a local peculiarity, bearing in mind, however, the great extent of the region involved.

Under the name of *L. seminiformis*, Egger * figures, but does not

* Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. pl. x. figs. 19, 87, 88.

describe, two examples whose affinities, however, seem to be rather with *L. seminarginata.*

Brady speaks of it as essentially a deep-water species.

L. seminiformis with the single keel is very rare in the Malay Archipelago; but the form with the double keel is not infrequent, and passes insensibly into *L. formosa.*

To its fossil localities may be added the Tertiary beds of St. Erth, and the Coralline Crag of Broom Hill.

Lagena marginato-perforata Seguenza, plate XIV. fig. 4.

Lagena marginato-perforata Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. vi. p 332, pl. xvii. fig. 34. *L. castrensis* (?) (Schwager) Brady, 1884, Chall. Rept., p. 485, pl. lx. fig. 3.

The compressed *Lagenæ* having circular markings of various descriptions on their opposite faces are very abundant in the Malay Archipelago, and all the named varieties are represented. That with a single keel is the variety of *L. marginata* named by Seguenza *L. marginato-perforata*; the double keeled form, which corresponds to *L. bicarinata*, is the *Fissurina punctata* of Seguenza; whilst the triple-keeled, which is a variety of *L. Orbignyana*, has received from Schwager the name *L. castrensis*, from Schlumberger the name *L. variolata*, and has been named by Burrows and Holland *L. lacunata.*

Although the forms which have been accepted and named are thus acknowledged, it must be urged, that even if it were zoologically correct to receive these markings as distinctive characters, yet in practice it would be highly inconvenient, as each kind of ornament, whether a dot, pit, bead, vesicle, or perforation, would have to be considered separately, in connection not only with the number of the keels, but with the position of the aperture, whether sessile or pedunculate, and with the size and plan of arrangement of the markings; thus leading to the creation of varieties in a geometrical ratio not pleasant to contemplate.

The forms named occur in abundance all over the Malay Archipelago, that with the single keel being the most numerous.

Lagena Elcockiana sp. n., plate XIV. figs. 5, 6.

Test oval or pyriform, compressed; periphery carinate or bordered. One face curved from the oral to the aboral extremity; the opposite face composed of two plane surfaces, which, projecting from the lateral margins, meet at the centre and form a straight ridge which extends from the aperture to the base of the shell. Aperture a curved slit on one side of a projecting crescent-shaped process, with recurved ends, which overlaps the face bearing the central ridge. Length 0·16 mm.

The shell is very delicate and translucent. The central ridge may be either acute or carinate, and sometimes there are a few bars across the aperture.

At first sight this might be mistaken for one of the trifacial varieties of *Lagena*; but a close examination proves that the resemblance is superficial, and that the triangular shape of the section results from the diverse form of the two opposite faces.

This variety is named after Charles Elcock, of Belfast, at the request of Mr. Durrand, and as a token of his esteem.

It is very rare in the Malay Archipelago, and is found only at a few Stations in Area 2.

Lagena radiato-marginata Parker and Jones.

Lagena radiato-marginata Parker and Jones, 1865, Phil. Trans., vol. clv. p. 355, pl. xviii. fig. 3. *Fissurina radiato-marginata* (P. and J.) Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. vi. p. 136. *L. radiato-marginata* (P. and J.) Brady, 1884, Chall. Rept., p. 481, pl. lxi. figs. 8, 9.

This beautiful form is very abundant in the Malay Archipelago, and occurs at several Stations in both Areas.

The specimens are fine, and are remarkably uniform in size, shape, and ornamentation.

Found by Parker and Jones on the coral reefs of Australia; and fossil at Bordeaux. Seguenza reports it from the Miocene of Southern Italy. The 'Challenger' Stations are Nares Harbour, Admiralty Islands, 37 fathoms; and Raine Island, Torres Strait, 155 fathoms.

Lagena Wrightiana Brady.

Lagena Wrightiana Brady, 1884, Chall. Rept., p. 482, pl. lxi. figs. 6, 7. *L. Wrightiana* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 334, pl. x. figs. 42, 43.

This, although equally widely diffused in the Malay Archipelago, is less abundant than the preceding variety. It is more diversified in its characteristics, the grooves often being curved and sometimes bifurcated, and they do not always leave a smooth space in the centre of the faces.

The only 'Challenger' locality is Nares Harbour, Admiralty Islands, 37 fathoms. The 'Gazelle' Stations for the very minute examples recorded by Dr. Egger, are Mauritius, 190 fathoms; and West Australia, 196 fathoms.

Lagena squamoso-marginata Parker and Jones, plate XIV. fig. 7.

Lagena squamoso-marginata Parker and Jones, 1865, Phil. Trans., vol. clv. p. 356, pl. xviii. fig. 2. *Fissurina squamoso-marginata* (P. and J.) Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. vi. p. 136. *L. squamoso-marginata* (P. and J.) Brady, 1884, Chall. Rept., p. 481, pl. lx. fig. 24. *L. squamoso-marginata* (P. and J.) Dreyer, 1891, Jenaische Zeitschr. für Naturwiss., vol. xxvi. p. 396, pl. xxvii. fig. 241.

According to the figure given by Parker and Jones, this form has but one keel, and may therefore be treated as a variety of *L. marginata*. All the examples from the Malay Archipelago have the triple keel, which indicates their affinity with *L. Orbignyana*, and still more closely with *L. castrensis*, since the hexagonal areolations appear to be produced by the enlargement and crowding together of the circular surface ornaments of that variety.

The *L. squamoso-alata* of Brady* differs but little in its general form from *L. formosa*, and may be regarded as a reticulate variety of that species.

In the Malay Archipelago *L. squamoso-marginata* is rare, and is confined to Area 2.

Parker and Jones found it in the white mud of the Australian coral-reefs; and also record it fossil from the Tertiaries of San Domingo.

Brady (Chall. Rept.) writes: "The species occurs at three points in the North Atlantic, the depths varying from 422 to 816 fathoms; on the Australian coral-reefs; and on the west coast of New Zealand, 1100 fathoms."

It is recorded fossil by Seguenza from the Miocene and Pleistocene of Italy.

L. squamoso-alata, according to Brady, "has been met with at three 'Porcupine' Stations in the North Atlantic, west of Ireland, at depths of 173 fathoms, 630 fathoms, and 1445 fathoms respectively."

Lagena lagenoides Williamson sp., plate XIV. figs. 8, 9.

Entosolenia marginata var. *lagenoides* Williamson, 1858, Rec. Foram. Gt. Britain, p. 11, pl. i. figs. 25, 26. *Lagena lagenoides* (Will.) Reuss, 1862, Sitzber. k. Akad. Wiss. Wien, vol. xlvi. p. 324, pl. ii. figs. 27, 28. *L. lagenoides* (Will.) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 82, pl. ii. fig. 11. *L. lagenoides* (trigonal) (Will.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 341, pl. xii. fig. 22. *L. lagenoides* (Will.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 223, pl. xliv. fig. 23. *L. serrata* Schlumberger, 1894, Mém. Soc. Zool. Fr., vol. vii. p. 258, pl. iii. fig. 7. *L. lagenoides* (Will.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 83, pl. xiii. fig. 752. *L. lagenoides* (Will.) Jones, 1895, Palæont. Soc., p. 201. *L. lagenoides* (Will.) Morton, 1897, Proc. Portland Soc. Nat. Hist., vol. ii. p. 118, pl. i. fig. 5.

This protean variety is abundant in Area 2, and occurs sparingly at a few Stations in Area 1. Both of the forms indicated by Williamson's figures are plentiful. In the longer of the two the marginal keel or wing is double, and the interspace is more or less occupied by cellular or granular matter; in the shorter form the wing is less complex; in both, the tubular neck projects into the body of

* Chall. Rept., p. 481, pl. lx. fig. 23.

the shell, and is central and free; in these respects differing from the other compressed *Lagenæ* in which, as a rule, the entosolenian tube is attached throughout its whole length to the internal surface of one of the faces of the test. The trifacial form *L. trigono-ornata* Brady is represented by a few feeble examples.

Living, the species is widely distributed. Fossil, it has been recorded from the Miocene deposits of Sicily; from the Pleistocene of Canada; from the Coralline Crag; and from the Tertiary beds of St. Erth.

Lagena lagenoides var. *tenuistriata* Brady.

Lagena tubulifera var. *tenuistriata* Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 61. *L. lagenoides* var. *tenuistriata* Brady, 1884, Chall. Rept., p. 479, pl. lx. figs. 11, 15, 16. *L. lagenoides* var. *tenuistriata* (Brady) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 82, pl. ii. fig. 12.

This variety is less abundant than the type, and like it, is more plentiful in Area 2.

Lagena formosa Schwager, plate XIV. figs. 10, 11, 12.

Lagena formosa (pars) Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 206, pl. iv. fig. 19. *L. formosa* (Schwager) Brady, 1884, Chall. Rept., p. 480, pl. lx. figs. 10, 18–20, 8?, 17? *L. lagenoides* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 335, pl. x. fig. 85. *L. formosa* (Schwager) Jones, 1885, Palæont. Soc., p. 202, pl. vi. fig. 6.

This species seems to differ from *L. lagenoides* only in the raised border which immediately surrounds the body of the test. As in *L. lagenoides*, the form varies considerably. In the example represented by fig. 11 the raised border is composed of beads instead of the usual punctate ornament.

It is rare in the Malay Archipelago, although found in both Areas.

Group of *Lagena bicarinata.*

Lagena bicarinata Terquem sp., plate XIV. fig. 13.

Fissurina bicarinata Terquem, 1882, Mém. Soc. Géol. Fr., sér. 3, vol. ii. p. 31, pl. ix. fig. 24. *Lagena bicarinata* (Terquem) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 82, pl. ii. fig. 4; and trifacial pl. iii. fig. 9. *L. bicarinata* (Terq.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 342, pl. xii. fig. 30. *L. bicarinata* (Terq.) Wright, 1886, Proc. Belfast Nat. Field Club, App. ix. p. 320, pl. xxvi. fig. 8. *L. bicarinata* (Terq.) Halkyard, 1889, Trans. and Ann. Rept. Manchester Micr. Soc., p. 66, pl. ii. fig. 1. *L. bicarinata* var. *placentina* Fornasini, 1901, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. ix. p. 51, fig. 5.

Published forms nearly allied, or possibly identical.

Fissurina marginata Seguenza, 1862, Foram. Monotal. Miocen. Messina, p. 66, pl. ii. figs. 27, 28. *F. capillosa* Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 210, pl. v. fig. 25. *F. foliacea* Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. vi. p. 306, pl. xvii. fig. 13.

Although this species occurs in the Malay Archipelago in a variety of forms and with diverse surface ornaments, in none of them are to be found the two concentric circular costæ characteristic of the examples from the Eocene of the neighbourhood of Paris.

The form which is most abundant is that with the faces covered with minute dots, to which allusion has already been made in treating of *L. marginato-perforata*.

L. bicarinata occurs at several Stations, but is most plentiful in Area 2.

It has been found fossil in the Eocene of Paris; in the Tertiaries of St. Erth; and in the Neogene of Italy.

Lagena auriculata Brady, plate XIV. figs. 14, 15, 16.

Lagena auriculata Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. n.s. p. 61. *L. auriculata* Brady, 1884, Chall. Rept., p. 487, pl. lx. figs. 29, 33, and ? 31.

As shown by Brady's figures, this is a very variable species, and in the Malay Archipelago it occurs in many forms, ranging from a smooth test similar to that of *L. lævigata*, with a small loop on either side of the base, to the complex form with an extended neck, and provided with a luxuriant tubulated wing. This latter variety is usually much contorted, as represented by fig. 14. The trifacial variety is represented by fig. 16.

Essentially a deep-water species; being found, according to Brady, at depths of from 1370 to 2740 fathoms in the North and South Atlantic and South Pacific; whilst off Gomera, Canaries, in only 620 fathoms, the specimens were small and poorly developed. In view of these facts it is interesting to note that the species is abundant and varied in the shallow waters of the Malay Archipelago, and deficient only in size, being about one-half the length of the deep-water examples.

It occurs in more or less abundance at several Stations, and, like several other species of *Lagena*, is most plentiful in Area 2.

Lagena quadrangularis Brady, plate XIV. fig. 17.

Lagena quadrangularis Brady, 1884, Chall. Rept., p. 483, pl. cxiv. fig. 11.

This is a very rare species, and has hitherto been found only at Raine Island, Torres Strait, 155 fathoms.

Brady's figure is drawn from an imperfect specimen; I have examples from the same locality, and in these the neck is elongated and terminates in a prominent lip.

In the Malay Archipelago examples these features are not so well defined.

It has been found only at Station 25 in Area 2.

Group of *Lagena Orbignyana.*

Lagena Orbignyana Seguenza sp.

Entosolenia marginata (pars) Williamson, 1858, Rec. Foram. Great Britain, p. 10, pl. i. figs. 19, 20. *Fissurina Orbignyana* Seguenza, 1862, Foram. Monotal. Miocen. Messina, p. 6, pl. ii. figs. 65, 66. *Lagena Orbignyana* (Seguenza) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 81, pl. iii. fig. 1. *L. Orbignyana* (Seguenza) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 222, pl. xliv. fig. 20. *L. Orbignyana* (Seguenza) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 333, pl. x. figs. 89–91. *L. Orbignyana* (Seguenza) Grzybowski, 1895, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej-Krakowie, vol. xxx. p. 291, pl. x. fig. 4. *L. Orbignyana* (Seguenza) Jones, 1895, Palæont. Soc., p. 204, pl. vii. fig. 13. *L. Orbignyana* (Seguenza) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 308, pl. liv. fig. 4. *L. Orbignyana* (Seguenza) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 104, pl. v. figs. 8, 9.

Little need be said about this ubiquitous species. Here as elsewhere it occurs in great abundance and in great variety of form, the trifacial variety *L. trigono-marginata* Parker and Jones being included.

Lagena Orbignyana var. *calcar* Millett, plate XIV. fig. 18.

Lagena Orbignyana var. *calcar* Millett, 1898, Trans. R. Geol. Soc. of Cornwall, vol. xii. p. 175, pl.

Hitherto recorded only from the Tertiary beds of St. Erth. In the recent specimens the spines are smaller and more numerous.

It is very rare, and occurs only at a few Stations in Area 2.

Lagena Orbignyana var. *castrensis* Schwager, plate XIV. fig. 20.

Lagena castrensis Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 208, pl. v. fig. 22. *Entosolenia variolata* Schlumberger, 1882, Feuille Jeunes Nat., p. 25, pl. i. fig. 3. *Lagena scarensis* Hantken, 1883, Ertek. termesz. Köreböl, vol. xiii. p. 24, pl. i. fig. 9. *L. castrensis* (Schwag.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 341, pl. xii. figs. 20, 21. *L. castrensis* (Schwag.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 333, pl. x. figs. 71, 72. *L. lacunata* (Burrows and Holland) Jones, 1895,

Palæont. Soc., p. 205, pl. vii. fig. 12. *L. castrensis* (Schwag.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 308, pl. liv. fig. 5.

This variety occurs in great abundance at many Stations in both Areas.

There is considerable diversity in the surface ornamentation, as well in the nature as in the arrangement of its components.

As a matter of convenience, in the synonymy are included all the described varieties of *L. Orbignyana* in which the surface markings are circular, without regard to their being depressions or elevations, or to any other character which they may happen to possess.

Trifacial varieties of this form are very uncommon, and for this reason an example having this character has been selected for illustration.

Lagena Orbignyana var. *Walleriana* Wright, plate XIV. fig. 19.

Lagena Orbignyana var. *Walleriana* Wright, 1886, Proc. R. Irish Acad., ser. 2, vol. iv. p. 611; and 1891, ser. 3, vol. i. p. 481, pl. xx. fig. 8.

This variety is very rare, and has been found only at Station 22, in Area 2.

Wright reports it from various Stations off the south-west of Ireland, at depths ranging from 53 to 345 fathoms.

It is not uncommon in the Tertiary beds of St. Erth; and in the fossil examples the central boss is often replaced by a ring of corresponding size.

Lagena Orbignyana var. *pulchella* Brady, plate XIV. fig. 21.

Lagena pulchella Brady, 1866, Rept. Brit. Assoc. (Nottingham) p. 70. *L. pulchella* Brady, 1870, Ann. and Mag. Nat. Hist., ser. 4, vol. vi. p. 294, pl. xii. fig. 1. *L. pulchella* (Brady) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 81, pl. ii. fig. 13; and pl. iii. fig. 11. *L. pulchella* (Brady) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. p. 342, pl. xii. fig. 19.

In the Malay Archipelago this variety is rare, although it occurs at Stations in both Areas.

The irregular branching or reticulated costæ proper to this form are often mixed with the circular vesicles usually found in *L. castrensis*. This is shown in the specimen selected for illustration.

Lagena Orbignyana var. *variabilis* Wright, plate XIV. fig. 22.

Lagena Orbignyana var. *variabilis* Wright, 1891, Proc. R. Irish Acad., ser. 3, vol. i. p. 482, pl. xx. fig. 9.

The Malay Archipelago examples are not so elongated as that figured by Wright, and but for the riblets would not be distinguishable

from *L. Orbignyana.* They are also smaller than the Irish specimens, and altogether more delicate in structure.

It is by no means uncommon in the Malay Archipelago, and occurs at several Stations, but most abundantly in Area 2.

Joseph Wright records it as frequent at 750 fathoms off the west coast of Ireland, and adds that he has met with it in several of the 'Porcupine' soundings from the North Atlantic.

Lagena Orbignyana var. *clathrata* Brady, plate XIV. fig. 23.

Lagena clathrata (Brady) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 82, pl. ii. fig. 14; and pl. iv. fig. 3. *L. clathrata* Brady, 1884, Chall. Rept., p. 485, pl. lx. fig. 4.

Typical examples are rare, the parallel costæ being usually represented by lines of closely set beads; other specimens resemble *L. variabilis* in having the ribs radiating from the base.

It is found in both Areas, but always in small quantities.

The only localities recorded hitherto are shore-sands, Galway (Balkwill and Millett); and sands dredged near the islands to the south-west of New Guinea, notably off the Ki Islands, 580 fathoms; and off Aru Island, 800 fathoms (Brady).

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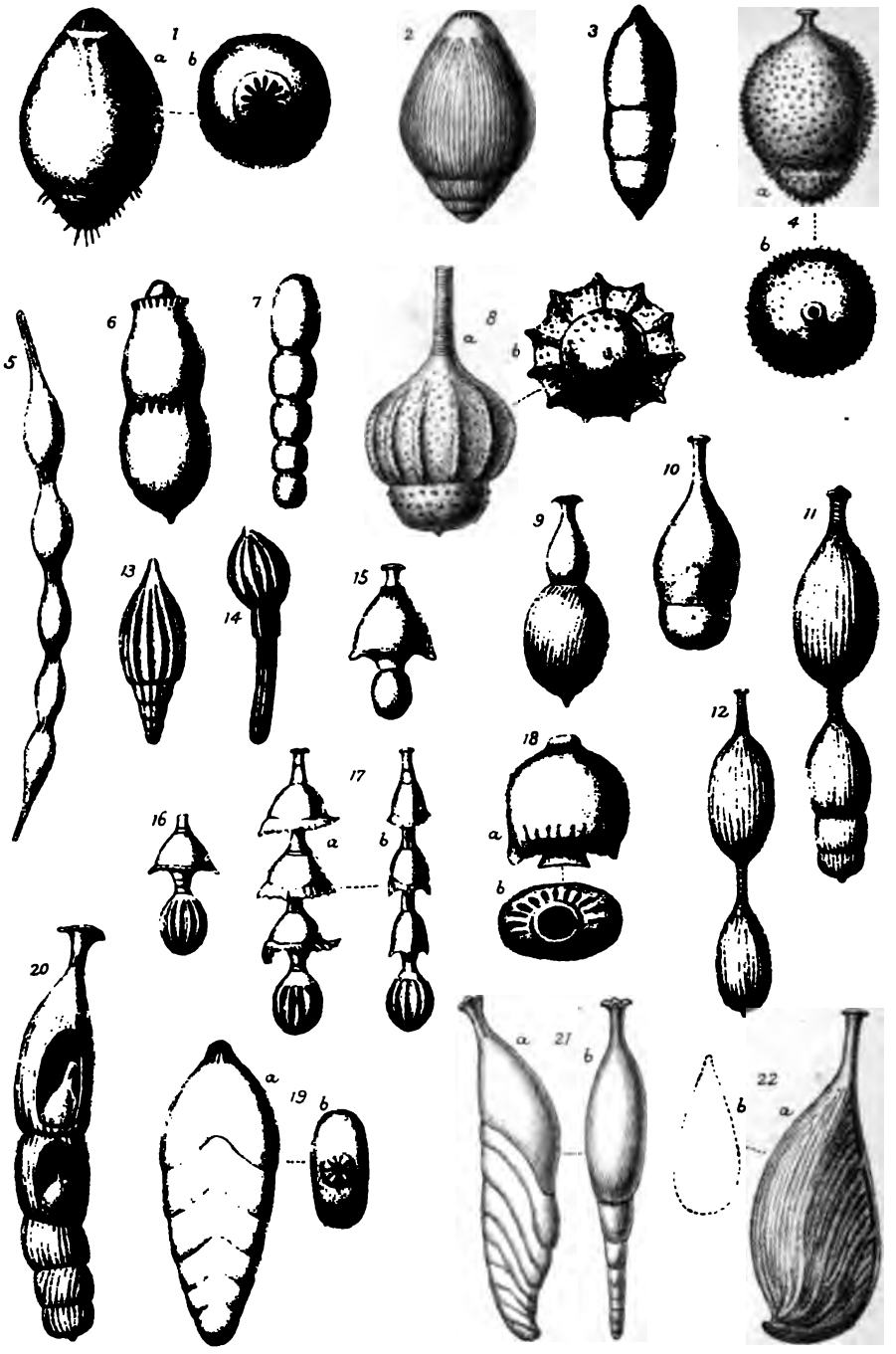

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Foraminifera of Malay Archipelago.

(Journ. R. Micr. Soc., 1902, pp. 509-528.)

IX.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part XIII.*

By Fortescue William Millett, F.R.M.S.

(*Read March 19th*, 1902.)

Plate XI.

Sub-Family **Nodosarinæ.**

Nodosaria Lamarck.

Nodosaria (*Glandulina*) *lævigata* d'Orbigny, plate XI. fig. 1.

"Cornu Hammonis erectum globosius," Plancus, 1739, Conch. Min., p. 16, pl. ii. fig. 3. *Nodosaria* (*Glandulina*) *lævigata* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 252, pl. x. figs. 1–3. *Glan-*

EXPLANATION OF PLATE XI.

Fig. 1.—*Nodosaria* (*Gl.*) *lævigata* d'Orbigny. × 90. *a*, lateral aspect; *b*, oral aspect.
„ 2. „ „ *comata* Batsch sp. × 90.
„ 3. „ „ *æqualis* Reuss. × 90.
„ 4. „ „ *echinata* sp. n. × 65. *a*, lateral aspect; *b*, oral aspect.
„ 5.—*Nodosaria semirugosa* d'Orbigny. × 60.
„ 6. „ *capitata* Boll. × 65.
„ 7. „ *limbata* d'Orbigny. × 90.
„ 8. „ *bicamerata* F. W. O. R. Jones sp. × 90. *a*, lateral aspect *b*, aboral aspect.
„ 9. „ *proxima* O. Silvestri. × 90.
„ 10. „ *scalaris* Batsch sp. var. × 75.
„ 11, 12. „ „ „ var. *separans* Brady. × 60.
„ 13, 14. „ (?) *obscura* Reuss. Fig. 13 × 65; fig. 14 × 90.
„ 15.—*Lingulina limbata* sp. n. × 100.
„ 16, 17. „ *pagoda* sp. n. × 75. *a*, lateral aspect; *b*, peripheral aspect.
„ 18. „ sp. indet. × 100. *a*, lateral aspect; *b*, aboral aspect.
„ 19.—*Frondicularia nitida* Terquem. × 80.
„ 20.—*Marginulina costata* Batsch sp. × 60.
„ 21.—*Vaginulina legumen* Linné sp. var. × 75. *a*, lateral aspect; *b*, peripheral aspect.
„ 22. „ *formosa* sp. n. × 90. *a*, lateral aspect; *b*, horizontal section.

dulina lævigata var. *inflata* (Born.) Andreae, 1884, Abhandl. geol. Special Karte Elsass-Loth., vol. ii. p. 206, pl. vii. fig. 12; and var. *elliptica* (Reuss), p. 206, pl. x. fig. 22. *G. lævigata* (d'Orb.) Gumbel, 1885, Geol. Bayern, p. 422, fig. 266, 4. *Nodosaria* (*Glandulina*) *abbreviata* (Neug.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., p. 746, pl. xiv. fig. 20. *G. lævigata* Haeusler, 1887, Neues Jahrb. für Min., p. 189, pl. v. fig. 29. *Nodosaria* (*Gland.*) *lævigata* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 556, pl. ix. figs. 14, 15. *G. lævigata* (d'Orb.) Haeusler, 1890, Abhandl. schweiz. Pal. Gesell., vol. xvii. p. 91, pl. xiii. figs. 61–63; and pl. xiv. fig. 2. *G. lævigata* (d'Orb.) Crick and Sherborn, 1891, Journ. Northamp. Nat. Hist. Soc., vol. vi. p. 209, pl. vi. fig. 4. *G. lævigata* (d'Orb.) Beissel (Holzapfel), 1891, Abhandl. k. Preuss. geol. Landesanst., N.F., Heft 3, p. 29, pl. vi. figs. 7–9. *G. lævigata* (d'Orb.) Hosius, 1892, Verhandl. Nat. Ver. Preuss. Rheinlands Westphal., Jahrg. xlix. p. 152, pl. ii. figs. 1, 2. *G. lævigata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. pp. 336 and 339, pl. xi. fig. 31. *Nodosaria lævigata* (d'Orb.) Dervieux, 1893, Boll. Soc. Geol. Italia, vol. xii. p. 597, pl. v. figs. 1, 2. *Nodosaria lævigata* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 71, pl. xiii. figs. 702, 703, 706, 707, 709. *G. cuspidata* Franzenau, 1894, Glasnik Hrv. Nar. Družtva, p. 259, pl. v. fig. 5. *G. lævigata* (d'Orb.) Jones, 1895, Palæont. Soc., p. 207. *G. lævigata* var. *chilostoma* Rzehak, 1895, Ann. k. k. Naturh. Hofmuseums, vol. x. part 2, p. 219, pl. vii. fig. 6. *Nodosaria lævigata* (d'Orb.) Silvestri, 1896, Mem. Pontif. Acad. Nuovi Lincei, vol. xii. p. 122, pl. iii. fig. 11 (anomalous). *Nodosaria lævigata* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 308, pl. lv. fig. 3. *G. lævigata* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 81, pl. v. fig. 31. *G. lævigata* (d'Orb.) Silvestri, 1900, Mem. Pontif. Acad. Nuovi Lincei, vol. xvii. p. 248, pl. vi. figs. 41, 49. Idem, 1900, Atti e Rendic. Acad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. x. p. (1) pl. figs. 1–5, 9, 16. *G. lævigata* (d'Orb.) var. *subornata* Fornasini, 1901, Mem. R. Acad. Sci. Ist. Bologna, ser. 5, vol. ix. p. 56, fig. 9.

This form is very abundant and exhibits the usual variations, the chambers sometimes being almost entirely exposed; at other times nearly concealed by the embracing latest chamber. The sutures are of various degrees of obliquity, and the aperture is frequently entosolenian.

It is found at most of the Stations in both Areas, and is very evenly distributed.

Nodosaria (*Glandulina*) *rotundata* Reuss.

Glandulina rotundata Reuss, 1849, Denkschr. K. Akad. Wiss. Wien, vol. i. p. 366, pl. xlvi. fig. 2. *Nodosaria* (*Gl.*) *obtusissima* (Reuss) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2,

vol. vi. p. 746, pl. xiv. fig. 21. *Nodosaria* (*Gl.*) *obtusissima* (Reuss) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 556, pl. ix. fig. 16. *G. rotundata* (Reuss) Fornasini, 1896, Rivista Ital. di Paleont., fig. 1. *Nodosaria rotundata* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 308, pl. liv. fig. 6. *G. lævigata* A (d'Orb.) (*rotundata*) Silvestri, 1899, 1900, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. x. pl. figs. 7, 8, 10–15.

This variety with the rounded base is almost as abundant as the foregoing, and is just as evenly distributed. The aperture likewise is often entosolenian, but there is not quite so much variation in the form of the test.

In treating of the fauna of an extensive region it is hardly desirable to enter into the controversy with regard to the dual forms, and it must be left to other investigators to determine if *G. lævigata* and *G. rotundata* are respectively the microspheric and megalospheric states of the same species, but it may be pointed out that their almost equal abundance in the Malay Archipelago is rather against the theory.

Nodosaria (*Glandulina*) *echinata* sp. n., plate XI. fig. 4.

Test subovate; broadest near the centre and tapering towards each end, the base being either acute or rounded. Sutures indistinct. Aperture situated in a short neck with an everted lip. Surface of the shell beset with minute spines which are longest at the primordial end of the test. Length 0·38 mm.

This may be described as a spinous variety of both *N. lævigata* and *N. rotundata*. In the present state of uncertainty as to the nature of the relations between the Nodosariæ differing in character only in having the base either acute or rounded, it is here considered inadvisable to follow the hitherto accepted rule of treating the two forms as representing different species, and giving them distinctive names, consequently the more simple course has been adopted of associating them under one heading.

Their intimate relationship is shown by their both possessing the phialine aperture, which is an unusual feature in *Glandulina*.

There are numerous examples of a variety of *N. lævigata*, in which the spines are confined to the base. This form has the aperture invariably mammillate with radiating striæ; and the base is always acute or apiculate.

The three spinous varieties here described are by no means uncommon in the Malay Archipelago, being found at several Stations in both Areas and are about equal in number.

Nodosaria (*Glandulina*) *æqualis* Reuss, plate XI. fig. 3.

Glandulina æqualis Reuss, 1863, Sitzungsber. k. Akad. Wiss. Wien, vol. xlviii. p. 48, pl. iii. fig. 28. *G. æqualis* (Reuss) Forna-

sini, 1886, Boll. Soc. Geol. Italia, vol. v. p. 337, pl. vii. figs. 1–12. *Nodosaria candela* (Egger) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 556, pl. ix. fig. 18. *Nodosaria æqualis* (Reuss) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 202, pl. i. fig. 1. *Nodosaria æqualis* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 72, pl. xiii. figs. 704, 705, 708, 710, 711. *G. æqualis* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 84, pl. v. fig. 22. *G. æqualis* (Reuss) Silvestri, 1900, Mem. Pontif. Accad. Nuovi Lincei, vol. xvii. p. 249, pl. vi. figs. 58, 59.

This cylindrical variety is rounded at the base typically, and in that condition may be regarded as an elongate form of *N. rotundata*. In the Malay Archipelago the examples are invariably acutely pointed at the primordial end, thus indicating an affinity with *N. lævigata*. For the reasons given in treating of *N. echinata* the two forms are again associated.

It is very rare in the Malay Archipelago, and occurs only in Area 1.

Nodosaria (*Glandulina*) *comata* Batsch sp., plate XI. fig. 2.

Nautilus (*Orthocerus*) *comatus* Batsch, 1791, Conch. Seesands, p. 2, pl. i. fig. 2 a–d. *Nodosaria* (*Glandulina*) *glans* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 252, No. 2; and Modèle No. 51. *N.* (*Gland.*) *glans* (d'Orb.) Jones and Parker, 1860, Quart. Journ. Geol. Soc., vol. xvi. p. 453, pl. xix. fig. 7. ? *Glandulina glans* (d'Orb.) Fornasini, 1883, Boll. Soc. Geol. Italia, vol. ii. pl. ii. fig. 6. *Nodosaria comata* (Batsch sp.) Fornasini, 1891, Foram. Plioc. del Ponticello di Savena, pl. ii. fig. 18. *Nodosaria cornuta* (sic) (Batsch sp.) Grzybowski, 1895, Rozprawy Wydz. mat.-Przyr. Akad. Umiej-Krakowie, vol. xxx. p. 293, pl. x. fig. 8. *Nodosaria comata* (Batsch sp.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 311, pl. lvii. fig. 3. *Glandulina comata* (Batsch sp.) Fornasini, 1900, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. viii. p. 380, fig. 29.

