XII.—*On the Recent and Fossil Foraminifera of the Shore-sands of Selsey Bill, Sussex.*—VII. *Supplement* (*Addenda et Corrigenda*).

By Edward Heron-Allen, F.L.S., F.R.M.S.,
and Arthur Earland, F.R.M.S.

(*Read February* 15, 1911.)

Plates IX.–XIII.

The series of papers, of which this forms, for the present, the conclusion, has now been in process of publication for three years. During the whole of this time the work of making gatherings, and the examination of the material collected, has been in progress, and this has naturally resulted in the discovery of a great number of additional species, of which some are new. Such additional species are described in the pages which follow, and after allowing for corrections and the withdrawal of one or two species from the list, bring the total of forms described up to 390, or, including varietal forms, 399.

We have been obliged, by engagements entered into by us with regard to other material, to relegate to some future occasion the publication of the results of examination and study of the living Foraminifera which have occupied us concurrently with the examination of the shore-gatherings, and also the geological study of the forms found in the material derived from the artesian borings at "Large Acres."

We take this opportunity of recording our sense of obligation to the Council of the Society for the liberal manner in which they have afforded us scope for the publication of our report. We also

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EXPLANATION OF PLATE IX.

Fig. 1.—*Gromia Dujardini* Schulze (?). Side view. × 100.
,, 2. Ditto. Oral view. × 100.
,, 3.—*Nubecularia tibia* Jones and Parker. × 100.
,, 4.—*Articulina foveolata* H-A. and E. Early or Milioline stage. × 100.
,, 5.—*Cornuspira foliacea* Philippi sp. Abnormal. × 100.
,, 6. Ditto.
,, 7.—*Reophax ampullacea* Brady. Side view. × 100.
,, 8. Ditto. Oral view. × 100.
,, 9.—*Haplophragmium nanum* Brady. Superior view. × 100.
,, 10. Ditto. Inferior view. × 100.
,, 11. Ditto. Lateral view. × 100.
,, 12.—*Textularia inconspicua* (Brady) var. *jugosa* Brady. × 100.
,, 13.—*Bulimina Terquemiana* sp. n. × 100.
,, 14. Ditto.

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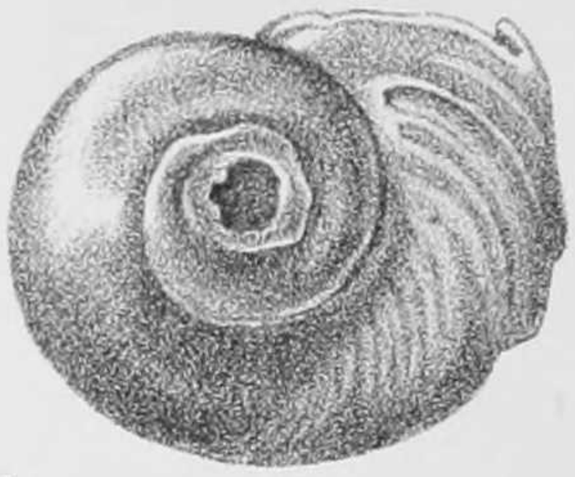

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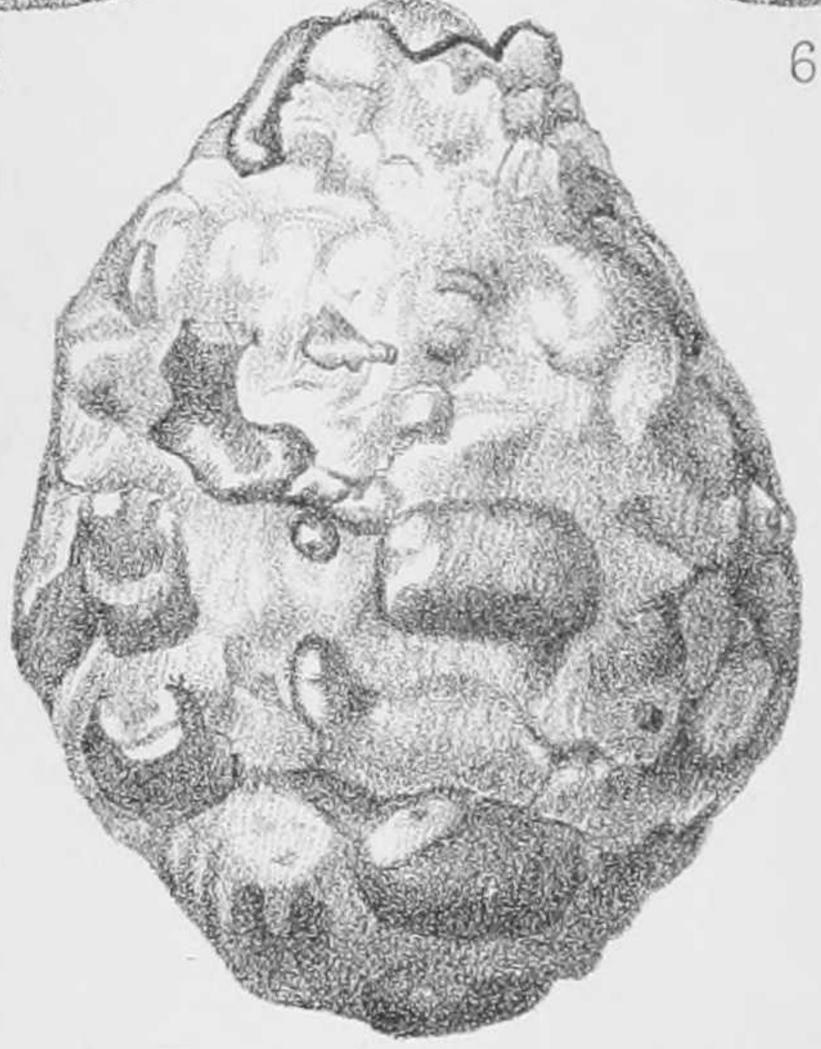

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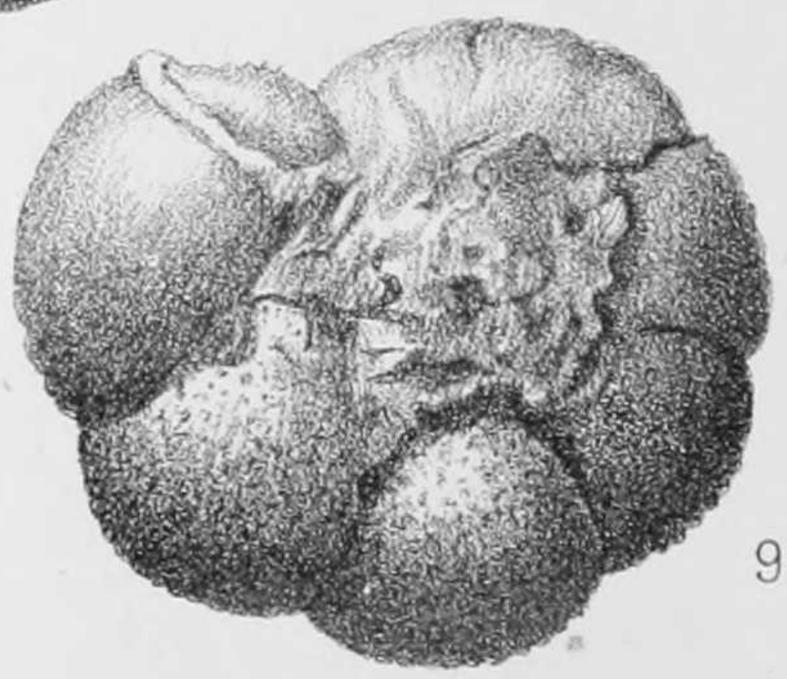

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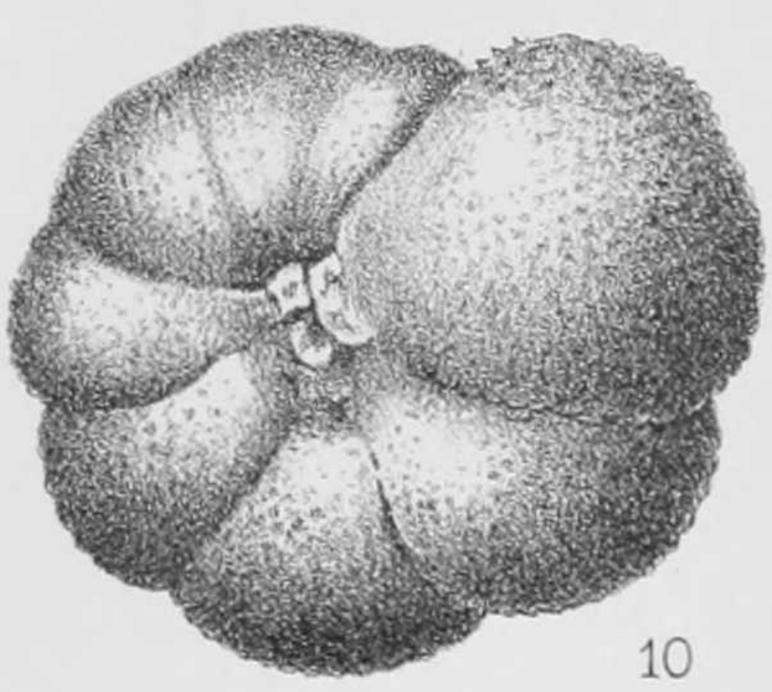

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West, Newman lith.

desire to express our indebtedness to Mr. Herbert R. Lilley, of Belfast, who has made the drawings which have illustrated our work, and to Mr. F. W. Millett and Mr. Joseph Wright for assistance and advice ungrudgingly given us on all occasions when it was sought.

The following must be added to the list of chalk-fossil forms (Art. V.):—

52. (H-A) *Ammodiscus incertus* d'Orbigny.
123. (H-A) *Polymorphina gibba* d'Orbigny.
127. (H-A) „ *compressa* d'Orbigny.
360. *Uvigerina asperula* Brady.
210. *Nonionina pompilioides* Fichtel and Moll sp.
325. *Textularia rugosa* Reuss.
160. *Discorbina orbicularis* Terquem.
352. *Nodosaria calomorpha* Reuss.

GROMIA Dujardin.

299. *Gromia oviformis* Dujardin.
299A. *Gromia Dujardini* Schulze.

For a year now past we have been keeping under observation in the tanks which we have described at some length in 'Knowledge' * and in this Journal,† a large number of living specimens of these two species of *Gromia*, both of which occur in abundance in washings of algæ from the Mixon Reef. We do not propose to enter into any description of the observations which we have made, reserving these for a future paper.

Among the Mixon Reef gatherings we have met with many specimens of the organism figured on Plate IX. figs. 1, 2. Of its rhizopodal nature there can be no doubt, as sarcode is often found adherent round its orifice. Beyond this we do not at present feel disposed to form any conjecture. Its external form and size agree very well with *G. Dujardini*, and that species in the living state frequently covers its natural chitinous envelope with a loose crust of sandy mud, but the sandy envelope of *Gromia* is not apparently cemented together with any durable medium; it can be removed with a camel-hair brush without injuring the living animal, which will proceed at once to form a second covering, which appears to us to consist of mud separated by the pseudopodia from the surrounding water during the assimilation of nutriment. Moreover, such incrusted *Gromiæ*, when dried in the same manner as the shore-gatherings are dried, shrivel up into amorphous crinkled sacs, the nature of which could not be ascertained from a mere casual inspection of the dried specimens.

