

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

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(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

EXPLANATION OF PLATES.

PLATE V.

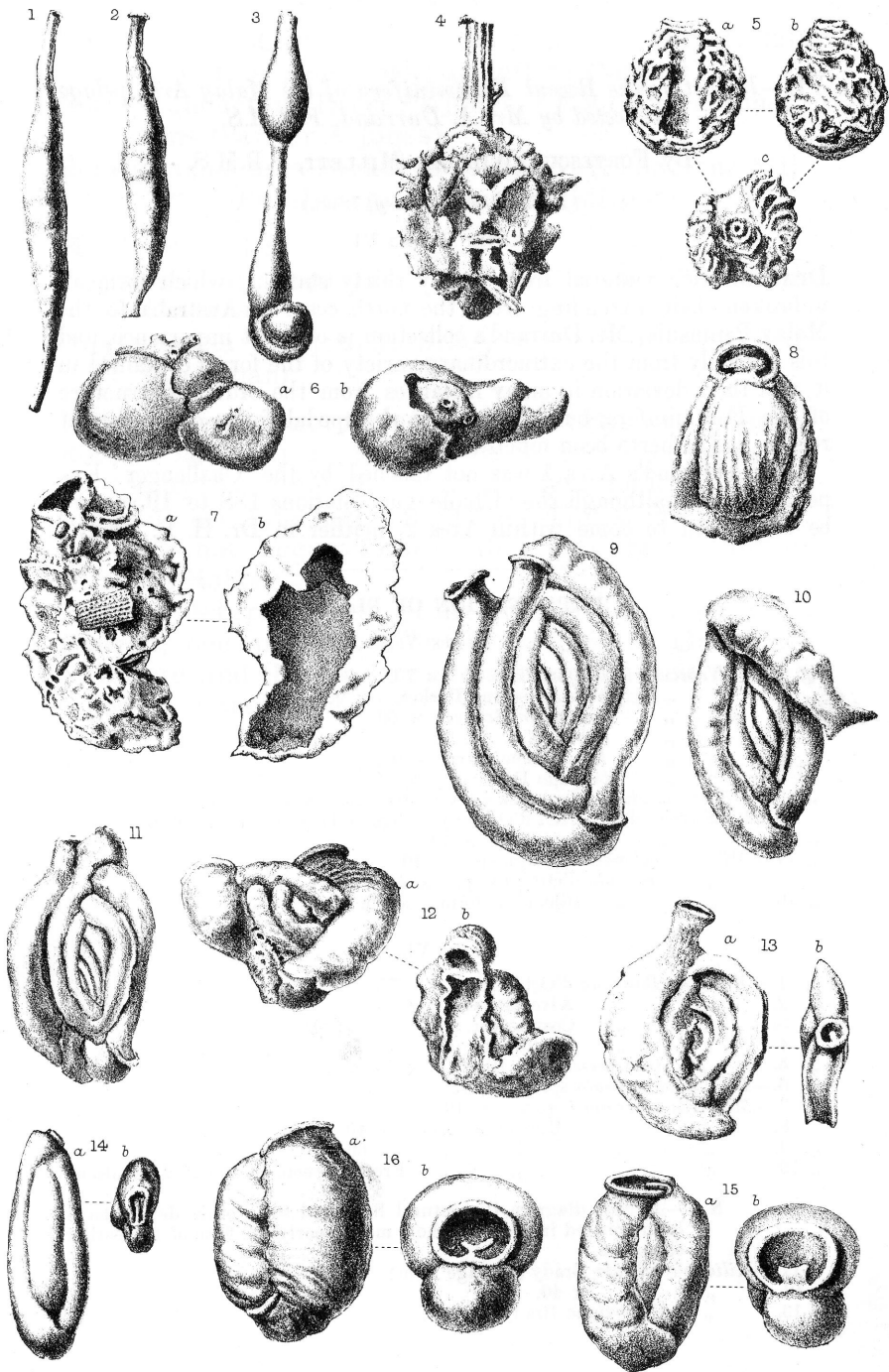
- Fig. 1, 2.—*Nubecularia fusiformis* sp. n. × 75.
 „ 3. „ „ *tibia* Jones and Parker. × 90.
 „ 4. „ „ *divaricata* Brady. × 60.
 „ 5. „ „ *dubia* sp. n. × 90.
 „ 6. „ „ *Bradyi* nom. nov. × 60.
 „ 7. „ „ *lucifuga* DeFrance. × 60.
 „ 8.—*Biloculina ringens* Lamarek sp. var. *striolata* Brady. × 90.
 „ 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.