This, in its more compact form, is nothing more nor less than a typical *Glandulina lævigata*, having its surface covered with delicate striæ, and has been well represented by d'Orbigny under the name of *Glandulina glans*. Amongst a multitude of specimens from the Malay Archipelago, passage, forms are to be found in abundance leading gradually and insensibly from this Glanduline to the elongated Nodosarian form, which may be considered to represent *Nodosaria radicula* with a striated surface.

In his 'Challenger' Report,* Brady has so thoroughly dealt

* Brady, Chall. Rept., 1884, p. 509.

with the subject and so well explained the affinity of the apparently dissimilar forms figured by Batsch, that to attempt to add anything to his statement would be a mere waste of time.

As a recent form, it has been recorded from only a very few Stations, but these are wide apart, extending from the West Indies to Mauritius, at depths not exceeding 450 fathoms.

In the Malay Archipelago, it occurs in great abundance all over the region.

Nodosaria radicula Linné sp.

Cornu Hammonis erectum" Plancus, 1739, Conch. Min., p. 14, pl. i. fig. 5, A, B, C. *Nautilus radicula* Linné, 1767, Syst. Nat., p. 1164. *Nodosaria radicula* (Linn.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 746, pl. xiv. fig. 24. *N. radicula* (Linn.) Malagoli, 1887, Boll. Soc. Geol. Italia, vol. vi. p. 520, pl. xiii. fig. 4. *N. radicula* (L) Idem, 1887, Atti Soc. Nat. Modena, ser. 3, vol. iii. p. 109, pl. i. fig. 8. *N. radicula* Mariani, 1889, Boll. Soc. Geol. Italia, vol. vii. p. 286, pl. x. fig. 7. *N. radicula* (Linn.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 92, pl. xiii. figs. 41–45, 47, 48, 50, 53. *N. radicula* (Linn.) Crick and Sherborn, 1891, Journ. Northamp. Nat. Hist. Soc., vol. vi. pl. i. fig. 5. *N. radicula* (Linn.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 78, pl. ii. fig. 4. *N. radicula* (Linn.) Haeusler, 1893, Abhandl. schweiz. pal. Gesell., vol. xx. p. 23, pl. ii. figs. 36–46. *N. radicula* (Linn.) Grzybowski, 1897, Rozprawy Wydz. Przyr. Akad. Umiej-Krakowie, vol. xxxiii. p. 296, pl. xii. fig. 18. *N. radicula* (Linn.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 309, pl. lv. fig. 1. *N. radicula* (Linn.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II., vol. xxi. p. 67, pl. v. fig. 40.

This is a widely distributed form, but Brady states that it has not been found in the North Pacific.

Nodosaria calomorpha Reuss.

Nodosaria calomorpha Reuss, 1865, Denkschr. k. Akad. Wiss. Wien, vol. xxv. p. 129, pl. i. figs. 15–19. *N. bistegia* Dunikowski, 1879, Kosmos (Lemberg) vol. iv. p. 106, pl., fig. 4. *N. calomorpha* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 223, pl. xliv. figs. 1, 4. *N. calomorpha* (Reuss) Haeusler, 1890, Abhandl. schweizer Pal. Gesell., vol. xvii. p. 95, pl. xiii. figs. 35–37. *N. calomorpha* (Reuss) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 566, pl. ix. fig. 21. *N. calomorpha* (Reuss) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 78, pl. ii. fig. 5. *N. calomorpha* (Reuss) Chaster, 1892, First Rept. of the Southport Soc. of Nat. Sci., 1890–1891 (1892) p. 63, pl. i. fig. 12. *N. calomorpha* (Reuss) Haeusler, 1893, Abhandl. schweizer Pal. Gesell.,

vol. xx. p. 27, pl. i. fig. 73; pl. iii. fig. 47. *N. calomorpha* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 340, pl. xi. figs. 21, 26. *N. calomorpha* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 72, pl. xiii. figs. 712, 713. *N. calomorpha* (Reuss) Grzybowski, 1895, Rozprawy Wydz. mat.-Przyr. Akad. Umiej-Krakowie, vol. xxx. p. 293, pl. x. fig. 31. *N. calomorpha* (Reuss) Morton, 1897, Proc. Portland Soc. Nat. Hist., vol. ii. p. 118, pl. i. fig. 6.

This delicate little *Nodosaria*, with its thin transparent chambers resembling a string of bubbles, is common in the Malay Archipelago, and widely distributed in both Areas. Usually the test consists of two or three segments only, and these, from the formation of the last added chamber, appear to be complete in themselves, but there are examples which possess four and even five segments. Some of the two-chambered specimens differ from *N. simplex* Silvestri only in wanting the mucro at the base of the initial chamber. Goës suggests that *N. calomorpha* may be the megaspheric form of *N. radicula* or *N. pauperata*.

The area of distribution of the species is very wide; whilst bathymetrically its range according to Brady is from 6 fathoms to 2200 fathoms, and it is recorded by Dr. Egger from depths of 17 to 677 metres.

Nodosaria pyrula d'Orbigny.

Nodosaria pyrula d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 253, No. 13. *Lagena lævis* (W. and J.) Clarke, 1849, Ann. and Mag. Nat. Hist., ser. 2, vol. iii. p. 382, fig. *Nodosaria pyrula* (d'Orb.) Williamson, 1858, Rec. Foram. Gt. Britain, p. 17, pl. ii. fig. 39. *N. pyrula* (d'Orb.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 343, pl. xii. fig. 23. *N. pyrula* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 223, pl. xliv. fig. 2. *N. pyrula* (d'Orb.) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4, vol. x. p. 468, pl. fig. 11. *N. pyrula* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. part 1, p. 89, pl. ii. fig. 29. *N. pyrula* (d'Orb.) Haeusler, 1893, Abhandl. schweizer Pal. Gesell., vol. xx. p. 28, pl. v. figs. 25, 26. *N. pyrula* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss. Cl. II. vol. xviii. p. 345, pl. xi. figs. 14, 15. *N. pyrula* (d'Orb.) Dervieux, 1893, Boll. Soc. Geol. Italia, vol. xii. fasc. 4, p. 603, pl. v. fig. 15. *N. pyrula* (d'Orb.) Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 134, pl. iii. fig. 21. *N. pyrula* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 309, pl. lv. fig. 4.

This fragile variety is represented by both the straight and the curved form *D. guttifera* d'Orbigny. At no Station is it abundant, but it occurs in both Areas.

Nodosaria hispida d'Orbigny.

"Orthoceratia quasi hispida" Soldani, 1798, Testaceographia, vol. ii. p. 15, pl. ii. fig. P. *Nodosaria hispida* d'Orbigny, 1846, For. Foss. Vienne, p. 35, pl. i. figs. 24, 25. *N. hispida* (d'Orb.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 343, pl. xii. fig. 31. *N. hispida* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 748, pl. xiv. fig. 32. *N. hispida* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 223, pl. xliv. figs. 3, 5. *N. hispida* (d'Orb.) Mariani, 1889, Boll. Soc. Geol. Italia, vol. vii. p. 286, pl. x. fig. 6. *N. hispida* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 81, pl. ii. fig. 13. *N. hispida* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 343, pl. xi. fig. 16. *N. hispida* (d'Orb.) Chapman, 1893, Journ. R. Micr. Soc., p. 591, pl. ix. fig. 5. *N. hispida* (d'Orb.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 13, pl. ii. figs. 8–11. *N. hispida* (d'Orb.) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 208, pl. i. figs. 16–18. *N. hispida* (d'Orb.) Rhumbler, 1895, Zool. Anzeiger, No. 474, fig. 6. *N. hispida* (d'Orb.) Perner, 1897, Ceská Akad. Císaře Františka Josefa (Palæont. Bohemiæ No. 4) p. 24, pl. iii. fig. 31. *N. hispida* (d'Orb.) Fornasini, 1897–98, Rendic. R. Accad. Sci. Ist. Bologna, n.s. vol. ii. p. 4, pl. i. fig. 1. *N. hispida* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 79, pl. ix. figs. 23, 24. *N. hispida* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 311, pl. lvii. fig. 1. *N. hispida* (d'Orb.) Fornasini, 1901, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. ix. p. 53, fig. 6.

N. hispida in its typical form may be regarded as a variety of *N. pyrula* with its surface beset with spines. There is great diversity in the form as well as in the disposition of the chambers; usually these are connected by a long stoloniferous tube, but frequently this is wanting, and the test, composed of sessile chambers, differs only from *N. radicula* or *N. scalaris* in having the surface hispid. Sometimes both forms appear in one test, the later chambers only having the stoloniferous tubes.

It is found at several Stations in both Areas, but is by no means common, and the examples are small.

Nodosaria semirugosa d'Orbigny, plate XI. fig. 5.

Nodosaria semirugosa d'Orbigny, 1846, For. Foss. Vienne, p. 34, pl. i. figs. 20–23. *Nodosaria* No. 35, Von Schlicht, 1870, Foram. Septarienthones von Pietzpuhl, p. 24, pl. vii. fig. 20. *N. stipitata* var. *costulata* Reuss, 1870, Sitzungsber. k. Akad. Wiss. Wien, vol. lxii. Abth. i. p. 471. *N. costulata* (Reuss) Brady, 1884, Chall. Rept., p. 515, pl. lxiii. figs. 23–27. *N.* (*cf.*) *semirugosa* (d'Orb.)

Hantk. 1868, Verhandl. Nat. Ver. Preuss. Rheinl. Westphal., Jahrg. xlv. p. 157, pl. ii. fig. 3. *N. costulata* (Reuss) Perner, 1897, Česká Akad. Císaře Františka Josefa (Palæont. Bohemiæ No. 4), p. 25, pl. iii. fig. 13. *N. costulata* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897, 1899, p. 312, pl. lviii. fig. 1.

This variety of the *N. pyrula* group differs from the last described only in having the base of the chambers marked by short costæ. The remarks on the diversity of shapes in the hispid variety apply equally to the partially costate form, and in the Malay Archipelago the distribution is similar.

It is difficult to understand why Reuss should have failed to identify Von Schlicht's figure with d'Orbigny's *N. semirugosa*, and why Brady, on the faith of Reuss, should have accepted it as a new variety. D'Orbigny states that *N. semirugosa* differs from *N. pyrula* only in the partially costate condition of the base of the chambers; whilst Brady gives as the differences between the two forms that "the walls are thick and the basal aspect of each chamber is decorated externally with raised costæ."

Elsewhere it is by no means so common nor so widely distributed as *N. hispida*. The 'Challenger' Stations are three in the North Atlantic and one near the Philippine Islands, at depths ranging from 95 to 450 fathoms. Flint records two 'Albatross' Stations, both in the Gulf of Mexico, 210 and 227 fathoms respectively.

Nodosaria (*Dentalina*) *soluta* Reuss.

Dentalina soluta Reuss, 1851, Zeitschr. deutsch. geol. Gesell., vol. iii. p. 63, pl. iii. fig. 4. *Nodosaria soluta* (Reuss) Andreae, 1884, Abhandl. geol. Special Karte Elsass-Loth., vol. ii. p. 201, pl. x. fig. 8. *N. soluta* (Reuss) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 746, pl. xiv. figs. 25, 26. *N. (D.) soluta* (Reuss) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 557, pl. ix. fig. 26. *Dentalina soluta* (Reuss) Wisniowski, 1890, Pamiętnik Wydz. iii. Ak. Umiej-Krakowie, vol. xvii. p. 20, pl. viii. figs. 37, 38. *N. soluta* (Reuss) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4, vol. x. p. 469, pl. fig. 8. *N. soluta* (Reuss) Fornasini, 1891, Foraminiferi Pliocenici del Ponticello di Savena, pl. ii. figs. 14, 15. *N. soluta* (Reuss) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 80, pl. ii. fig. 10. *N. (D.) soluta* (Reuss) Chapman, 1893, Journ. R. Micr. Soc., p. 587, pl. viii. fig. 26. *N. soluta* (Reuss) Goes, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 70, pl. xii. fig. 690. *N. soluta* (Reuss) Egger, 1895, Naturh. Ver. Passau, Jahresber., xvi. p. 21, pl. ii. figs. 6, 15, 16. *N. soluta* (Reuss) Perner, 1897, Česká Akad. Císaře Františka Josefa (Palæont. Bohemiæ No. 4), p. 26, pl. iii. fig. 10. *N. soluta* (Reuss) Egger, 1899, Abhandl.

k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 59, pl. vi. fig. 23, and pl. vii. fig. iii. *N. soluta* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 310, pl. lvi. fig. 3. *N. soluta* (Reuss) Chapman, 1900. Proc. California Acad. of Sci., ser. 3, Geol., vol. i. p. 248, pl. xxix. fig. 14 *N. soluta* (Reuss) Silvestri, 1900, Mem. Pontif. Accad. Nuovi Lincei, vol. xvii. p. 252, pl. vi. figs. 67, 68.

The difference between the slender *N. pyrula* and the more compact *N. soluta* is only one of degree, and that chiefly in the length and thickness of the stoloniferous tubes. In the original figures by Reuss these are almost as long and as slender as in *N. pyrula*, and one of the examples figured has the later chambers only connected by the tube, which, as before mentioned, is a common feature in *N. hispida*.

In the Malay Archipelago *N. soluta* is of great rarity and has been observed only in Area 1.

Nodosaria capitata Boll, plate XI. fig. 6.

Nodosaria capitata Boll, 1846, Geogn. deutsch. Ostseeländer, p. 177, pl. ii. fig. 13. *Dentalina antennula* d'Orbigny, 1846, For. Foss. Vienne, p. 53, pl. ii. figs. 29, 30; and *D. semicostata*, p. 53, pl. ii. figs. 26, 28. *D. Buchi* Reuss, 1851, Zeitschr. deutsch. geol. Gesell., vol. iii. p. 60, pl. iii. fig. 6; and *D. Philippi*, p. 60, pl. iii. fig. 5. *D. capitata* (Boll) Reuss, 1855, Sitzungsber. k. Akad. Wiss. Wien, vol. xviii. p. 223, pl. i. fig. 4; and 1864 (1865) vol. l. p. 454, pl. i. figs. 8–10. *Nodosaria tholigera* Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 218, pl. v. fig. 41. *Dentalina* Nos. 149 and 150 Von Schlicht, 1870, Foram. Septarienthones von Pietzpuhl, p. 27, pl. viii. figs. 9, 11. *D. capitata* (Boll) Hantken, 1875 (1876), A magy. kir. földt. int. evkönyve, vol. iv. p. 29, pl. iii. fig. 16. *Nodosaria aciculata* (d'Orb.) Fornasini, 1891, Foraminiferi Pliocenici del Ponticello di Savena, pl. ii. fig. 17. *N. soluta* (Reuss) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 13, pl. iii. figs. 16, 17. *N. plicosuturata* Dervieux, 1894, Boll. Soc. Geol. Italia, vol. xii. fasc. 4, p. 613, pl. v. fig. 43.

N. capitata, as interpreted by Reuss and other authors, seems to be nothing more nor less than *N. soluta* with the sutures or base of the chambers costate or plicate. *N. capitata*, when so named, is always figured as a test with few chambers, the initial one being larger than those which immediately succeed it; but there is another form composed of numerous chambers and tapering almost to a point at the base. This is well represented by one of Soldani's figures, to which d'Orbigny has given the name of *Dentalina aciculata*.* This form also has the con-

* Ann. Sci. Nat., vol. vii. 1826, p. 255, No. 41.

sutural portions between the chambers costate, and may be considered to represent the microspheric condition of the species. To this latter form may be assigned the *Orthocerata vitrea*, &c. Soldani;* *Nodosaria intermittens* Roemer;† *Dentalina semicostata* d'Orbigny;‡ *Nodosaria aciculata* (d'Orb.) Fornasini;§ and *Nodosaria* [illegible] Franzenau.‖

There is no previous record of this form in the living condition, and the only example from the Malay Archipelago is the fragment figured; this is from Station 25 in Area 2.

Nodosaria limbata d'Orbigny, plate XI. fig. 7.

Nautilus [illegible] Batsch, 1791, Conch. Seesands, pl. [illegible] fig. [illegible]. *Nodosaria limbata* d'Orbigny, 1840, Mém. Soc. Géol. France, sér. 1, vol. iv. p. 12, pl. i. fig. 1. *N. antipodum* Stache, 1864, Novara-Exped., Geol. Theil, vol. i. p. 194, pl. xxii. fig. [illegible]; and *Dentalina* [illegible], p. 204, pl. xxii. fig. 31. *Dentalina* [illegible] Terquemi Tate and Blake, 1876, Yorkshire Lias, p. [illegible], pl. xviii. fig. 25. *N. limbata* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 557, pl. ix. fig. 23. *N. limbata* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 62, pl. xxiv. fig. 41.

In this form the stoloniferous tubes of *N. pyrula* are reduced to a mere collar or band, but the propriety of placing them in the same group can hardly be questioned.

Although d'Orbigny restricts the number of chambers to three or four, there are frequently five in the straight specimens, and a still larger number in the curved examples.

The form is represented by but one example from the Malay Archipelago, and this is from Station 5 in Area 1. This, with Batsch's specimens from an unknown locality, are the only records of the species in the living condition.

Nodosaria bicamerata F. W. O. R. Jones sp., plate XI. fig. 8.

Lagena vulgaris (Will.) var. *bicamerata* F. W. O. R. Jones, 1872, Trans. Linn. Soc., vol. xxx. p. 65, plate xix. figs. 60–62.

Under this name Rymer Jones lumps together several forms which appear to have nothing in common beyond being composed of two chambers. He describes the primordial chamber as "being more or less globular and sometimes compressed," and in some

* Sagg. Critt., 1780, p. 107, pl. v. fig. 41 v.
† Neues Jahrb., 1838, p. 382, pl. iii. fig. 2.
‡ For. Foss. Vienne, 1846, p. 53, pl. ii. figs. 36–38
§ Foram. Plioc. del Ponticello di Savena, 1891, pl. ii. fig. 17.
‖ Glasnik Hrvatsko Naravoslov Društvo, vol. vi. 1894, p. 273, pl. vi. fig. 48.

instances these compressed chambers are provided with a marginal keel.

In the Malay Archipelago examples the exposed portion of the primordial chamber is hemispherical; it is studded with minute tubercles, and bears a small mucro. The terminal chamber is flask-shaped and ornamented with from nine to eleven longitudinal costæ. The neck of this chamber bears a delicate spiral coil, whilst the surface of the body, including the costæ, is minutely aculeated and perforated. In Rymer Jones's fig. 62, which most nearly resembles the Malay examples, the number of costæ is stated to be fourteen.

Probably some of the specimens described by Rymer Jones are really double-celled *Lagenæ*, as the individual chambers have the characters of known species of that genus with which they are associated in the same locality; but in the Malay Archipelago there have been found no *Lagenæ* having cells identical with those of the form here described, hence it may be treated as a true *Nodosaria*.

In the Malay Archipelago it is very rare, and has been observed only at Station 13 in Area 1.

Ry. Jones's specimens were obtained from a sounding ten miles south of Sandalwood Island in the Java Seas at a depth of 1080 fathoms.

Nodosaria proxima O. Silvestri, plate XI. fig. 9.

Nodosaria proxima O. Silvestri, 1872, Atti Accad. Gioenia Sci. Nat., n.s. vol. vii. p. 63, pl. vi. figs. 138–147. *N. proxima* (Silvestri) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 82, pl. ii. fig. 17. *N. mutabilis* (Terquem) Crick and Sherborn, 1891, Journ. Northamp. Nat. Hist. Soc., vol. vi. p. 214, pl. vi. figs. 7, 8. *N. proxima* (Silvestri) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 206, pl. i. figs. 33–35. *N. proxima* (Silvestri) Jones, 1896, Palæont. Soc., p. 219, pl. vii. fig. 15 and (1866) pl. iv. fig. 8. *N. scalaris* (Batsch) var. *proxima* (Silv.) A. Silvestri, 1896, Mem. Pontif. Acad. Nuovi Lincei, vol. xii. p. 159, pl. iv. figs. 12–15.

The specimens of this variety are all bilocular and the initial chamber is always larger than that which follows it, in this respect being exactly the reverse of the bilocular form of *N. scalaris*. The examples of *N. proxima* differ from one another in little more than the character of the ornamentation, the costæ of some being few and strong, as in *Lagena sulcata*, whilst in others they are very delicate as in *L. striata*.

It is not uncommon in the Malay Archipelago, being found at several Stations in both areas.

Nodosaria scalaris Batsch sp. var., plate XI. fig. 10.

Nautilus (*Orthoceras*) *scalaris* Batsch, 1791, Conch. Seesands, No. 4, pl. ii. fig. 4. *Nodosaria longicauda* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 254, No. 28. *N. intersita* Franzenau, 1888, Földt. Közlöny, vol. xviii. p. 172, pl. ii. figs. 1, 2. *N. scalaris* (Batsch) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 223, pl. xliv. figs. 6, 19. *N. scalaris* (Batsch) Fornasini 1889, Minute forme Rizopod. Retic., pl. fig. 24. *N. scalaris* (Batsch) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 82, pl. 2, fig. 15; and *N. raphanus* (Linné) p. 82, pl. ii. fig. 16. *N. scalaris* (Batsch) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 344, pl. xi. figs. 40, 41. *N. scalaris* (Batsch) A. Silvestri, 1893, Mem. Pontif. Accad. Nuovi Lincei, vol. ix. p. 203, pl. v. fig. 4. *N. scalaris* (Batsch) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 73, pl. xiii. figs. 716–718. *N. scalaris* (Batsch) A. Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 156, pl. iv. figs. 5–11; pl. v. fig. 1. *N. scalaris* (Batsch) Fornasini, 1902, Mem. R. Accad. Sci. Ist. Bologna, ser. 5ª, vol. x. p. 34, figs. 27, 28.

Bilocular examples of this species are common in the Malay Archipelago, and on some of these the costæ are very faint whilst on others they are entirely wanting; in this state the form is not to be distinguished from *N. simplex* Silvestri, and this latter may well be regarded as the smooth condition of *N. scalaris*.

As before mentioned, the embryonal chamber of these bilocular forms of *N. scalaris* is always the smaller, as opposed to the arrangement characteristic of *N. proxima*; but this distinction may after all be purely artificial, for taking these bilocular forms, they are assigned to one or other of the species according as one or other of the chambers is the larger, whilst both forms are to be found embodied in the multilocular *N. scalaris* in which the second chamber is usually larger than the embryonal, but is often smaller as in *N. proxima*.

It is one of the commonest of the *Nodosariæ* in the Malay Archipelago and is found at several Stations in both Areas.

Nodosaria scalaris Batsch sp. var. *separans* Brady, plate XI. figs. 11, 12.

Nodosaria separans Batsch sp. var. *separans* Brady, 1884, Chall. Rept., p. 511, pl. lxiv. figs. 16–19. *N. scalaris* var. *separans* (Brady) A. Silvestri, 1893, Mem. Pontif. Accad. Nuovi Lincei, vol. ix. p. 203, pl. iv. fig. 4.

In *N. scalaris* as in *N. hispida* there is a tendency to have some of the chambers separated by a stoloniferous tube.

This variety appears to be very local. It was found only in one

'Challenger' sounding, off the west coast of New Zealand, 275 fathoms; and Brady says that good examples have been dredged on the coast of Kerry. It has been recorded by Joseph Wright at three stations off the south west of Ireland at depths of from 110 to 120 fathoms and is stated by him to be common at one of these Stations. Silvestri's examples were dredged off the east coast of Sicily, 22 to 700 metres.

In the Malay Archipelago it is represented by a few samples from Station 6 in Area 1 and from Station 25 in area 2.

Nodosaria obscura (?) Reuss, plate XI. figs. 13, 14.

Nodosaria obscura Reuss, 1845, Verstein. böhm. Kreide, part 1, p. 26, pl. xiii. fig. 7. *N. obscura* (Reuss) Reuss, 1874, Palæontographica, vol. xx. part 2, p. 81, pl. xx. figs. 1–4. *N. obscura* (Reuss) Berthelin, 1880, Mém. Soc. Géol. France, sér. 3, vol. i. p. 31, pl. xxiv. fig. 17.

Here are two somewhat anomalous specimens which appear to be related to *N. scalaris*. Under the name of *N. obscura* Reuss has described and figured a variable form which in some examples shows no constriction at the sutures throughout the whole of the growth, whilst in other instances the septation of the earlier chambers is indistinct although in the succeeding ones the sutures are deeply sunk. An exaggerated example of this latter form is shown in one of the Malay specimens, fig. 14.

It is with some hesitation that these examples are ascribed to *N. obscura*, but whatever they may be they are interesting forms, and therefore worthy of being recorded.

The only Malay Archipelago Station is No. 22 in Area 2.

Nodosaria raphanus Linné sp.

"Cornu Hammonis erectum striatum" Plancus, 1739, Conch. Min., p. 15, pl. i. fig. 6. *Nautilus raphanus* Linné, 1767, Syst. Nat., 12th ed. p. 1164, No. 283. *Nodosaria raphanus* (Linné), Parker and Jones, 1859, Ann. and Mag. Nat. Hist., ser. 3, vol. iii. p. 477. *N. raphanus* (Linné) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 342, pl. xii. fig. 26. *N. raphanus* (Linné) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 749, pl. xiv. figs. 36, 37. *N. raphanus* (Linné) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4, vol. x. p. 470, pl. figs. 24, 25. *N. scalaris* (Batsch) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 101, pl. xiii. fig. 91; and *N. multicostata* (d'Orb.) p. 102, pl. xiii. fig. 92. *N. raphanus* (Linné) Crick and Sherborne, 1891, Journ. Northamp.

Nat. Hist. Soc., vol. vi. p. 205, pl. i. fig. 11. *N. raphanus* (Linné) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di, Acireale, vol. v. p. 13, pl. ii. figs. 4–7. *N. raphanus* (Linné) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 204, pl. i. figs. 41–45. *N. raphanus* (Linné) Jones, 1896, Palæont. Soc., p. 213, pl. vi. figs. 9, 10. *N. raphanus* (Linné) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 35, pl. ii. fig. 8. *N. raphanus* (Linné) Perner, 1897, Ceská Akad. Císaře Františka Josefa (Palæont. Bohemiæ No. 4) p. 27, pl. ii. fig. 19.

The Malay examples of this form show little variation. It is common at Station 13 in Area 1, and occurs at a few other Stations in both Areas.

Nodosaria (*D.*) *communis* d'Orbigny.

Nodosaria (*Dentalina*) *communis* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 254, No. 35. *Dentalina communis* d'Orbigny, 1840, Mém. Soc. Géol. France, sér. 1, vol. iv. p. 13, pl. i. fig. 4. *Nodosaria* (*D.*) *communis* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 557, pl. ix. fig. 27. *N. communis* (d'Orb.) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4, vol. x. p. 469, pl. figs. 14–16, 19, 21. *N.* (*D.*) *communis* (d'Orb.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 99, pl. xiii. figs. 97, 100, 108. *D. communis* (d'Orb.) Crick and Sherborn, 1891, Journ. Northam. Nat. Hist. Soc., vol. vi. p. 4, pl. i. fig. 13. *N.* (*D.*) *communis* (d'Orb.) Chapman, 1893, Journ. R. Micr. Soc., p. 590, pl. ix. fig. 1. *N.* (*D.*) *communis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 342, pl. xi. figs. 22–24. *N. communis* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 67, pl. xii. figs. 667–671. *N. communis* (d'Orb.) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 211, pl. i. figs. 8, 9; and p. 214, pl. ii. fig. 2. *D. legumen* (Reuss) = *communis* (d'Orb.) Perner, 1897, Ceská Akad. Císaře Františka Josefa (Palæont. Bohemiæ No. 4) p. 35, pl. iii. fig. 5. *N. communis* (d'Orb.) Fornasini, 1898, Mem. R. Accad. Sci. Ist. Bologna ser. 5, vol. vii. p. 209, pl. figs. 11, 13, 14. *N. communis* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 65, pl. vi. fig. 4. *N. communis* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 310, pl. lvi. fig. 2.

This species occurs in various forms, those with oblique sutures predominating and partaking of the characters of *N. Roemeri* and *N. mucronata*.

It is moderately common in the Malay Archipelago and pretty evenly distributed over the whole of the region.

Nodosaria (*D.*) *farcimen* Soldani sp.

" Orthoceras farcimen " Soldani, 1791, Testaceographia, vol. i. part 2, p. 98, pl. cv. fig. o. *Dentalina farcimen* (Sold.) Reuss, 1863, Bull. Acad. Roy. Belg., sér 2, vol. xv. p. 146, pl. i. fig. 18. *Nodosaria* (*D.*) *farcimen* (Sold.) Howchin, 1888, Journ. R. Micr. Soc., p. 543, pl. ix. fig. 21. *N.* (*D.*) *farcimen* (Sold.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 100, pl. xiii. fig. 109; pl. xiv. figs. 24, 25. *N. farcimen* (Sold.) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4, vol. x. p. 463, pl. fig. 13. *N. farcimen* (Sold.) Mariani, 1891, Boll. Soc. Geol. Italia, vol. x. fasc. 2, p. 173, pl. vi. fig. 5. *Dentalina monile* (Hag.) Beissel (Holzapfel) 1891, Abhandl. k. preuss. geol. Landesanst., N.F. Heft 3, p. 31, pl. vi. fig. 31. *N.* (*D.*) *farcimen* (Sold.) Haeussler, 1893, Abhandl. schweiz. pal. Gesell., vol. xx. p. 31, pl. iv. figs. 17–21. *N. farcimen* (Sold.) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 211, pl. i. figs. 6, 7. *N. farcimen* (Sold.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 309, pl. lv. fig. 5.

This form occurs in both Areas, but is very rare; the specimens are typical and well developed.

Nodosaria (*D.*) *filiformis* d'Orbigny.

" Orthoceratia filiformia aut capillaria " Soldani, 1798, Testaceographia, vol. ii. p. 35, pl. x. fig. *e*. *Nodosaria filiformis* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 253, No. 14. *Dentalina* sp. de Folin, 1887, Le Naturaliste, vol. ix. p. 140, fig. 20 *a*. *N. filiformis* (d'Orb.) Fornasini, 1889, Foram. Mioc. di San Rufillo, pl. i. fig. 14. *N.* (*D.*) *filiformis* (d'Orb.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 97, pl. xiii. figs. 105, 107. *N.* (*D.*) *filiformis* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 79, pl. ii. fig. 7. *N. filiformis* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 310, pl. lv. fig 6.

This also is a very rare form in the Malay Archipelago, and is represented mainly by fragments. The majority of the examples have oblique sutures, resembling plate lxiii. fig. 4 of Brady's 'Challenger' Report.

Lingulina d'Orbigny.

Lingulina limbata sp. n., plate XI. fig. 15.

Primordial chamber oval, surmounted by an expanding neck; surface smooth. Succeeding chamber triangular, compressed, base limbate with a short process on either margin. Aperture oval, in a phialine neck. Length 0·20 mm.

This is one of an interesting group of [illegible] in which the [illegible] of being [illegible] as in the type, are [illegible] of two or more [illegible] chambers arranged in a linear series, the primordial chamber being of a character different from the others.

One of this group was [illegible] and figured by Dr. [illegible] under the name of *L.* [illegible].* This was a solitary specimen from [illegible] at Southport.

In one of the examples of *L.* [illegible] figured by Brady † the primordial chamber is armed with a pair of [illegible] spines at the [illegible] end.

Amongst the [illegible] forms of [illegible] figured by [illegible] two bear a resemblance to this group of [illegible]. ‡

From my friend Mr. [illegible] of [illegible] Hulme, I have specimens and drawings of a form closely allied to *L.* [illegible], but [illegible]. About [illegible] specimens were found in the material from off the coast of the Island of [illegible] [illegible] by Mr. [illegible] and myself. In six cases there is a third chamber similar to the second, only rather larger. The [illegible] in other parts of the Mediterranean very rarely, [illegible] Islands.

L. [illegible] is very rare in the Malay Archipelago, and has been found only at Station [illegible] in Area [illegible].