The specimens which we figure, however, are firm though somewhat flexible. They consist of a spherical chitinous envelope covered with a uniform layer of very fine sand-grains, which are so closely adherent to the envelope that they resist any attempt at

* Knowledge, xxxiii. No. 504 (1910) pp. 285–6.
† See this Journal, 1910, p. 695. Paper No. VI. of this series.

disintegration. At one pole of the sac a large roughly circular aperture is situated; in the immediate neighbourhood of the aperture the sandy covering thins out, so that the chitinous sac becomes visible. A few somewhat similar specimens have been obtained from muddy dredgings by the 'Goldseeker' in the Moray Firth and in the Norwegian fiords.

Pending the discovery of additional specimens, we are figuring the Selsey individuals under the genus *Gromia*, but it appears to us not improbable that further investigations may result in its transference to *Hippocrepina*, with the general characteristics of which genus it appears to conform, though differing entirely in shape.

Diameter 0·3–0·4 mm.

300. *Nubecularia Bradyi* Millett.

Nubecularia inflata Brady, 1884, Foram. 'Challenger,' p. 135, pl. i. figs. 5–8.
Nubecularia Bradyi Millett, 1898, Malay Foraminifera, Journ. R. Micr. Soc. p. 261, pl. v. fig. 6 *a*,*b*.
Nubecularia Bradyi (Millett) Sidebottom, 1904, Mem. Manchester Lit. and Phil. Soc. vol. xlviii. No. 5, p. 3.

Brady's specific name "*inflata*," having been previously used by Terquem (1876) for another *Nubecularia*, had to be abandoned.

A single specimen, consisting of one, or perhaps two, chambers. As the specimen is somewhat worn it is difficult to decide whether it is fossil or recent. Brady's specimens, which were recent, were principally from tropical shallow waters, but he also reports its occurrence at Balfour Bay, Kerguelen Island (which is far from the tropics) in 20 to 50 fathoms. Brady also refers to the fact that on the British coasts wild growing specimens of *Miliolina subrotunda* were to be found possessing some Nubecularine characteristics, but that the Milioline affinities of such specimens could always be identified by the nature of the aperture. The aperture of our specimen has no Milioline character, being distinctly, but irregularly, circular, and without sign of tooth.

301. *Nubecularia tibia* Jones and Parker.

(Plate IX. fig. 3.)

Nubecularia tibia Jones and Parker, 1860, Quart. Journ. Geol. Soc., vol. xvi. p. 455, pl. xx. figs. 48–51.
Ditto. (Jones and Parker), Brady, 1879, Quart. Journ. Micr. Sci., vol. xix., N.S., p. 52, pl. viii. figs. 1, 2.
Ditto. (Jones and Parker) Brady, 1884, Foram. 'Challenger,' p. 135, pl. i. figs. 1–4.
Ditto. (Jones and Parker) Millett, 1898, Foram. Malay Archipelago, Journ. Micr. Soc., p. 261, pl. v. fig. 3.

One or two specimens have been found which we think should be attributed to this species, although perhaps they are more

flattened in appearance than any of the published figures. They are, as is almost invariably the case with this species, fragments of the original organism. *Nubecularia tibia* has hitherto been known in the recent condition only from tropical and sub-tropical shallow seas; it occurs, however, among Earland's list of specimens from one of the 'Goldseeker' Stations in the Moray Firth, Scotland (Noss Head, N. by W. ½ W., 3 miles, 43 fms.), and probably is a widely diffused species, although owing to its fragility and small size, it is liable to be overlooked. It occurs in the fossil state as far back as the Trias and Upper Lias, but, according to Brady, there are no records of its occurrence in beds between these strata and recent times.

302. *Biloculina elongata* d'Orbigny.

Biloculina elongata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 298, No. 4.
Biloculina ringens var. *patagonica* Williamson, 1858, Recent Foram. Great Britain, p. 80, pl. vii. figs. 175, 176.
Miliola (*Biloculina*) *elongata* (d'Orbigny) Parker and Jones, 1865, Phil. Trans., vol. clv., p. 409, pl. xvii. figs. 88, 90, 91.
Biloculina elongata (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 144, pl. ii. fig. 9.
Ditto. (d'Orbigny) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (d'Orbigny) Goës, 1894, Arctic and Scandinavian Foram., p. 119, pl. xxiv. figs. 906–13.

Fossil specimens only have been found, and this is the more noteworthy as the species is not uncommon as a recent shell, in many shallow water gatherings round the British Islands.

303. *Spiroloculina antillarum* d'Orbigny.

Spiroloculina antillarum d'Orbigny, 1839, Foram. Cuba, p. 149, pl. xi. figs. 3, 4.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 155, pl. x. fig. 21 *a*, *b*.
Ditto. (d'Orbigny) Earland, 1905, Journ. Quekett Micr. Club, ser. 2, vol. ix., No. 57, p. 193.

Fossil only; doubtless derived from some of the Eocene deposits characterized by the presence of warm water fauna. This is one of the species recorded by Earland from Bognor. "One specimen found, weak, but identifiable. Not previously recorded from Great Britain. The species is at home in the shallow water of warm seas." In view of the occurrence of fossils at Selsey, in the immediate neighbourhood of Bognor, the recent condition of the Bognor specimen must be regarded as doubtful, and the species should, therefore, be removed from the list of recent British Foraminifera until specimens are found to occur in localities far removed from Tertiary deposits.

June 21st, 1911

304. *Spiroloculina nitida* d'Orbigny.

Spiroloculina nitida d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 298, No. 4.
Ditto. (d'Orbigny) Parker and Jones, 1871, Ann. Mag. Nat. Hist., ser. 4, vol. viii , p. 248, pl. viii. fig. 24.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 149, pl. ix. figs. 9, 10.
Ditto. (d'Orbigny) T. Rupert Jones, 1895, Crag Foram. Palæont. Soc., p. 112, pl. v. fig. 3, and woodcut fig. 5.
Ditto. (d'Orbigny) Millett, 1898, Malay Foraminifera, Journ. R. Micr. Soc., p. 265, pl. v. figs. 9–13 *a*, *b*.

Frequent in the recent condition. No fossil specimens found. There is a considerable range of variation in the specimens of this simplest of the Spiroloculine types, and they serve to link it up with other Milioline species. Many of the specimens are somewhat rugose, and show a tendency to adopt a subarenacous type of shell. This type of shell closely approaches *Miliolina sclerotica* in texture and general appearance.

Millett (*supra*) gives many interesting notes as to the morphology of this species, which, under various names, appears to have a very extensive geological record, ranging back to the Lias at least.

305. *Spiroloculina planulata* Lamarck sp.

Miliolites planulata Lamarck, 1805, Ann. du Muséum, vol. v. p. 352, No. 4; 1822, Anim. sans Verteb., vol. vii. p. 613, No. 4.
Spiroloculina depressa d'Orbigny, 1826, Ann Sci. Nat., vol. vii. p. 298, No. 1; Modèle No. 92.
Spiroloculina badenensis d'Orbigny, 1846, Foram. Foss. Vienne, p. 270, pl. xvi. figs. 13–15.
Spiroloculina depressa var. *rotundata* Williamson, 1858, Recent Foram. Great Britain, p. 82, pl. vii. fig. 178.
Spiroloculina planulata (Lamarck) Brady, 1884, Foram. 'Challenger,' p. 148, pl. ix. fig. 11 *a*, *b*.
Ditto. (Lamarck) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Lamarck) Goës, 1894, Arctic and Scandinavian Foram., p. 107, pl. xviii. figs. 836 *a–c*.

Fossil, with one exception. The fossil specimens display a considerable variety of form. The recent one is typical. It is a common species on British coasts, and in temperate seas all over the world, and its geological range extends back at least as far as the Lias.

306. *Spiroloculina Terquemiana* sp. n.

Spiroloculina ornata Terquem, 1882, Mém. Soc. Géol. France, sér. 3, vol. ii. pt. iii. p. 159, pl. xvi. (xxiv.) fig. 23 *a*, *b*.

As the specific name "*ornata*" has been previously used by d'Orbigny for a different organism,* it becomes necessary to re-

* *Spiroloculina ornata* (d'Orbigny), 1839, Foram. Cuba, p. 167, pl. xii. figs. 7–7*a* = *Miliolina ornata* (d'Orbigny) Möbius, 1880, Beitrag. Meeresfauna Insel Mauritius, etc., p. 76, pl. ii. figs. 4–7.

name Terquem's very distinctive little form, and we therefore propose to associate it with Terquem's name.

A considerable number of specimens, all more or less eroded or waterworn, which we have no hesitation in ascribing to Terquem's species, which was described from specimens obtained from the Eocene of Septeuil. Terquem describes it as follows: "Shell oval, obtuse at each end, bounded by a leaf-like carination, formed of curved and depressed chambers, the inner ones smooth, the two outer chambers ornamented with fine and short striæ running parallel to each other, but obliquely to the axis, regularly spaced. Aperture oval, and rimmed, without any tooth."

307. *Miliolina boueana* d'Orbigny sp.

Quinqueloculina boueana d'Orbigny, 1846, Foram. Foss. Vienne, p. 293, pl. xix. figs 7–9.
Quinqueloculina nussdorfensis d'Orbigny, 1846, Foram. Foss. Vienne, p. 295, pl. xix. figs. 13–15.
Quinqueloculina costata Terquem, 1878, Mém. Soc. Géol France, sér. 3, vol. iii. p. 63, pl. vi. figs. 3–5.
Miliolina boueana (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 173, pl. vii. fig. 13 *a*, *b*, *c*
Ditto. (d'Orbigny) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (d'Orbigny) Goës, 1894, Arctic and Scandinavian Foram., p. 114, pl. xxi. fig. 865.

A single fossil specimen. *Miliolina boueana*, according to Brady, is nothing more than a compact and regular variety of *M. bicornis*, with distinct and neatly rounded segments. He further remarks that its distribution is probably co-extensive with that of *M. bicornis*, but in our Selsey gatherings *M. bicornis* is of frequent occurrence in the recent condition, whilst *M. boueana* is represented by this unique fossil.

308. *Miliolina insignis* Brady.

Miliolina insignis Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. N.S. p. 45.
Ditto. Brady, 1884, Foram. 'Challenger,' p. 165, pl. iv. figs. 8–10.
Ditto. (Brady), 1886, J. Wright, Proc. Belfast Nat. Field Club (1885–1886), Appendix, p. 319, pl. xxvi. fig. 4.
Ditto. (Brady), 1887, Brady, Synopsis British Recent Foraminifera.
Ditto *trigonula* (Lamarck sp.), striate variety, Millett, 1898, Malay Foram., Journ. R. Micr. Soc., p. 503.

This is merely a striate form of the ubiquitous species *Miliolina trigonula* (Lamarck sp.), but it is of rare occurrence compared with the type, although it is not infrequent in some Australian shore-sands. A few small specimens distinctly fossil.

309. *Miliolina rotunda* d'Orbigny sp.

Triloculina rotunda d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. No. 4, p 299.
Ditto (d'Orbigny) Schlumberger, 1893, Mém. Soc. Zool. de France, vol. vi. p. 206, pl. i. figs. 48–50.
Miliolina rotunda (d'Orbigny) Millett, 1898, Malay Foram., Journ. R. Micr. Soc., p. 267, pl. v. figs. 15, 16.

