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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.

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.

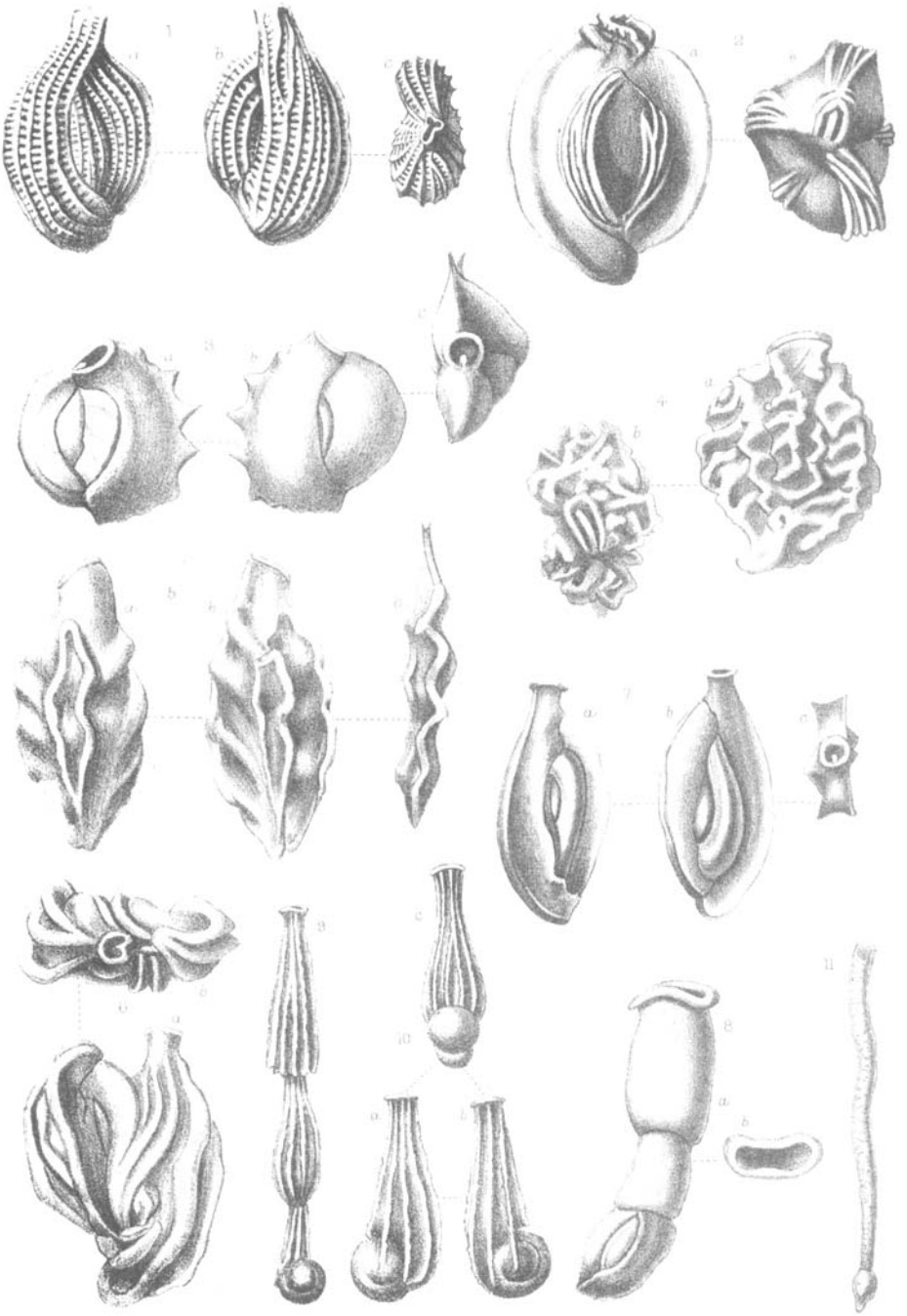
One of the 'Gazelle' Stations is Western Australia; and under the name of *M. Candeiana*, Dr. Goës‡ records it from the North Atlantic.

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 lith.

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.