[illegible] sp. n., plate XI. figs. 16, 17.

Test [illegible]. Primordial chamber flask-shaped with longitudinal costæ. Succeeding chambers pyriform, compressed, broad at the base, which is encircled by a tubuliferous fringe. Aperture oval, in a phialine neck. Length 0·50 mm.

This curious form may be said to be compounded of an initial cell resembling *Lagena sulcata*, from which proceeds a series of cells each of which has somewhat of the characters of *L. fimbriata*, the base of each being attached to the phialine neck of the preceding, and each successive chamber increasing slightly in size.

This form also is very rare in the Malay Archipelago, and has been observed only at Station 6 in Area 1.

Fig. 18 represents a detached chamber found at Station 30 in Area 2, which indicates a species distinct from those described. The length of the chamber is 0·15 mm.

* First Rept. of the Southport Soc. of Nat. Sci., 1890–91 (1892) p. 63, pl. i. fig. 9.
† Chall. Rept., 1884, p. 517, pl. lxv. fig. 17.
‡ Abhandl. schweiz. pal. Gesell., vol. xvii. 1890, p. 92, pl. xiii. figs. 56–59.

Frondicularia Defrance.

Frondicularia nitida Terquem, plate XI. fig. 19.

Frondicularia nitida Terquem, 1858, Mém. Acad. Imp. de Metz, vol. xxxix. p. 592, pl. i. fig. 9. *F.* cf. *nitida* (Terq.) Uhlig, 1883, Jahrb. k. k. geol. Reichs., vol. xxxiii. p. 756, pl. ix. fig. 19. *F. nitida* (Terq.) Burbach, 1886, Zeitschr. Naturw. Halle, vol. lix. p. 45, pl. i. fig. 7. *F. spathulata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 346, pl. xi. fig. 32.

Of this almost extinct genus Mr. Durrand's collection yields but a single individual; this is from Station 30 in Area 2.

This form, with slight variations, is common in the lias, and has received a variety of names. Its nearest living representative appears to be the *F. spathulata* of Brady.* The solitary specimen found by Dr. Egger in the 'Gazelle' Soundings, and attributed by him to *F. spathulata*, seems to correspond in all respects with the Malay Archipelago example.

Rhabdogonium Reuss.

Rhabdogonium tricarinatum d'Orbigny sp.

Vaginulina tricarinata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 258, No. 4; Modèle, No. 4. *Rhabdogonium tricarinatum* (d'Orb.) Brady, 1884, Chall. Rept., p. 525, pl. lxvii. figs. 1–3. *R. tricarinatum* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 752, pl. xv. fig. 16. *R. tricarinatum* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 223, pl. xlv. fig. 3. *R. tricarinatum* (d'Orb.) Schrodt, 1890, Zeitschr. deutsch. geol. Gesell., vol. xlii. p. 411, pl. xxii. fig. 2. *R. tricarinatum* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 558, pl. x. fig. 7. *R. tricarinatum* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 355, pl. xi. figs. 49, 50; pl. xii. figs. 36–38. *R. tricarinatum* (d'Orb.) Jones, 1895, Palæont. Soc., p. 232, pl. vii. fig. 16. *R. tricarinatum* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 23, pl. ii. figs. 18, 19. *R. tricarinatum* (d'Orb.) Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 194, pl. i. fig. 8 (vol. xv. 1899).

This form occurs sparingly at a few Stations in both areas. All the examples are twisted and have a produced neck.

Brady states that it has not been noticed at any point in the North Pacific.

* Quart. Journ. Micr. Sci., n.s. vol. xix. 1879, p. 270, pl. viii. fig. 5.

Marginulina d'Orbigny.

Marginulina glabra d'Orbigny.

Marginulina glabra d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 259, No. 5: Modèle, No. 55. *M. attenuata* (Neug.) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 487, pl. xi. fig. 27. *M. glabra* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 558, pl. x. fig. 1. *M. glabra* (d'Orb.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 106, pl. xiv. figs. 35–40, 42, 43. *M. glabra* (d'Orb.) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4. vol. x. p. 470, pl. figs. 20, 26–30. *M. glabra* (d'Orb.) Mariani, 1891, Boll. Soc. Geol. Italia, vol. x. p. 173, pl. vi. fig. 6. *M. elongata* (d'Orb.) Perner, 1892, Česká Akad. Cisaře Františka Josefa (Palæont. Bohemiæ No. 1) p. 61, pl. v. figs. 13, 14. *M. glabra* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 346, pl. xi. figs. 28, 29. *M. glabra* (d'Orb.) Chapman, 1894, Journ. R. Micr. Soc., p. 160, pl. iv. fig. 11. *Vaginulina glabra* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. pl. xi. figs. 659–661. *M. glabra* (d'Orb.) Jones, 1896, Palæont. Soc., p. 233, pl. i. fig. 26 (1866). *M. glabra* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 313, pl. lx. fig. 1.

This form is moderately common in the Malay Archipelago and appears at several Stations in both Areas. The examples are short and inflated, and in most cases have but two chambers.

Marginulina costata Batsch sp., plate XI. fig. 20.

Nautilus (*Orthoceras*) *costatus* Batsch, 1791, Conch. Seesands, pl. i. fig. 1. *Marginulina raphanus* (Linné) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 258, No. 1, pl. x. figs. 7, 8; Modèle, No. 6. *M. costata* (Batsch) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 92, pl. iii. fig. 4. *Cristellaria* (*Marginulina*) *costata* Hosius, 1892, Verhandl. Nat. Ver. Preuss. Rheinl. Westph., Jahrg. xlix. p. 184, pl. ii. fig. 22; and *raricosta*, p. 124, pl. ii. fig. 23. *M. costata* (Batsch) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 434, pl. ii. fig. 6; and 1894, ser. 5, vol. iv. pp. 213, 214, 217, pl. ii. figs. 18–21. *Nodosaria raphanus* (Linné) Dervieux, 1893, Boll. Soc. Geol. Italia, vol. xii. p. 621, pl. v. figs. 56, 57. *M. costata* (Batsch) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 23, pl. ii. fig. 17. *M. costata* (Batsch) Jones, 1896, Palæont. Soc., p. 235, pl. i. fig. 21 (1866, *M. raphanus*) (d'Orb.). *M. costata* (Batsch) Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 200, pl. i. fig. 9. *M. costata* (Batsch) Fornasini, 1897–98, Rendic. R. Accad. Sci. Ist. Bologna, n.s. vol.

ii. p. 5, pl. i. fig. 3. *M. costata* (Batsch) Silvestri, 1900, Mem. Pontif. Accad. Nuovi Lincei, vol. xvii. p. 273, pl. vi. fig. 22.

This species occurs in two forms, one short and inflated with a few strong ribs; the other elongate with numerous and delicate costæ as shown in the illustration.

It is moderately common at Station 30 in Area 2, and appears at a few stations in Area 1.

Brady states that with the exception of a few small examples from off the coast of New Zealand, it has not been observed in either the North or South Pacific, the Southern Ocean, or the Red Sea.

Vaginulina d'Orbigny.

Vaginulina legumen Linné sp. var., plate XI. fig. 21.

Nautilus legumen Linné, 1767, Syst. Nat., 12th ed. p. 1164, No. 288. *Vaginulina legumen* (Linné) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 257, No. 2. *V. legumen* var. *lævigata* (Röm.) Jones, 1884, Quart. Journ. Geol. Soc., vol. xl. p. 769, pl. xxxiv. fig. 5. *V. legumen* (Linné) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 753, pl. xv. fig. 19; and Ibid., 1889, p. 487, pl. xi. fig. 25. *V. legumen* (Linné) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 559, pl. x. fig. 16. *V. legumen* (Linné) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 107, pl. xiv. fig. 49. *V. legumen* (Linné) Crick and Sherborn, 1891, Journ. Northamp. Nat. Hist. Soc., vol. vi. p. 4, pl. vi. fig. 15. *V. legumen* (Linné) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 94, pl. iii. fig. 6. *V. lævigata* (Röm.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 65, pl. xi. figs. 648–655. *V. lævigata* (Röm.) Jones, 1896, Palæont. Soc., p. 227, pl. v. fig. 8. *V. legumen* (Linné) Bagg, 1898, Bull. U.S. Geol. Survey, No. 88, p. 53, pl. iv. fig. 4. *V. legumen* (Linné) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 314, pl. lx. fig. 2. *V. legumen* (Linné) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 98, pl. ix. figs. 29, 30; and *V. denudata* (Reuss) p. 100, pl. ix. figs. 29, 30.

A very rare form in the Malay Archipelago and has been found only in Area 2.

Most of the examples are normal, but the variety figured approaches *Cristellaria crepidula*, whilst the inflated terminal chamber suggests an affinity with the dimorphous genus *Amphicoryne*.

Vaginulina formosa sp. n., plate xi. fig. 22

Test oblong, tapering towards the apertural end; aboral end broad and rounded; dorsal margin thin and carinate; ventral

margin broad and inflated; chambers few in number, triangular, radiating from a point at the aboral extremity of the test. Sutures obscure; surface covered with costæ parallel with the sutures. Aperture in a produced neck. Length 0·47 mm.

This is a passage form from *Vaginulina* to *Cristellaria* and is interesting as being a survival from the mesozoic period. In the lias and more especially in the oolite, types similar in character were extremely abundant, and a multitude of them has been figured by Terquem in his various works on the foraminifera of those formations.

There is but a single specimen from the Malay Archipelago, and this is from Station 25 in Area 2.

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED
GREAT WINDMILL STREET, W., AND DUKE STREET, STAMFORD STREET, S.E.

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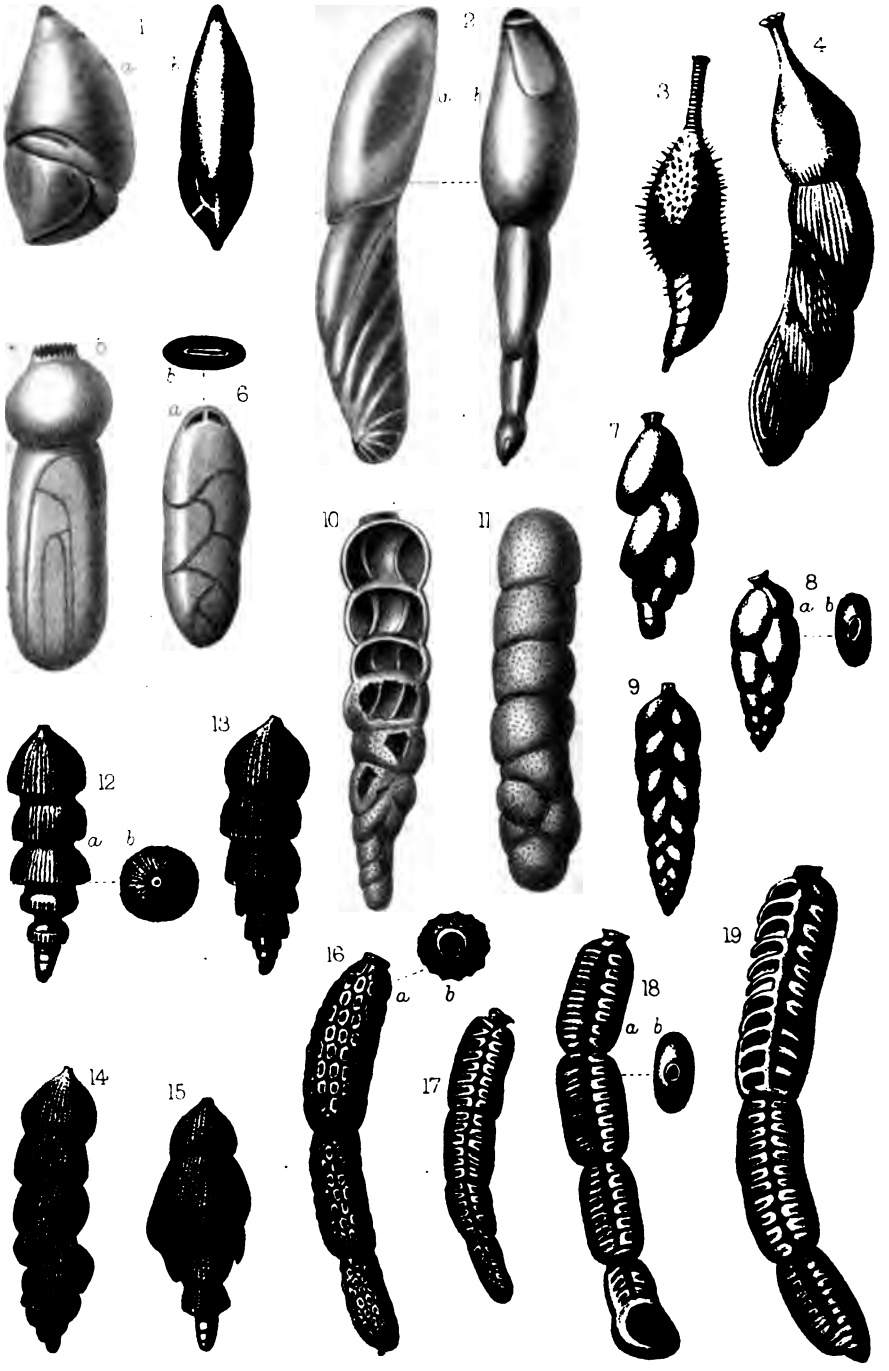

F.W.Millett del. ad nat.

West, Newman lith.

Foraminifera of Malay Archipelago.

(Journ. Roy. Micr. Soc., 1903, pp. 253–275.)

IV.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part XIV.*

By Fortescue William Millett, F.R.M.S.

(*Read April 17th*, 1903.)

Plate V.

Cristellaria Lamarck.

Cristellaria Schloenbachi Reuss.

Cristellaria Schloenbachi Reuss, 1862, Sitzungsber. k. Akad. Wiss. Wien, vol. xlvi. p. 65, pl. vi. figs. 14, 15. *C. Schloenbachi* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 315, pl. lxiii. fig. 4. *C. Schloenbachi* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 110, pl. xii. figs. 38–40; pl. xxiv. figs. 30, 31.

EXPLANATION OF PLATE V.

Fig. 1.—*Cristellaria variabilis* Reuss. × 100.
„ 2.—*Amphicoryne glabra* sp. n. × 70.
„ 3. „ *Bradyi* A. Silvestri sp. × 90.
„ 4. „ *falx* Parker and Jones sp. × 70.
„ 5.—*Polymorphina lactea* var. *oblonga* Williamson. × 60.
„ 6.—*Dimorphina lingulinoides* sp. n. × 90.
„ 7.—*Uvigerina canariensis* d'Orbigny var. × 90.
„ 8, 9. „ *Auberiana* d'Orbigny, var. *glabra* var. n. × 90.
„ 10.—*Sagrina columellaris* Brady. × 75. Microspheric form.
„ 11. „ „ × 75. Megalospheric form.
„ 12–15. „ *nodosa* Parker and Jones. × 90.
„ 16. „ *tessellata* Brady. × 75.
„ 17. „ *limbata* Brady. × 70. From a drawing by C. Elcock.
„ 18, 19. „ „ „ × 75. Specimens from Raine Island.

In the Pacific Ocean the genus *Cristellaria* is very sparingly distributed, and there are few records of its occurrence in the equatorial region or in the North Pacific.

In Mr. Durrand's collection, although the genus is represented by several species, the individuals are few and ill-developed.

C. Schloenbachi possessing characters common to both *Vaginulina* and *Cristellaria* comes naturally as a connecting link between the two genera.

It occurs sparingly at Stations in both Areas, and is not uncommon at Station 30.

'Challenger' Stations are off Bermuda, 435 fathoms; off Culebra Island, 390 fathoms; and off Raine Island, 155 fathoms. Flint records it from two Stations in the Gulf of Mexico, at depths of 169 and 210 fathoms.

Cristellaria crepidula Fichtel and Moll sp.

Nautilus crepidula Fichtel and Moll, 1803, Test. Micr., p. 107, pl. xix. figs. *g–i*. *Cristellaria crepidula* d'Orbigny, 1839, Foram. Cuba, p. 64, pl. viii. figs. 17, 18. *C. crepidula* (F. and M.) Jones, 1884, Quart. Journ. Geol. Soc., vol. xl. p. 770, pl. xxxiv. fig. 8. *C. crepidula* (F. and M.) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 84, pl. iv. fig. 8. *C. crepidula* (F. and M.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. ii. vol. vi. p. 753, pl. xv. fig. 21. *C. crepidula* (F. and M.) Halkyard, 1889, Trans. and Ann. Rept. Manchester Micr. Soc., p. 67, pl. ii. fig. 5. *C. dilatata* Wisniowsky, 1890, Pamietnik Wydz. iii. Akad. Umiej-Krakowie, vol. xvii. p. 31, pl. ix. fig. 10; and *C. dorsoarcuata* p. 31, pl. ix. fig. 11. *C. crepidula* (F. and M.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 111, pl. xiv. fig. 59; pl. xv. figs. 1, 18. *C. crepidula* (F. and M.) Fornasini, 1890, Mem. R. Accad. Sci. Ist. Bologna, ser. 4, vol. x. p. 471, pl. figs. 31–33, 56–60. *C. crepidula* (F. and M.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 350, pl. xi. figs. 51, 52; pl. xii. figs. 34, 35. *C. crepidula* (F. and M.) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 220, pl. iii. fig. 10. *C. crepidula* (F. and M.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 62, pl. xi. figs. 599, 600. *C. crepidula* var. *intermedia* Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 40, pl. i. fig. 11; var. *cymboides*, pl. i. figs. 1–3; var. *subarcuatula*, pl. i. fig. 17; var. *harpa*, pl. i. figs. 12, 18–21. *C. crepidula* (F. and M.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 316, pl. lxiii. fig. 2. *C. crepidula* (F. and M.) Egger, 1899, Abhandl. k. bayer, Akad. Wiss., Cl. II. vol. xxi. p. 110, pl. xxiii. figs. 21, 22; pl. xxv. figs. 27, 28.

Very few specimens of this form have been observed, and these are of the *subarcuatula* type.

It occurs in both Areas.

Cristellaria acutauricularis Fichtel and Moll sp.

Nautilus acutauricularis Fichtel and Moll, 1803, Test. Micr., p. 102, pl. xviii. figs. *g–i*. *Cristellaria acutauricularis* (F. and M.) Parker and Jones, 1860, Ann. and Mag. Nat. Hist., ser. 3, vol. v. p. 114, No. 20. *C. acutauricularis* (F. and M.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 753, pl. xv. fig. 22. *C. acutauricularis* (F. and M.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 113, pl. xv. fig. 17. *C. acutauricularis* (F. and M.) Crick and Sherborn, 1891, Journ. Northamptonshire Nat. Hist. Soc., vol. vi. p. 212, pl. fig. 25; and 1892, vol. vii. pl. ii. figs. 17, 18. *C. acutauricularis* (F. and M.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 353, pl. xii. figs. 19, 20. *C. acutauricularis* (F. and M.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 316, pl. lxiii. fig. 5. *C. acutauricularis* (F. and M.) Chapman, 1900, Quart. Journ. Geol. Soc., vol. lvi. p. 259, pl. xv. fig. 9.

The examples of this species are small and pass imperceptibly into *C. gibba*.

It occurs at several Stations in both Areas, but always in small numbers.

In the recent condition this is by no means a common form, although it has a very wide range. Besides the localities mentioned by Brady it has been recorded by Egger from Mauritius, and by Flint from two Stations off the Atlantic coast of the United States.

Cristellaria gibba d'Orbigny.

Cristellaria gibba d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 292, No. 17. *C. gibba* d'Orbigny, 1839, Foram. Cuba, p. 40, pl. vii. figs. 20, 21. *C. gibba* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 259, pl. x. figs. 19, 21. *C. gibba* (d'Orb.) Crick and Sherborn, 1891, Journ. Northamptonshire Nat. Hist. Soc., vol. vi. p. 212, pl. fig. 29. *C. gibba* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 352, pl. xii. figs. 21, 27. *C. gibba* (d'Orb.) Silvestri, 1893, Mem. Pontif. Accad. Nuovi Lincei, vol. ix. p. 207, pl. vi. fig. 4. *C. gibba* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 61, pl. x. figs. 287, 288. *C. gibba* (d'Orb.) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 221, pl. iii. fig. 20. *C. gibba* (d'Orb.) Jones, 1895, Palæont. Soc., p. 247, pl. vii. fig. 19. *C. gibba* (d'Orb.) Chapman, 1896, Journ. R. Micr. Soc., p. 4, pl. i. fig. 7. *C. gibba* (d'Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. pp. 44, 45, pl. ii. figs. 5, 6. *C. gibba* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 317, pl. lxiv. fig. 1. *C. gibba* (d'Orb.) Chapman, 1900, Journ. Linn. Soc. (Zool.) vol. xxviii. p. 31,

pl. v. fig. 13; and Proc. California Acad. of Sci., ser. 3, Geol., vol. i. p. 251, pl. xxx. fig. 3.

This species is rather more plentiful than *C. acutauricularis*, and its distribution is much the same.

Brady records notes of its occurrence in the North Atlantic and the South Pacific. Silvestri has found it in the Mediterranean, and Egger at Mauritius, West Australia, and New Guinea; whilst Flint adds the Gulf of Mexico to the list of localities.

Cristellaria italica Defrance sp.

Saracenaria italica Defrance, 1824, Dict. Sci. Nat., vol. xxxii. p. 177; 1827, vol. xlvii. p. 344; Atlas Conch., pl. xiii. fig. 6. *Cristellaria* (*Saracenaria*) *italica* (Defr.) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 293, No. 26; and Modèles, Nos. 19 and 85. *C. italica* (Defr.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 754, pl. xv. fig. 23; pl. xvi. fig. 4. *C. italica* (Defr.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 350, pl. xii. figs. 22, 23, 26, 40–42. *C. italica* (Defr.) Chapman, 1894, Journ. R. Micr. Soc., p. 653, pl. x. fig. 10. *C. italica* (Defr.) Fornasini, 1894, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iv. p. 219, pl. iii. fig. 8; and 1895, vol. v. p. 12, pl. iv. fig. 28. Idem, 1895, Palæont. Italica, vol. i. p. 145, pl. vii. fig. 10. *C. italica* (Defr.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 316, pl. lxiii. fig. 6.

In the Malay Archipelago this is a very rare form and has been observed only at Station 12 in Area 1.

To the numerous list of localities mentioned by Brady, Egger adds West Australia; and Flint records it from the coast of Georgia and the Gulf of Mexico.

Cristellaria variabilis Reuss, plate V. fig. 1.

Cristellaria variabilis Reuss, 1849, Denkschr. k. Akad. Wiss. Wien, vol. i. p. 369, pl. xlvi. figs. 15, 16. *C. variabilis* (Reuss) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 224, pl. xliv. fig. 12. *C. variabilis* (Reuss) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 560, pl. x. fig. 22. *C. Bradyana* Procházka, 1893, Vestnik král. české spol. náuk. Třída Math., p. 44, pl. xi. fig. 5. *C. variabilis* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 353, pl. xii. figs. 16–18. *C. variabilis* (Reuss) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 62, pl. x. figs. 593–595. *C. variabilis* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 316, pl. lxiii. fig. 1.

There are several examples of this form from Station 25 in Area 2, and it also occurs at Station 13 in Area 1. The specimens

are small and ill-developed, none of them attaining the carinate stage.

Brady states that it is by no means uncommon from 100 to 600 fathoms; Egger records it from four Stations at depths of from 37 to 650 fathoms; Goës from 126 fathoms; and Flint from six Stations, 68 to 196 fathoms.

Cristellaria rotulata Lamarck sp.

Lenticulites rotulata Lamarck, 1804, Ann. Mus., vol. v. p. 188, No. 3; and 1806, vol. viii. pl. lxii. fig. 11. *Cristellaria rotulata* d'Orbigny, 1840, Mém. Soc. Géol. Fr., sér. i. vol. iv. p. 26, pl. ii. figs. 16–18. *C. rotulata* (Lam.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 224, pl. lxiv. fig. 15. *C. rotulata* (Lam.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 559, pl. x. fig. 17. *C. rotulata* (Lam.) Haeusler, 1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 114, pl. xv. figs. 7, 8, 10, 12, 13. *C. rotulata* (Lam.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 95, pl. iii. fig. 8. *C. rotulata* (Lam.) Beissel (Holzapfel), 1891, Abhandl. k. Preuss. geol. Landesanst., N.F., Heft 3, p. 55, pl. i. figs. 2, 3; pl. x. figs. 20–43. *C. rotulata* (Lam.) Perner, 1892, Ceská Akad. Císaře Františka Josefa (Palæont. Bohemicæ No. 1) p. 62, pl. iv. figs. 1–11. *C. rotulata* (Lam.) Crick and Sherborn, 1892, Journ. Northamp. Nat. Hist. Soc., vol. vii. p. 70, pl. ii. fig. 14. *C. rotulata* (Lam.) A. Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 14. pl. iii. figs. 22, 23. *C. rotulata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 351, pl. xii. figs. 1, 2, 32, 33. *C. rotulata* (Lam.) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 435, pl. ii. fig. 11; and 1894, vol. iv. pp. 221, 222, pl. iii. figs. 24, 25. *C. rotulata* (Lam.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 60, pl. x. figs. 559–578. *C.* (*Lenticulites*) *rotulata* (Lam.) Egger, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 26, pl. iii. figs. 4–7. *C. rotulata* (Lam.) Fornasini, 1895, Palæont. Italica, vol. i. p. 146, pl. vii. fig. 12. *C. rotulata* (Lam.) Chapman, 1896, Journ. R. Micr. Soc., p. 5, pl. i. fig. 8. *C. rotulata* (Lam.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 314, pl. lxiv. fig. 4. *C. rotulata* (Lam.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 122, pl. xi. figs. 3, 4. *C. rotulata* (Lam.) Chapman, 1900, Journ. Linn. Soc. (Zool.), vol. xxviii. p. 32, pl. v. fig. 14; and Proc. California Acad. of Sci., ser. 3, Geol. vol. i. p. 251, pl. xxx. fig. 4.

Brady speaks of this as one of the most widely diffused of all the foraminifera. In the Malay Archipelago it is one of the rarest and has been observed only at Station 25 in Area 1.

margin broad and inflated; chambers few in number, triangular, radiating from a point at the aboral extremity of the test. Sutures obscure; surface covered with costæ parallel with the sutures. Aperture in a produced neck. Length 0·47 mm.

This is a passage form from *Vaginulina* to *Cristellaria* and is interesting as being a survival from the mesozoic period. In the lias and more especially in the oolite, types similar in character were extremely abundant, and a multitude of them has been figured by Terquem in his various works on the foraminifera of those formations.

There is but a single specimen from the Malay Archipelago, and this is from Station 25 in Area 2.

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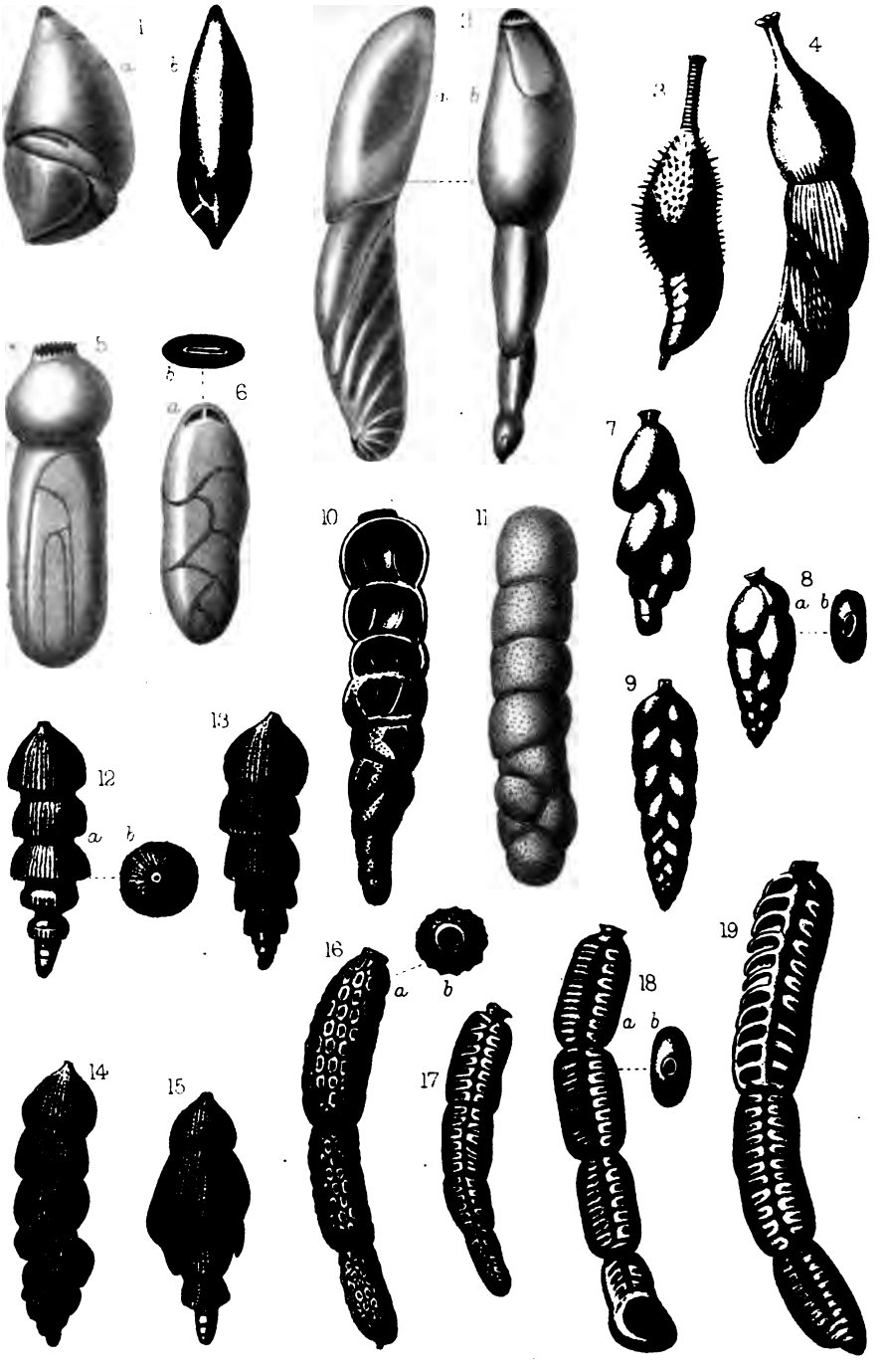

F.W.Millett del ad nat.

West, Newman lith

Foraminifera of Malay Archipelago.

(Journ. Roy. Micr. Soc., 1903, pp. 253–275.)

IV.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part XIV.*

By Fortescue William Millett, F.R.M.S.

(*Read April 17th*, 1903.)

Plate V.

Cristellaria Lamarck.

Cristellaria Schloenbachi Reuss.

Cristellaria Schloenbachi Reuss, 1862, Sitzungsber. k. Akad. Wiss. Wien, vol. xlvi. p. 65, pl. vi. figs. 14, 15. *C. Schloenbachi* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 315, pl. lxiii. fig. 4. *C. Schloenbachi* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 110, pl. xii. figs. 38–40; pl. xxiv. figs. 30, 31.

EXPLANATION OF PLATE V.

Fig. 1.—*Cristellaria variabilis* Reuss. × 100.
„ 2.—*Amphicoryne glabra* sp. n. × 70.
„ 3. „ *Bradyi* A. Silvestri sp. × 90.
„ 4. „ *falx* Parker and Jones sp. × 70.
„ 5.—*Polymorphina lactea* var. *oblonga* Williamson. × 60.
„ 6.—*Dimorphina lingulinoides* sp. n. × 90.
„ 7.—*Uvigerina canariensis* d'Orbigny var. × 90.
„ 8, 9. „ *Auberiana* d'Orbigny, var. *glabra* var. n. × 90.
„ 10.—*Sagrina columellaris* Brady. × 75. Microspheric form.
„ 11. „ „ × 75. Megalospheric form.
„ 12–15. „ *nodosa* Parker and Jones. × 90.
„ 16. „ *tessellata* Brady. × 75.
„ 17. „ *limbata* Brady. × 70. From a drawing by C. Elcock.
„ 18, 19. „ „ „ × 75. Specimens from Raine Island.