A few small specimens, recent and fossil, of this little type. The inflated chambers and circular aperture are well marked. This species is very variable in appearance, and links up the genera *Biloculina* and *Miliolina*. It is very common in many tropical and Mediterranean gatherings, but does not appear to have been previously recorded as a British species in the recent condition, although Millett mentions that it occurs of large size in the clay of St. Erth, Cornwall (? Pliocene).

310. *Miliolina sclerotica* Karrer sp.

Quinqueloculina sclerotica Karrer, 1868, Sitz. k. Ak. Wiss. Wien, vol. lviii. Abth. i. p 152, pl. iii. fig. 5.
Miliolina sclerotica (Karrer) Balkwill and Millett, 1884, Jour. Micr. and Nat. Sci. vol. iii. p 24, pl. i. fig. 2.
Ditto. (Karrer) Brady, 1887, Synopsis British Recent Foraminifera.

There are a number of fossil specimens which appear to be referable to Karrer's species, but the identification is made with some reserve, as the specimens are somewhat longer in contour than the type, and a few of them show a tendency to bear sulci on the external edges.

This form is, as pointed out by Brady (*supra*), closely allied to, if not identical with, *M. contorta* d'Orb. sp.

311. *Miliolina suborbicularis* d'Orbigny sp.

Triloculina suborbicularis d'Orbigny, 1839, Foram. Cuba, p. 156, pl. x. figs. 9–11.
Triloculina fichteliana d'Orbigny, 1839, Foram. Cuba, p. 152, pl. ix. figs. 8–10.
Miliolina fichteliana (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 169, pl. iv. fig. 9 *a.b.c.*
Quinqueloculina suborbicularis (d'Orbigny) Schlumberger, 1893, Mém. Soc. Zool. France, vol. vi. p. 73, pl. ii. figs. 63, 64; pl. iii. fig. 67 and woodcuts figs. 26–28.
Miliolina suborbicularis (d'Orbigny) Millett, 1898, Malay Foram., Journ. R. Micr. Soc. p. 502, pl. xi. fig. 13.

One specimen, which has every appearance of recent origin, although the published records of the species do not, so far as we are aware, extend north of the Mediterranean. It is not uncommon in tropical and sub-tropical sands.

312. *Miliolina undosa* Karrer sp.

Quinqueloculina undosa Karrer, 1867, Sitzungsb. d. k. Akad. Wiss. Wien, vol. lv. p. 361, pl. iii. fig. 3.
Miliolina undosa (Karrer) Brady, 1884, Foram. 'Challenger,' p. 176, pl. vi. figs. 6–8.
Ditto. (Karrer) Egger, 1893, Abhandl. bayer. Akad. Wiss. ch. ii. vol. xviii. p. 237, pl. ii. figs. 41, 42.
Ditto. (Karrer) Millett, 1898, Malay Foram., Journ. R. Micr. Soc. p. 506, pl. xii. fig. 5 *a-c*.

Several specimens, all apparently recent, varying considerably in appearance, and forming a series connecting *M. contorta* and *M. ferrusacii* with the extreme development of the type as figured by Brady.

313. *Vertebralina striata* d'Orbigny.

Vertebralina striata d'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 283, No. 1 Modèle No. 81.
Ditto. (d'Orbigny) Parker, Jones and Brady, 1865, Ann. and Mag. Nat. Hist. ser. 3, vol. xvi. p. 32, pl. i. fig. 1.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 187, pl. xii. figs. 14–16.
Ditto. (d'Orbigny) Millett, 1898, Malay Foram., Journ. R. Micr. Soc. p. 607, pl. xiii. fig. 1.

One small fossil specimen, representing an early stage of the shell, and doubtless derived from an Eocene clay.

33. *Articulina foveolata* Heron-Allen and Earland.

(Plate IX. fig. 4.)

Articulina foveolata Heron-Allen and Earland, 1909, Journ. R. Micr. Soc. p. 317, pl. xv. fig. 8.

The pretty little fossil specimen which we figure is apparently the early Milioline stage of *Articulina foveolata*. It possesses a characteristic circular Articuline aperture without sign of tooth.

The markings are much more regular and pronounced than in the type specimen of the species, which was in a poor state of preservation.

314. *Articulina sagra* d'Orbigny.

Articulina sagra d'Orbigny, 1839, Foram. Cuba, p. 160, pl. ix. figs. 23–26.
Vertebralina cassis d'Orbigny, 1839, Foram. Cuba, p. 72, pl. vii. figs. 14, 15.
Vertebralina mucronata d'Orbigny, 1839, Foram. Cuba, p. 72, pl. vii. figs. 16–19.
Ditto. (d'Orbigny) d'Orbigny, 1846, Foram. Foss. Vienne, p. 120, pl. xxi. figs. 18, 19.
Articulina sagra (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 184, pl. xii. figs. 22–24.

A single fossil specimen, broken, but showing sufficient post-Milioline development for the identification of the species.

This is a somewhat infrequent constituent of coral sands all over the world, but not uncommon in the West Indian seas.

As a fossil d'Orbigny records it from the Miocene of Vienna.

35. *Cornuspira foliacea* Philippi sp.

(Plate IX. figs. 5, 6.)

Since our original note was written we have found the elegant little specimen which we figure. The shell is semi-transparent, and instead of the normal flatness it presents a curious curvature which is well brought out in the drawing.

315. *Orbitolites complanata* Lamarck.

Orbitolites complanata Lamarck, 1801, Syst. Anim. sans Vertéb., p. 376.
Ditto. Lamarck, 1816, Nat. Hist. Anim. sans Vertéb, vol. ii., p. 196, No. 2.
Ditto. (Lamarck) Carpenter, 1850, Quart. Journ. Geol. Soc., vol. vi., p. 30, pl. vii. figs. 24–30.
Ditto. (Lamarck) Carpenter, 1856, Phil. Trans., p. 224, pls. iv.–ix., etc.
Ditto. (Lamarck) Carpenter, 1883, Report on Genus *Orbitolites*, Zool. 'Challenger' Expedition, part xxi., p. 29, pl. v. figs. 14–18, pls. vi., vii., viii.
Ditto. (Lamarck) Brady, 1884, Foram. 'Challenger,' p. 218, pl. xvi. figs. 1–6, pl. xvii. figs. 1–6.

Fragments of this species are not uncommonly met with among the coarser siftings, and we have one or two almost perfect specimens representing early stages of the shell. They are doubtless all derived from Eocene strata. According to Brady, the species has been recorded by Fisher from the Bracklesham Beds of Hampshire, but we have been unable to trace the record to which he refers. It occurs in many continental Tertiary deposits.

316. *Pelosina variabilis* Brady.

Pelosina variabilis Brady, 1879, Quart. Journ. Micr. Sci., vol. xix., N.S. p. 30, pl. iii. figs. 1–3.
Ditto. (Brady) Robertson, 1881, Proc. Nat. Hist. Soc., Glasgow, vol. v., p. 163.
Ditto. (Brady) Brady, 1884, Foram. 'Challenger,' p. 235, pl. xxvi. figs. 7–9.
Ditto. (Brady) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Brady) Flint, 1899, Report U.S. Nat. Museum (1897) p. 266, pl. iv. fig. 1.

Among the washings of mud from the Mixon Reef we have found many specimens, more or less fragmentary, referable to this species. Individual fragments also occur in some of the shore gatherings. This is one of the lowest types of the Foraminifera, the organism consisting merely of a single chamber of irregular shape, bounded by thick walls of fine mud upon a chitinous tube or layer. The chitinous envelope frequently extends without an external covering of mud at the oral end of the shell. It often attains to a considerable size. In some of the 'Goldseeker' dredgings from the North Sea, specimens half to three-quarters of an inch in length are found.

44. *Psammosphæra fusca* Schulze.

45. *Saccammina sphærica* M. Sars.

Since our original note upon these species was published we have found a considerable number of specimens of both at various points of the shore.

317. *Hyperammina vagans* Brady.

Hyperammina vagans Brady, 1879, Quart. Journ. Micr. Sci., vol. xix., N.S., p. 33, pl. v. fig. 3.
Ditto. Brady) Haeusler, 1883, Quart. Journ. Geol. Soc., vol. xxxix., p. 26, pl. ii. figs. 2–6.

Hyperammina vagans (Brady) Brady, 1884, Foram. 'Challenger,' p. 260, pl. xxiv. figs. 1–9.
Ditto. (Brady) Goës, 1894, Arctic and Scandinavian Foraminifera, p. 17, pl. iv. fig. 60.
Ditto. (Brady) Earland, 1905, Journ. Quekett Micr. Club, ser. 2, vol. ix., No. 57, p. 199.

This organism, which represents one of the simplest conceivable types of Rhizopod life, occurs quite frequently in washings of algæ from the Mixon Reef, usually in a more or less fragmentary condition. Fragments are also found in the shore-sands. There is considerable variety in the texture of individual specimens, some only utilizing the finest sand-grains mixed with a considerable amount of cement, while in others the sand utilized is much coarser and the cement is inconspicuous. Under favourable conditions the species, which grows attached to other organisms, probably attains to a considerable size, as many of the fragments appear to have been broken from quite large patches of labyrinthic tubes.

Until Earland (*suprâ*) recorded this species from the neighbouring locality of Bognor, where it is equally abundant, the only British record was Canon Norman's from a dredging off Oban, quoted by Brady (*suprâ*). The species is of world wide distribution, but normally a deep water type, often occurring in enormous abundance in deep dredgings.

318. *Reophax ampullacea* Brady.

(Plate IX. figs. 7, 8.)

Reophax ampullacea Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi., N.S., p. 49.
Ditto. Brady, 1884, Foram. 'Challenger,' p. 290, pl. xxx. fig. 6.
Ditto. (Brady) Chapman, 1892, Journ. R. Micr. Soc., p. 320, pl. v. fig. 2.
Ditto. (Brady) Millett, 1899, Journ. R. Micr. Soc., p. 253, pl. iv. fig. 9.

One recent specimen, which presents the same curious selective habits as we have remarked upon in dealing with *Verneuilina polystropha* and *Haplophragmium agglutinans*, grains of garnet and magnetite entering largely into the construction of the test. The species may be considered as an arenaceous isomorph of *Lagena marginata*. *Reophax difflugiformis* being an equivalent isomorph of the rotund species *Lagena globosa*.

319. *Reophax fusiformis* Williamson sp.

Proteonina fusiformis Williamson, 1858, Recent Foram. Gt. Britain, pl. 1, fig. 1
Reophax fusiformis (Williamson) Siddall, 1879, Cat. Recent British Foram., p. 4.
Ditto. (Williamson) Brady, 1884, Foram. 'Challenger,' p. 290, pl. xxx. figs. 7–11.
Ditto. (Williamson) Brady, 1887, Synopsis British Recent Foraminifera.

We have a record of this species, but the slide having been mislaid or lost we cannot give any further information respecting it. It was, however, of recent origin, the species being widely distributed round our coasts.

320. *Haplophragmium latidorsatum* Bornemann sp.