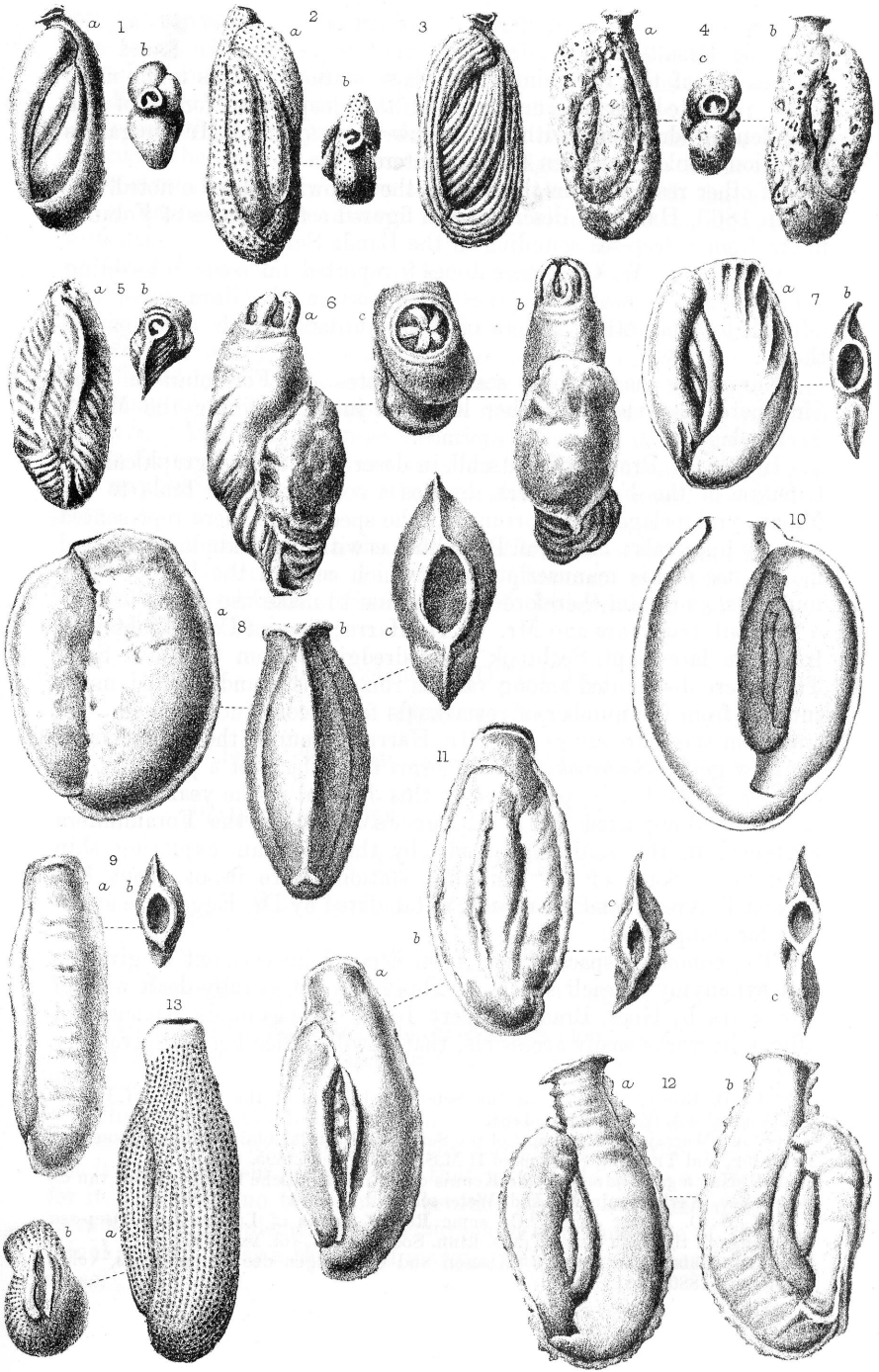
- „ 11.—*Miliolina cultrata* Brady (passage form). × 40.
 „ 12. „ „ „ × 40.
 „ 13. „ „ „ *Rupertiana* Brady. × 40.



F.W. Millett del. ad nat.

West, Newman lith.

Foraminifera of Malay Archipelago.



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West, Newman lith.

Foraminifera of Malay Archipelago.

'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 Lagenæ 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. xlv. 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 *Poly-morphina*, 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 resemblance 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. 2a, 2b.

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, 8a, 8b.

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. 2¹⁷. *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.

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.)