Usually the sutures are more depressed than in the figures given by Reuss, consequently the chambers are more inflated.

Polymorphina lactea var. *oblonga* Williamson, plate V. fig. 5.

Polymorphina lactea (W. and J.) var. *oblonga* Williamson, 1858, Rec. Foram. Gt. Britain, p. 71, pl. vi. fig. 149. *P. oblonga* (Will.) Brady, Parker, and Jones, 1870, Trans. Linn. Soc., vol. xxvii. p. 222, pl. xxxix. fig. 7. *P. oblonga* (Will.) Terquem, 1875, Ess. Anim. Plage Dunkerque, part i. p. 37, pl. v. fig. 11. *P. formosa* Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 440, pl. ix. figs. 17–19.

This is an intermediate variety connecting *P. lactea* with *P. compressa*, and must not be confounded with the *P. oblonga* of d'Orbigny, which resembles an elongated *P. problema*. The example figured well represents the normal form, with the exception that it possesses a supplementary chamber of a Nodosarian character. This is evidently a monstrosity, otherwise the specimen would have to be assigned to the genus *Dimorphina*. This chamber appears to have nothing in common with the fistulose extraneous growths so frequently found in the *Polymorphinæ* generally, but rare or unknown in the examples from the Malay Archipelago.

P. lactea var. *oblonga* occurs in more or less abundance at several Stations in both Areas.

Of its distribution generally Brady, Parker, and Jones write, "The geographical range of *P. oblonga* seems to be limited; it is most abundant on the Devonshire and Cornwall coast, and may be found sparingly distributed at intervals all round the British Islands. We are not aware of its occurrence in the seas of warmer latitudes or in a fossil condition."

P. formosa is recorded by Egger from Cape Verde Islands, 38 fathoms; and from West Australia, 196 fathoms.

As a fossil it is not uncommon in the tertiary beds of St. Erth.

Polymorphina compressa d'Orbigny.

"Polymorpha subovalia" Soldani, 1791, Testaceographia, vol. i. part 2. p. 114, pl. cxiv. fig. F; pl. cxv. fig. N; pl. cxvi. fig. X. *Polymorphina compressa* d'Orbigny, 1846, For. Foss. Vienne, p. 233, pl. xii. figs. 32–34. *P.* aff. *amygdala* Deecke, 1886, Mém. Soc. émul. Montbéliard, sér. 3, vol. xvi. p. 37, pl. i. fig. 20. *P. polygona* Terquem, 1886, Mém. Soc. Géol. France, sér. 3, vol. iv. p. 63, pl. xiii. fig. 18. *P. lactea* (W. and J.) Dawson, 1886, Handbook Zoology, p. 44, fig. 34. *P. compressa* (d'Orb.) Mariani, 1888, Boll. Soc. Geol. Italia, vol. vii. p. 288, pl. x. fig. 13. *P. compressa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 309, pl. ix. figs. 11–13. *P. compressa* (d'Orb.) Goës, 1894, K. Svenska

Vet.-Akad. Handl., vol. xxv. p. 58, pl. x. figs. 539–553. *P. compressa* (d'Orb.) Jones, 1895, Palæont. Soc., p. 258, pl. v. figs. 26, 28. *P. compressa* var. *marginalis* Jones and Chapman, 1896, Journ. Linn. Soc. (Zool.), vol. xxv. p. 507, fig. 37. *P. compressa* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 319, pl. lxvii. fig. 3. *P. proteus* (Beissel) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 131, pl. xxv. figs. 16, 17.

Found sparingly at several Stations in both Areas. The examples are with difficulty separable from *P. amygdaloides*.

Polymorphina elegantissima Parker and Jones.

Polymorphina elegantissima Parker and Jones, 1864, Phil. Trans., vol. clv. table x. p. 438. *P. elegantissima* (P. and J.) Brady, Parker, and Jones, 1870, Trans. Linn. Soc., vol. xxvii. p. 231, pl. xl. fig. 15. *P. elegantissima* (P. and J.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 319, pl. lxvii. fig. 4.

This form is tolerably abundant at Station 13 in Area 1, and occurs sparingly at Station 22 and a few others in Area 2. The examples are invariably small, and rarely consist of more than three chambers. Their affinity is with *P. problema*.

According to Brady,* the species appears to be confined to the shores of the Pacific, and is best known from Australian specimens. Flint does not mention the locality of the 'Albatross' examples nor the depth from which they were obtained.

Polymorphina communis d'Orbigny.

Polymorphina (*Guttulina*) *communis* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 266, pl. xii. figs. 1–4; Modèle, No. 62. *P.* (*Guttulina*) *problema* var. *deltoidea* Andreae, 1884, Abhandl. geol. Special-Karte Elsass-Loth., vol. ii. p. 210, pl. ix. fig. 21. *P. glommerata* (Röm.) Beissel (Holzapfel) 1891, Abhandl. k. Preuss. geol. Landesanst., N.F. Heft 3, p. 62, pl. xii. figs. 17–29. *Bulimina pyrula* (d'Orb.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 12, pl. v. figs. 73, 74. *Polymorphina gibba* near *communis* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 55, pl. ix. figs. 523, 524. *P. communis* (d'Orb.) Jones, 1895, Palæont. Soc., p. 265, pl. v. fig. 24; pl. vi. fig. 16. *P. communis* (d'Orb.) var. *acuplacenta* Jones and Chapman, 1896, Journ. Linn. Soc. (Zool.) vol. xxv. p. 502, fig. 9. *P. communis* (d'Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 46, pl. ii. fig. 14. *P. communis* (d'Orb.) Bagg, 1898, Bull. U.S. Geol. Survey, No. 88, p. 60, pl. vi. fig. 2.

* Chall. Rept., 1884, p. 567.

P. communis var. *acuplacenta* (J. and C.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 233, pl. iv. fig. 2. *P. communis* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 319, pl. lxvii. fig. 6. *P. communis* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 128, pl. xvii. figs. 36, 37. *P. communis* (d'Orb.) Fornasini, 1900, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. viii. p. 387, fig. 37.

Is not common nor widely distributed, but the examples are more robust than those of the other species of the genus found in the Malay Archipelago.

Polymorphina problema d'Orbigny.

Polymorphina (Guttulina) problema d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 266, No. 14; Modèle, No. 61. *Bulimina pyrula* (d'Orb.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 12, pl. v. figs. 79, 80. *Polymorphina problema* (d'Orb.). Jones, 1895, Palæont. Soc. p. 267, pl. v. fig. 23; pl. vi. fig. 12. *P. problema* (d'Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 46, pl. ii. fig. 17. *P. problema* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 129, pl. xvii. figs. 33–35.

The specimens which can be distinguished from *P. communis* are few and insignificant, and seem to be confined to a few Stations in Area 1.

Polymorphina oblonga d'Orbigny.

Polymorphina oblonga d'Orbigny, 1846, For. Foss. Vienne, p. 232, pl. xii. figs. 29–31. *P. oblonga* (d'Orb.) Terquem, 1882, Mém. Soc. Géol. Fr., sér. 3, vol. ii. p. 145, pl. xxiii. fig. 9. *P. oblonga* (d'Orb.) Chaster, 1892, First Rept. of the Southport Soc. of Nat. Sci., 1890–1891 (1892), p. 64, pl. i. fig. 13. *P. oblonga* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 309, pl. xi. figs. 9, 10, 24. *P. oblonga* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 319, pl. lxvii. fig. 5.

This form is very rare in the Malay Archipelago and has been observed only at Station 22 in Area 2.

Of its occurrence in the recent condition, Brady states that its distribution is similar to that of the allied forms *P. problema* and *P. compressa*. Chaster records it from the neighbourhood of Southport. Egger's 'Gazelle' Stations are Table Bay, 50 fathoms; Mauritius, 225 fathoms; and West Australia, 196 fathoms. Flint records it from off the coast of Georgia and North Carolina, 276 and 168 fathoms.

Polymorphina sororia Reuss.

Polymorphina (*Guttulina*) *sororia* Reuss, 1863, Bull. Acad. Roy. Belg., sér. ii. vol. xv. p. 151, pl. ii. figs. 25–29. *P. sororia* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 308, pl. ix. fig. 20. *P. sororia* (Reuss) Jones, 1896, Palæont. Soc., p. 257, pl. vi. fig. 13. *P. sororia* (Reuss) Chapman, 1896, Journ. R. Micr. Soc., p. 12, pl. ii. figs. 11, 12. *P. sororia* (Reuss) var. *fistulosa* Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 319, pl. lxvii. fig. 2. *P. sororia* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 126, pl. xvii. figs. 6, 7.

Although moderately plentiful and widely distributed in the Malay Archipelago, the examples are small and composed of but few chambers.

Brady says of this form that it is less common than the type (*P. lactea*), but it has a similar wide area of distribution. Egger records it from West Africa, 371 fathoms; and Flint has the fistulose variety from the North Atlantic, from off the coast of Brazil, and from the Gulf of Mexico, 671 to 1781 fathoms.

Polymorphina sororia var. *cuspidata* Brady.

Polymorphina sororia var. *cuspidata* Brady, 1884, Chall. Rept., p. 563, pl. lxxi. figs. 17–19, pl. lxxii. fig. 4. *P. sororia* var. *cuspidata* (Brady) Chapman, 1896, Journ. R. Micr. Soc., p. 13, pl. ii. fig. 13. *P. sororia* var. *cuspidata* (Brady) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 127, pl. xvii. figs. 10, 11.

This variety is better represented than the type, it is rather more abundant, and widely distributed, and the examples are less feeble.

Brady says, "This form has been met with at two points in the North Atlantic, west of Ireland, depth 808 fathoms and 1443 fathoms respectively; and at Station 146, about midway between the Cape of Good Hope and Kerguelen Island, 1375 fathoms."

Polymorphina regina Brady, Parker, and Jones.

Polymorphina regina Brady, Parker, and Jones, 1870, Trans. Linn. Soc., vol. xxvii. p. 241, pl. xli. fig. 32; and *P. Orbignii* (Zborzewski sp.) p. 244, pl. xlii. fig. 38*m*. *P. semicostata* Marsson, 1878, Mitth. Nat. Ver. Neu-Vorpommern u. Rugen, Jahrg. x. p. 150, pl. ii. fig. 19. *P. regina* (B., P., and J.) var. Wright, 1886, Proc. Belfast Nat. Field Club, 1884–1885, App. ix. p. 331, pl. xxvii. figs. 13, 14. *P. regina* (P. and J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 310, pl. ix. figs. 45, 50, 51. *P. regina* var. *damæcornis* (Reuss) Jones and Chapman, 1896, Journ.

Linn. Soc. (Zool.), vol. xxv. p. 501, fig. 3; and var. *marginalis*, p. 507, fig. 36.

This form is represented by a few examples from Station 22 in Area 2. The shell is very thin and there are rarely more than two chambers.

Of its distribution in the recent condition Brady writes,* "The distribution of *Polymorphina regina* seems limited to comparatively shallow water in the neighbourhood of the islands of the Pacific."

Egger records it from Kerguelen Island, 57 fathoms.

Dimorphina d'Orbigny.

Dimorphina lingulinoides sp. n., plate V. fig. 6.

Test elongate, straight, compressed; extremities rounded or obtuse; earlier portion biserial, with triangular chambers; sutures sinuous, not depressed; final portion Linguline; aperture a long slit, with protruding lips. Length 0·33 mm.

This form closely resembles the *D. compacta* of the Coralline Crag of Sutton, but is easily distinguished from it by the slit-like aperture.

In the tertiary beds of St. Erth *Dimorphinæ* are not uncommon, but all the forms are compounded of the genera *Polymorphina* and *Lingulina*, thus differing from all the described species with the exception of *Polymorphina regularis* var. *parallela* † of the St. Erth clay, which evidently belongs to this group. In *Dimorphina Capellini*,‡ from the lower pliocene of Bonfornello in Sicily, the aperture is a lipped slit, but it is slightly curved, and the chamber to which it pertains is circular in transverse section.

In the Malay Archipelago *D. lingulinoides* is very rare and has been noticed only at Station 25 in Area 2.

Uvigerina d'Orbigny.

Uvigerina canariensis d'Orbigny, plate V. fig. 7.

Uvigerina canariensis d'Orbigny, 1839, Foram. Canaries, p. 138, pl. i. figs. 25–27. *U. canariensis* (d'Orb.) Fornasini, 1891, Foraminiferi Pliocenici del Ponticello di Savena, pl. ii. fig. 26. *U. canariensis* (d'Orb.), Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 39, pl. D, fig. 9. *U. canariensis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 311, pl. ix. fig. 43. *U. canariensis* (d'Orb.) Goës, 1894,

* Chall. Rept., 1884, p. 571.
† Millett, Trans. R. Geol. Soc. of Cornwall, vol. xi. 1895, p. 658, pl. figs. 5, 6.
‡ De Amicis, Naturalista Siciliano, anno xiv. 1895, p. 45, pl. i. fig. 18.

K. Svenska Vet.-Akad. Handl., vol. xxv. p. 52, pl. xi. figs. 489–492. *U. canariensis* (d'Orb.) forma *distoma* De Amicis, 1894, Atti Soc. Tosc. Sci. Nat., Mem., vol. xiv. p. 29, pl. ii. fig. 5. *U. canariensis* (d'Orb.) var. *farinosa* (Hantken) Jones, 1896, Palæont. Soc., p. 278, pl. vii. fig. 27.

This form is very abundant and occurs at nearly all the Stations in both Areas. The surface of the test, normally smooth, is often more or less rough, and without a break passes into that of *U. aculeata.*

The typical form is common, but the specimen chosen for illustration represents an interesting variety which occurs only at Station 22 in Area 2.

Uvigerina asperula Czjzek.

Uvigerina asperula Czjzek, 1848, Haidinger's Naturwiss. Abhandl., vol. ii. p. 146, pl. xiii. figs. 14, 15. *U. asperula* (Czjzek) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 755, pl. xvi. fig. 7. *U. asperula* (Czjzek) Toutkowsky, 1887, Zap. Kievsk. Obsch. Estest., vol. ix. p. 41, pl. ii. fig. 3. *U. asperula* (Czjzek). Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 225, pl. xlv. figs. 4, 5. *U. asperula* (Czjzek) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 100, pl. iii. fig. 25. *U. asperula* (Czjzek) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 312, pl. ix. fig. 41. *U. asperula* (Czjzek) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 320, pl. lxviii. fig. 4.

This is just as plentiful as the smooth form, *U. canariensis*, and the distribution is identical. It may be noted that at the individual Stations the relative abundance of the two forms is invariably the same.

The disposition to become uniserial is shown in many examples, and in this respect they resemble the var. *ampullacea* of Brady, which is described as a dimorphous *U. asperula*, connecting the *Uvigerinæ* with the *Sagrinæ.*

Uvigerina asperula Czjzek var. *ampullacea* Brady.

Uvigerina asperula (Czjzek) var. *ampullacea* Brady, 1884, Chall. Rept., p. 579, pl. lxxv. figs. 10, 11. *U. ampullacea* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 313, pl. ix. fig. 37. *U. asperula* var. *ampullacea* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 320, pl. lxviii. fig. 5.

In the Malay Archipelago this variety o *U. asperula* is very rare, and is confined to Area 1.

Brady names nine localities where it has been found, the depths ranging from 350 fathoms to 725 fathoms; Egger records it from

Mauritius, 225 fathoms, and from West Australia, 560 fathoms; whilst the only 'Albatross' Station is off the Brazil coast, 1019 fathoms.

Uvigerina interrupta Brady.

Uvigerina interrupta, Brady, 1879, Quart. Journ. Micr. Sci., n.s. vol. xix. p. 274, pl. viii. figs. 17, 18. *U. interrupta* Brady, 1884, Chall. Rept., p. 580, pl. lxxv. figs. 12–14. *U. interrupta* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 313, pl. ix. fig. 58.

This appears to be nothing more than an attenuated form of *U. ampullacea*, and the gradation from one to the other is well shown by the Malay specimens.

It is plentiful at Station 25 in Area 2, and occurs, but very sparingly, at a few Stations in Area 1.

Brady says it has only been observed in the South Pacific, and names six localities, the depths varying from 37 to 1375 fathoms.

Egger gives two 'Gazelle' Stations, both off the coast of West Australia, at depths of 196 and 650 fathoms.

Uvigerina auberiana d'Orbigny var. *glabra* var. n., pl. V. figs. 8, 9.

Uvigerina auberiana d'Orbigny, 1839, Foram. Cuba, p. 106, pl. ii. figs. 23, 24. *U. auberiana* (d'Orb.) Goës, 1882, K. Svenska Vet.-Akad. Handl., vol. xix. p. 60, pl. iv. figs. 71–75.

The Malay examples of this form are more compressed and neater than those from the West Indies described by d'Orbigny; they also differ in having the surface of the test quite smooth, but they agree in the more important character of being biserial. The elongated form (fig. 9) differs from *Bolivina* only in the form of the aperture. It closely resembles the figures of *U. Parkeri* given by Karrer,* but he does not state that his species is biserial. Brady in his 'Challenger' Report makes *U. auberiana* a variety of *U. asperula*; if this diagnosis were accepted the Malay form would have to be treated as a compressed biserial variety of *U. canariensis*, but taking surface ornamentation as being of less value than the mode of aggregation of the chambers, it seems more natural to group together the biserial varieties.

Goës, writing of *U. auberiana* from the Caribbean Sea, says, "Our form is often more smooth and more slender than d'Orbigny's —also from the West Indies." These, it will be observed, are pre-

* Abhandl. k. k. geol. Reichs., vol. ix. 1877, p. 385.

cisely the differences between d'Orbigny's and the Malay examples.

The smooth form is very abundant in the Malay Archipelago and occurs at most of the Stations in both Areas.

Uvigerina pygmæa d'Orbigny.

Uvigerina pygmæa d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 269, pl. xii. figs. 8, 9; and Modèle, No. 67. *U. pygmæa* (d'Orb.), Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 224, pl. xlv. figs. 1, 2. *U. pygmæa* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 100, pl. iii. fig. 24. *U. pygmæa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 314, pl. ix. fig. 42. *Polymorphina regina* (B., P., and J.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 14, pl. v. figs. 70–72. *U. pygmæa* (d'Orb.) Silvestri, 1893, Mem. Pontif. Accad. Nuovi Lincei, vol. ix. p. 207, pl. v. fig. 5. *U. pygmæa* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 51, pl. ix. figs. 496–501. *U. pygmæa* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 320, pl. lxviii. fig. 2. *U. pygmæa* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 239, pl. iv. fig. 5; and *U. pygmæa* var. *asperula* Idem, 1900, Ibid. vol. xvii. p. 277, pl. vi. fig. 95.

This form is represented by a few feeble examples from Station 2, in Area 1.

Uvigerina porrecta Brady.

Uvigerina porrecta Brady, 1879, Quart. Journ. Micr. Sci., n.s. vol. xix. p. 274, pl. viii. figs. 15, 16; Idem, 1884, Chall. Rept., p. 577, pl. lxxiv. figs. 21–23. *U. porrecta* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 315, pl. ix. figs. 51, 63.

This form also is very rare in the Malay Archipelago, although it occurs at Stations in both Areas.

With regard to its distribution generally, Brady writes, "This is a coral-reef species, and with one exception all the localities lie within the tropics." He names several Stations where it has occurred at depths ranging from 12 fathoms to 1850 fathoms. The solitary 'Gazelle' Station is West Australia, 196 fathoms.

Uvigerina angulosa Williamson.

Uvigerina angulosa Williamson, 1858, Rec. Foram. Gt. Britain, p. 67, pl. v. fig. 140. *U. angulosa* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 314, pl. ix. figs. 40, 46, 47,

U. angulosa (Will.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 51, pl. ix. figs. 502–509. *U. angulosa* (Will.) Jones, 1895, Palæont. Soc., p. 277, pl. vii. fig. 26. *U. angulosa* (Will.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 320, pl. lxviii. fig. 3. *U. angulosa* (Will.) Liebus, 1901, Neues Jahrb. für Min., vol. i. p. 120, pl. v. fig. 3.

This species is likewise rare in the Malay Archipelago, but it is found in both Areas, and the examples are well developed.

Sagrina d'Orbigny, emended by Parker and Jones.

Sagrina columellaris Brady, plate V. figs. 10, 11.

Sagrina columellaris Brady, 1881, Quart. Journ. Micr. Sci., n.s. vol. xxi. p. 64. *Siphogenerina glabra* Schlumberger, 1883, Feuille Jeunes Nat., p. 118, pl. iii. fig. 1. *Siphogenerina* (*Sagrina*) *columellaris* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 316, pl. ix. figs. 28, 31, 33. *Siphogenerina columellaris* (Brady) Idem, 1899, Ibid., vol. xxi. p. 134, pl. xvi. figs. 20, 21. *Sagrina columellaris* (Brady) Fornasini, 1900, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. viii. p. 391, fig. 41. *Siphogenerina columellaris* (Brady) Silvestri, 1902, Atti Pontif. Accad. Romana dei Nuovi Lincei, anno lv. p. 1, figs. 1, 2.

In treating of *Bigenerina* (*Siphogenerina*) *Schlumbergerii* mention was made of the difficulty of assigning to the various forms of *Siphogenerina* their correct position in the classification of the foraminifera; whether *columellaris* would be more at home amongst the *Sagrinæ* or the *Bigenerinæ*, is still a matter of opinion.

The recent discovery by Prof. Silvestri* of characteristic specimens of *Pleurostomella brevis* having the contorted internal tube, is of great interest in its bearing on this question.

In the Malay Archipelago the number of examples is small and the species seems to be confined to Area 1. There are, however, specimens of both the microspheric and megalospheric forms, which are well differentiated in this species, as shown by the figures given by Schlumberger in 1883, and by Silvestri in 1902.

With regard to its general distribution in the living condition, Brady in his 'Challenger' Report gives thirteen localities, at depths varying from the shore to 1125 fathoms; Egger quotes three 'Gazelle' Stations, at depths from 75 fathoms to 225 fathoms; whilst Fornasini and Silvestri record it from the Adriatic and Mare Jonio.

Sagrina bifrons Brady.

Sagrina bifrons Brady, 1881, Quart. Journ. Micr. Sci., n.s. vol. xxi. p. 64; and 1884, Chall. Rept., p. 582, pl. lxxv. figs. 18–20.

* Atti R. Accad. Sci. Torino, vol. xxxviii. 1903, p. 5, fig. 1a–c.

Siphogenerina (*Sagrina*) *bifrons* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 317, pl. ix. figs. 25, 26, 29. *Sagrina bifrons* (Brady) Idem, 1899, Ibid., vol. xxi. p. 134, pl. xv. figs. 25, 26.

Of this rare form a few poor examples occur at several Stations in both Areas; they differ from *columellaris* in little more than the compression of the test.

Brady states that it has only been observed in one locality, the *Hyalonema*-ground, south of Japan, depth 345 fathoms. Egger's very doubtful 'Gazelle' examples are from West Australia, 560 fathoms.

Sagrina virgula Brady.

Sagrina virgula Brady, 1879, Quart. Journ. Micr. Sci., n.s. vol. xix. p. 275, pl. viii. figs. 19–21; and 1884, Chall. Rept., p. 583, pl. lxxvi. figs. 4–10. *Siphogenerina* (*Sagrina*) *virgula* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 318, pl. ix. fig. 27.

In the Malay Archipelago this is the predominant species of the genus, being found in abundance at most of the Stations all over the Region. The examples are large, well developed, and possess all the characters of the species.

With regard to its distribution elsewhere, Brady writes, "*Sagrina virgula* has been obtained in the South Atlantic off Pernambuco, 675 fathoms; with that exception the distribution, which extends altogether to ten localities, is confined to the South Pacific, the bathymetrical range being from 12 fathoms to 2075 fathoms." Egger reports it from the western coast of South Africa, 1914 fathoms; and two Stations off West Australia, 196 fathoms and 560 fathoms.

Sagrina nodosa Parker and Jones, plate V. figs. 12–15.

Uvigerina (*Sagrina*) *nodosa* Parker and Jones, 1865, Phil. Trans., vol. clv. p. 363, pl. xviii. fig. 15. *Sagrina nodosa* (P. and J.) Brady, 1884, Chall. Rept., p. 583, pl. cxiv. fig. 18. *S. cylindrica* (d'Orb. sp.) Fornasini, 1897, Rivista Ital. di Paleont., fasc. v. vi. p. 13, fig.

As indicated by the figures, the Malay Archipelago representatives of this species vary considerably from the type. The uniserial chambers are often irregularly lobed at their base; whilst in some examples the Uvigerine portion is obscure, and the test appears to be uniserial throughout. In the surface ornamentation the usual costæ are replaced by regular rows of closely placed dots; a few of the examples, however, have the surface quite smooth. In my cabinet are examples dredged from 50 fathoms off the coast of

Portugal which resemble the Malay forms in every respect. It may be noted that in some of Terquem's figures of *Uvigerina mantkis* from the Paris eocene,* there is an evident tendency to the lobulation of the base of the chambers.

S. nodosa is not uncommon in the Malay Archipelago and occurs at several Stations in both Areas.

Brady in his 'Challenger' report writes "*Sagrina nodosa* is by no means a common form: so far as the 'Challenger' collections are concerned, it only appears at one locality,—off the Cape of Good Hope, depth 150 fathoms. Otherwise it has been reported from the Mediterranean and from the Italian tertiaries."

Sagrina striata Schwager sp.

Dimorphina striata Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 251. pl. vii. fig. 99, and fig. 2 in text. *Sagrina striata* Schwager, 1877, Boll. R. Com. Geol. Italia, p. 25, pl. fig. 35. *S. striata* (Schwager) Brady, 1884, Chall. Rept., p. 524, pl. lxxv. figs. 25, 26. *Siphogenerina* (*Sagrina*) *striata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 316, pl. ix. figs. 32, 34, 35, 64, 65.

Usually this is not a common form, but in the Malay Archipelago it is well represented, being found in considerable numbers at several Stations in both Areas. The examples are fine and exhibit greater affinity with *S. raphanus* than with *S. nodosa*.

Brady specifies the following localities:—"Off the coast of South America, south of Pernambuco, 350 fathoms; shore-sand, east coast of Madagascar; off Kandavu, Fiji Islands, 210 fathoms; off New Hebrides, 125 fathoms; Torres Strait, 3 to 11 fathoms; off Ki Islands, 129 fathoms; and off the Philippines, 95 fathoms." The 'Gazelle' Stations are Mauritius, 225 fathoms, and West Australia, 196 fathoms.

Sagrina raphanus Parker and Jones.

Uvigerina (*Sagrina*) *raphanus* Parker and Jones, 1865, Phil. Trans., vol. clv. p. 363, pl. xviii. figs. 16, 17. *Siphogenerina costata* Schlumberger, 1883, Feuille Jeunes Nat., p. 118, fig. B. *Sagrina raphanus* (P. and J.) Brady, 1884, Chall. Rept., p. 585, pl. lxxv. figs. 21–25. *Siphogenerina* (*Sagrina*) *raphanus* (P. and J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 317, pl. ix. fig. 36.

Although not quite so abundant in the Malay Archipelago as *S. striata*, nor so widely distributed, the examples are fine and characteristic, and both the microspheric and megalospheric forms are represented.

* Mém. Soc. Géol. Fr., sér. 3, vol. ii. 1882, p. 119, pl. xx. figs. 26–29.

Brady writes, "*Sagrina raphanus* is essentially a coral-reef Foraminifer," and then specifies a number of Stations, the depths ranging from 2 to 260 fathoms. The solitary 'Gazelle' example is from Mauritius, 225 fathoms.

Sagrina tessellata Brady, plate V. fig. 16.

Sagrina (?) *tessellata* Brady, 1884, Chall. Rept., p. 585, pl. lxxvi. figs. 17–19.

Of this very rare and doubtful form several examples have been found in the material from Station 2, in Area 1. Externally they agree in all respects with the figures of the 'Challenger' specimens; but internally the chambers are subdivided into chamberlets by transverse septa, usually from eight to ten in each chamber.

According to Brady his knowledge of the species was derived from two or three specimens from Nares Harbour, Admiralty Islands, 17 fathoms, and Raine Island, Torres Strait, 155 fathoms.

Sagrina limbata Brady, plate V. figs. 17–19.

Sagrina limbata Brady, 1884, Chall. Rept., p. 586, pl. cxiii. fig. 14. *S. limbata* (Brady) Howchin, 1889, Trans. R. Soc. S. Australia, vol. xii. p. 11, pl. i. fig. 7.

Of this very rare and little understood form a solitary example has been found in the material from Station 2, in Area 1. Unfortunately the specimen has been mislaid, but the finder, Charles Elcock of Belfast, had previously made a drawing of it, and a copy of this appears on the plate (fig. 17).

Brady's diagnosis of the species was made from ill-grown examples, and is necessarily imperfect. Having myself been especially fortunate in finding examples in the material from Raine Island, kindly sent me by Sir John Murray of the 'Challenger' office, I am in a position to add to Brady's description. Essentially the test is composed of a series of elongate-oval chambers, usually four in number, as shown by fig. 18; these chambers, as in *S. tessellata*, are subdivided into chamberlets by transverse septa which are well shown in the abraded specimen, fig. 19. Brady was unaware of these characters until he had examined my specimens shortly after the publication of the 'Challenger' Report on the Foraminifera, and his figure does not represent them. Howchin's drawing represents a much more characteristic example and indicates the division of the test into chambers. In several specimens the initial chamber is broad at the base, and obliquely truncated as shown in fig. 18.

The division of the chambers by transverse septa is not a character of the genus *Sagrina*, and further researches will prob-

sidy render it necessary to constitute a new genus embracing the species [illegible], [illegible], and probably *annulata*.

With regard to its hitherto recorded distribution, Brady writes, "*Sagrina* [illegible] has only been encountered at a single locality,—off Raine Island, Torres Strait, depth 155 fathoms."

Howchin writes, "A single specimen of this very rare form was obtained from the Lower-Bed. The test is longer and more slender than Mr. Brady's figure and is also more curved in outline, but in all essential features agrees with the type." The "Lower-Bed," mentioned above, is a portion of the Older Tertiary of Muddy Creek, Victoria, Australia.

Sub-family Ramulininae.

Ramulina Rupert Jones.

Ramulina lævis Jones.

Ramulina lævis (Jones) Wright, 1875, Proc. Belfast Nat. Field Club, 1873–1874. App. iii. p. 88, pl. iii. fig. 19; and *R. brachiata* (Jones), p. 88, pl. iii. fig. 20. *Ramulina* sp., Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 83, pl. iv. fig. 7. *R. Bradyi* Rzehak, 1895, Ann. k. k. Naturh. Hofmuseums, vol. x. p. 223, pl. vi. fig. 5; and *R. exigua*, p. 223, pl. vi. fig. 4. *R. lævis* (Jones) Chapman, 1896, Journ. R. Micr. Soc., p. 582, pl. xii. fig. 2; and 1898, p. 2, pl. ii. fig. 15. *R. lævis* (Jones) Jones and Chapman, 1897, Journ. Linn. Soc. (Zool.), vol. xxvi. p. 339, figs. 1–4. *R. proteiformis* Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 321, pl. lxviii. fig. 7. *R. lævis* (Jones) Schubert, 1901, Zeitschr. deutsch. geol. Gesell., Jahrg. 1901, p. 19, fig. 1.

This smooth variety of *Ramulina* is represented by a few fragments from Station 13, in Area 1.

It is much more abundant as a fossil than as a recent form.

Ramulina globulifera Brady.

Ramulina globulifera Brady, 1879, Quart. Journ. Micr. Sci., n.s. vol. xix. p. 272, pl. viii. figs. 32, 33; and 1884, Chall. Rept., p. 587, pl. lxxvi. figs. 22–28. *Tinoporus baculatus* Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. ii. vol. vi. p. 758, pl. xvi. fig. 24. *Lagena lævis* (Montagu) Terrigi, 1899, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 112, pl. vi. figs. 2, 3. *Lagena protea* Chaster, 1892, First Rept. of the Southport Soc. of Nat. Sci., 1890–1891 (1892), p. 62, pl. i. fig. 14. *Ramulina globulifera* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 310, pl. ix. fig. 62. *R. globulifera* (Brady) De Amicis, 1895, Naturalista Siciliano, anno xiv. p. 112, pl. i. fig. 14. *R. globulifera* (Brady) Chapman, 1896, Journ.