Nonionina latidorsata Bornemann, 1855, Zeitschr. d. deutsch. geol. Gesell., vol. vii. p. 339, pl. xvi. fig. 4 *a*, *b*.
Haplophragmium crassum Reuss, 1867, Sitzungsb. d. k. Akad. Wiss. Wien, vol. lv. p. 46, pl. i. figs. 1, 2.
Lituola subglobosa M. Sars, 1868, Vidensk.-Selsk. Forhandlinger, p. 250.
Ditto. (M. Sars) G. O. Sars, 1871, Vidensk.-Selsk. Forhandlinger, p. 253.
Haplophragmium rotundidorsatum Hantken, 1875, Mittheil. Jahrb. d. k. ung. geol. Anstalt., vol. iv. p. 12, pl. i. fig. 2.
Haplophragmium latidorsatum (Bornemann) Brady, 1884, Foram. 'Challenger,' p. 307, pl. xxxiv. figs. 7–10, 14.
Ditto. (Bornemann) Goës, 1894, Arctic and Scandinavian Foram., p. 21, pl. v. figs. 102–120.

We have one minute specimen derived from the rarely-visible band of clays, named by Mr. Clement Reid "the Selsey Beds," which appears to be referable to this species. If so, its presence in our gatherings is certainly noteworthy, as *H. latidorsatum* is one of the most typical of deep-water and cold-area forms. In the cold area of the Shetland-Faeroe channel and in the Norwegian Deep to the north of this channel the species occurs in such enormous numbers as to form a true deposit or ooze, in which the presence of other organisms is completely masked by the preponderance of this species, which also attains to a considerable size. Apart from this area, the records of *H. latidorsatum* are almost confined to very deep water, except in the Arctic and Antarctic seas. As a fossil it has been recorded from several Eocene clays in Germany and Hungary.

EXPLANATION OF PLATE X.

Fig. 1.—*Bulimina selseyensis* sp. n. × 100.
,, 2. Ditto. Ditto.
,, 3.—*Bolivina tortuosa* Brady. × 100.
,, 4. Ditto. Ditto.
,, 5.—*Bolivina Durrandii* Millett. × 100.
,, 6.—*Bolivina eocænica* Terquem. × 100.
,, 7. Ditto. Ditto.
,, 8.—*Bolivina lævigata* Williamson sp. × 100.
,, 9. Ditto Ditto.
,, 10.—*Bolivina textilarioides* Reuss. × 100.
,, 11. Ditto. Ditto.
,, 12. Ditto. Ditto.
,, 13.—*Lagena perlucida* Williamson. × 100.
,, 14.—*Lagena squamosa* var. *Montagui* Alcock sp. Base view. × 100.
,, 15. Ditto. Oral view. × 100.
,, 16.—*Lagena lucida* Williamson sp. Double shell. × 100.
,, 17.—*Polymorphina acuminata* d'Orbigny sp. × 100.
,, 18. Ditto. Ditto.
,, 19.—*Dimorphina longicollis* Brady sp. × 100.
,, 20.—*Discorbina rosacea* var. *selseyensis* var. nov. Superior side. × 100.
,, 21. Ditto. Inferior side. × 100.
,, 22.—*D. patelliformis* var. *corrugata* var. nov. Inferior side. × 100.
,, 23. Ditto. Superior side. × 100.
,, 24. Ditto. Edge view. × 100.

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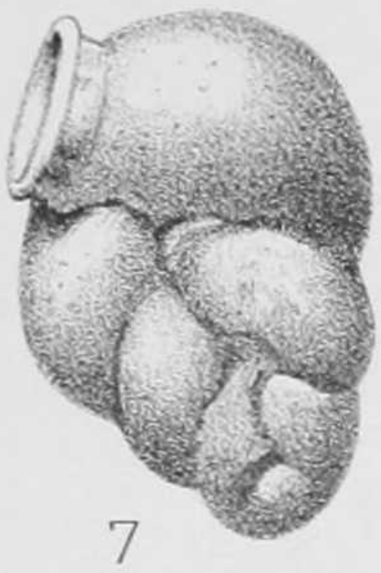

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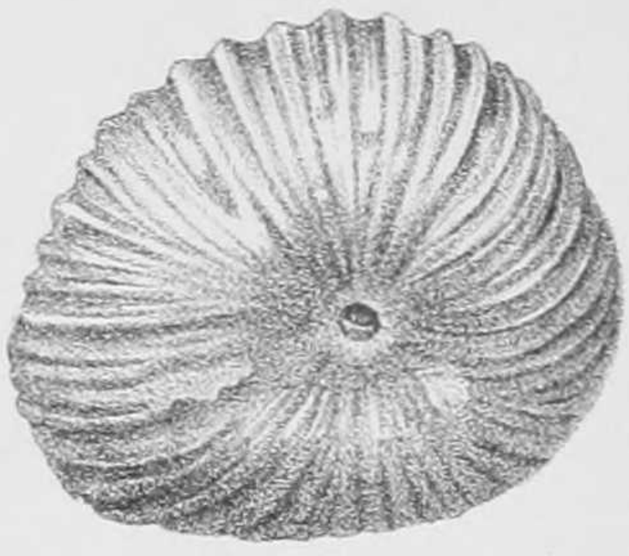

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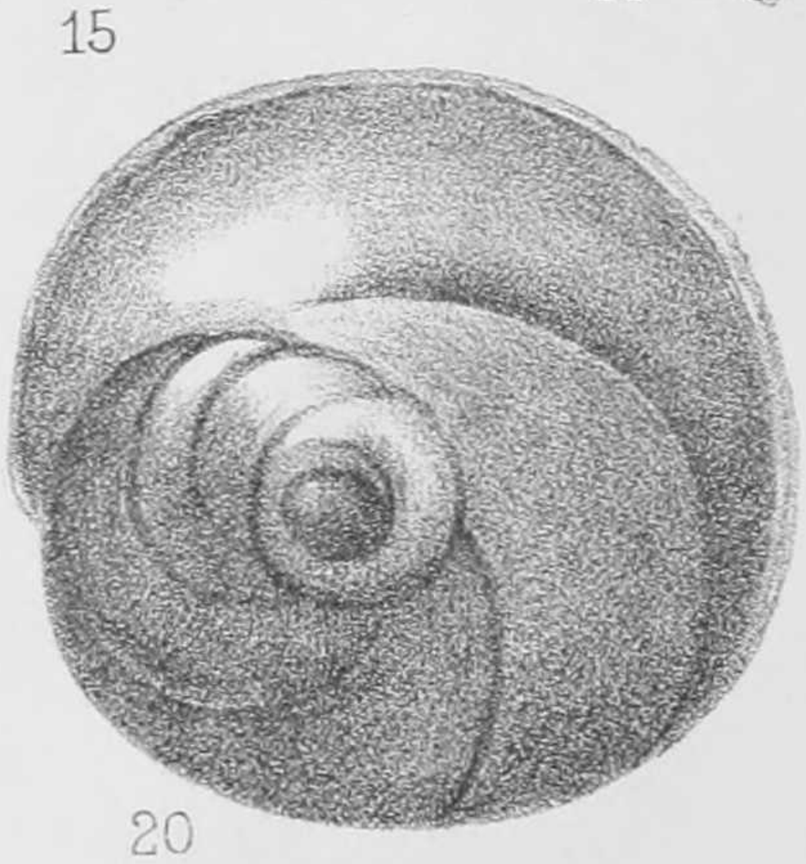

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West, Newman, lith.

321. *Haplophragmium nanum* Brady.

(Plate IX. figs. 9–11.)

Haplophragmium nanum Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi., N.S. p. 50.
Ditto. Brady, 1881, Denkschr. d. k. Akad. Wiss. Wien, vol. xliii. p. 99, pl. ii. fig. 1.
Ditto. Brady, 1884, Foram. 'Challenger,' p. 311, pl. xxxv. figs. 6–8.
Ditto. Brady, 1894, Goës, Arctic and Scandinavian Foram., p. 22, pl. v. figs. 124–127.

One very typical specimen, to all appearances recent, which presents the usual rotaliform character of the species. It presents a somewhat curious feature, inasmuch as the sutures are marked by a sort of thickening of the sandy deposit, giving them a limbate appearance. Most of the records of this form are from Arctic seas; otherwise it appears to be purely a deep-water form.

50. *Thurammina papillata* Brady.

A few further fragments have been found of the organism we described as referable to this species, but not in such a condition as to enable us to modify or amplify the views that we originally expressed.

322. *Trochammina rotaliformis* J. Wright MS.

Trochammina inflata (Montagu) var. Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Science) p. 331, pl. xiii. figs 11, 12.
Ditto. (Montagu) var. Balkwill and Wright, 1892, Chaster, First Rep. Southport Soc. Nat. Sci. (1890-1), p. 58.

A single well-developed recent specimen, which has been submitted to Mr. J. Wright and identified by him. As Mr. Wright will, we understand, describe and figure the variety shortly under the name *rotaliformis*, we refrain from further particulars of the variety, which has not hitherto been accorded a distinctive name, although presenting well-marked characteristics.

Chaster describes it as "rather rare" in most of his Southport gatherings. The same remarks apply to its distribution in Earland's North Sea dredgings, in many of which an occasional specimen may be found. It is of more frequent occurrence in the dredgings taken near the Norwegian coast.

323. *Textularia concava* Karrer sp.

Plecanium concavum Karrer, 1868, Sitzungsb. d. k. Akad. Wiss. Wien., vol. lviii. pt. i. p. 129, pl. i. fig. 3.
Textularia concava (Karrer) Brady, 1884. Foram. 'Challenger,' p. 360, pl. xlii. figs. 13, 14; 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.
Ditto. (Karrer) Millett, 1899, Journ. R. Micr. Soc., p. 559, pl. vii. fig. 5.

Two specimens which we think should be attributed to this species have been found. They are fossils, somewhat pyritized,

and probably derived from a Tertiary clay. They differ somewhat from Karrer's specimens in respect of the rapidly increasing breadth of the shell, which is also of practically uniform thickness from the initial to the final chambers, i.e. the opposite faces of the shell are practically parallel. Karrer's specimens were from the Miocene of Kostej in the Banat. As a recent species it occurs in all the great oceans, most of the records being from deep water.

324. *Textularia inconspicua* (Brady) var. *jugosa* Brady.

(Plate IX. fig. 12.)

Textularia jugosa Brady, 1884, Foram. 'Challenger,' p. 358, pl. xlii. fig. 7.
Ditto. (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 273, pl. vi. figs. 19–21.
Textularia inconspicua var. *jugosa* (Brady) Millett, 1899, Malay Foram., Journ. R. Micr. Soc., p. 558, pl. vii. fig. 2.

A single, well preserved, and typical fossil specimen which agrees perfectly with Brady's type figure (*supra*). The shell is hyaline and the sutures very strikingly limbate.

Millett (*supra*) goes at some length into the relationship of this variety with other species.

The variety is at the present day confined to tropical and sub-tropical seas. Our knowledge of its geological range is somewhat doubtful, for reasons explained by Millett.

325. *Textularia rugosa* Reuss sp.

Plecanium rugosum Reuss, 1869, Sitzungsb. d. k. Akad. Wiss. Wien., vol. lix. p. 453. pl. i. fig. 3 *a*, *b*.
Textularia rugosa (Reuss) Brady, 1884, Foram. 'Challenger,' p. 363, pl. xlii. figs. 23, 24.

A few small fossil specimens which present the characteristic plications of the chambers which mark this species. At the present day this is a tropical shallow-water species and under favourable circumstances reaches a very large size. We have specimens from the Philippine Islands $\frac{1}{6}$ inch in length. The original record by Reuss was from the Oligocene of the south of France.