R. Micr. Soc., p. 582, pl. xii. figs. 3–6. *R. globulifera* (Brady) Jones and Chapman, 1897, Journ. Linn. Soc. (Zool.), vol. xxvi. p. 340, figs. 5–22. *R. globulifera* (Brady) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 135, pl. ii. fig. 2; and pl. xxii. fig. 33. *R. globulifera* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 321, pl. lxviii. fig. 6.

This fragile form is well represented in the Malay Archipelago, and occurs in more or less abundance at many Stations in both Areas.

Brady and other authorities record the species from numerous localities widely apart, but it appears to be most at home in the South Pacific.

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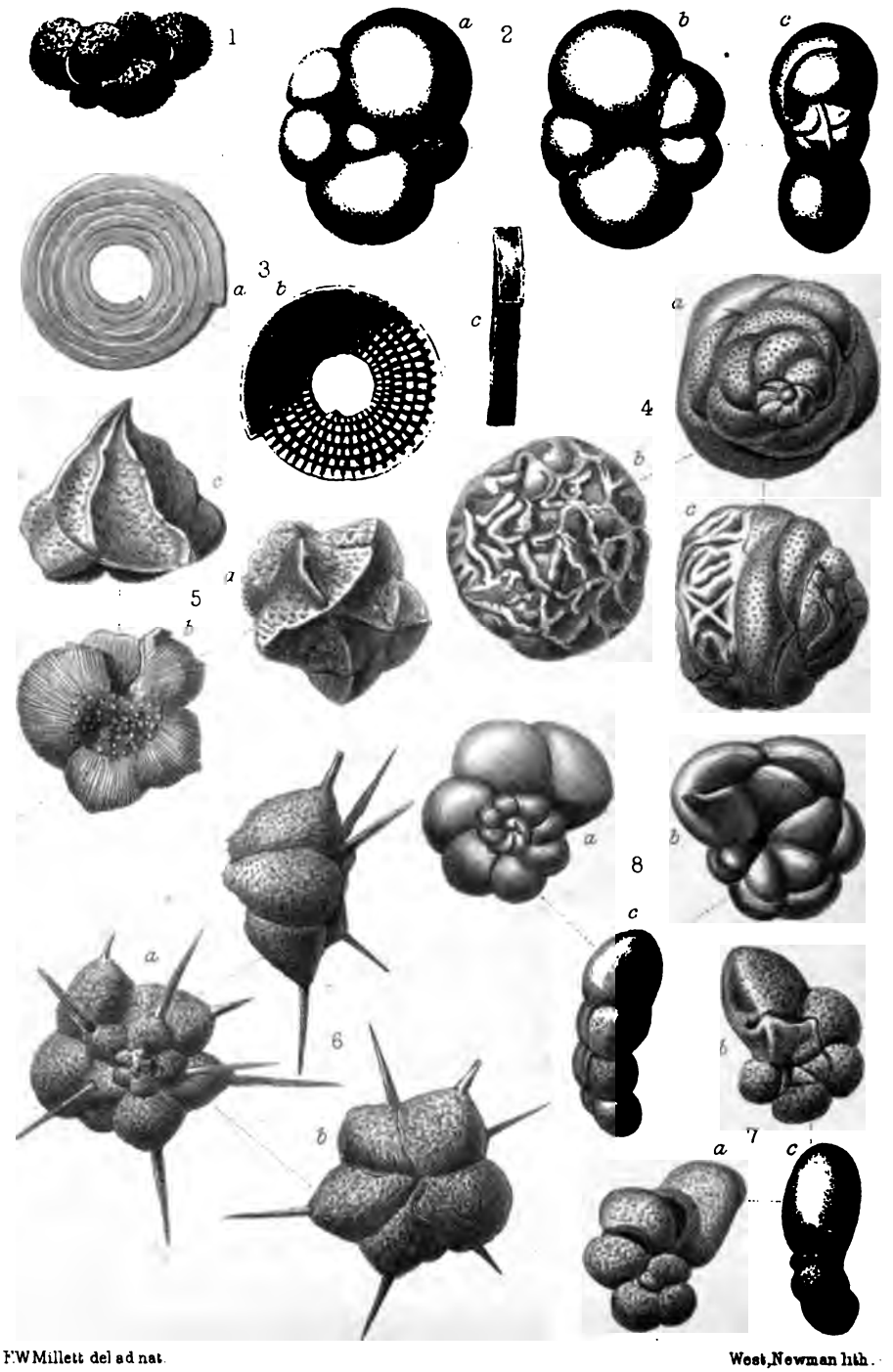

F.W.Millett del ad nat. West,Newman lith.

RECENT FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1903, pp. 685-704.)

XII.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part XV.*

By Fortescue William Millett, F.R.M.S.

(*Read October 2nd, 1903.*)

Plate VII.

Family GLOBIGERINIDÆ.

Globigerina d'Orbigny.

Globigerina bulloides d'Orbigny.

Globigerina bulloides d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 277, No. 1; and Modèles Nos. 17 and 76. *G. bulloides* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 756, pl. xvi. fig. 8. *G. bulloides* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 225, pl. xlv. fig. 15. *G. bulloides* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 561, pl. xi. fig. 17. *G. bulloides* (d'Orb.) Haeusler,

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EXPLANATION OF PLATE VII.

Fig. 1.—*Globigerina helicina* d'Orbigny. × 65.
„ 2.—*Candeina nitida* d'Orbigny. × 45.
„ 3.—*Spirillina margaritifera* Williamson var. *semiornata* var. n. × 45.
„ 4.—*Cymbalopora bulloides* d'Orbigny sp. × 90.
„ 5.—*Discorbina corrugata* sp. n. × 90.
„ 6. „ *imperatoria* d'Orbigny sp. × 135.
„ 7. „ *rimosa* Parker and Jones. × 90.
„ 8. „ *semi-marginata* d'Orbigny sp. (fide Terquem) × 90.

Note.—In all the figures the letter *a* denotes the superior aspect; *b*, the inferior aspect; and *c*, the peripheral aspect.

1890, Abhandl. schweiz. pal. Gesell., vol. xvii. p. 118, pl. xv. fig. 46. *G. bulloides* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 101, pl. iii. fig. 26; and var. *triloba* (Reuss) p. 101, pl. iii. fig. 27. *G. bulloides* (d'Orb.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 15, pl. v. figs. 59, 61, 64. *G. bulloides* (d'Orb.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota. vol. iii. p. 40, pl. D, figs. 14–17. *G. bulloides* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 362, pl. xiii. figs. 1–3. *G. bulloides* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 83, pl. xiv. figs. 754–760. *G. bulloides* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 36, pl. iv. fig. 13. *G. bulloides* (d'Orb.) Jones, 1896, Palæont. Soc., p. 280. *G. bulloides* (d Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 46, pl. ii. fig. 19. *G. bulloides* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 245, pl. iv. figs. 7–9. *G. bulloides* (d'Orb.) Fornasini, 1899, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 579, pl. i. fig. 4, pl. ii. figs. 1, 3, 5–8, pl. iv. fig. 2. *G. bulloides* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 170, pl. xxi. figs. 5–7. *G. bulloides* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 321, pl. lxix. fig. 2. *G. bulloides* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 21, figs. 24–26. *G. bulloides* (d'Orb.) Chapman, 1900, Geol. Mag., n. s., dec. 4, vol. vii. pl. xiv. fig. 5. *G. bulloides* (d'Orb.) Jones and Chapman, 1900, in A Monograph of Christmas Island, p. 258, pl. xxi. fig. 17. *G. bulloides* (d'Orb.) Wright, 1900, Geol. Mag., n.s., dec. 4, vol. vii. p. 100, pl. v. fig. 18.

This cosmopolitan species occurs in considerable abundance all over the region. The examples show the usual variations of size, form, and texture, and have no special characters to distinguish them from those of other localities.

Globigerina dubia Egger.

Globigerina dubia Egger, 1857, Neues Jahrb. für Min., p. 281, pl. ix. figs. 7–9. Idem, 1893, Abhandl. k. bayer. Akad. Wiss., C. II. vol. xviii. p. 366, pl. xiii. figs. 36–38, 77. Idem, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 37, pl. iv. fig. 17. *G. dubia* (Egger) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 322, pl. lxix. fig. 4. *G. Eggeri* Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 19, fig. 20.

As shown by Rhumbler, there is a distinct difference between the recent specimens illustrated by Brady and Flint and the fossil example from Ortenburg figured by Egger. In these recent forms, the apertures of the chambers open directly into the umbilical

vestibule, as in *G. bulloides*. In the fossil example, the aperture is a narrow slit at the end of the last chamber, towards the central depression of the under side of the test. Following Brady's "Scheme of the genus Globigerina," the recent form must be placed in group A with *G. bulloides*, &c.; whilst Egger's fossil *G. dubia* must find a place with *G. Dutertrei* in group B.

In the Malay Archipelago, Brady's form is but little removed from *G. bulloides*, and hardly deserves separate mention. Egger's *G. dubia* scarcely differs from *G. Dutertrei*; the plan of growth is similar, and in the young specimens the aperture is large, becoming more and more constricted in the adult stage until in the thick-shelled mature examples it is reduced to a mere slit.

It will be sufficient here to record that the four varieties are represented in the Malay Archipelago, leaving the identity of *bulloides* and *Eggeri*, and of *dubia* and *Dutertrei*, an open question.

Globigerina inflata d'Orbigny.

Globigerina inflata d'Orbigny, 1839, Foram. Cuba, p. 134, pl. ii. figs. 7–9. *G. inflata* (d'Orb.) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 84, pl. iv. fig. 11. *G. inflata* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 102, pl. iv. fig. 2. *G. inflata* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 369, pl. xiii. figs. 45–47. *G. inflata* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 85, pl. xiv. figs. 763–765. *G. inflata* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 322, pl. lxix. fig. 3. *G. inflata* (d'Orb.) Fornasini, 1899, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 577, pl. i. fig. 3. *G. inflata* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 19, fig. 19.

This variety is not very abundant in the Malay Archipelago, but occurs at several Stations in both Areas.

Globigerina rubra d'Orbigny.

Globigerina rubra d'Orbigny, 1839, Foram. Cuba, p. 82, pl. iv. figs. 12–14. *G. rubra* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 225, pl. xlv. fig. 12. *G. rubra* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 360, pl. xiii. figs. 42–44. *G. rubra* (d'Orb.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti e P.P. dello Studio di Acireale, vol. v. p. 16, pl. v. figs. 62, 63, 65. *G. rubra* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 85, pl. xiv. fig. 766. *G. rubra* (d'Orb.) Rhumbler, 1897, Verhandl. Deutsch. Zool. Gesellsch., p. 172, fig. 16. *G. rubra* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 262, pl. v. fig. 4, *G. rubra* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899),

p. 322, pl. lxix. fig. 5. *G. rubra* (d'Orb.) Fornasini, 1899, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 580, pl. ii. fig. 11.

There are numerous examples from most of the Stations, but the individuals are insignificant, and have little to distinguish them beyond the colour.

Globigerina conglobata Brady.

Globigerina conglobata Brady, 1879, Quart. Journ. Micr. Sci., n.s., vol. xix. p. 72 ; and Chall. Rept., 1884, p. 603, pl. lxxx. figs. 1–5, pl. lxxxii. fig. 5. *G. conglobata* (Brady) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 225, pl. xlv. fig. 13. *G. conglobata* (Brady) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 114, pl. vi. fig. 14. Idem, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 102, pl. iv. fig. 3 ; and *G. bulloides* var. *triloba* (Reuss), p. 101, pl. iv. fig. 1. *G. conglobata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 368, pl. xiii. figs. 55, 56. *G. conglobata* (Brady) Goës, 1894, K. Svenska Vet.-Akad. Handl., p. 86, pl. xiv. figs. 768, 769. *G. conglobata* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 322, pl. lxix. fig. 6. *G. conglobata* (Brady) Fornasini, 1899, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 582, pl. ii. figs. 12–15, pl. iii. figs. 1–5. *G. conglobata* (Brady) Chapman, 1900, Geol. Mag., dec. 4, vol. vii. pl. xiv. fig. 6. *G. conglobata* (Brady) Jones and Chapman, 1900, in A Monograph of Christmas Island, p. 234, pl. xx. fig. 3.

This form is well represented, and occurs in more or less abundance at nearly all of the Stations.

Globigerina sacculifera Brady.

Globigerina sacculifera Brady, 1877, Geol. Mag., ser. 2, vol. iv. p. 535 ; and Chall. Rept., 1884, p. 604, pl. lxxx. figs. 11–17, pl. lxxxii. fig. 4. ? *G. helicina* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 103, pl. iv. fig. 4. *G. sacculifera* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 369, pl. xiii. figs. 50–51. *G. sacculifera* (Brady) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 263, pl. v. fig. 5. *G. sacculifera* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 322, pl. lxx. fig. 1.

Is very rare, and has been noted only at Station 2 in Area 1.

Globigerina helicina d'Orbigny, plate VII. fig. 1.

Globigerina helicina d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 277, No. 5. *G. helicina* (d'Orb.) Parker, Jones, and Brady, 1871, Ann. and Mag. Nat. Hist., ser. 4, vol. viii. p. 175, pl. xi. fig. 113.

G. helicina (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 114, pl. vi. fig. 15. *G. helicina* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 370, pl. xiii. fig. 52. *G. helicina* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 264, pl. v. fig. 6. *G. helicina* (d'Orb.) Fornasini, 1899, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 583, pl. iii. figs. 11, 12.

This appears to be the most unsatisfactory of all the forms assigned to the genus *Globigerina*; and, as shown by the "Planches inédites," d'Orbigny himself was not quite clear as to its characters. Brady's description of it as a "Globigerine shell of the '*rubra*' type, with the addition of an inflated chamber at two opposite points of its periphery," is perhaps the best definition of the normal form; but, judging from the published figures, and the examination of actual specimens, it is frequently nothing more than an irregular aggregation of globose chambers, two or more of which exhibit an exterior arched aperture.

In the Malay Archipelago, the form in very rare; but it occurs in both areas.

Brady writes, "Globigerina helicina is a comparatively rare form. Occasional specimens have been met with at nine or ten 'Challenger' Stations, scattered over the North and South Atlantic and in the South Pacific; to which may be added, on the authority of Soldani, certain points in the Mediterranean and the Adriatic." Egger reports it from nine 'Gazelle' Stations, extending from the west coast of Africa to the Fiji Islands.

Globigerina æquilateralis Brady.

Globigerina æquilateralis Brady, 1879, Quart. Journ. Micr. Sci., n.s., vol. xix. p. 71; and 1884, Chall. Rept., p. 605, pl. lxxx. figs. 18–21. *G. æquilateralis* (Brady) Wright, 1886, Proc. Belfast Nat. Field Club, 1884–85, App. ix., 1886, p. 332, pl. xxvii. fig. 9. *G. æquilateralis* (Brady) Chapman, 1892, Quart. Journ. Geol. Soc., vol. xlviii. p. 517, pl. xv. fig. 14. *G. æquilateralis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 364, pl. xiii. figs. 5–8. *G. æquilateralis* (Brady) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 86, pl. xiv. fig. 767. *G. æquilateralis* (Brady) Madsen, 1895, Medd. Dansk Geol. Forening, No. 2, p. 210, pl. fig. 5. *G. æquilateralis* (Brady) Chapman, 1896, Journ. R. Micr. Soc., p. 589, pl. xiii. fig. 7. *G. æquilateralis* (Brady) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 265, pl. v. fig. 8. *G. æquilateralis* (Brady) Fornasini, 1899, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 580, pl. iv. figs. 3, 4. *G. æquilateralis* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 323, pl. lxx. fig. 3. *G. æquilateralis* (Brady) Rhumbler,

1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 20, figs. 21–23.

In the Malay Archipelago this planospiral form occurs at several Stations, and is moderately abundant. The examples exhibit considerable diversity of form and texture, and often closely resemble *Hastigerina pelagica*.

Orbulina d'Orbigny.

Orbulina universa d'Orbigny.

Orbulina universa d'Orbigny, 1839, Foram. Cuba, p. 3, pl. i. fig. 1. *O. universa* (d'Orb.) Woodward and Thomas, 1885, 13th Ann. Rept. Geol. and Nat. Hist. Survey of Minnesota for 1884, p. 174, pl. iii. figs. 25–31. *O. universa* (d'Orb.) Malagoli, 1887, Boll. Soc. Geol. Italia, vol. vi. p. 522, pl. xiii. fig. 9. *Globigerina* (*Orbulina*) *universa* (d'Orb.) Idem, 1888, Atti Sci. Nat. Modena, ser. 3, vol. vii. p. 113, pl. iii. fig. 8. *O. universa* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 225, pl. xlv. figs. 7, 8, 14. *Globigerina* (*Orbulina*) *universa* (d'Orb.) Terrigi, 1889, Mem. R Accad. Lincei, ser. 4, vol. vi. p. 114, pl. vi. figs. 16, 17. *O. universa* (d'Orb.) Mariani, 1891, Boll. Soc. Geol. Italia, vol. x. p. 729, pl. xxi. figs. 23, 24. *O. universa* (d'Orb.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 43, pl. D, figs. 23–27. *O. universa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 374, pl. xiv. figs. 7–9, 11, 12, 39, 40. *O. universa* (d'Orb.) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 430, pl. ii. fig. 12. *O. universa* (d'Orb.) Silvestri, 1893, Atti e Rendic. Accad. Sci. Lett. e Arti dei Zelanti di Acireale, vol. v. p. 16. pl. ii. figs. 1–3. *O. universa* (d'Orb.) Lister, 1895, Phil. Trans., vol. clxxxvi. p. 408, figs. *a–e*. *O. universa* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 38, pl. iv. figs. 18, 19. *O. universa* (d'Orb.) Rhumbler, 1897, Abhandl. Deuts. Zool. Gesell., p. 174, fig. 21. *O. universa* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 266, pl. v. figs. 11–16, 19–22. *O. universa* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 322, pl. lxix. fig. 1. *O. universa* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 173, pl. xxi. figs. 46, 47. *O. universa* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 27, figs. 27–30.

This form is but poorly represented in the Malay Archipelago; the examples are few and insignificant. It occurs at a small number of Stations in both Areas.

Hastigerina Wyville Thomson.

Hastigerina pelagica d'Orbigny sp.

Nonionina pelagica d'Orbigny, 1843, Foram. Amér. Mérid., p. 27, pl. iii. figs. 13, 14. *Hastigerina Murrayi* (Wy. Thomson) Murray, 1876, Proc. Roy. Soc., vol. xxiv. p. 534, pls. xxii. xxiii. *H. pelagica* (d'Orb.) Brady, 1879, Quart. Journ. Micr. Sci., n.s., vol. xix. p. 77. *H. pelagica* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 372, pl. xiii. figs. 53, 54. *H. pelagica* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 324, pl. lxx. fig. 4. *H. pelagica* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 273, pl. v. fig. 9. *H. pelagica* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, p. 29, fig. 31.

Of this essentially surface species, examples occur at numerous Stations in both Areas. Many of the individuals bear short spines, similar to those figured by d'Orbigny in the South American example.

Pullenia Parker and Jones.

Pullenia sphæroides d'Orbigny sp.

Nonionina sphæroides d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 293, No. 1; Modèle No. 43. *Pullenia sphæroides* (d'Orb. sp.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 368, pl. xiv. fig. 43. *P. bulloides* (d'Orb.) Andreae, 1884, Abhandl. geol. Special Karte Elsass-Loth., vol. ii. p. 206, pl. ix. fig. 23. *P. sphæroides* (d'Orb.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 348, pl. xii. fig. 28. *P. sphæroides* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 756, pl. xvi. fig. 10. *P. sphæroides* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 226, pl. xliii. figs. 21, 24 *P. sphæroides* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 372, pl. xix. figs. 30, 31. *P. sphæroides* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 87, pl. xiv. figs. 771, 772. *P. sphæroides* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 39, pl. iv. fig. 21. *P. sphæroides* (d'Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 47, pl. ii. fig. 20. *P. sphæroides* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 174, pl. xxi. figs. 27, 28. *P. sphæroides* (d'Orb.) Chapman, 1900, Proc. California Acad. of Sci., ser. 3, Geol., vol. i. p. 252, pl. xxx. fig. 6.

This species is represented in the Malay Archipelago by a few insignificant specimens from Area 1.

Pullenia obliquiloculata Parker and Jones.

Pullenia obliquiloculata Parker and Jones, 1865, Phil. Trans., vol. clv. p. 368, pl. xix. fig. 4. *P. obliquiloculata* (P. and J.) Egger 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 372, pl. xiii. figs. 62–64. *P. obliquiloculata* (P. and J.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 324, pl. lxx. fig. 6.

This form is not uncommon at a few Stations in each of the Areas, and the examples are of the normal size.

Sphæroidina d'Orbigny.

Sphæroidina bulloides d'Orbigny.

Sphæroidina bulloides d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 267, No. 1; Modèle No. 65. *S. bulloides* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 226, pl. xlv. figs. 9–11. *S. bulloides* (d'Orb.) Burrows, Sherborn, and Bailey, 1890. Journ. R. Micr. Soc., p. 562, pl. xi. figs. 20, 21. *S. bulloides* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 104, pl. iv. fig. 6. *S. bulloides* (d'Orb) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 430, pl. ii. fig. 14. *S. bulloides* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 375, pl. xiii. figs. 48, 49. *S. bulloides* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 87, pl. xiv. fig. 770. *S. austriaca* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 40, pl. iv. fig. 22. *S. bulloides* (d'Orb.) Chapman, 1896, Journ. R. Micr. Soc., p. 589, pl. xiii. fig. 8. *S. bulloides* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 173, pl. xxi. figs. 29, 30. *S. bulloides* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 325, pl. lxxi. fig. 1.

S. bulloides is not uncommon in the Malay Archipelago, and has been observed at most of the Stations. There is considerable variety in the aggregation of the chambers, as well as in the number of them visible externally. Whilst the majority of the examples have the usual smooth shining surface, a few show a tendency to the roughness characteristic of *S. dehiscens*, although not to such an extent as to warrant their being assigned to that species.

Candeina d'Orbigny.

Candeina nitida d'Orbigny, plate VII. fig. 2.

Candeina nitida d'Orbigny, 1839, Foram. Cuba, p. 108, pl. ii. figs. 27, 28. *C. nitida* (d'Orb) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 373, pl. xiii. fig. 57. *C. nitida*

(d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 325, pl. lxxi. fig. 3. *C. nitida* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 31, fig. 33.

This species is very rare in the Malay Archipelago, and has been found only in Area 2.

The example figured differs materially from the published illustrations of the species, the test being compressed rather than conical.

C. nitida is not so widely distributed as the other members of the Globigerinidæ to which reference has been made in this Report. Besides the localities mentioned by Brady in the 'Challenger' Report, Egger names five Stations, at all of which it is said to be rare. Flint's only Station is "near the Windward Islands."

Family ROTALIDÆ.

Sub-Family **Spirillininæ.**

Spirillina Ehrenberg.

Spirillina vivipara Ehrenberg.

Spirillina vivipara Ehrenberg, 1841, Abhandl. k. Akad. Wiss. Berlin, p. 422, pl. iii. VII. fig. 41. *S. vivipara* (Ehren.) Bütschli, 1886, Morph. Jahrb., vol. xi. p. 84, pl. vi. fig. 12. *S. vivipara* (Ehren.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 394, pl. xviii. figs. 56–58; and Ibid., 1899, vol. xxi. p. 18, pl. i. figs. 50, 51. *S. vivipara* (Ehren.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 326, pl. lxxi. fig. 4.

This cosmopolitan species is abundant in the Malay Archipelago, and occurs at several Stations in both Areas. The individuals are normal in character, and vary but little in size.

Spirillina inæqualis Brady.

Spirillina inæqualis Brady, 1879, Quart. Journ. Micr. Sci., n.s., vol. xix. p. 278, pl. viii. fig. 25. *S. inæqualis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 394, pl. xviii. figs. 40–42.

This variety is very rare in the Malay Archipelago, and has been observed only at Station 2, in Area 1.

Brady states that it has been found in shallow-water dredgings from several of the island groups of the Pacific; the depths ranging from 12 to 155 fathoms. Egger reports it from two 'Gazelle' Stations: Mauritius, 225 fathoms, and West Australia, 196 fathoms.

Spirillina limbata Brady.

Spirillina limbata Brady, 1879, Quart. Journ. Micr. Sci., n.s., vol. xix. p. 278, pl. viii. fig. 26. *S. limbata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 395, pl. xviii. figs. 43, 44. *S. limbata* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 326, pl. lxxi. fig. 5.

S. limbata—as represented by the form having a square periphery, and the faces plane, with limbate sutures, but without tubercles—is rare and poor in the Malay Archipelago, and has been noted only at Stations No. 2 and No. 22.

Brady names thirteen localities for the species, widely apart; Egger records it from four 'Gazelle' Stations; and Siddall has found it in the Estuary of the Dee. The 'Albatross' Station from which Flint procured it has not been recorded.

Spirillina limbata var. *denticulata* Brady.

Spirillina limbata var. *denticulata* Brady, 1884, Chall. Rept., p. 632, pl. lxxxv. fig. 17. *S. limbata denticulata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 396, pl. xviii. fig. 66.

This variety also is very rare, and has been found only in the material from Station 17.

The Stations recorded by Brady are: East Moncœur Island, Bass Strait, 38 fathoms; Raine Island, Torres Strait, 155 fathoms; and Nares Harbour, Admiralty Islands, 17 fathoms. The solitary 'Gazelle' Station is at Kerguelen, 57 fathoms.

In the Tertiary beds of St. Erth, Cornwall, a modification of this variety occurs; in which, whilst one face is in all respects similar to those of *denticulata*, the other is covered with tubercules, and the suture is not apparent.

Spirillina margaritifera Williamson var. *semiornata* var. n., plate VII. fig. 3.

Test, inequilateral; convolutions, numerous; peripheral edge, square. One of the lateral faces flat and smooth, with the spiral suture excavated; the opposite face concave, and ornamented with a single row of tubercles arranged closely together in a spiral line Diameter 0·60 mm.

Williamson's knowledge of *Spirillina margaritifera* was derived from a single specimen from an unknown locality, and, as he justly states, "any species founded on a single specimen can

only be accepted as a provisional one awaiting further elucidation." *

It cannot be said that subsequent researches have altogether settled the characters of the species. The *S. tuberculata* of Brady † is very doubtfully distinct; on this point Wright observes,‡ "The specimens recorded as *Spirillina tuberculata*, both by Siddall, in 'Memoir on the Foraminifera of the Estuary of the Dee,' and by Balkwill and myself, in 'Foraminifera of Dublin Bay and Irish Sea,' should I feel satisfied be referred to *S. margaritifera*; and *S. tuberculata* should be no longer included among the British species." And Brady himself writes,§ "I am by no means confident that this form, or at any rate the British specimens that have been assigned to it, can be separated from *Sp. margaritifera*." Concerning these inequilateral forms of *Spirillina*, Chapman observes,‖ "The inequilateral modifications of *Spirillinæ* are not unfrequent at Funafuti, and are of much interest since they point to the rotaline affinities which the genus has towards shells of the trochoid type."

Of published figures resembling or identical with *S. margaritifera*, may be mentioned:—*S. margaritifera* Terquem (not Williamson) ¶; this has a square periphery, and concave faces with two rows of tubercles. *S. nodosa* Terquem,** in which there is a single row of nodosities; he remarks that this species is sometimes inequilateral, and shows one of the faces nearly plane with the nodosities less pronounced. *S. nodifera* Terquem,†† which is slightly concave in the centre, angular at the periphery, and ornamented with one series of granulations. *S. tuberculata-limbata* Chapman,‡‡ has the larger and flat surface limbate, and the peripheral edge of the coil sharp on that side; the smaller face is slightly rounded and strongly tuberculate.

The variety *semiornata* is very rare in the Malay Archipelago, and has been noted only at Station 22 in Area 2.

Spirillina decorata Brady.

Spirillina decorata Brady, 1884, Chall. Rept., p. 633, pl. lxxxv. figs. 22–25. *S. decorata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 394, pl. xviii. figs. 64, 65.

This also is very rare in the Malay Archipelago, and has been found only at Station 2 in Area 1.

* Rec. Foram. Gt. Britain, 1858, p. 93.
† Quart. Journ. Micr. Sci., n.s., vol. xix. 1879, p. 279, pl. viii. fig. 28.
‡ Proc. Belfast Nat. Field Club, App. 1885, 1886, p. 321.
§ Journ. R. Micr. Soc., 1887, p. 918.
‖ Journ. Linn. Soc., vol. xxviii. 1901, p. 411.
¶ Anim. Plage de Dunkerque, part 3, 1881, p. 110, pl. xiii. fig. 2.
** Op. cit., fig. 1.
†† Mém. Soc. géol. Fr., sér. 3, vol. ii. 1882, p. 34, pl. ix. fig. 32.
‡‡ Journ. Linn. Soc., vol. xxviii. 1900, p. 11, pl. i. fig. 8.

Brady names three points at which it has been obtained in the North Atlantic, one point in the South Atlantic, and three points in the South Pacific; the depths varying from 6 to 1125 fathoms. There are three 'Gazelle' Stations, West Africa, Mauritius and West Australia, at depths from 196 to 371 fathoms.

Sub-Family **Rotalinæ**.

Patellina Williamson.

Patellina corrugata Williamson.

Patellina corrugata Williamson, 1858, Rec. Foram. Gt. Britain, p. 46, pl. iii. figs. 86–89. *P. corrugata* (Will.) Terquem, 1875, Anim. Plage de Dunkerque, pt. 1, p. 31, pl. iv. fig. 3; and *P. punctata* Ibid., 1881, pt. 3, p. 128, pl. xvi. fig. 9. *P. corrugata* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 393, pl. xv. figs. 70–72. *P. corrugata* (Will.) Schaudinn, 1895, Sitzungsber. Gesell. Naturforsch. Freunde zu Berlin, No. 10, p. 181, fig. *P. corrugata* (Will.) Schlumberger, 1896, Feuille Jeunes Nat., sér. 3, Ann. xxvi. p. 129, fig. *P. corrugata* (Will.) Wright, 1900, Geol. Mag., n.s., dec. 4, vol. vii. p. 100, pl. v. fig. 20.

P. corrugata in the Malay Archipelago is rather scarce, but there are examples from Stations in each Area.

In the living condition its distribution is world-wide, but as a fossil it is rare; and it may be worthy of mention that it is abundant in the Tertiary beds of St. Erth, Cornwall.

Cymbalopora Hagenow.

Cymbalopora Poeyi d'Orbigny sp.

Rotalia squamosa d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 272, No. 8. *Rosalina Poeyi* d'Orbigny, 1839, Foram. Cuba, p. 92, pl. iii. figs. 18–20. *Cymbalopora* (*Rosalina*) *Poeyi* (d'Orb.) Carpenter, 1862, Introd. Foram., p. 215, pl. xiii. figs. 10–12. *C. Poeyi* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 226, pl. xlvi. fig. 12. *C. Poeyi* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 381, pl. xviii. figs. 51, 52; and Ibid., 1899, p. 167, pl. xix. figs. 28–30. *C. Poeyi* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 280, pl. vi. fig. 3. *C. Poeyi* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 326, pl. lxxii. fig. 1.

This species occurs in great abundance all over the region, and the examples exhibit great variety of form, but the trivial characters are retained throughout, and they show no tendency to coalesce with any allied forms.

Cymbalopora tabellæformis Brady.

Cymbalopora tabellæformis Brady, 1884, Chall. Rept., p. 637, pl. cii. figs. 15–18. *C. tabellæformis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 382, pl. xviii. figs. 54, 55.

Although this is a very distinct form, and easily recognised, it seems to have escaped the notice of authors generally, and has been figured only by Brady and Egger.

In the Malay Archipelago it is rare, but it has been noted at two Stations in each Area.

Brady says that it is a coral-reef species, and all the Stations at which it occurs, recorded by him, are in the Pacific and Indian Oceans. The solitary 'Gazelle' Station is Mauritius.

Cymbalopora bulloides d'Orbigny sp., plate VII. fig. 4.

Rosalina bulloides d'Orbigny, 1839, Foram. Cuba, p. 104, pl. iii. figs. 2-5. *Cymbalopora bulloides* (d'Orb.) Carpenter, 1862, Introd. Foram., p. 216. *Discorbina bulloides* (d'Orb.) Goës, 1882, K. Svenska Vet.-Akad. Handl., vol. xix. p. 106, pl. viii. figs. 262, 263. *C. bulloides* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 381, pl. xviii. fig. 53. *C. bulloides* (d'Orb.) Earland, 1902, Journ. Quekett Micro. Club, ser. 2, vol. viii. p. 309, pl. xvi. figs. 6–9.

The structure of the balloon-chamber, characteristic of this species, with its internal float, has been recently so thoroughly worked out by Earland, that it will suffice here to call attention to his paper on the subject in the Journal of the Quekett Club referred to above.

The species is well represented in the Malay Archipelago and occurs at many Stations, but is most abundant in Area 1. The examples vary considerably in form, some being as flat as a watch-case whilst others equal in height any of those figured by Möbius or Goës.

Still more numerous is an interesting variety in which the balloon-chamber is always much wrinkled, and is apparently devoid of pores or internal tube. This variety is never depressed, and seldom varies from the contour shown in the figure. Like the normal form it is most abundant at the Stations in Area 1.

Discorbina Parker and Jones.

Discorbina turbo d'Orbigny sp.

Rotalia (*Trochulina*) *turbo* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 274, No. 39; Modèle No. 73. *Discorbina turbo* (d'Orb.)

Carpenter, 1862, Introd. Foram., p. 200. *D. turbo* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 389, pl. xv. figs. 42–44. *D. turbo* (d'Orb.) Jones, 1895, Palæont. Soc., p. 291, pl. vii. fig. 29. *D. turbo* (d'Orb.) Chapman, 1896, Journ. R. Micr. Soc., p. 591, pl. xiii. fig. 13.

Typical examples of this species are very rare in the Malay Archipelago, but a passage-form approaching *D. rosacea* is very common in Area 2.

Discorbina globularis d'Orbigny sp.

Rosalina globularis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 271, pl. xiii. figs. 1–4; Modèle No. 69. *Discorbina turbo* var. *globularis* Carpenter, 1862, Introd. Foram., p. 204, pl. iii. fig. 1. *D. globularis* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 226, pl. xlvi. fig. 6. *D. globularis* Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. pl. xv. figs. 7–9; and *Globigerina* (*Rosalina*) *globularis* (d'Orb.), p. 365, pl. xiii. figs. 65–68. *D. globularis* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 94, pl. xv. fig. 793. *D. globularis* (d'Orb.) Jones, 1895, Palæont. Soc., p. 292, pl. vii. fig. 28. *D. globularis* (d'Orb.) Chapman, 1896, Journ. R. Micr. Soc., p. 590, pl. xiii. fig. 11. *D. globularis* (d'Orb.) Morton, 1897, Proc. Portland Soc. Nat. Hist., vol. ii. p. 120, pl. i. fig. 22. *D. globularis* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 327, pl. lxxii. fig. 2. *D. globularis* (d'Orb.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 21. *D. globularis* (d'Orb.) Chapman, 1900, Geol. Mag., dec. 4, vol. vii. pl. xiv. fig. 8.

Occurs in abundance at nearly all the Stations in both Areas. The examples, although small, have all the characters of the species.

Discorbina rosacea d'Orbigny sp.

Rotalia rosacea d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 273, No. 15; Modèle No. 39. *Discorbina rosacea* (d'Orb.) Brady, 1864, Trans. Linn. Soc., vol. xxiv. p. 473, No. 69. *D. rosacea* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 756, pl. xvi. fig. 11. *D. rosacea* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 385, pl. xv. figs. 39–41. *D. rosacea* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 94, pl. xv. fig. 792. *D. rosacea* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 327, pl. lxxii. fig. 3.

This species also is abundant and widely distributed in the Malay Archipelago. The examples are small, and exhibit little variety of form and texture.

Discorbina Vilardeboana d'Orbigny sp.

Rosalina Vilardeboana d'Orbigny, 1843, Foram. Amér. Mérid., p. 44, pl. vi. figs. 13–15. *Discorbina Vilardeboana* (d'Orb.) Parker and Jones, 1872, Quart. Journ. Geol. Soc., vol. xxviii. p. 115. *D. Vilardeboana* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 387, pl. xv. figs. 13–15. *D. Vilardeboana* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 95. pl. xvi. fig. 796. *D. Vilardeboana* (d'Orb.) Chapman, 1898, Journ. R. Micr. Soc., p. 15, pl. ii. fig. 16.

This variety is still more abundant, but it is doubtful if any of the examples are sufficiently distinct from *D. rosacea* to warrant their separation from that form.

Discorbina concinna Brady.

Discorbina concinna Brady, 1884, Chall. Rept., p. 646, pl. xc. figs. 7, 8. *D. concinna* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 388, pl. xv. figs. 22–24.

This form, rare elsewhere, is very common in the Malay Archipelago, and occurs all over the region. Amongst a multitude of individuals there must of necessity be much variation, and this is here in the direction of *D. orbicularis*.

Brady enumerates seven 'Challenger' Stations where it has been found, at depths varying from 16 to 620 fathoms; to these I can add Station 185, from which there are examples in my collection.

There are three 'Gazelle' Stations at depths of from 33 to 196 fathoms. These appear to be the only records of its occurrence.

Discorbina orbicularis Terquem sp.

Rosalina orbicularis Terquem, 1876, Anim. Plage de Dunkerque, p. 75, pl. ix. fig. 4. *Discorbina orbicularis* (Terq.) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 23, pl. iv. fig. 13. *D. orbicularis* (Terq.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 349, pl. xiii. figs. 31–33. *D. orbicularis* (Terq.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 227, pl. xlvi. fig. 1. *D. orbicularis* (Terq.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 115, pl. xvii. figs. 2, 3. *D. orbicularis* (Terq.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 389, pl. xv. figs. 16–18, 76–78. *D. orbicularis* (d'Orb.) Jones, 1895, Palæont. Soc., p. 295, pl. vii. fig. 31. *D. subrotunda* (d'Orb. sp.) Fornasini, 1898, Rendic. Accad. Sci. Ist. Bologna, n.s., vol. ii. (figures in the text, after d'Orbigny).

This form is plentiful at Stations 2 and 22; and occurs also at Station 14, but in very small numbers.

Discorbina patelliformis Brady.

Discorbina patelliformis Brady, 1884, Chall. Rept., p. 647, pls. lxxxviii. fig. 3, lxxxix. fig. 1. *D. patelliformis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 390, pl. xv. figs. 48–50.

Is not uncommon at Station 2, and occurs at Station 6, both in Area 1, but has not been observed at any other Station.

Brady states, "Is not uncommon amongst the islands of the Pacific, at depths of 6 to 150 fathoms. It has been observed also in shallow-water dredgings from the shores of Ceylon, Madagascar, the Mauritius and Malta."

The 'Gazelle' localities are Cape Verde, Mauritius, and Western Australia.

Discorbina tabernacularis Brady.

Discorbina tabernacularis Brady, 1881, Quart. Journ. Micr. Sci., n.s., vol. xxi. p. 65; and Chall. Rept., 1884, p. 648, pl. lxxxix. figs. 5–7. *D. tabernacularis* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 390, pl. xv. figs. 58–60, 79.

In the Malay Archipelago this is a very rare form, and the examples are small and thin-shelled. It occurs at Stations 2, 6 and 14, in Area 1; and at Station 17 in Area 2.

Brady says that it is a minute coral-reef species, and names several localities where it has occurred at depths of from 2 to 255 fathoms.

Egger reports it from Mauritius, 75 and 225 fathoms; and from Western Australia, 44 fathoms.

Discorbina corrugata sp. n., plate VII. fig. 5.

Test, conical; base, flat or concave; peripheral margin acute. A series of sharp ridges extends from the apex to the base of the test, the spaces between the ridges being excavated. The umbilical region either hollow, or filled up with granular matter beyond which are minute radiating striæ which extend to the peripheral margin. Shell-substance dense, obscuring the sutures on the superior face of the test. Diameter, 0·28 mm.

The above is an incomplete description of an interesting form, of which there are only two (more or less damaged) specimens available for examination. The polygonal shape of the superior face is, however, sufficient to distinguish it from any other species of *Discorbina*. The number of convolutions, and the form of the chambers, cannot be determined; but there are indications that the ridges mark the centre of the chambers, and that the junction of

the sutures is in the hollow between the ridges. The species partakes of the characters of both *D. patelliformis* and *D. tabernacularis*, but is distinct from either.

The examples are from Station 31, in Area 2.

Discorbina opercularis d'Orbigny sp.

Rosalina opercularis d'Orbigny, 1839, Foram. Cuba, p. 93, pl. iii. figs. 24, 25, pl. iv. fig. 1. *Discorbina opercularis* (d'Orb.) Parker and Jones, 1872, Quart. Journ. Geol. Soc., vol. xxviii. p 114. *D. opercularis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 389, pl. xv. figs. 73–75.

This form is badly represented in the Malay Archipelago, the examples being few and insignificant. It has been noticed only at Stations 2 and 6, both in Area 1.

It is recorded by d'Orbigny from the Islands of Cuba and Martinique; by Brady from four points on the coast of Australia, at depths of from 2 fathoms to 155 fathoms; and by Egger from West Africa, Mauritius and Western Australia from 37 to 225 fathoms.

Discorbina pulvinata Brady.

Discorbina pulvinata Brady, 1884, Chall. Rept., p. 650, pl. lxxxviii. fig. 10. *D. pulvinata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 391, pl. xv. figs. 33–35.

Of this rare form there are some rather feeble specimens from a few Stations in both Areas.

The 'Challenger' localities given by Brady are: Nares Harbour, Admiralty Islands, 17 fathoms; and off Booby Island, south of Papua, 6 to 8 fathoms. To which I can add Raine Island, 155 fathoms, from specimens in my own collection.

The sole 'Gazelle' Station is Kerguelen, 57 fathoms.

Discorbina imperatoria d'Orbigny sp., var. *globosa* var. n., plate VII. fig. 6.

Rosalina imperatoria d'Orbigny, 1846, For. Foss. Vienne, p. 176, pl. x. figs. 16–18.

This variety differs from the type in several respects: the superior face is flatter, and the inferior more convex; the chambers are more inflated, and the peripheral edge less acute; the aperture is indistinct, and the radiating lines on the umbilical region are not apparent.

This is one of the characteristic forms of the Malay Archipelago,

and occurs in vast abundance at almost every Station in both Areas.

D'Orbigny's specimens were from the Tertiary of Tarnapol, in Galicia.

Discorbina Bertheloti d'Orbigny sp.

Rosalina Bertheloti d'Orbigny, 1839, Foram. Canaries, p. 135, pl. i. figs. 28–30. *Discorbina Bertheloti* (d'Orb.) Brady, 1864, Trans. Linn. Soc., vol. xxiv. p. 469, pl. xlviii. fig. 10. *D. Bertheloti* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 227, pl. xlvi. figs. 7, 8. *D. Bertheloti* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 387, pl. xv. figs. 10–12. *D. Berthelotiana* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 93, pl. xv. fig. 790. *D. Bertheloti* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 327, pl. lxxii. fig. 4.

This widely-distributed form is very abundant in the Malay Archipelago, and occurs in profusion all over the region.

Discorbina vesicularis Lamarck s.p.

Discorbites vesicularis Lamarck, 1804, Ann. du Muséum, vol. v. p. 183; vol. viii. 1806, pl. lxii. fig. 7. *Discorbina vesicularis* (Lam.) Carpenter, 1862, Introd. Foram., p. 204, pl. xiii. figs. 2, 3. *D. vesicularis* (Lam.) Halkyard, 1889, Trans. and Ann. Rept. Manchester Micr. Soc., p. 69, pl. ii. fig. 8.

Is common in Area 1, and occurs at one or two Stations in Area 2.

Discorbina rimosa Parker and Jones, plate VII. fig. 7.

Discorbina rimosa (Parker and Jones) Carpenter, 1862, Introd. Foram., p. 205, *D. rimosa* Parker and Jones, 1865, Phil. Trans., vol. clv. pp. 385, 421, pl. xix. fig. 6.

The examples of this species are few, and rather small. It occurs at Stations 2 and 14, in Area 1; and at Station 31, in Area 2.

Parker and Jones report it as occurring from India to Australia, including Fiji, in the recent condition; and, as fossil, from the Tertiary of Grignon, &c.

Discorbina semi-marginata d'Orbigny sp. (fide Terquem), plate VII. fig. 8.

Rotalia (*Turbinulina*) *semi-marginata* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 276, No. 53. (Figures without name or

description). Deshayes, 1824–1837, Description des Coquilles fossiles des environs de Paris, pl. cvi. figs. 16–19. *Rotalina semi-marginata* (d'Orb.) Terquem, 1882, Mém. Soc. Geól. Fr., sér. 3, vol. ii. p. 56, pl. xi. figs. 12–14.

As represented in the Malay Archipelago, this is a Rotaline form, with a thin smooth hyaline test, and provided with a well-developed series of Asterigerine umbilical chambers. It bears a strong resemblance to the *D. rimosa* of Parker and Jones, but is devoid of the chinks between the chambers characteristic of that species. It may be noted that both forms are found in the same localities, whether recent or fossil.

The only description of *D. semi-marginata* published by d'Orbigny is in the Prodrome de Paléontologie, vol. ii. 1850, p. 407, No. 1317, "Espèce rugueuse, ovale, bordée intérieurement," which is insufficient to identify it; whilst the figure in the "Planches inédites," referred to by Terquem, has never been published. Deshayes neither names nor describes the form figured by him, consequently the first author to give a sufficient description of the species was Terquem.

In the Malay Archipelago the form occurs in great profusion at Station 12, and in smaller quantities at Station 11; both Stations being in Area 1.

Discorbina rugosa d'Orbigny sp.

Rosalina rugosa d'Orbigny, 1843, Foram. Amér. Mérid., p. 42, pl. ii. figs. 12–14. *Discorbina rugosa* (d'Orb.) Brady, 1884, Chall. Rept., p. 652, pl. lxxxvii. figs. 3, 4. *D. rugosa* (d'Orb.) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 487, pl. xi. fig. 33. *D. rugosa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 383, pl. xv. figs. 1–3. *D. rugosa* (d'Orb.) Chapman, 1896, Journ. R. Micr. Soc., p. 590, pl. xiii. fig. 10; and 1900, Geol. Mag., dec. 4, vol. vii. pl. xiv. fig. 9.

Examples of the form are numerous, and occur all over the region; but they are small, and the shells thin and more or less hyaline.

D'Orbigny obtained it from Patagonia. There are but two 'Challenger' Stations, both on the southern shores of Papua, 155 and 580 fathoms respectively. Egger gives numerous 'Gazelle' Stations, extending from West Africa to Fiji, at depths of from 37 to 3020 fathoms.

Discorbina allomorphinoides Reuss sp.

Valvulina allomorphinoides Reuss, 1860, Sitzungsber. k. Akad. Wiss. Wien, vol. xl. p. 223, pl. xi. fig. 6. *Discorbina allomor*

phinoides (Reuss) Brady, 1884, Chall. Rept., p. 654, pl. xci. figs. 5, 8. *Valvulina allomorphinoides* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 43, pl. ii. figs. 4, 5. *Pulvinulina allomorphinoides* (Reuss) Fornasini, 1900, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. viii. p. 394, fig. 44. *D. allomorphinoides* (Reuss) Chapman, 1900, Proc. California Acad. of Sci., ser. 3, Geol., vol. i. p. 253, pl. xxx. fig. 8.

This species is confined to Area 1; and the examples, although not numerous, are sufficiently characteristic.

Elsewhere it is rare in the living condition. Under the name of *Rotalina utriculata*, Terquem reported it from Dunkerque, very rare. The 'Challenger' Stations are: off the Philippine Islands, 95 fathoms; off Raine Island, 155 fathoms; and Port Jackson, 2–10 fathoms. Fornasini records a solitary specimen from the Adriatic. In my cabinet are some examples from Korea, 20–30 fathoms.

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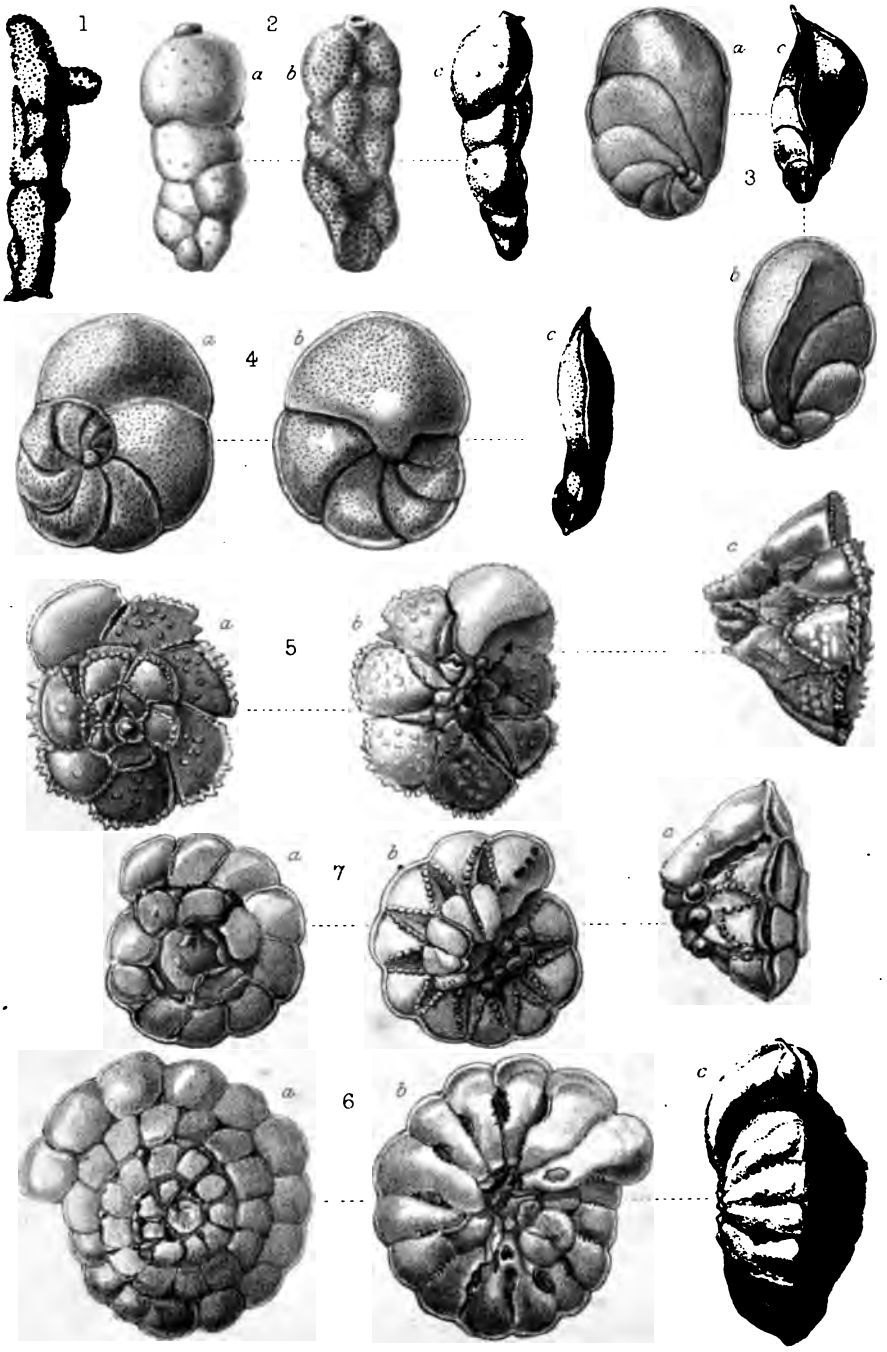

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FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. Roy. Micr. Soc., 1904, pp. 489–506.)

X.—*Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R.M.S.—Part XVI.*

By Fortescue William Millett, F.R.M.S.

(*Read June 15th*, 1904.)

Plate X.

Planorbulina d'Orbigny.

Planorbulina mediterranensis d'Orbigny.

Planorbulina mediterranensis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 280, pl. xiv. figs. 4–6; Modèle, No. 79. *P. mediterranensis* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 227, pl. xlv. fig. 18. *P. mediterranensis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 380, pl. xiv. figs. 24–26. *P. mediterranensis* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 91, pl. xv. fig. 786. *P. mediterranensis* (d'Orb.) Jones, 1895, Palæont. Soc., p. 298, pl. v. fig. 30. *P. mediterranensis* (d'Orb.) Flint, 1899, Rep. U.S. Nat.

EXPLANATION OF PLATE X.

Fig. 1, 2.—*Carpenteria proteiformis* Goës. Fig. 1 × 65; fig. 2 × 90.
„ 3.—*Pulvinulina oblonga* Williamson sp., var. *carinata* var. n. × 80.
„ 4. „ *Brongniartii* d'Orbigny sp. × 40.
„ 5.—*Rotalia Schroeteriana* Parker and Jones, var. *inflata* var. n. × 60.
„ 6. „ *annectens* Parker and Jones. × 30.
„ 7. „ „ var. *concinna* var. n. × 60.

Note.—In all the figures the letter *a* denotes the superior aspect; *b*, the inferior aspect; and *c*, the peripheral aspect.

Mus. for 1897 (1899), p. 328, pl. lxxii. fig. 6. *P. mediterranensis* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 286, pl. vi. figs. 4–7.

Planorbulina acervalis Brady.

Planorbulina acervalis Brady, 1884, Chall. Rept., p. 657, pl. xcii. fig. 4. *P. acervalis* (Brady) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 227, p. xlvi. fig. 11. *P. acervalis* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 328, pl. lxxii. fig. 7.

Planorbulina larvata Parker and Jones.

Planorbulina vulgaris var. *larvata* Parker and Jones, 1860, Ann. and Mag. Nat. Hist., ser. 3, vol. v. p. 294. *P. larvata* Idem, 1865, Phil. Trans., vol. clv. p. 380, pl. xix. fig. 3. *P. larvata* (P. and J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 381, pl. xiv. fig. 31.

These three forms are not well represented in the Malay Archipelago; they occur at the same Stations, and are most abundant in Area 1.

Truncatulina d'Orbigny.

Truncatulina echinata Brady.

Planorbulina echinata Brady, 1879, Quart. Journ. Micr. Sci., n.s., vol. xix. p. 283. pl. viii. fig. 31. *Truncatulina echinata* Idem, 1884, Chall. Rept., p. 670, pl. xcvi. figs. 9–14. *T. echinata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 403, pl. xvi. figs. 40, 41.

This is an aberrant form which seems as nearly allied to *Planorbulina* as to *Truncatulina*, and may be treated as a connecting link between the two genera.

It is not uncommon in Area 1, and occurs sparingly in Area 2. The examples are normal, both in size and form.

Brady states that it has its home amongst the coral-sands of the Pacific and Indian oceans at depths of from 2 to 155 fathoms. The 'Gazelle' Station is Mauritius, 225 fathoms.

Truncatulina reticulata Czjzek sp.

Rotalina reticulata Czjzek, 1848, Haidinger's Naturw. Abhandl., vol. ii. p. 145, pl. xiii. figs. 7–9. *Truncatulina reticulata* (Czjzek) Brady, 1884, Chall. Rept., p. 669, pl. xcvi. figs. 5–8. *T. reticulata* (Czjzek) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 228, pl. xlv. figs. 23, 24. *T. reticulata* (Czjzek) Terrigi, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 107, pl. iv. fig. 10. *T. reticulata* (Czjzek) Chaster, 1892, First Rept. of the Southport Soc. of

Nat. Sci., 1890–1891 (1892), p. 66, pl. i. fig. 16. *T.* (*Rotalina*) *reticulata* (Czjzek) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 402, pl. xvi. figs. 42–44; Idem, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 32, pl. v. fig. 7. *T. reticulata* var. *tuberculata*, Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 300, pl. vi. fig. 11; and var. *plano-convexa*, p. 300, pl. vi. fig. 12. *T. reticulata* (Czjzek) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 334, pl. lxxviii. fig. 3.

This form is very rare in the Malay Archipelago, and occurs only in Area 1.

According to Brady it has a somewhat wide geographical range, at depths of from 17 to 450 fathoms; but at one of the 'Gazelle' Stations the depth was 1914 fathoms.

Truncatulina refulgens Montfort sp.

Cibicides refulgens Montfort, 1808, Conch. Syst., vol. i. p. 122, 31ᵉ genre. *Truncatulina refulgens* (Montf.) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 279, pl. xiii. figs. 9–11; Modèle, No. 77. *T. refulgens* (Montf.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 756, pl. xiv. fig. 13. *T. refulgens* (Montf.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vii. p. 117, pl. viii. figs. 1–3. *T. refulgens* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 401, pl. xvi. figs. 31–33. *Planorbulina refulgens* (Montf.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 89, pl. xv. figs. 775, 776. *T. refulgens* (Montf.) Jones, 1895, Palæont. Soc., p. 302, pl. v. fig. 31. *T. refulgens* (Montf.) Chapman, 1898, Journ. R. Micr. Soc., p. 1, pl. i. fig. 1. *T. refulgens* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 151, pl. xx. figs. 20, 21.

The examples are few and insignificant, but they occur in both Areas.

Truncatulina lobatula Walker and Jacob sp.

" Nautilus spiralis lobatus, etc.," Walker and Boys, 1784, Test. Min., p. 20, pl. iii. fig. 71. *Truncatulina lobatula* d'Orbigny, 1846, For. Foss. Vienne, p. 168, pl. ix. figs. 18–23. *T. lobatula* (W. and J.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 756, pl. xvi. fig. 12. *T. lobatula* (Walker) Malagoli, 1887, Atti Soc. Nat. Modena, ser. 3, vol. iii. p. 110, pl. i. fig. 14. *T. lobatula* (W. and J.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 227, pl. xlii. fig. 20, pl. xlv. fig. 26. *T. lobatula* (W. and J.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 116, pl. vii. figs. 5–7. *T. lobatula* (W. and J.) Mariani, 1893, Ann. Istit. Tecn. Udine, ser. 2, vol. xi. p. 24, pl. i. figs. 19–21. *T. lobatula* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 396,

pl. xvi. figs. 1-3, 10–12. *T. lobatula* (W. and J.) Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 435, pl. ii. figs. 15, 16. *Planorbulina lobatula* (W. and J.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 88, pl. xv. fig. 774. *T. lobatula* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 31, pl. v. fig. 5. *T. lobatula* (W. and J.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 47, pl. ii. fig. 24. *T. lobatula* (Walker) Chapman, 1898, Journ. R. Micr. Soc., p. 2, pl. i. fig. 2. *T. lobatula* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 151, pl. xxiii. figs. 12–14. *T. lobatula* (W. and J.) Chapman, 1902, Proc. Roy. Soc. Edinburgh, vol. xxiii. p. 392, pl. i. figs. 2, 3.

Truncatulina variabilis d'Orbigny.

Truncatulina variabilis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 279, No. 8; Idem, 1839, Foram. Canaries, p. 135, pl. ii. fig. 29. *T. variabilis* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 227, pl. xlv. fig. 17. *T. variabilis* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 116, pl. vii. fig. 9. *T. variabilis* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 562, pl. xi. fig. 22. *T. variabilis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 404, pl. xvi. figs. 57–59, 63, 64. *T. varians* (Reuss) Hosius, 1893, Verhandl. Naturhist. Ver. Preuss. Rheinl. Westph., Jahrg. 1, p. 127, pl. ii. fig. 14. *T. variabilis* (d'Orb.) Jones, 1896, Palæont. Soc., p. 309, pl. vi. fig. 23. *T. variabilis* (d'Orb.) Fornasini, 1896, Revista Ital. di Paleont., p. 95, pl.

These allied forms are widely distributed in the Malay Archipelago, but are most abundant in Area 1. The examples are small and weak.

Truncatulina Wuellerstorfi Schwager sp.

Anomalina Wuellerstorfi Schwager, 1886, Novara Exped., Geol. Theil, vol. ii. p. 258, pl. vii. fig. 105. *Truncatulina Wuellerstorfi* (Schw.) Brady, 1884, Chall. Rept., p. 662, pl. xciii. figs. 8, 9. *T. Wuellerstorfi* (Schw.) Uhlig, 1886, Jahrb. k. k. geol. Reichs., vol. xxxvi. p. 174, fig. 3. *T. Wuellerstorfi* (Schw.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 397, pl. xvi. figs. 13–15. *Planorbulina Wuellerstorfi* (Schw.) Goës, 1889, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 89, pl. xv. fig. 777. *T. Wuellerstorfi* (Schw.) Egger, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 31, pl. v. fig. 6. *T. Wuellerstorfi* (Schw.) Chapman, 1893, Journ. R. Micr. Soc., p. 3, pl. i. fig. 3. *T. Wuellerstorfi* (Schw.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 333, pl. lxxvii. fig. 1.

This form is represented by a few weak examples from Station 27, in Area 2.

Truncatulina Haidingeri d'Orbigny sp.

Rotalina Haidingeri d'Orbigny, 1846, For. Foss. Vienne, p. 154, pl. viii. figs. 7–9. *Truncatulina Haidingeri* (d'Orb.) Reuss, 1867, Sitzungsber. k. Akad. Wiss. Wien, vol. lv. p. 100. *T. Haidingeri* (d'Orb.) Toutkowski, 1888, Zap. Kievsk. Obsch. Estest., vol. ix. p. 58, pl. viii. fig. 3. *T. Haidingeri* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 118, pl. viii. figs. 7–9. *T.* (*Rotalina*) *Haidingeri* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 401, pl. xvi. figs. 25–27; Idem, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 29, pl. v. fig. 1. *Rotalina Haidingeri* (d'Orb.) Idem, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 159, pl. xxv. figs. 36–38; and *R. Brueckneri* (Reuss) p. 159, pl. xxv. figs. 19–21. *T. Haidingeri* (d'Orb.) Liebus, 1902, Jahrb. k. k. geol. Reichs., vol. lii. Heft i. p. 90, fig. 4.

This also is a rare form in the Malay Archipelago, but it is found at Stations in both Areas. The examples, although small, are typical.

Truncatulina Ungeriana d'Orbigny sp.

Rotalina Ungeriana d'Orbigny, 1846, For. Foss. Vienne, p. 157, pl. viii. figs. 16–18. *T. Ungeriana* (d'Orb.) Reuss, 1865, Denkschr. k. Akad. Wiss. Wien, vol. xxv. p. 161. *Planorbulina Ungeriana* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 757, pl. xvi. fig. 16. *T. Ungeriana* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 117, pl. viii. fig. 4; and *Truncatulina* sp., p. 118, pl. viii. fig. 6. *T. involuta* (Reuss) Franzenau, 1899, Math. természz. értesitö, vol. vii. p. 263, pl. iv. fig. 4. *T. Ungeriana* (d'Orb.) Terrigi, 1891, Mem. R. Com. geol. d'Italia, vol. iv. p. 106, pl. iv. fig. 9. *T. Ungeriana* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. (not described) pl. xvi. figs. 19–21. *T. Ungeriana* (d'Orb.) Silvestri, 1893, Mem. Pontif. Accad. Nuovi Lincei, vol. ix. p. 213, pl. vi. fig. 3. *Planorbulina Ungeriana* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 90, pl. xv. fig. 780. *T. Ungeriana* (d'Orb.) Jones, 1896, Palæont. Soc., p. 312 (1886), pl. ii. figs. 11, 12. *T. Ungeriana* (d'Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 47, pl. ii. fig. 23. *T. Ungeriana* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 150, pl. xix. figs. 4–6. *T. Ungeriana* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 333, pl. lxxvii. fig. 2.

This form is not quite so rare in the Malay Archipelago as *T. Haidingeri*, and occurs at a greater number of Stations in both Areas.

Truncatulina Akneriana d'Orbigny sp.