326. *Spiroplecta biformis* Parker and Jones sp.

Textularia agglutinans var. *biformis* Parker and Jones, 1865, Phil. Trans., vol. clv. p. 370, pl. xv. figs. 23, 24.
Textularia biformis (Parker and Jones) Brady, 1878, Ann. and Mag. Nat. Hist., ser 5, vol. i. p. 436, pl. xx. fig. 8.
Spiroplecta biformis (Parker and Jones) Brady, 1884, Foram. 'Challenger,' p. 376, pl. xlv. figs. 25–27.
Ditto. (Parker and Jones) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. Sci. p. 333. pl. xiii. fig. 21 and woodcut fig. 2.
Ditto. (Parker and Jones) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Parker and Jones) Millett, 1900, Malay Foram., Journ. R. Micr. Soc., p. 8, pl. i. fig. 8.

One small fossil specimen of cretaceous origin. The species has been recorded as far back as the Gault, and as a recent species it

seems to be principally confined to cold areas in high latitudes, although the 'Challenger' report records it from the South Atlantic and South Pacific in depths from 1900 to 2375 fathoms.

69. *Spiroplecta fusca* Earland.

Many typical specimens of this species have been found in the shore-sand opposite Medmerry Farm.

327. *Gaudryina filiformis* Berthelin.

Gaudryina filiformis Berthelin, 1880, Mem. Soc. Géol. France, ser. 3, vol. i. No. 5, p. 25, pl. i. fig. 8.
Ditto. (Berthelin) Wright, 1882, Proc. Belfast Nat. Field Club (1880–1), App. p. 180, pl. viii. fig. 3.
Ditto. (Berthelin) Brady, 1884, Foram. 'Challenger,' p. 380, pl. xlvi. fig. 12.
Ditto. (Berthelin) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Berthelin) Brady, Parker and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xlii. fig. 6.
Ditto. (Berthelin) Millett, 1900, Malay Foram., Journ. R. Micr. Soc., p. 9.

A few very fine and perfect specimens, probably Cretaceous. The triserial portion is very indistinct, the initial chamber is markedly megalospheric, the apex of the shells in fact terminating in a little spherical bulb. The largest specimen has no less than sixteen series of chambers. *G. filiformis* was originally described from Gault fossils from the north of France. It is fairly widely distributed in the recent condition, and small specimens are not uncommon in dredgings from the Shetland-Faeroe area.

328. *Clavulina obscura* Chaster.

Verneuilina polystropha Reuss sp., dimorphous form, Wright, 1886, Proc. Belfast Nat. Field Club (1885–6), App. p. 320, pl. xxvi. fig. 2.
Clavulina obscura Chaster, 1892, First Rep. Southport Soc. Nat. Sci. (1890–1), p. 58, pl. i. fig. 4.
Ditto. (Chaster) Earland, 1905, Journ. Quekett Micr. Club, ser. 2, vol. ix. No. 57, p. 206.

Recent specimens. This little species, originally described by Chaster from shore-mud and shallow dredgings at Southport (Lancs.), may be nothing more than a starved form of *Clavulina parisiensis* (d'Orb.), with which it agrees in the general formation of the test and the triangulation of the earlier chambers. It is probably widely distributed, although owing to its small size the records are few. Wright has recorded it from shallow water off Ireland, and Earland has records from anchor-mud, Valetta (Malta), and several of the 'Goldseeker' dredgings in the North Sea.

329. *Bulimina elegantissima* (d'Orbigny) var. *seminuda* Terquem.

Bulimina seminuda Terquem, 1882, Mém. Soc. Géol. France, sér. 3, vol. ii. Mém. 3, p. 117, pl. xii. fig. 21.
Bulimina elegantissima var. *seminuda* (Terquem) Brady, 1884, Foram. 'Challenger,' p. 403, pl. l. figs. 23, 24.

Many specimens, fossils from an Eocene sand. Terquem's specimens were from the Eocene beds of Paris. Ours show a con-

siderable variation in the relative length and breadth of the shell, which may indicate two different sources of origin, especially as the texture of the shell differs in the two forms.

330. *Bulimina fusiformis* Williamson.

Bulimina pupoides (d'Orbigny) var. *fusiformis* Williamson, 1858, Recent British Foraminifera, p. 63, figs. 129, 130.
Bulimina presli var. *ovata* (d'Orbigny) Parker and Jones, 1862, Carpenter's Introduction to the Foraminifera, p. 311.
Bulimina fusiformis (Williamson) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Williamson) Wright, 1900, Geol. Mag., ser. 4, vol. vii. p. 100, pl. v. fig. 5.
Ditto. (Williamson) Millett, 1900, Malay Foram., Journ. R. Micr. Soc., p. 275, pl. ii. fig. 2.

With one or two exceptions the specimens are pyritized fossils. Parker and Jones (*supra*) in their identification of Williamson's figures, ascribed this species to *B. ovata* d'Orbigny, but, as pointed out by Brady (*supra*), Williamson's type is very distinct, and we do not see any grounds for suppressing it. It is not very frequently met with in shore gatherings, but it is very abundant in most muddy dredgings made round the British Islands, and we have observed it in many similar gatherings from nearly all parts of the world. Millett's record is from the Malay Seas, where he states that the specimens, "although neither numerous nor widely distributed, are sufficiently characteristic."

Joseph Wright (*supra*) states that it is common in the Post-Glacial beds of Cheshire.

331. *Bulimina marginata* d'Orbigny.

Bulimina marginata d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 269, No. 4, pl. xii. figs. 10–12.
Bulimina pupoides var. *marginata* (d'Orbigny) Williamson, 1858, Recent Foram. Great Britain, p. 62, pl. v. figs. 126, 127.
Bulimina presli var. *marginata* (d'Orbigny) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 372, pl. xv. fig. 10; pl. xvii. fig. 70.
Bulimina marginata (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 405, pl. li. figs. 3–5.
Ditto. (d'Orbigny) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (d'Orbigny) Goës, 1894, Arctic and Scandinavian Foram., p. 46, pl. ix. figs. 439–444.

Numerous specimens, the majority recent, the others fossil. As usual, the specimens show a tendency to vary in the direction of *B. aculeata*. *B. marginata* is very abundant in the recent condition in the Atlantic, as far north as the Norwegian Fiords, although Brady states that there is no certain record farther north than the Faeroe Channel. It has been recorded in the fossil state from the Tertiaries of Italy and from post-Tertiary deposits in Norway, Scotland, and Ireland.

332. *Bulimina pupa* Terquem.

Bulimina pupa Terquem, 1882, Mém. Soc. Géol. France, ser. 3, vol. ii. Mém. 3, p. 116, pl. xii. fig. 18.

One specimen only. Fossil. Terquem's species, although obviously closely allied to *B. elegantissima* d'Orbigny, is yet sufficiently distinctive to merit separation. His figure differs from *B. elegantissima* in its more regular contour and neatness. The shell is almost cylindrical in shape with rounded extremities, and only one series of chambers is visible, externally wound in an elongate spiral round the central axis. The sutures are flush with the surface of the shell and the "comma" shaped aperture is set on the flat face of the final segment.

Terquem's specimens were fossils from the Eocene of Vaudancourt, "very rare."

333. *Bulimina selseyensis* sp. n.

(Plate X. figs. 1, 2.)

The specimen figured is a fossil, and was at first regarded as an abnormal specimen of *Uvigerina selseyensis* (Heron-Allen and Earland), but closer examination having determined the entire absence of Uvigerine aperture and the presence of a distinctly Bulimine opening on the side of the shell, we can only regard it as a Bulimine isomorph of that species, from which it differs externally in its broader and stouter build. It consists of four or five convolutions of heart-shaped chambers arranged round a spiral axis, the narrow ends being disposed towards the oral end of the shell. The sutural lines were deeply undercut as in *U. selseyensis*. The species is possibly of much more frequent occurrence than is apparent, as specimens would be readily confused with *U. selseyensis*, which is very common.

Length, 0·25 mm. Greatest breadth, nearly 0·2 mm.

Bulimina striato-punctata Terquem.

Bulimina striato-punctata Terquem, 1882, Mém. Soc. Géol. France, sér. 3, vol. ii. Mém. 3, p. 116, pl. xii. fig. 19.

This form is also obviously near to *B. elegantissima* (d'Orbigny), but is characterized by the foramina being placed in regular lines, so that there is a superficial appearance of external striation. The sutures are flush and the sides of the shell are almost parallel, the aboral end being a blunt cone and the aperture set on the flattened face of the terminal chamber.

Terquem's specimens were Eocene fossils from Septeuil, near Paris; "very rare."

We have several specimens, obviously fossil, which may be referred to this species, as they possess the linear punctation characteristic of Terquem's form.

335. *Bulimina subteres* **Brady.**

Bulimina presli var. *elegantissima* (d'Orbigny) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 374, pl. xv. figs. 12–17.
Bulimina elegantissima (d'Orbigny) var. Brady, 1878, Ann. and Mag. Nat. Hist., ser. 5, vol. i. p. 436, pl. xxi. fig. 12.
Bulimina subteres Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. N.S. p. 55.
Ditto. (Brady) Wright, 1882, Proc. Belfast Nat. Field Club (1880-1), Appx. p. 180, pl. viii. fig. 2.
Ditto. (Brady) Brady, 1884, Foram. 'Challenger,' p 403, pl. l. figs. 17–18.
Ditto. (Brady) Goës, 1894, Arctic and Scandinavian Foraminifera, p. 46, pl. ix. figs. 445–453.

One specimen from the general shore sand, a pyritized fossil. In the recent condition *B. subteres* is widely distributed, especially in high latitudes, but so far as we are aware it has not previously been recorded as a fossil. If its distribution at the present day may be regarded as any clue to the origin of our specimen, it points to its derivation from a Glacial, or post-Glacial deposit.

336. *Bulimina Terquemiana* **sp. n.**

(Plate IX. figs. 13, 14.)

Bulimina obliqua Terquem, 1882, Mém. Soc. Géol. France, sér. 3, vol. ii. Mém. 3, p. 118, pl. xii. fig. 23.

We have two specimens of the pretty little form figured and described by Terquem under the name of *B. obliqua*. As, however, the specific name *obliqua* has already been used by d'Orbigny for a distinct form, we have associated Terquem's specimens with the name of the author. His description is as follows: "Shell irregular, more developed on one side than the other; sub-rotund, enlarged anteriorly, domed posteriorly, and furnished with a small spur. Domed on one side and incurved on the other; ornamented with very fine and curved sulci. Formed of three whorls of prominent spiral layers, oblique, elongated, chambers indistinct, the last whorl highly developed, aperture round, situated in a very large lateral depression of a pointed oval shape furnished with a thickened rim. Terquem's specimens were from the Eocene of Septeuil, near Paris—very rare—and ours are doubtless fossils derived from a similar formation.

Length, 0·27 mm. Breadth, 0·18 mm.

82. *Virgulina subsquamosa* **Egger.**

Many further specimens have been found, both recent and fossil.

337. *Bolivina Durrandii* **Millett.**

(Plate X. fig. 5.)

Bolivina Durrandii Millett, 1900, Malay Foram., Journ. R. Micr. Soc., p. 544, pl. iv. fig. 7.