Rotalina Akneriana d'Orbigny, 1846, For. Foss. Vienne, p. 156, pl. viii. figs. 13–15. *T. Akneriana* (d'Orb.) Reuss, 1865, Denkschr. k. Akad. Wiss. Wien, vol. xxv. p. 160. *T. Akneriana* (d'Orb.) Toutkowski, 1887, Zap. Kievsk. Obsch. Estest., p. 46, pl. vi. figs. 1, 2. *T. Ackneriana* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 400, pl. xvi. figs. 60–62. *T.* (*Rotalina*) *Ackneriana* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 30, pl. v. fig. 2. *T. Akneriana* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. 1897 (1899), p. 333, pl. lxxvii. fig. 5.

Is represented by a few characteristic examples from Stations in Area 2.

Truncatulina præcincta Karrer sp.

Rotalia præcincta Karrer, 1868, Sitzungsber. k. Akad. Wiss Wien, vol. lviii. p. 189, pl. v. fig. 7. *T. præcincta* (Karr.) Brady, 1884, Chall. Rept., p. 667, pl. xcv. figs. 1–3. *T. præcincta* (Karr.) Terrigi, 1891, Mem. R. Com. geol. d'Italia, vol. iv. p. 107, pl. iv. fig. 11. *T. præcincta* (Karr.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 403, pl. xvi. figs. 51–53. *T. præcincta* (Karr.) Fornasini, 1895, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. v. p. 12, pl. iv. fig. 36. *T. præcincta* (Karr.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 334, pl. lxxviii. fig. 1. *T. præcincta* var. *ornata* Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 299, pl. v. fig. 10.

This form also is very rare in the Malay Archipelago, and has been noted only at Station 2 in Area 1, and at Station 22 in Area 2.

According to Brady it most affects the coral reefs of the tropics, at depths of from 15 to 225 fathoms.

Anomalina d'Orbigny.

Anomalina ammonoides Reuss sp.

Rosalina ammonoides Reuss, Geogn. Skizze Böhmen, p. 214; and 1845, Verstein. böhm. Kreide, p. 36, pl. viii. fig. 53, pl. xiii. fig. 66. *A. ammonoides* (Reuss) Brady, 1884, Chall. Rept., p. 672, pl. xciv. figs. 2, 3. *Planorbulina ammonoides* (Reuss) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 756, pl. xvi. fig. 14. *Planorbulina ammonoides* (Reuss) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 562, pl. xi. fig. 23. *A.* (*Rosalina*) *ammonoides* (Reuss) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 378, pl. xiii. fig. 35, pl. xiv. figs. 36, 37. *A. ammonoides* (Reuss) Woodward and Thomas, 1893 (1895), Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 44, pl. D,

figs. 28, 29. *A. ammonoides* (Reuss) Perner, 1897, Ceská. Akad. Cisaře Františka Josefa (Palæont. Bohemicæ No. 4), p. 53, fig. 13. *A. ammonoides* (Reuss) Fornasini, 1898, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 205, pl. fig. 24. *A. ammonoides* (Reuss) Chapman, 1898, Journ. R. Micr. Soc., p. 4, pl. i. fig. 5. *A. ammonoides* (Reuss) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 152, pl. xviii. figs. 10–12. *A. ammonoides* (Reuss) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 335, pl. lxxviii. fig. 4. *A. ammonoides* (Reuss) Bagg, 1899, Bull. U.S. Geol. Survey, No. 88, p. 67, pl. vi. fig. 5.

Anomalina grosserugosa Gümbel sp.

Truncatulina grosserugosa Gümbel, 1868, Abhandl. k. bayer. Akad. Wiss., vol. x. p. 660, pl. ii. fig. 104. *A. grosserugosa* (Gümb.) Brady, 1884, Chall. Rept., p. 673, pl. xcvi. figs. 4, 5. *A. grosserugosa* (Gümb.) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 487, pl. xi. fig. 34. *Truncatulina grosserugosa* (Gümb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 117, pl. viii. fig. 5. *A. grosserugosa* (Gümb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 563, pl. xi. fig. 25. *A. grosserugosa* (Gümb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 378, pl. xiv. figs. 4–6. *A. grosserugosa* (Gümb.) var. Jones, 1897, Palæont. Soc., p. 315, pl. vii. fig. 30. *A. grosserugosa* (Gümb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 48, pl. ii. fig. 26. *A. grosserugosa* (Gümb.) Bagg, 1898, Bull. U.S. Geol. Survey, No. 88, p. 67, pl. vi. fig. 4. *A. grosserugosa* (Gümb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 335, pl. lxxviii. fig. 5. *A. grosserugosa* (Gümb.) Chapman, 1900, Proc. California Acad. of Sci., ser. 3, Geol., vol. i. p. 253, pl. xxx. fig. 9. *A. grosserugosa* (Gümb.) Schubert, 1901, Zeitschr. deutsch. geol. Gesell., Jahrg. 1901, p. 21, figs. 5, 6.

Anomalina ariminensis d'Orbigny sp.

Planulina ariminensis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 280, pl. xiv. figs. 1–3; Modèle, No. 26. *A. ariminensis* (d'Orb.) Brady, 1884, Chall. Rept., p. 674, pl. xciii. figs. 10, 11. *A. ariminensis* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 228, pl. xiv. figs. 20–22. *A. ariminensis* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 107, pl. iv. fig. 12. *Planorbulina ariminensis* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 91, pl. xv. figs. 784, 785. *A. ariminensis* (d'Orb.) Fornasini, 1895, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. v. p. 13, pl. iv. fig. 37. *A. ariminensis* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 335, pl. lxxix. fig. 1.

Of these three forms, *ammonoides* and *grosserugosa* are widely distributed in the Malay Archipelago and occur at most of the

Stations; whilst *ariminensis* is rare, although it is found in both Areas. All the examples are small and thin-shelled.

A. grosserugosa is essentially a deep-water form. Brady gives depths of from 345 to 2160 fathoms; Egger records it from one 'Gazelle' Station, at a depth of 371 fathoms; whilst the 'Albatross' Stations range from 420 to 1019 fathoms.

Carpenteria Gray.

Carpenteria monticularis Carter.

Carpenteria monticularis Carter, 1877, Ann. and Mag. Nat. Hist., ser. 4, vol. xix. p. 211, pl. xiii. figs. 9–12. *C. monticularis* (Carter) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 439, pl. xxi. fig. 12. *C. monticularis* (Carter) Chapman, 1900, Journ. Linn. Soc. (Zool.), p. 14, pl. ii. fig. 5, pl. iv. figs. 5, 6.

This form is very rare in the Malay Archipelago, and has been found only at Station 4 in Area 1.

Carpenteria proteiformis Goës, plate X. figs. 1, 2.

Carpenteria balaniformis var. *proteiformis* Goës, 1882, K. Svenska Vet.-Akad. Handl., vol. xix. p. 94, pl. vi. figs. 208–214, pl. vii. figs. 215–219. *C. lithothamnica* Uhlig, 1886, Jahrb. k. k. geol. Reichs., vol. xxxvi. p. 189, pl. v. figs. 1, 2; and *C.* cf. *proteiformis* (Goës) p. 188, pl. v. fig. 3. *Karreria fallax*, Rzehak, 1895, Ann. k. k. Naturh. Hofmuseums, vol. x. part 2, p. 226, pl. vii. figs. 7, 8. *C. proteiformis* Goës, 1896, Bull. Mus. Comp. Zool. Harvard College, vol. xxix. p. 74, pl. vi. figs. 8–17. *C. proteiformis* (Goës) Chapman, 1900, Journ. Linn. Soc. (Zool.), vol. xxviii. p. 195, pl. xix. fig. 11.

This form is much more abundant than the preceding, and occurs at several Stations in both Areas. Usually the examples are irregular in growth and coarsely perforated as shown by fig. 1, but there is a solitary specimen from Station 25, which bears a remarkable resemblance to the example of *Karreria fallax*, figured by Rzehak; this is represented by fig. 2 in our Plate.

Pulvinulina Parker and Jones.

Pulvinulina repanda Fichtel and Moll sp.

Nautilus repandus Fichtel and Moll, 1798, Test. Micr., p. 35, pl. iii. figs. *a–d*. *Pulvinulina repanda* (F. and M.) Parker and Jones, 1862, in Carpenter's Introd. Foram., p. 311. *P. repanda* (F. and M.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., p. 757, pl. xvi.

fig. 18. *P. repanda* (F. and M.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 405, pl. xviii. figs. 28–30, 34, 35. *P. repanda* (F. and M.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 95, pl. xvi. fig. 801. *P. repanda* (F. and M.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 328, pl. lxxii. fig. 8. *P. repanda* (F. and M.) Jones and Chapman, 1900, in a Monograph of Christmas Island, p. 228, pl. xx. fig. 1.

This species is not common in the Malay Archipelago, but it is widely distributed and the examples are large and well-grown.

Pulvinulina concentrica Parker and Jones.

Pulvinulina concentrica (P. and J., Ms.) Brady, 1864, Trans. Linn. Soc., vol. xxiv. p. 470, pl. xlviii. fig. 14. *P. concentrica* (P. and J.) Uhlig, 1886, Jahrb. k. k. geol. Reichs., vol. xxxvi. p. 190, pl. iii. figs. 3, 4. *P. concentrica* (P. and J.) Grzybowski, 1894, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej-Krakowie, vol. xxix. p. 202, pl. iv. fig. 9.

This form is very rare, being represented by a solitary specimen from Station 13.

Pulvinulina lateralis Terquem sp.

Rosalina lateralis Terquem, 1878, Mém. Soc. Géol. France, sér. 3, vol. i. p. 25, pl. vii. fig, 11. *Pulvinulina lateralis* (Terq.) Brady, 1884, Chall. Rept., p. 689, pl. civ. figs. 2, 3. *P. lateralis* (Terq.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 413, pl. xviii. figs. 48–50.

This form, which in the living condition appears to be nothing more than a wild-growing variety of *P. repanda*, is tolerably plentiful at Station 22, and is represented at a few other Stations mostly in Area 2.

Like *P. repanda* it is a shallow-water variety. Our knowledge of its distribution in the existing seas, is confined to the localities mentioned by Brady, and the solitary Station recorded by Egger.

Pulvinulina oblonga Williamson sp.

Nautilus auricula var. *β*, Fichtel and Moll, 1798, Test. Micr., p. 110, pl. xx. figs. *d, e, f*. *Rotalina oblonga* Williamson, 1858, Rec. Foram. Gt. Britain, p. 51, pl. iv. figs. 98–100. *Pulvinulina repanda* var. *auricula* (F. and M.) Parker and Jones, 1862, Introd. Foram., App., p. 311. *P. oblonga* (Will.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 229, pl. xlvi. fig. 5. *P. oblonga* (Will.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 415, pl. xvii. figs. 23–25. *P. oblonga* (Will.) Grzybowski,

1894, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej-Krakowie, vol. xxix. p. 203, pl. iv. fig. 8.

This form is well represented, and occurs abundantly at most of the Stations in both Areas. The examples are large and usually have a clear patch on the septal face, similar to that found in recent specimens of *P. Haueri*.

Pulvinulina oblonga Williamson sp. var. *carinata* var. n., plate X. fig. 3.

This is a well-marked variety, and differs from the type in having an acute ridge down the centre of the septal face; this peculiarity causes the transverse section of the chambers to be of a triangular form.

It occurs at a few Stations, but in small numbers.

Pulvinulina Brongniartii d'Orbigny sp., plate X. fig. 4.

Rotalia Brongniartii d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 273, No. 27. *Rotalina Brongniarti* Idem, 1846, For. Foss. Vienne, p. 158, pl. viii. figs. 22–24. *Pulvinulina auricula* (F. and M.) Parker, Jones, and Brady, 1871, Ann. and Mag. Nat. Hist., ser. 4, vol. viii. p. 173, pl. xii. fig. 143.

This variety of the *P. auricula* group is so abundant in the Malay Archipelago, and its characters so persistent, that it may be worth while to record it under the name given to it by d'Orbigny.

The chambers are ventricose, and the sutures limbate, and formed of clear shelly matter.

It is common at several Stations in both Areas.

Pulvinulina Hauerii d'Orbigny sp.

Rotalina Hauerii d'Orbigny, 1846, For. Foss. Vienne, p. 151, pl. vii. figs. 22–24. *Pulvinulina Hauerii* (d'Orb.) Brady, 1884, Chall. Rept., p. 690, pl. cvi. figs. 6, 7. *P. petrolei* Andreae, 1884, Abhandl. geol. Special-Karte Elsass-Loth., vol. ii. p. 217, pl. viii. fig. 15. *P. (Rotalina) Haueri* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 414, pl. xvii. figs. 29–31. *P. Hauerii* (d'Orb.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 44, pl. E, fig. 34. *P. Hauerii* (d'Orb.) Chapman, 1898, Journ. R. Micr. Soc., p. 5, pl. i. fig. 7. *P. Hauerii* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 154, pl. xviii. figs. 4–6.

Abundant at two or three Stations, and occurs at several others in both Areas. All the examples possess the characters shown in Brady's drawing, pl. civ. fig. 6.

Pulvinulina Menardii d'Orbigny sp.

Rotalia Menardii d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 273, No. 26; Modèle, No. 10. *Pulvinulina repanda* var. *Menardii* (d'Orb.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 394, pl. xvi. figs. 35–37. *P. Menardii* (d'Orb.) Malagoli, 1887, Boll. Soc. Geol. Italia, vol. vi. p. 523, pl. xiii. fig. 10. *P. Menardii* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 228, pl. xlvi. fig. 3. *P. Menardii* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 411, pl. xvii. figs. 7–9, 10–12. *P. Menardii* (d'Orb.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 45, pl. E, fig. 33. *Discorbina pusilla* (Uhlig) Grzybowski, 1894, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej-Krakowie, vol. xxix. p. 197, pl. iii. fig. 7. *P. Menardii* (d'Orb.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 48, pl. ii. fig. 22. *P. Menardii* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 329, pl. lxxiii. fig. 3. *P. Menardii* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 14, figs. 6–8; Idem, 1902, Zeitschr. für allgem. Phys., vol. ii. part 2, p. 234, fig. 67. *P. Menardii* (d'Orb.) Fornasini, 1902, Mem. R. Accad. Sci. Ist. Bologna, ser. 5a, vol. x. p. 58, fig. 55.

Pulvinulina Menardii d'Orbigny var. *fimbriata* Brady.

Pulvinulina Menardii var. *fimbriata* Brady, 1884, Chall. Rept., p. 691, pl. ciii. fig. 3. *P. fimbriata* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 412, pl. xvii. fig. 19. *P. Menardii* var. *fimbriata* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 329, pl. lxxiii. fig. 4. *P. Menardii* var. *fimbriata* (Brady) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 16, fig. 9.

The normal form, although stunted in growth, is plentiful and widely distributed throughout the region.

Wherever the type is abundant, examples occur which have the margin more or less fimbriated.

Pulvinulina tumida Brady.

Pulvinulina Menardii var. *tumida* Brady, 1877, Geol. Mag., ser. 2, vol. iv. p. 535. *P. tumida* Idem, 1884, Chall. Rept., p. 692, pl. ciii. figs. 4–6. *P. tumida* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 414, pl. xvii. figs. 4–6, 35–37, 44. *P. tumida* (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 329, pl. lxxiii. fig. 5.

This thick variety is but poorly represented, and has been noted at two Stations only, and there only in small quantities.

Pulvinulina canariensis d'Orbigny sp.

Rotalina canariensis d'Orbigny, 1839, Foram. Canaries, p. 130, pl. i. figs. 34–36. *Pulvinulina repanda* var. *Menardii* subvar. *canariensis* (d'Orb.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 395, pl. xvi. figs. 47–49. *P. canariensis* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 413, pl. xvii. figs. 20–22. *P. canariensis* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 16, fig. 10.

Pulvinulina patagonica d'Orbigny sp.

Rotalina patagonica d'Orbigny, 1843, Foram. Amér. Mérid., p. 36, pl. ii. figs. 6–8. *Pulvinulina scitula* Brady, 1882, Proc. Roy. Soc. Edinburgh, vol. xi. p. 716. *P. scitula* (Brady) Balkwill and Millett, 1884, Journ. Micr., vol. iii. p. 85, pl. iv. fig. 12. *P. patagonica* (d'Orb.) Brady, 1884, Chall. Rept., p. 693. pl. ciii. fig. 7. *P. patagonica* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 413, pl. xvii. figs. 16–18. *P. patagonica* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 13, fig. 5.

These closely allied forms are scarce in the Malay Archipelago, and restricted to a few Stations. Of the two *canariensis* is the less rare.

Pulvinulina crassa d'Orbigny sp.

Rotalina crassa d'Orbigny, 1840, Mém. Soc. Géol. France, vol. iv. p. 32, pl. iii. figs. 7, 8. *Pulvinulina crassa* (d'Orb.) S. R. J. Owen, 1867, Journ. Linn. Soc. (Zool.), vol. ix. p. 148, pl. v. figs. 18, 19. *P. crassa* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 108, pl. iv. fig. 13. *P. crassa* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 416, pl. xviii. figs. 7–12. *P. crassa* (d'Orb.) Flint, 1897, Rep. U.S. Nat. Mus. for 1897 (1899), p. 329, pl. lxxiv. fig. 1. *P. crassa* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 17, figs. 12, 14, 15.

This also is a rare form in the Malay Archipelago. The examples, although small, are characteristic.

Pulvinulina Micheliniana d'Orbigny sp.

Rotalina truncatulinoides d'Orbigny, 1839, Foram. Canaries, p. 132, pl. ii. figs. 25–27. *Rotalina Micheliniana* Idem, 1840, Mém. Soc. Géol. France, vol. iv. p. 31, pl. iii. figs. 1–3. *Pulvinulina repanda* var. *Menardii* subvar. *Micheliniana* (d'Orb.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 396, pl. xvi. figs. 41–43; pl. xiv. fig. 16. *P. Micheliniana* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 229, pl. xlvi. fig. 10.

Rotalina Michelini (d'Orb.) Fritel, 1888, Foss. Caract. terr. sed. second., pl. xx. figs. 33–35. *Rotalia Michelini* (d'Orb.) Beissel (Holzapfel), 1891, Abhandl. k. Preuss. geol. Landesanst, N.F., Heft 3, p. 73, pl. xiv. figs. 7–10. *P. Micheliniana* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 416, pl. xviii. figs. 1–6. *Rotalina Micheliniana* (d'Orb.) Idem, 1899, Ibid., vol. xxi. p. 155, pl. xx. figs. 1–3. *P. truncatulinoides* (d'Orb.) Rhumbler, 1900, in Dr. Karl Brandt's Nordisches Plankton, Heft 14, p. 17, fig. 16.

In according precedence to the trivial name *truncatulinoides*, Dr. Rhumbler is no doubt technically right, that is, as far as the dates on the title pages are concerned; but the name *Micheliniana* is so well established, that even a slight excuse for its retention may be willingly accepted. The uncertainty of d'Orbigny's dates is shown by the fact that the memoirs on the foraminifera of the Canary Isles, and of South America both bear on the title the date 1839. On the very first page of the latter work allusion is made to a memoir published in 1840, and this is asserted to have been issued in the year previous to 1839, whilst to complete the incongruity the original wrapper of my copy bears the date 1843. Brady, in his 'Challenger' Report, notices some of these discrepancies and accords preference to the name *Micheliniana*.

The form is rare in the Malay Archipelago, and has been found only at Station 2.

Pulvinulina Schreibersii d'Orbigny sp.

Rotalina Schreibersii d'Orbigny, 1846, For. Foss. Vienne, p. 154, pl. viii. figs. 4–6. *Pulvinulina Schreibersii* (d'Orb.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 393. *P. Schreibersii* (d'Orb.) Brady, Parker, and Jones, Trans. Zool. Soc., vol. xii. p. 228, pl. xlvi. fig. 4. *P. Schreibersii* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 409, pl. xviii. figs. 31–33, 67–69.

This form also is rare in the Malay Archipelago, and has been observed only in Area 2.

Pulvinulina elegans d'Orbigny sp.

Rotalia (*Turbinulina*) *elegans* d'Orbigny, 1826, Ann. Sci. Nat., vol. xii. p. 276, No. 54. *Pulvinulina elegans* (d'Orb.) Jones and Parker, 1864, Geologist, vol. vii. p. 88. *P. elegans* (d'Orb.) Brady. Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 228, pl. xlvi. fig. 2. *P. elegans* (d'Orb.) Sherborn and Chapman, 1889, Journ. R. Micr. Soc., p. 489, pl. xi. figs. 30–32. *Rotalia* cf. *Bouei* (d'Orb.) Beissel (Holzapfel), 1891, p. 72, pl. xiv. figs. 25–29. *P. elegans* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 410, pl. xviii. figs. 37–39. *P. elegans* (d'Orb.)

Fornasini, 1893, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. iii. p. 435, pl. ii. fig. 18. *P. elegans* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 97, pl. xvi. fig. 808. *P. elegans* (d'Orb.) Jones, 1895, Palæont. Soc., p. 324, pl. vii. fig. 32. *P. elegans* (d'Orb.) Chapman, 1898, Journ. R. Micr. Soc., p. 6, pl. i. fig. 8. *P. elegans* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 331, pl. lxxv. fig. 1.

Pulvinulina Partschiana d'Orbigny sp.

Rotalina Partschiana d'Orbigny, 1846, For. Foss. Vienne, p. 153, pl. vii. figs. 28–30; pl. viii. figs. 1–3. *Pulvinulina repanda* var. *elegans* (d'Orb.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 397, pl. xvi. figs. 44–46. *P. Partschiana* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 410, pl. xvii. fig. 43, pl. xviii. figs. 25–27. *P.* (*Rotalina*) *Partschiana* (d'Orb.) Idem, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 33, pl. v. fig. 9. *P. Partschiana* (d'Orb.) Grzybowski, 1897, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej-Krakowie, vol. xxxiii. p. 299, pl. xii. fig. 25. *P. Partschiana* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 154, pl. xx. figs. 10–12. *P. Partschiana* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 331, pl. lxxv. fig. 3.

Although these allied forms occur at several Stations in both Areas; the examples are very small and weak, and nowhere numerous.

Pulvinulina Berthelotiana d'Orbigny sp.

Rotalina Berthelotiana d'Orbigny, 1839, Foram. Canaries, p. 130, pl. i. figs. 31–33. *Pulvinulina Berthelotiana* (d'Orb.) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 393. *P. Berthelotiana* (d'Orb.) De Amicis, 1893, Boll. Soc. Geol. Italia, vol. xii. p. 455, pl. iii. fig. 12.

Is represented by a solitary, but fine specimen from Station 2 in Area 1.

Little is known of its distribution in the living condition; d'Orbigny found it in the sand of Teneriffe, and Brady records two 'Challenger' Stations, both near the coast of Papua, at depths from 16 to 25 fathoms.

Rotalia Lamarck.

Rotalia Beccarii Linné sp.

Cornu Ammonis Plancus, 1739, Conch. Min., p. 8, pl. i. fig. 1. *Nautilus Beccarii* Linné, 1758, Syst. Nat., p. 710, No. 237. *Rotalia*

(*Turbinulina*) *Beccarii* (Turt.) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 275, No. 42. *R. Beccarii* (Linné) Wright, 1886, Proc. Belfast Nat. Field Club, 1884–1885, App. ix. p. 332, pl. xxvii. fig. 15. *R. Beccari* (Linné) Malagoli, 1887, Boll. Soc. Geol. Italia, vol. vi. p. 523, pl. xiii. fig. 11. *R. Beccari* var. *ammoniformis* Idem, Ibid., p. 523, pl. xiii. fig. 12; Idem, 1888, Atti Soc. Nat. Modena, ser. 3, vol. vii. p. 113, pl. iii. fig. 10. *R. Beccarii* (Linné) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 119, pl. viii. fig. 5. *Rotalina Beccarii* (Linné) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 420, pl. xix. figs. 25–27. *Rotalina Beccarii* (Linné) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 99, pl. xvi. fig. 811. *R. Beccarii* (Linné) Rhumbler, 1894, Zeitschr. für Wiss. Zool., vol. lvii. p. 574, pl. xxii. fig. 41. *R. Beccarii* (Linné) Lister, 1895, Phil. Trans., vol. clxxxvi. p. 436, pl. viii. figs. 38–40. *R. Beccarii* (Linné) Fornasini, 1898, Mem. R. Accad. Sci. Ist. Bologna, p. 259, figs. *R. Beccarii* (Linné) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 331, pl. lxxv. fig. 2. *R. Beccarii* (Linné) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 22. *R. Beccarii* (Linné) Fornasini, 1902, Mem. R. Accad. Sci. Ist. Bologna, ser. 5ª, vol. x. p. 59, figs. 56–58. *R. Beccarii* (Linné) Chapman, 1902, The Foraminifera, p. 37, fig. 23. *R. Beccarii* (Linné) Lister, 1903, The Foraminifera, in Lankester's Zoology, p. 120, fig. 50.

This well-known form is very abundant and occurs at nearly all of the Stations. The examples are small, but are marked with great variety, not only in the number and degree of inflation of the chambers, but also in the thickness and translucency of the shell-substance.

Rotalia Broeckhiana Karrer.

Rotalia Broeckhiana Karrer, 1878, in Drasche's Geol. Luzon, p. 98, pl. v. fig. 26. *Rotalina Broeckhiana* (Karr.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 421, pl. xix. figs. 19–21.

This even at its best is a very unsatisfactory form, and the Malay Archipelago examples, which are always found in company with *R. Beccarii*, are small and poor.

Brady records it from off Ki Islands, 580 fathoms. The solitary 'Gazelle' Station is West Australia, 196 fathoms.

Rotalia Soldanii d'Orbigny.

Rotalia (*Gyroidina*) *Soldanii* d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 278, No. 5; Modèle, No. 36. *R. Soldanii* (d'Orb.) Terrigi, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 109, pl. iv. fig. 15. *Rotalina Soldanii* (d'Orb.) Egger, 1893, Abhandl. k. bayer.

Akad. Wiss., Cl. II. vol. xviii. p. 420, pl. xix. figs. 16–18, 51. *Rotalina Soldanii* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 99, pl. xvi. fig. 812. *Rotalina Soldanii* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber., xvi. p. 34, pl. v. fig. 10. *R. Soldanii* (d'Orb.) Grzybowski, 1897, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej-Krakowie, vol. xxxiii. p. 300, pl. xii. fig. 23. *R. Soldanii* (d'Orb.) Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. vi. p. 328, pl. vi. fig. 14. *R. Soldanii* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 332, pl. lxxv. fig. 4. *Rotalina Soldanii* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 156, pl. xx. figs. 26–28.

This form is found at two Stations in considerable numbers, but the examples are small and weak. They vary in the direction of *R. orbicularis*, but no typical specimens of this latter form have been observed.

Rotalia Schroeteriana Parker and Jones.

Ammonshorn Schroeter, 1784, Neue Litt. u. Beyträge, vol. i. p. 307, pl. i. fig. 1. *Faujasina* sp., Williamson, 1853, Trans. Micr. Soc. London, ser. 2, vol. i. p. 87, pl. x. figs. 1–6. *R. Schroeteriana* (Parker and Jones, M.S.) Carpenter, 1862, Introd. Foram. p. 212, pl. iv. fig. 3, pl. xiii. figs. 7–9. *Rotalina Schroeteriana* (Carpenter) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 422, pl. xix. figs. 10–12. *R. Schroeteriana* (P. and J.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 338, pl. lxxvi. fig. 1.

This fine species is abundant, large and typical, at Stations 14 and 17.

Schroeter records it from Tranquebar, and states that the examples are the size of poppy-seeds. Brady * writes, "No well-marked specimens of *Rotalia Schroeteriana* have been met with in the 'Challenger' dredgings. Though somewhat local in distribution, it is by no means rare amongst the islands of the Eastern Archipelago, at depths of less than 50 or 60 fathoms." The 'Gazelle' Stations are West Australia, Amboyna and New Guinea, at depths of from 30 to 560 fathoms. The 'Albatross' locality is not recorded.

Rotalia Schroeteriana Parker and Jones, var. *inflata* var. n., plate X. fig. 5.

This is an interesting variety which occurs in great profusion throughout the region. The conical form of the test and the flat superior face indicate that it is a modification of *R. Schroeteriana*; whilst being constant in maintaining the conical shape, the surface

* Chall. Rept., 1884, p. 707.

is subject to great variation, being smooth in some examples, whilst others are beset with tubercles and spines in various degrees. The peripheral margin is more or less fimbriate and often deeply indented at the sutures. A series of umbilical lobes is always present.

The example illustrated shows all these characters in a modified form.

Rotalia papillosa Brady.

R. papillosa Brady, 1884, Chall. Rept., p. 708, pl. cvi. fig. 9.
R. papillosa (Brady) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 322, pl. lxxvi. fig. 2.

At Station 13 in Area 1 this form is common, and it occurs sparingly at a few other Stations in both Areas.

Brady states that it was obtained at seven 'Challenger' Stations in the South Pacific, and at one in the North Pacific, at depths of from 2 to 37 fathoms. The 'Albatross' locality is not recorded.

Rotalia annectens Parker and Jones, plate X. fig. 6.

Rotalia annectens Parker and Jones, 1865, Phil. Trans., vol. clv. pp. 387, 422, pl. xix. fig. 11.

Parker and Jones describe this as "A well-developed conus-shaped Rotalia, which has on its under or umbilical surface, partially formed secondary chambers, owing to angular processes of the septa nipping the umbilical lobes. It is thus a passage-form between *R. Schroeteriana* P. and J., and *R.* (*Asterigerina*) *lobata* d'Orbigny." The localities given are Hong Kong (anchor-mud) and Fiji (coral-reef).

The Malay examples are less conical than the type, and the angular processes of the septa are not so well marked.

It occurs sparingly at Stations 14 and 17.

Rotalia annectens Parker and Jones, var. *concinna* var. n., plate X. fig. 7.

This is a neat compact form, subject to but little variation. The sutures on the inferior face of the test are deeply excavated, forming angular depressions which increase in width as they recede from the peripheral margin. They are bordered by two rows of tubercles, which combine to form a zigzag beading encircling the test. The supplementary chambers are obtuse on the superior margin, and usually cover the whole of the umbilical region. In the example selected for illustration these lobes are absent from

a portion of the test, and are replaced by large clear tubercles or beads.

The variety occurs at the same Stations as the type, as well as at a few others in both Areas.

Rotalina calcar d'Orbigny sp.

Calcarina calcar d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 276, No. 1; Modèle, No. 34. *Rotalia calcar* (d'Orb.) Brady, 1884, Chall. Rept., p. 709, pl. cviii. fig. 3. *Rotalina calcar* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 423, pl. xix. figs. 1–3.

Rotalia venusta Brady.

Rotalia venusta Brady, 1884, Chall. Rept., p. 708, pl. cviii. fig. 2. *Rotalina venusta* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 422, pl. xix. figs. 13–15.

Whilst a few more or less typical examples of these two species occur in the Malay Archipelago, the greater mass is made up of forms in which the characters of both are so intermixed that it is useless to attempt to separate them. They both occur in considerable numbers at several of the Stations in both Areas.

For the occurrence of *R. venusta*, Brady names five South Pacific Stations, 3 to 11 fathoms; and off Calpentyn, Ceylon, 2 fathoms, or thereabouts. The 'Gazelle' locality is off the Cape of Good Hope, 50 fathoms.

Rotalia pulchella d'Orbigny sp.

Calcarina pulchella d'Orbigny, 1839, Foram. Cuba, pp. 30, 92, pl. v. figs. 16–18. *Rotalia pulchella* (d'Orb.) Brady, 1884, Chall. Rept., p. 710, pl. cxv. fig. 8. *R. pulchella* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 332, pl. lxxvi. fig. 3.

This beautiful little form is very abundant at Station 17, and occurs sparingly at other Stations in both Areas. The inferior surface of the test is much more complex than would appear from the published drawings, and is almost identical with that of *R. annectens* var. *concinna*. The superior face is usually of a delicate fawn colour.

With respect to its general distribution, d'Orbigny found a few examples in sand from Cuba; Brady gives 'Challenger' Stations, Kandavu, 255 fathoms; and Humboldt Bay, Papua, 37 fathoms. He also states that it has been obtained from the Straits of Banca, 7 or 8 fathoms; off Java; and off Penang. The 'Albatross' locality is not recorded.