One large and very fine specimen of unquestionably recent origin.

The finding in an English shore gathering of this unique and well developed specimen of a species known hitherto only from the Malay Archipelago, represents possibly the greatest surprise of the whole collection, and illustrates the glorious uncertainty of work among the Foraminifera. The specimen has been submitted to Mr. Millett, who agrees with our identification. Similar abnormal occurrences are well known to all rhizopodists, and have sometimes been regarded as due to the use of sieves which had not been effectually cleaned after use with other material, but such an objection is discounted in this instance by the fact that the sieves used for the Selsey material were new when first taken into use and have been religiously preserved for Selsey gatherings only.

Millett's specimens were from various localities in the Malay Archipelago, where it is one of the most typical and abundant species. We have met with it in anchor mud from Singapore, but the specimens were much smaller than our Selsey find.

338. *Bolivina eocaenica* Terquem.

(Plate X. figs. 6, 7.).

Bolivina eocaenica Terquem, 1882, Mém. Soc. Géol. France, sér. 3, vol. ii. Mém. 3, p. 148, pl. xv. fig. 18 *a*, *b*.
Bolivina gibbera Millett, 1894, Trans. R. Geol. Soc. of Cornwall, p. 2, figs. 1, 2.

We have one perfect fossil specimen, which agrees very closely with Millett's figure and description except in one or two minor points. The sutures in our specimen are not so deeply sunk as in Millett's figures, with the result that the chambers appear less inflated than in the St. Erth specimens. The aperture in ours is circular, as in Millett's fig. 2.

Millett's record was from the Pliocene beds of St. Erth in Cornwall—"frequent." His description of the test is as follows: "Test ovoid, compressed, margin obtuse, lobulated, segments few and inflated, sutures deeply sunk, surface minutely punctate, aperture panduriform, sometimes circular, surrounded by a thickened lip, and situated in a more or less produced neck. This species is nearly allied to *B. textilarioides*."

Terquem in 'Les Foraminifères de l'Eocène de Paris' has figured under the name of *Bolivina eocaenica* a form which we take to be identical with Millett's species. His description is as follows: "Shell oval, compressed, smooth, not perforate, anteriorly broadened, posteriorly narrowed and obtuse, rounded as to the periphery and furnished with a blunt keel, composed of few chambers, rounded, increasing regularly, the last two being triangular; aperture at the side of the last chamber, occupying its entire breadth, funnel shaped ("panduriform"—Millett) with a thick lip, at the bottom of which is an oval opening."

It will thus be seen that the principal difference between the

two descriptions lies in the fact that Terquem's species had a more or less carinated edge: this, however, is a feature of practically no more than varietal importance. The constriction of the last chamber in front of the oral aperture is much more pronounced in Millett's figures than in Terquem's, and this gives an air of greater refinement and symmetry to the contour of the St. Erth specimen as compared with Terquem's somewhat clumsy figure. Terquem does not note it as being rare; according to Millett the species is frequent in the Pliocene of St. Erth in Cornwall.

Length, 0·27 mm. Breadth, 0·19 mm.

339. *Bolivina robusta* Brady.

Bolivina robusta Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. N.S. p. 57.
Ditto. (Brady) 1884, Foram. 'Challenger,' p. 421, pl. liii. figs. 7–9.
Ditto. (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 294, pl. viii. figs. 31, 32.
Ditto. (Brady) Millett, 1900, Malay Foraminifera, Journ. R. Micr. Soc., p. 543.

A few specimens, apparently fossil, from a Tertiary shell-sand.

340. *Bolivina textilarioides* Reuss.

(Plate X. figs 10–12.)

Bolivina textilarioides Reuss, 1862, Sitzungsb. d. k. Akad. Wiss. Wien., vol. xlvi. p. 81, pl. x. fig. 1.
Ditto. (Reuss) Brady, 1884, Foram. 'Challenger,' p. 419, pl. lii. figs. 23–25.
Ditto. (Brady) Millett, 1900, Malay Foraminifera, p. 542, pl. iv. fig. 5.
Bolivina lævigata (Williamson) Heron-Allen and Earland, 1909, Journ. R. Micr. Soc., p. 335.

In the second number of our series of papers we described our specimens with reservations under the name *Bolivina lævigata* Williamson sp. After fuller consideration, and after examining a considerable series of specimens of Williamson's type dredged in

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EXPLANATION OF PLATE XI.

Fig. 1.—*Discorbina pileolus* d'Orbigny sp. Superior view. × 100.
,, 2. Ditto. Inferior view. × 100.
,, 3.—*Discorbina inæquilateralis* sp. n. Superior view. × 100.
,, 4. Ditto. Inferior view. × 100.
,, 5. Ditto. Edge view. × 100.
,, 6.—*Pulvinulina haliotidea* sp. n. Inferior view. × 100. Selsey specimen.
,, 7. Ditto. Ditto.
,, 8. Ditto. Ditto.
,, 9. Ditto. Edge view. × 100.
,, 10. Ditto. Superior view. × 100.
,, 11. Ditto. Ditto.
,, 12.—*Nonionina quadriloculata* sp.n. Oral view. × 100.
,, 13. Ditto. Side view. × 100.
,, 14. Ditto. Ditto.
,, 15. Ditto. Ditto.
,, 16.—*Nonionina pauperata* Balkwill and Wright. Side view. × 100.
,, 17. Ditto. Oral view. × 100.

(Figs. 7–11 are drawn from North Sea specimens.)

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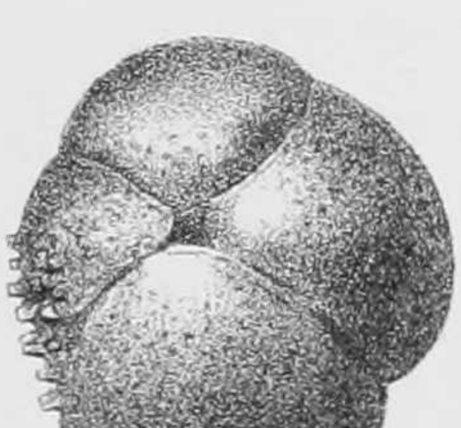

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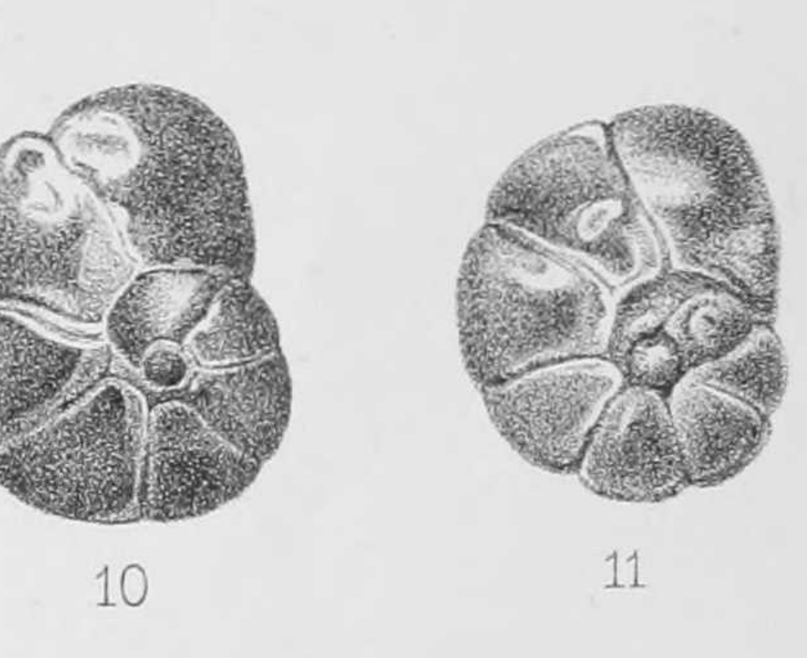

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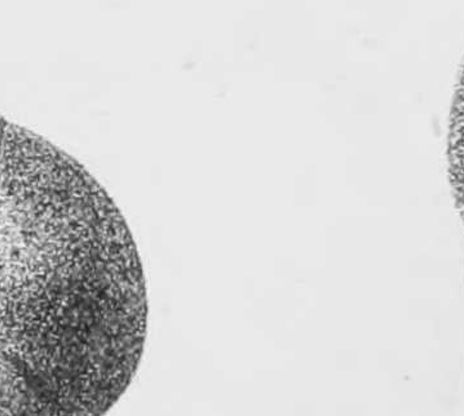

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West, Newman lith.

the North Sea, we are no longer able to agree with Balkwill, Millett and Brady in the identification of *B. lævigata* with *B. textilarioides.* Williamson's species, which has a peculiarly characteristic initial portion and an entire absence of that roughened granular deposit in the neighbourhood of the sutures which is so characteristic of the type commonly referred to *B. textilarioides* Reuss, exists side by side with Reuss' type in many of Earland's North Sea dredgings, but we have failed to trace any specimens showing characters intermediate between the two species.

Our Selsey gatherings afford abundant instances of Reuss' type as figured by Brady, but none resembling Williamson's species, and we therefore withdraw *B. lævigata* from the list and substitute *B. textilarioides.* We have figured both forms in order to show the differences to which we refer. The Selsey specimens are mostly fossils, but there are several which to all appearance are of recent origin.

341. *Bolivina tortuosa* Brady.

(Plate X. figs. 3, 4.)

Bolivina tortuosa Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. N.S. p. 57.
Ditto. (Brady) Brady, 1884, Foram. 'Challenger,' p. 420, pl. lii. figs. 31–34.
Ditto. (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 298, pl. viii. figs. 43, 44.
Ditto. (Brady) Millett, 1900, Malay Foraminifera, p. 543.
Ditto. (Brady) Earland, 1905, Journ. Quekett Micr. Club, ser. 2, vol. ix. No. 57, p. 209.

A few good and typical recent specimens.

The species, which is of fairly frequent occurrence in warm seas, was first recorded in Britain by Earland (*supra*) from the neighbouring locality of Bognor. It does not appear to have been met with otherwise in Great Britain.

248. *Ellipsoidella pleurostomelloides* (H.-A. and E.).

Since the publication of our description and figures of *Ellipsoidella*, Mr. F. W. Millett has drawn our attention to two papers by Sig. Alfredo Silvestri,* in which that eminent and industrious rhizopodist has already adumbrated the presence of the peculiar internal tube or siphon (which characterizes our genus), in connexion with other allied forms; cf. *Pleurostomella, Bulimina, Glandulina, Polymorphina*, etc. Dr. Silvestri's papers, to which we have devoted considerable and careful attention, are extremely interesting and suggestive, but a good deal of the matter seems to be of a theoretical nature. It appears to us somewhat doubtful whether his conclusions were arrived at as the result of a sufficiently ex-

* 1. A. Silvestri, Atti R. Accad. Sci. di Torino, vol. xxxviii. 1902-3, p. 206 "Alcune osservazioni sui Protozoi fossili piemontesi." 2. Mem. Pontif. Accad. Rom. dei Nuovi Lincei, vol. xxii. p. 235. "Richerche strutturali su alcune forme dei Trubi di Bonfornello (Palermo)." Rome, 1904.

tended examination of the material in which these phenomena are to be observed, and whether the creation of new genera (*Ellipsoglandulina*, *Ellipsobulimina*, *Ellipsopolymorphina*) would be valid in the absence of specific forms for which such generic names would appear to be required. All these "Ellipsoidiniform" types are so rare, and so highly localized, that it occurs to us that the whole problem of their structure, and still more of their affinities, is still a matter of conjecture, and one requiring more extended and particular research; and it appears to us that the creation of such genera, pending such research, is likely to tend to confusion, and to increase the difficulties which already beset the enquiry.

Since reading Dr. Silvestri's papers we have made a further study of considerable minuteness of such material as is available to us, including transparent preparations of particularly well preserved specimens, with the result that we find that the internal siphon is not by any means a constant feature in *Pleurostomella alternans* Schwager. It is sometimes entirely absent, although a superficial observer might be misled by the refraction of the inner walls of the chambers so far as to conclude that the inward siphon, as figured by Beissel and Silvestri, is uniformly present.

As to whether there are two distinct but isomorphic types, viz. *Pleurostomella* devoid of siphon, and *Ellipsopleurostomella*, Silvestri, (= *Ellipsoidella* Heron-Allen and Earland), in which the siphon is normally present, or whether these two apparently distinct forms are identical, i.e., that the siphon is a growth accessory to the full development of the shell, we are not at present in a position to express an opinion. We can only hope that the further researches promised by Dr. Silvestri will clear up this uncertainty, and throw additional light on this interesting group of Rhizopods. Pending such further investigations, it appears that our generic name must be withdrawn in favour of Dr. Silvestri's earlier but, in our opinion, less felicitous, title, *Ellipsopleurostomella*.

104. *Lagena lucida* Williamson sp.

(Plate X. fig. 16.)

We figure a particularly fine double specimen which we have found. Twin *Lagenæ* are very uncommon, and, so far as our experience goes, double specimens are always joined mouth to base, as in the figure, and not mouth to mouth as usual in plastogamic specimens in other genera. The abnormality is therefore probably due to budding, and not to true plastogamy.

342. *Lagena bicarinata* Terquem sp.

Fissurina bicarinata Terquem, 1882, Mém. Soc. Géol. France, sér. 3, vol. ii. Mém. 3, p. 31, pl. i. 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.

Lagena bicarinata (Terquem) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Science) p. 342, pl. xii. fig. 30.
Ditto. (Terquem) Wright, 1886, Proc. Belfast Nat. Field Club, Appx. ix. p. 320, pl. xxvi. fig. 8.
Ditto. (Terquem) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Terquem) Millett, 1901, Malay Foraminifera, Journ. R. Micr. Soc., p. 624, pl. xiv. fig. 13.

Two specimens, both clearly fossil, but from different deposits. One apparently Cretaceous, the other probably from a Tertiary sand. Both the specimens are quite plain on the surface, and devoid of the peculiar thickened and concentric ring of shell-substance which Terquem figures in his fossil specimens from the Eocene of Paris. We have not observed this concentric thickening in any of the numerous recent specimens from various localities which have come under our observation. The species, though never very abundant, has a practically world-wide distribution.

343. *Lagena gracillima* Seguenza sp.

Amphorina gracilis Costa, 1856, Atti dell' Accad. Pont., p. 121, pl. xi. fig. 11.
Amphorina gracillima Seguenza, 1862, Foram. Monotal. Mess., p. 51, pl. i. fig. 37.
Lagena gracillima (Seguenza) Jones, Parker and Brady, 1866, Monogr. Foram. Crag, p. 45, pl. i. figs. 36, 37.
Ditto. (Seguenza) Brady, 1870, Edinburgh Catalogue, p. 4.
Ditto. (Seguenza) Brady, 1884, Foram. 'Challenger,' p. 456, pl. lvi. figs. 19–28.
Ditto. (Seguenza) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Seguenza) Millett, 1901, Malay Foraminifera, Journ. R. Micr. Soc., p. 491.

One or two specimens, recent, rather weak, representing passage forms between *L. clavata* and *L. gracillima*.

344. *Lagena hispida* Reuss.

Lagena hispida Reuss, 1858, Zeitschr. d. deutsch. geol. Gesellsch., vol. x. p. 434.
Ditto. Reuss, 1863, Sitzungsb. d. k. Akad. Wiss. Wien., vol. xlvi. p. 335, pl. vi. figs. 77–79.
Lagena Jeffreysii Brady, 1866, Report Brit. Assoc., Trans. Sections, p. 70.
Lagena hispida (Reuss) Jones, Parker and Brady, 1866, Monog. Foram. Crag, p. 30, No. 15.
Ditto. (Reuss) Brady, 1884, Foram. 'Challenger,' p. 459, pl. lvii. figs. 1–4; pl. lix. figs. 2, 5.
Ditto. (Reuss) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Reuss) Millett, 1901, Malay Foraminifera, Journ. R. Micr. Soc., p. 6.

The specimens are perfect and characteristic, and probably fossil. The fine spines with which the specimens were originally covered have been worn down, leaving nothing but a shagreen-like texture of the shell. The specimens are probably derived from Tertiary sands, as they have the appearance characteristic of such fossils.

One of them has a long neck devoid of external ornament, another is entosolenian with a small produced external aperture. The affinities between the rugose *Lagenæ* have been recently made the subject of an ingenious study by Signor Fornasini.*

345. *Lagena lineata* Williamson sp.

Entosolenia lineata Williamson, 1848, Ann. and Mag. Nat. Hist., ser. 2, vol. i. p. 18, pl. ii. fig. 18.
Entosolenia globosa var. *lineata* Williamson, 1858, Recent Foraminifera of Great Britain, p. 9, pl. i. fig. 17.
Lagena caudata (d'Orbigny) Parker and Jones, 1862, Carpenter's Introduction to the Foraminifera, Appx. p. 309.
Lagena lineata (Williamson) Reuss, 1863, Sitzungsb. d. k. Akad. Wiss. Wien, vol. xlvi. p. 328, pl. iv. fig. 48.
Ditto. (Williamson) Brady, 1884, Foram. 'Challenger,' p. 461, pl. lvii. fig. 13.
Ditto. (Williamson) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Williamson) Millett, 1901, Malay Foraminifera, Journ. R. Micr. Soc., p. 7.

Numerous specimens, the majority recent, a few pyritized fossils. The species is common in recent British shore-gatherings and has been recorded from Post-Tertiary deposits in Scotland and Ireland.

346. *Lagena orbignyana* var. *walleriana* J. Wright.

Lagena orbignyana var. *walleriana* Wright, 1886, Proc. R. Irish Acad., ser. 2, vol. iv. p. 611; and *ibid.* 1891, ser. 3, vol. i. p. 481, pl. xx. fig. 8.
Ditto. (Wright) Millett, 1901, Malay Foraminifera, Journ. R. Micr. Soc., p. 627, pl. xiv. fig. 19.

One specimen, fossil, probably from an Eocene shell sand. This variety, which has the centre of the convex faces ornamented with a solid boss of shell-substance, was recorded by Wright from dredgings at various depths off the south coast of Ireland, but does not appear to have been noticed previously in the fossil condition, although its fossil distribution probably coincides more or less with that of the type, i.e. from the commencement of Tertiary times.

347. *Lagena perlucida* Williamson.

(Plate X. fig. 13.)

Lagena vulgaris var. *perlucida* Williamson, 1858, British Recent Foraminifera, p. 5, figs. 7, 8.

Many typical examples, all recent.

Williamson's figures represent transition types between *L. lævis* Montagu sp. and *L. semistriata* Will sp. and *L. sulcata* W. & J. sp., but hardly referable to any of these three species.

As such they are perhaps worth recording under their original name, although having no specific value.

* C. Fornasini, Revisione delle Lagena scabre fossili in Italia. R. Accad. Sci. dell' Ist. di Bologna, 27 Feb. 1910.

348. *Lagena quadrata* Williamson sp.

Entosolenia marginata var. *quadrata* Williamson, 1858, Rec. Foram. of Gt. Britain, p. 11, pl. i. figs. 27, 28.
Lagena lucida var. *quadrata* (Williamson) Reuss, 1862, Sitz. k. Akad. Wiss. Wien, vol. xlvi. p. 324, pl. ii. fig. 26.
Lagena quadrata (Williamson) Balkwill and Millett, 1884, Jour. Micr., vol. iii. p. 81, pl. ii. fig. 8.
Ditto. (Williamson) Brady, 1884, Foram. 'Challenger,' p. 475, pl. lix. figs. 3, 16; pl. lx. fig. 5.
Ditto. (Williamson) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Williamson) Millett, 1901, Malay Foraminifera, Journ. R. Micr. Soc., p. 496, pl. viii. fig. 18.

One specimen, probably fossil, belonging to the carinate division. There are two distinct forms commonly referred to *L. quadrata*; one, with rounded edges, the other with a carinate margin. The two forms serve to bridge the interval separating *L. lævigata* from *L. marginata*.

349. *Lagena squamosa* var. *Montagui* Alcock sp.

(Plate X. figs. 14, 15.)

Entosolenia Montagui Alcock, 1865, Proc. Lit. and Phil. Soc. Manchester, vol. iv. No. 15.
Lagena squamosa var. *Montagui* (Alcock) J. Wright, 1900, Irish Naturalist, vol. ix. No. 3, p. 54, pl. ii. fig. 2.
Ditto. (Alcock) Earland, 1905, Journ. Quekett Micr. Club, ser. 2, vol. ix. No. 57, p. 212.

The large wild-growing variety of *L. squamosa* originally described by Alcock under the name *Entosolenia Montagui* occurs at Selsey occasionally, as elsewhere whenever the type is abundant. We figure a specimen, however, which is rather noticeable owing to the fact that it combines the typical reticulate areolations with irregular costæ.

The specific name *Montagui** has recently been employed by Silvestri for spherical ento-ecto-solenian varieties of *L. hexagona* (Williamson sp.). The employment of a specific name which has already been allocated to a distinctive variety of a closely allied species seems to us likely to tend to confusion, and is greatly to be deplored.

350. *Lagena costata* Williamson sp.

Entosolenia costata Williamson, 1858, Recent Foram. of Great Britain, p. 9, pl. i. fig. 18.
Lagena costata (Williamson) Wright, 1877, Proc. Belfast Nat. Field Club (1876–77), Appendix, p. 103, pl. iv. figs. 11–13.
Lagena sulcata (Walker and Jacob) *pars* Brady, 1884, Foram. 'Challenger,' p. 462, pl. lvii. fig. 34.

* *Lagena Montagui*, Silvestri, 1902, "Lageninæ del Mare Tirreno," Mem. Pont. Acc. dei Nuovi Lincei, vol. xix. p. 153, figs. 40–43.

Lagena costata (Williamson) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Science) p. 338, pl. xiv. figs. 3-5.
Ditto. (Williamson) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Williamson) Millett, 1901, Malay Foraminifera, Journ. R. Micr. Soc., p. 7, pl. i. fig. 8.

One fossil specimen. Although frequently regarded and figured as an entosolenian variety of *L. sulcata* (Walker and Jacob) this type has sufficiently well marked characters to deserve separation. The grooves between the prominent sulci are usually neatly rounded off and the edges of the sulci are also smooth and finished.

351. *Nodosaria arundinea* Schwager.

Nodosaria arundinea Schwager, 1866, Novara Exped. Geol., vol. ii. p. 211, pl v. figs. 43–45.
Ditto. (Schwager) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., vol. vi. p. 747, pl. xiv. figs 28, 29.