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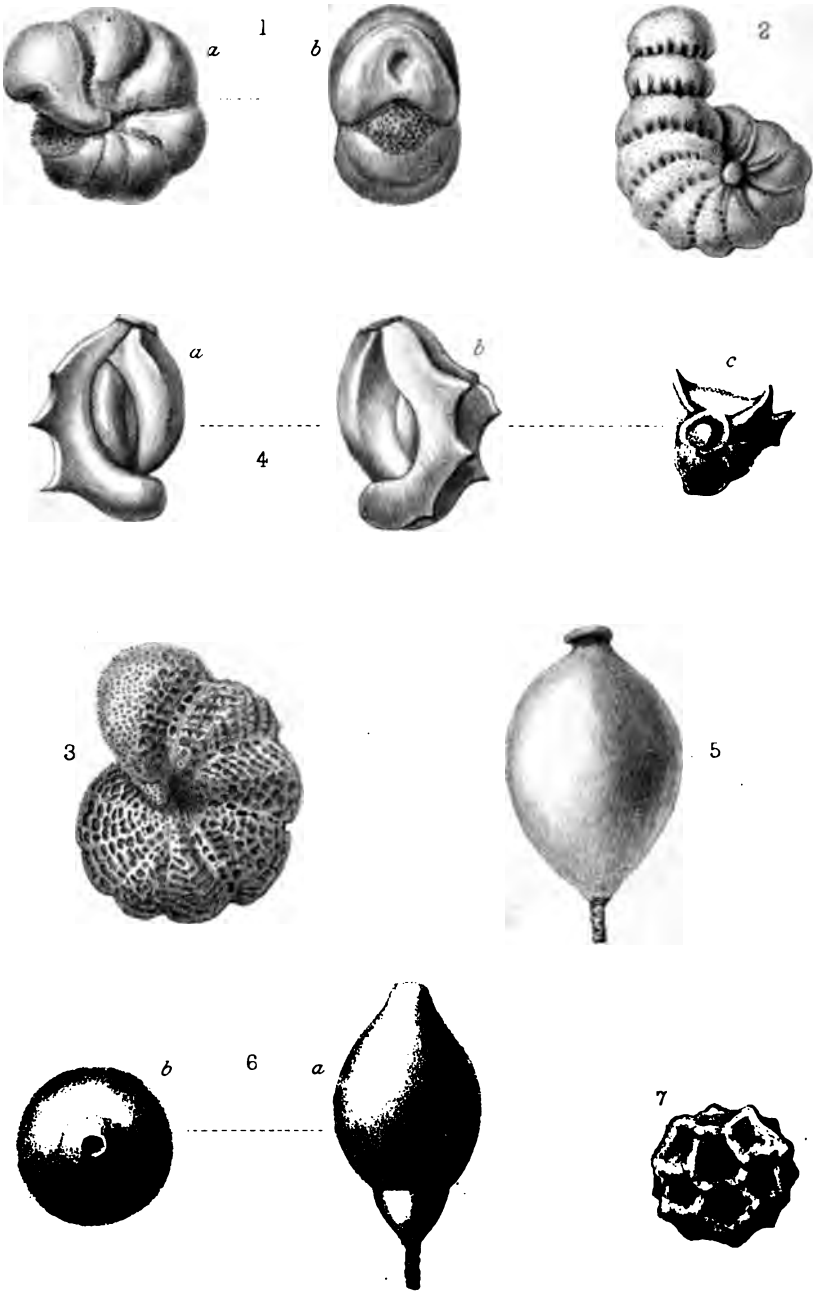

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FORAMINIFERA OF MALAY ARCHIPELAGO.

(Journ. R. Micr. Soc., 1904, pp. 597–609.)

XI.—*Report on the Recent Foraminifera of the Malay Archipelago, collected by Mr. A. Durrand, F.R.M.S.—Part XVII. (Conclusion).*

By Fortescue William Millett, F.R.M.S.

(*Read October 19th*, 1904.)

Plate XI.

Calcarina d'Orbigny.

Calcarina Spengleri Linné sp.

"Ammonshorn" Spengler, 1781, Danske Selsk. Skrifter, vol. i. p. 379, pl. ii. fig. 9. *Calcarina Spengleri* (Gmel.) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 276, No. 4. *C. Spengleri* (Linné) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 423, pl. xix. figs. 4–6. *C. calcitropoides* (Lam.) Idem, 1899, Ibid., vol. xxi. p. 167, pl. xvii. figs. 18, 38, pl. xxii. fig. 36.

This form is not uncommon at Stations 2, and 22. The examples are moderately large, and exhibit the usual variations.

Calcarina hispida Brady.

Calcarina Spengleri (Linné) hispid var. Carpenter, 1860, Phil. Trans., vol. cl. p. 551, pls. xix. figs. 8–11, xx. figs. 6, 8. *C. hispida* Brady, 1876, Proc. R. Irish Acad., ser. 2, vol. ii. p. 590. *C. hispida* (Brady) Lister, 1895, Phil. Trans., vol. clxxxvi. p. 437, pl. viii. figs. 34–37.

EXPLANATION OF PLATE XI.

Fig. 1.—*Nonionina orbicularis* Brady. × 75.
„ 2.—*Polystomella crispa* Linné sp. Abnormal. × 75.
„ 3.— „ *verriculata* Brady. × 60.
„ 4.—*Miliolina excisa* Brady, Parker, and Jones. × 115.
„ 5, 6.—*Pelosina distoma* sp. n. × 115.
„ 7.—*Thurammina favosa* Flint, var × 140.

In the Malay Archipelago the distribution of this form is identical with that of *C. Spengleri*. The examples are neither numerous nor large.

Brady in his 'Challenger' Report states that it has been observed at ten Stations, all of them amongst the Islands of the Pacific. The depths range from 3 to 155 fathoms.

Calcarina Defrancii d'Orbigny.

Calcarina Defrancii d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 276, pl. xiii. figs. 5–7.

In the Malay Archipelago, this is the most abundant species of the genus, and it occurs at several Stations in both Areas. The examples have the characters of the one figured by Brady in the 'Challenger' Report.*

According to Brady the best examples in the 'Challenger' collection have been found associated with the type, at one or two Stations in the Eastern Archipelago, notably off the Admiralty Islands, 15 to 25 fathoms. D'Orbigny's locality is the Red Sea.

Sub-Family **Tinoporinæ.**

Tinoporus Montfort.

Tinoporus baculatus Montfort.

Tinoporus baculatus Montfort, 1808, Conch. Syst., vol. i. p. 146, Genre 37. *T. baculatus* (Carp.) Dervieux, 1893, Atti R. Accad. Sci. Torino, vol. xxix. p. 6, pl. figs. 19, 26, 34. *T. baculatus* (Montf.) Sherlock, 1903, Bull. Mus. Comp. Zool. Harvard College, vol. xxxviii. p. 357, fig. 8.

The form is very rare in the Malay Archipelago, and has been noted only at Station 2, in Area 1.

Gypsina Carter.

Gypsina vesicularis Parker and Jones, sp.

Orbitolina vesicularis Parker and Jones, 1860, Ann. and Mag. Nat. Hist., ser. 3, vol. vi. p. 31, No. 5. *Gypsina vesicularis* (P. and J.) Carter, 1877, Ibid. ser. 4, vol. xx. p. 173. *G. vesicularis* (P. and J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 382, pl. xiv. figs. 20–23. *G. vesicularis* (P. and J.) Jones, 1897, Palæont. Soc., p. 335, fig. 25. *G. vesicularis* (P. and J.) Chapman, 1900, Journ. Linn. Soc. (Zool.), p. 198, pl. xix. fig. 12.

This is rather rare, but occurs at Stations in both Areas.

* Plate cviii. fig. 6.

Gypsina inhærens Schultze, sp.

Acervulina inhærens Schultze, 1854, Organ. Polythal., p. 68, pl. vi. fig. 12. *Gypsina inhærens* (Schultze) Brady, 1884, Chall. Rept., p. 718, pl. cii. figs. 1–6. *G. inhærens* (Schultze) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 229, pl. xli. fig. 19. *G. inhærens* (Schultze) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 91. pl. xv. fig. 787. *G. inhærens* (Schultze Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 336, pl. lxxix. fig. 6.

This is less rare than the preceding form, and is found in small numbers at several Stations in both Areas. The individuals exhibit the usual irregularities of growth, and size.

Family NUMMULINIDÆ.

Sub-Family **Polystomellinæ.**

Nonionina d'Orbigny.

Nonionina depressula Walker and Jacob, sp.

Nautilus spiralis utrinque subumbilicatus, &c. Walker and Jacob, 1784, Test. Min., p. 19, pl. iii. fig. 68. *Nautilus depressulus* Walker and Jacob, 1798, Adams's Essays, Kanmacher's edition, p. 641, pl. xiv. fig. 33. *Nonionina depressula* (W. and J.) Parker and Jones, 1859, Ann. and Mag. Nat. Hist., ser. 3, vol. iv. pp. 339, 341. *Pulvinulina nonionoides* Andreae, 1884, Abhandl. geol. Special-Karte Elsass-Loth., vol. ii. p. 256, pl. xi. fig. 2. *Nonionina depressula* (W. and J.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 229, pl. xliii. fig. 25. *N. depressula* (W. and J.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4. vol. vi. p. 119, pl. x. fig. 4; Idem, 1891, Mem. R. Com. Geol. Italia, vol. iv. p. 109, pl. iv. fig. 16. *N. depressula* (W. and J.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 427, pl. xix., figs. 38, 39. *N. depressula* (W. and J.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 103, pl. xvii. figs. 825, 826. *N. depressula* (W. and J.) Morton, 1897, Proc. Portland Soc. Nat. Hist., vol. ii. p. 121, pl. i. fig. 20. *N. depressula* (W. and J.) Jones, 1897, Palæont. Soc., p. 347. *N. depressula* (W. and J.) Wright, 1900, Geol. Mag., dec. 4, vol. vii. p. 100, pl. v. fig. 23. *N. depressula* (*N. complanata* d'Orb.) Fornasini, 1904, Mem. R. Accad. Sci. Ist. Bologna, ser. 6, vol. i. p. 12, pl. iii. fig. 6.

This species is abundant in Area 2, and occurs sparingly at a few Stations in Area 1. The forms vary in the direction of *N. asterizans*.

Nonionina orbicularis Brady, plate XI fig. 1.

Nonionina orbicularis Brady, [illegible], Denkschr. k. Akad. Wiss. Wien, vol. xliii. p. [illegible], pl. [illegible] fig. [illegible]. *N. depressula* var. *orbicularis* [illegible] 1895, [illegible] No. 2, p. 217, pl. fig. [illegible].

This [illegible] form is very rare and represented only at Station [illegible] in Area [illegible]. The examples are quite characteristic, even in the prominence of the sutures shown in Brady's figures.

Nonionina stelligera d'Orbigny.

Nonionina stelligera d'Orbigny, [illegible], Foram. Canaries, p. 128, pl. iii. figs. [illegible]. *N. stelligera* (d'Orb.) Fornasini 1888, Minute forme Rizopodi Ital. [illegible] pl. fig. [illegible]. *N. stelligera* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss. Cl. II vol. xviii. p. [illegible], pl. xix. fig. 44. *N. stelligera* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl. vol. xxv. p. [illegible], pl. xvii. figs. 827, 828. *N. stelligera* (d'Orb.) Millett, [illegible], Proc. Portland Soc. Nat. Hist., vol. ii. p. [illegible] pl. [illegible] fig. [illegible]. *N. stelligera* (d'Orb.) (*N. elegans* d'Orb.) Fornasini [illegible], Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vii. p. 654, fig. [illegible].

This occurs at Stations in both Areas, but is very rare.

Nonionina umbilicatula Montagu sp.

Nautilus umbilicatulus Montagu, 1803, Test. Brit., p. 191; Suppl., p. 78, pl. xviii. fig. 1. *Nonionina asterizans* (F. and M.) var. *umbilicatula* Parker and Jones, 1859, Ann. and Mag. Nat. Hist., ser. 3, vol. iv. p. 347. *N. umbilicatula* (Montagu) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 230, pl. xliii. fig. 19. *N. umbilicatula* (Montagu) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 426, pl. xix. figs. 36, 37. *N. umbilicatula* (Montagu) Silvestri, 1893, Atti e Rendic. Acad. Sci. Lett. e Arti dei Zelanti di Acireale, vol. v. p. 20, pl. iii. figs. 26, 27. *N. umbilicatula* (Montagu) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 103, pl. xvii. fig. 823. *N. Soldanii* (d'Orb.) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 40, pl. iii. fig. 18. *N. umbilicatula* (Montagu) Jones, 1897, Palæont. Soc., p. 345, fig. 29. *N. umbilicatula* (Montagu) var. *depressula* Silvestri, 1899, Mem. Pontif. Accad. Nuovi Lincei, vol. xv. p. 331, pl. vi. fig. 15. *N. Soldanii* (d'Orb.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 174, pl. xxii. figs. 7, 8. *N. umbilicatula* (Montagu) Chapman, 1900, Proc. California Acad. of Sci., ser. 3, Geol., vol. i. p. 256, pl. xxx. fig. 15.

A few characteristic examples occur at Stations in both Areas.

Nonionina pompilioides Fichtel and Moll sp.

Nautilus pompilioides Fichtel and Moll, 1798, Test. Micr., p. 31, pl. ii. figs. *a–c*. *Nonionina pompilioides* (F. and M.) Parker, Jones, and Brady, 1865, Ann. and Mag. Nat. Hist., ser. 3, vol. xvi. p. 18. pl. iii. fig. 98. *N. pompilioides* (F. and M.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 426, pl. xix. figs. 32, 33. *N. Soldanii*,(d'Orb.) Idem, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 40, pl. iii. fig, 16. *N. pompilioides* (F. and M.) Chapman, 1900, Proc. California Acad. of Sci., ser. 3, Geol., vol. i. p. 256, pl. xxx. fig. 16.

As might be anticipated, this deep-water form is not well represented in the anchor-mud of the Malay Archipelago. It has been observed only at Station 11, in Area 1, and is there very rare.

Brady states that it is almost exclusively a deep-water Foraminifer, and mentions several localities where it has occurred at depths of from 1000 to 2750 fathoms. Amongst numerous 'Gazelle' Stations one has a depth of as little as 75 fathoms.

Nonionina scapha Fichtel and Moll sp.

Nautilus scapha Fichtel and Moll, 1798, Test. Micr., p. 105 pl. xix. figs. *d–f*. *Polystomella crispa* (Linné) var. *Nonionina scapha* (F. and M.), Parker and Jones, 1865, Phil. Trans., vol. clv. p. 404, pl. xvi. figs. 37, 38, pl. xviii. figs. 55, 56. *N. scapha* (F. and M.) Brady, Parker, and Jones, 1888; Trans. Zool. Soc., vol. xii. p. 230, pl. xliii. fig. 20. *N. scapha* (F. and M.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 120, pl. x. fig. 7; Idem, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 110, pl. iv. fig. 18. *N. scapha* (F. and M.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 48, pl. E, figs. 35, 36. *N. scapha* (F. and M.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 424, pl. xix. figs. 43, 44. *N. scapha* (F. and M.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 104, pl. xvii. fig. 830. *N. scapha* (F. and M.) Egger, 1895, Naturhist. Ver. Passau, Jahresber. xvi. p. 40, pl. iii. fig. 17. *N. scapha* (F. and M.) Morton, 1897, Proc. Portland Soc. Nat. Hist., vol. ii. p. 121, pl. i. fig. 23. *N. scapha* (F. and M.) Jones, 1897, Palæont. Soc., p. 342, fig. 27. *N. scapha* (F. and M.) Egger, 1899, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xxi. p. 175, pl. xxv. fig. 56. *N. scapha* (F. and M.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 337, pl. lxxx. fig. 1. *N. scapha* (F. and M.) (*N. elongata* d'Orb.) Fornasini, 1904, Mem. R. Accad. Sci. Ist. Bologna, ser. 6, vol. i. p. 12, pl. iii. fig. 4. *N. scapha* (F. and M.) (*N. Grateloupi* d'Orb.), Idem, Ibid., p. 12, pl. xiii. fig. 5.

spines, whilst others add to the nautaloid a linear series of chambers, as in the example of *P. crispa* here figured.

Although many of the specimens of *P. crispa* are much compressed, none of them have the other characters of *P. macella*.

Polystomella subnodosa Münster sp.

Robulina subnodosa Münster (fide Römer), 1838, Neues Jahrb. für Min., p. 391, pl. iii. fig. 61. *Polystomella subnodosa* (Münst.) Reuss, 1856, Sitzungsber. K. Akad. Wiss. Wien, vol. xviii. p. 240, pl. iv. fig. 51. *P. subnodosa* (Münst.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 102, pl. xvii. figs. 817–819. *P. subnodosa* (Münst.) Fornasini, 1897, Rendic. Accad. Sci. Ist. Bologna, n. s., vol. ii. pl. i. fig. 12.

Although the form is compounded of characters taken from both *P. crispa* and *P. striatopunctata*, it is subject to but little variation, and the examples can usually be identified without difficulty.

In the Malay Archipelago it is found at several Stations in both Areas, and is abundant at Stations 13, 18, and 21.

Polystomella verriculata Brady, plate XI. fig. 3.

Polystomella verriculata Brady, 1881, Quart. Journ. Micr. Sci., n. s., vol. xxi. p. 66; and 1884, Chall. Rept., p. 738, pl. cx. fig. 12.

This form occurs at most of the Stations in the Malay Archipelago. The reticulations of the surface are much more delicate than those of the example figured by Brady. Specimens of a similar character occur in some sea-sand from Sagami Bay, Japan, for which I am indebted to the kindness of Prof. Yokoyama of Tokio.

Brady gives two 'Challenger' Stations, both off the west coast of Australia.

Polystomella craticulata Fichtel and Moll sp.

Nautilus craticulatus Fichtel and Moll, 1798, Test. Micr., p. 51, pl. v. figs. *h*, *i*, *k*. *Polystomella craticulata* (F. and M.) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 284, No. 3? *P. iberica* Schrodt, 1890, Zeitschr. deutsch. geol. Gesell., vol. xlii. p. 417, pl. xxii. fig. 9. *P. craticulata* (F. and M.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 433, pl. xx. figs. 24, 25.

A few fine examples occur at several Stations in both Areas.

Under the name of *P. iberica*, Schrodt describes a similar form from the Spanish Pliocene. If identical, this would be the first record of its occurrence in the fossil condition.

Sub-Family Nummulitinæ.

Amphistegina d'Orbigny.

Amphistegina Lessonii d'Orbigny.

Amphistegina Lessonii d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 304, No. 3, pl. xvii. figs. 1–4; Modèle No. 98. *A. vulgaris*, Id. Ibid., p. 305, No. 8; Modèle No. 40. *A. vulgaris* (d'Orb.) Amicis, 1886, Atti Soc. Tosc. Sci. Nat., (Mem.) vol. vii. p. 242, pl. xi. fig. 2. *A. Lessonii* (d'Orb.) Bütschli, 1886, Morph. Jahrb., vol. xi. p. 86, pl. vi. figs. 7, 8. *A. Lessonii* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 230, pl. xliii. fig. 15. *A. Lessonii* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 121, pl. ix. figs. 6–8. *A. Lessonii* (d'Orb.) Dreyer, 1891, Jenaische Zeitsch. für Naturwiss., vol. xxvi. pl. xxviii. fig. 267. *A. Lessonii* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 431, pl. xx. figs. 18, 19. *A. Lessonii* (d'Orb.) Zittel, 1896, Bull. Soc. Géol. France, sér. 3, vol. xxiv. p. 969, fig. 1^{1-7}. *A. Lessonii* (d'Orb.) Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899), p. 338, pl. lxxxii. fig. 4. *A. Lessonii* (d'Orb.) Chapman, 1901, Proc. R. Soc. Edinburgh, vol. xxiii. p. 394, pl. iii. fig. 2. *A. vulgaris* (d'Orb.) Newton and Holland, 1902, Journ. Coll. Sci. Imp. Univ. Tōkyō, vol. xvii. p. 16, pl. ii. fig. 1. *A. Lessonii* (d'Orb.) Fornasini, 1903, Rendic. R. Accad. Sci. Ist. Bologna, n. s., vol. vii. pl. ii. fig. 1. *A. Lessonii* (d'Orb.) Sherlock, 1903, Bull. Mus. Comp. Zool. Harvard College, vol. xxxviii. p. 356, fig. 5.

This form is not abundant, but it occurs at several Stations, and is most frequent in Area 1.

Amphistegina Cumingii Carpenter.

Amphistegina Cumingii Carpenter, 1859, Phil. Trans., vol. cxlix. p. 32, pl. v. figs. 13–17, pl. vi. figs. 5, 6. *A Cumingii* Murray and Renard, 1891, Chall. Rept. 'On Deep Sea Deposits,' pls. xiii., xiv.

Is represented by a few examples from one or two Stations in both Areas.

Whether this species should be assigned to *Amphistegina* or to *Nummulina* is still undecided. The Malay specimens exhibit a greater affinity with *Operculina* than with *Nummulina*.

Operculina d'Orbigny.

Operculina complanata Defrance sp.

Lenticulites complanata Defrance, 1822, Dict. Sci. Nat., vol. xxv. p. 453. *Operculina complanata* (Basterot) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 281, No. 1, pl. iv. figs. 7–10; Modèle, No. 80. *O. complanata* (Defr.) Woodward and Thomas, 1885, 13th Ann.

Rept. Geol. and Nat. Hist. Survey of Minnesota for 1884, p. 175, pl. iv. fig. 35. *Operculina* sp. Blackenhorn, 1890, Zeitschr. deutsch. geol. Gesell., p. 339, pl. xvii. figs. 2, 3. *O. complanata* (Defr.) Woodward and Thomas, 1893, Geol. and Nat. Hist. Survey of Minnesota, vol. iii. p. 45, pl. E. fig. 37. *O. complanata* (Defr.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 435, pl. xx. figs. 40–42. *O. complanata* (Defr.) Jones, 1897, Palæont. Soc., p. 362, pl. ii. figs. 49, 50. *O. complanata* (Defr.) Newton and Holland, 1902, Journ. Coll. Sci. Imp. Univ. Tōkyō, p. 13. pl. i. figs. 3, 5, pl. iii. fig. 3. *O. complanata* (Defr.) Lister, 1903, The Foraminifera, in Lankester's Zoology, p. 126, fig. 55.

Operculina complanata var. *granulosa* Leymerie.

Operculina granulosa Leymerie, 1846, Mém. Soc. Géol. France, sér. 2, vol. i. p. 359, pl. xiii. fig. 12. *O. complanata* var. *granulosa* (Leym.) Woodward and Thomas, 1885, 13th Ann. Rept. Geol. and Nat. Hist. Survey of Minnesota for 1884, p. 176, pl. iv. fig. 36. *O. granulosa* (Leym.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii., p. 435, pl. xx. figs. 36, 37, 43. *O. complanata* var. *granulosa* (Leym.) Idem, 1899, Ibid. vol. xxi. p. 175, pl. xix. figs. 33, 34. *O. complanata* var. *granulosa* (Leym.) Newton and Holland, 1902, Journ. Coll. Sci. Imp. Univ. Tōkyō, vol. xvii. p. 14, pl. ii. fig. 4, pl. iii. fig. 5.

Both these forms occur in the two Areas, and mostly at the same Stations. With few exceptions the examples are small and ill-developed.

Heterostegina d'Orbigny.

Heterostegina depressa d'Orbigny.

Heterostegina depressa d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 305, No. 2, pl. xvii. figs. 5–7; Modèle, No. 99. *H. depressa* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 122, pl. x. fig. 1. *H. curva* (Moebius) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 434, pl. xx. figs. 26–31; and *H. depressa* (d'Orb.) p. 433, pl. xx. figs. 34, 35. *H. depressa* (d'Orb.) Jones and Chapman, 1900, In A Monograph of Christmas Island, p. 229, pl. xx. fig. 1. *H. depressa* (d'Orb.) Chapman, 1900, Journ. Linn. Soc. (Zool.), vol. xxviii. p. 18, pl. iii. figs. 6, 7; Idem, 1900, Geol. Mag., n. s., dec. 4, vol. vii. pl. xiii. fig. 7; Idem, 1902, Ibid., vol. ix. p. 10, pl. iv. fig. 1. *H. depressa* (d'Orb.) Lister, 1903, The Foraminifera, in Lankester's Zoology, p. 128, fig. 56. *H. suborbicularis* (d'Orb.) (cf. *H. depressa* d'Orb.) Fornasini, 1903, Boll. Soc. Geol. Italiana, vol. xxii. p. 396, pl. xiv. figs. 5, 6.

This form is represented in the Malay Archipelago by a few small examples occurring at Stations in Area 1.

APPENDIX.

Miliolina excisa Brady, Parker, and Jones, plate XI. fig. 4.

Miliolina excisa Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 215, pl. xl. fig. 33.

A solitary example of this form has been found in the material from Station 7. The *M. cristata* described and figured in Part II. of this Report differs in having only one dentate ridge.

Brady, Parker, and Jones's specimens were from the Abrohlos Bank; depth 31 fathoms.

A somewhat similar form from Delos has been described and figured by my friend Mr. H. Sidebottom, under the name of *M. seminulum* var. *cornuta*.*

Miliolina crassatina Brady.

Miliolina incrassata Brady, 1881, Quart. Journ. Micr. Sci., n. s., vol. xxi. p. 46. *M. crassatina* Idem, 1884, Chall. Rept., p. 180, pl. viii. fig. 5,

A very few examples of this ambiguous form occur at two Stations in Area 1, and at one Station in Area 2. The minute crescentic aperture is in some examples concealed by the coarse grains of sand composing the test.

Brady writes, "*Miliolina crassatina* is exceedingly rare. It has only been met with in a single dredging, off East Moncœur Island, Bass Strait, 38 fathoms."

Sigmoilina tenuis Czjzek.

Quinqueloculina tenuis Czjzek, 1848, Haidinger's Naturw. Abhandl., vol. ii. p. 149, pl. xiii. figs. 31–34. *Miliolina tenuis* (Cz.) Balkwill and Wright, 1885, Trans. R. Irish. Acad., vol. xxviii. (Sci.) p. 324, pl. xii. figs. 3–5. *Spiroloculina panda* (Schwager) var. *Rengerriana* Deecke, 1886, Mém. Soc. émul. Montbeliard, sér. 3, vol. xvi. p. 16, pl. i. fig. 28. *Sigmoilina tenuis* (Cz.) Schlumberger, 1887, Bull. Soc. Zool. France, vol. xii. p. 117. *Miliolina* sp. Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 551, pl. viii. figs. 2, 3; and *Spiroloculina tenuis* (Cz.) p. 551, pl. viii. fig. 4. *Spiroloculina tenuis* (Cz.) Terrigi, 1891, Mem. R. Com. Geol. d'Italia, vol. iv. p. 65, pl. i. figs. 2, 3. *Spiroloculina tenuis* (Cz.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii.

* Mem. and Proc. Manchester Lit. and Phil. Soc., xlviii., 1904, p. 11, pl. iii. figs. 11, 12.

p. 222, pl. i. figs. 46, 47. *Sigmoilina tenuis* (Cz.) Jones, 1895, Palæont. Soc., p. 125, pl. vii. fig. 2.

This form is represented by a fine but solitary example from Station 13, in Area 1.

Pelosina distoma sp. n., Plate XI. figs. 5, 6.

Test pyriform or fusiform, with a rounded aperture at each extremity, that at the superior end being the larger. From the inferior orifice the chitinous lining protrudes in the form of a short tube. Length 0·35 mm.

In his definition of the genus *Pelosina* Brady specifies "aperture single." This limitation would exclude the species under consideration, but it is so evidently a true *Pelosina* that the emendation of Brady's definition would be less objectionable than the creation of a new genus.

The test of *P. distoma* is unusually dense, and often has a polished surface, which gives it a superficial resemblance to *Glandulina*. Sometimes there is a constriction in the test, as shown by fig. 6. The chitinous membrane is in some specimens visible at the superior orifice, but never forms there a projecting tube as in *P. rotundata*.

In its distribution it appears to be very local, being somewhat abundant at Station 6, and is represented sparingly at Station 22, but these are the only localities where it has been found.

Thurammina favosa Flint, Plate XI. fig. 7.

Thurammina favosa Flint, 1899, Rep. U.S. Nat. Mus. for 1897 (1899) p. 278, pl. xxi. fig. 2. *Thyrammina favosa* (Flint) Rhumbler, 1903, Schaudinn's Archiv für Protistenkunde, vol. iii. p. 236, fig. 65.

This is a doubtful Foraminifer, and I had hesitated in accepting it, but since it has been admitted by Flint and Rhumbler, I feel compelled to include it in the present Report. Like the also doubtful *Reophax pleurostomelloides* before described, there is a certain amount of flexibility about the test reminiscent of the vegetable kingdom, to which possibly both may belong.

In the Malay Archipelago it occurs at several Stations, but is most abundant in Area 1.

The 'Gazelle' Stations are in the Gulf of Mexico; 26 and 420 fathoms.

In conclusion, it should be explained that a few doubtful forms which may or may not be Foraminifera, have purposely been

included in this Report. By thus calling attention to them, their true position in Nature is more likely to be determined, than it would have been, had they been absolutely ignored.

CORRIGENDA AND ADDENDA.

Journ. R. Micr. Soc.

1898.

Page 610, line 1 from top, *for* sp. n. *read* sp.

1899.

„	249,	line	7	from foot	„ Bertholin	„	Berthelin
„	357	„	10	„	„ × 90	„	× 40
„	362	„	12	„	„ 1895	„	1894
„	557	„	3	„	„ *Candeina*	„	*Candeiana*
„	560	„	13	from top	„ *Sagraina affinis*	„	*Textularia concava*
„	562	„	20	„	„ *Candeina*	„	*Candeiana*
„	564	„	7	„	„ Fornasini	„	Malagoli

1900.

„	6	„	3	from foot	„ Reuss	„	Egger sp.
„	540	„	9	„	„ 6	„	10
„	545	„	9	from top	„ 42	„	62
„	145	„	11	„	„ 35	„	65

1901.

„	4	„	24	„	„ 17	„	9
„	493	„	18	„	„ vii.	„	viii.
„	496	„	15	„	*after* sp.	*add*	var.

1902.

	523	„	13	„	*for* Haeussler	*read*	Haeusler

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(Journ. R. Micr. Soc., 1898, pp. 255–257.)

V.—*On Anchor Mud from the Malay Archipelago.*

By A. Durrand, F.R.M.S.

(*Read* 16*th February*, 1898.)

Narrative.

Ever since perusing A. R. Wallace's 'Malay Archipelago,' which so attractively and graphically depicts the terrestrial life of the islands, curiosity about the denizens of the deep thereabouts existed in my mind; dredgings I had made in Western Australia, Port Jackson, and at various stations within the Great Barrier Reef, Queensland, from Townsville to Cape York and Thursday Island, led me to expect richer hauls on the north coast of Australia and in the warm shallow seas about the islands of the Archipelago.

In 1884, and several times subsequently, in passing from Torres to Sunda Straits, I had stray opportunities of obtaining small samples of bottom which showed traces of a rich foraminiferal fauna; and in 1886, in steaming from Java to Singapore, I sounded at Muntok, Banka, and Rhiouw, with good results in Foraminifera and Diatoms, the latter station furnishing *Navicula Durrandii*.

These casual results led to my getting the Netherlands India Steam Navigation Company, then (1889) controlled by the British India Steam Navigation Company, to instruct the commanders of their fleet plying about the islands of the Archipelago, to collect bottom from each port of call, the results of which are now submitted.

The cleaned material was picked over first by me, and then by Mr. Fortescue W. Millett, who finally determined species, and whose careful elaboration speaks for itself.

When it is remembered that all this series of material was taken from shallow water, more or less close inshore, in about 12 or 14 fathoms generally, some idea of the richness of this great area in minute marine life may be formed, and what awaits those who can systematically conduct series of soundings or dredgings from shallow to deep water at the most typical stations indicated in this paper.