A few typical fragments of this fragile species, fossils, apparently derived from a shell-sand. The species has been recorded from the London Clay by Sherborn and Chapman (*suprâ*).

352. *Nodosaria calomorpha* Reuss.

Nodosaria calomorpha Reuss, 1865, Denkschr. d. k. Akad. Wiss. Wien, vol. xxv. p. 129, pl. i. figs. 15-19.
Nodosaria (Dentalina) consobrina (d'Orbigny) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 342, pl. xvi. fig. 3.
Nodosaria calomorpha (Reuss) Brady, 1884, Foram. 'Challenger,' p. 497, pl. lxi. figs. 23–27.
Ditto. (Reuss) Chaster, 1892, First Report Southport Soc. Nat. Sci. (1890–1891), p. 63, pl. i. fig. 12.
Ditto. (Reuss) Goës, 1894, Arctic and Scandinavian Foraminifera, p. 72, pl. xiii. figs. 712–713.
Ditto. (Reuss) Millett, 1902, Malay Foraminifera, Journ. R. Micr. Soc., p. 513.

One Cretaceous fossil. The fossil records are apparently confined to the Tertiary, but owing to its small size this species might be easily overlooked, and its very simple structure would lead one to expect a far greater geological age for the form.

353. *Nodosaria scalaris* Batsch sp.

Nautilus (Orthoceras) scalaris Batsch, 1791, Conchyl. des Seesandes, No. 4, pl. ii. fig. 4.
Nodosaria radicula (Montagu) Williamson, 1858, Recent Foram. of Great Britain, p. 15, pl. ii. figs. 36–38.
Nodosaria scalaris (Batsch) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 340, pl. xvi. fig. 2.
Ditto. (Batsch) Brady, 1884, Foram. 'Challenger,' p. 510, pl. lxiii. figs. 28–31.
Ditto. (Batsch) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Batsch) Goës, 1894, Arctic and Scandinavian Foraminifera, p. 73, pl. xiii. figs. 716–718.
Ditto. (Batsch) Millett, 1902, Malay Foraminifera, Journ. R. Micr. Soc., p. 520, pl. xi. fig. 10.

One typical recent specimen of the type usually found in British dredgings, in which all the chambers are of practically the same diameter. This appears to be due to the large size of the primordial chamber, and may possibly represent the megalospheric form of the shell. So far as our experience goes, the species is very rarely found in shore-sands, though frequent in shallow water dredgings in temperate and tropical seas all over the world. With increasing depth the shell displays a tendency to a rapid increase in the diameter of the successive chambers, which thus become more or less spherical in shape. This again is probably due to the initial chamber being of the microspheric type, but it would require a long series of careful measurements to verify this observation, which we record without further comment.

354. *Marginulina glabra* d'Orbigny.

Marginulina glabra d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 259, No. 6; Modèle, No. 55.
Ditto. (d'Orbigny) Brady, 1870, Ann. and Mag. Nat. Hist., ser. 4, vol. vi. p. 296, pl. xii. fig. 3.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 527, pl. lxv. figs. 5, 6.
Ditto. (d'Orbigny) Burrows, Sherborn and Baily, 1890, Journ. R. Micr. Soc., p. 10, pl. x. fig. 1.
Vaginulina glabra (d'Orbigny) Goës, 1894, Arctic and Scandinavian Foraminifera, pl. xi. figs. 659–661.
Marginulina glabra (d'Orbigny) Flint, 1899, Report U.S. Nat. Museum for 1897, p. 313, pl. ix. fig. 1.
Ditto. (d'Orbigny) Millett, 1902, Malay Foraminifera, Journ. R. Micr. Soc., p. 526.

Several specimens, all fossil, and apparently from Tertiary shell-sands. They represent the two most widely divergent types of this extremely variable species, namely, those in which the initial spiral portion is reduced to a minimum, and is followed by a series of nodosarian chambers (compare *M. attenuata* Neugeboren, 1851, Berh. Mitth. Siebenbürgen Ver. Nat. Jahrg. ii., p. 121, pl. iv. figs. 3–6) and those in which there is a distinct spiral portion, followed by a few swollen and embracing Glanduline chambers. This variable type has been recorded as far back as the Lias, and is of frequent occurrence in the present day in dredgings at all moderate depths.

355. *Polymorphina acuminata* d'Orbigny sp.

(Plate X. figs. 17, 18.)

Pyrulina acuminata d'Orbigny, 1840, Mém. Soc. Géol. France, vol. iv. p. 43, pl. iv. figs. 18, 19. Facsimile in Science Gossip, 1870, p. 157, fig. 150.
Ditto. (d'Orbigny) Reuss, 1845–6, in Geinitz, Grund. Verstein, p. 670, pl. xxiv. fig. 64.

Atractolina sp. Von Schlicht, 1869, Foram. Septar. Pietzpuhl, p. 70, No. 397, pl. xxv. figs. 9, 10.
Pyrulina sp. Von Schlicht, 1869, Foram. Septar. Pietzpuhl, No. 442, pl. xxv. fig. 53.
Polymorphina acuminata (d'Orbigny) Brady, Parker and Jones, 1870, Trans. Linn. Soc. Lond., vol. xxvii. p. 219, pl. xxxix. fig. 4, *a b*.

Frequent, all fossil, and from various sources.

This pretty little fusiform variety of the *lactea* type might easily be passed for a *Glandulina*, but for the oblique direction of the flush sutural lines.

It occurs in the Chalk and subsequent Eocene deposits, but is apparently an extinct variety.

356. *Polymorphina lactea* var. *amygdaloides* Reuss.

Globulina amygdaloides (?) Reuss, 1851, Zeitschr. d. deutsch. geol. Gesellsch., vol. iii. p. 82, pl. vi. fig. 47.
Polymorphina amygdaloides Reuss, 1855, Sitzungsb. d. k. Akad. Wiss. Wien, vol. xviii. p. 250, pl. viii. fig. 84.
Polymorphina lactea var. *amygdaloides* (Reuss) Brady, Parker and Jones, 1870, Trans. Linn. Soc. Lond., vol. xxvii. p. 214, woodcuts.
Polymorphina amygdaloides (Reuss) Brady, 1884, Foram. 'Challenger,' p. 560, pl. lxxi. fig. 13.
Ditto. (Reuss) Millett, 1903, Malay Foraminifera, Journ. R. Micr. Soc., p. 261.

One specimen, infiltrated with pyrites, probably derived from a Tertiary clay. The variety, like the type, has a very wide range in time, and probably extends back to the Jurassic epoch. It is merely a compressed variety of *P. lactea* W. and J. sp.

132. *Polymorphina myristiformis* Williamson.

This is a frequent species in the shore-sands.

357. *Polymorphina problema* d'Orbigny.

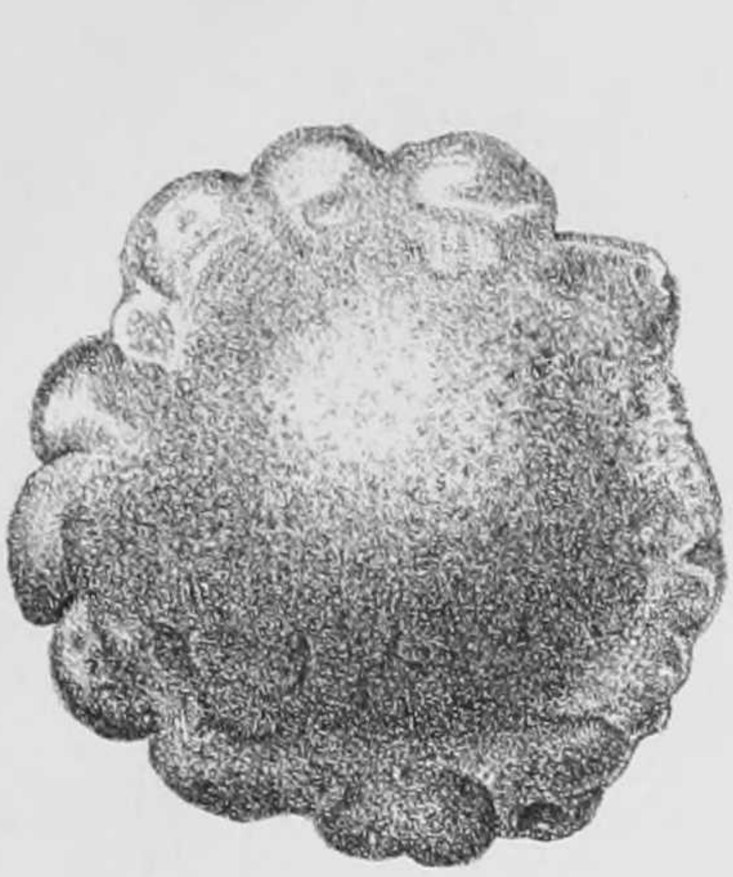
Polymorphina (Guttulina) problema d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 266, No. 14; Modèle, No. 61.
Guttulina problema (d'Orbigny) d'Orbigny, 1846, Foram. Foss. Vienne, p. 224, pl. xii. figs. 26-28.
Guttulina austriaca (d'Orbigny) d'Orbigny, 1846, Foram. Foss. Vienne, p. 223, pl. xii. figs. 23–25.

EXPLANATION OF PLATE XII.

Linderina brugesii Schlumberger.

Fig. 1.—Early stage. Side view.
,, 2. Ditto. Ditto.
,, 3. Ditto. Edge view.
,, 4.—Adult stage.
,, 5. Ditto.
,, 6.—Horizontal section of a large specimen.
,, 7.—Vertical section of a large specimen.

(All figures drawn to a magnification of 100 diameters.)



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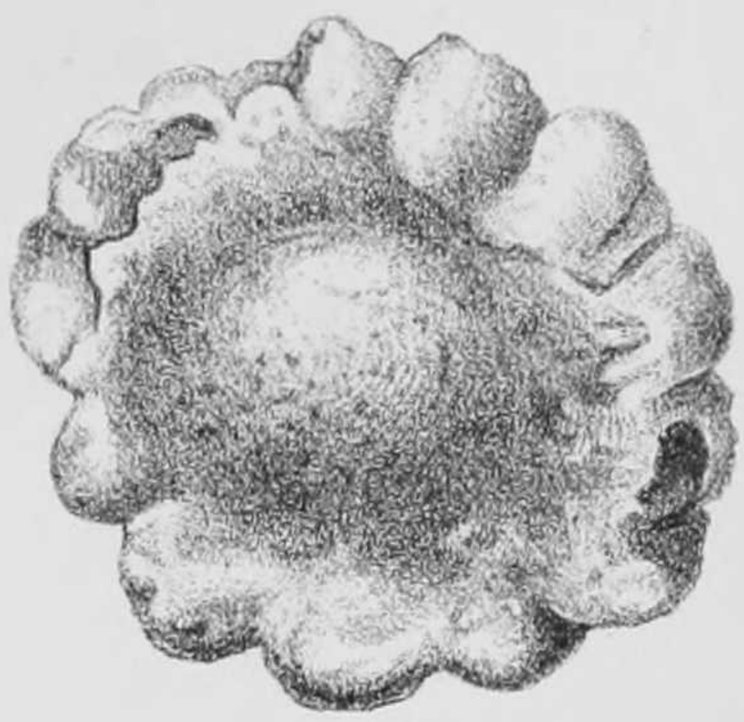

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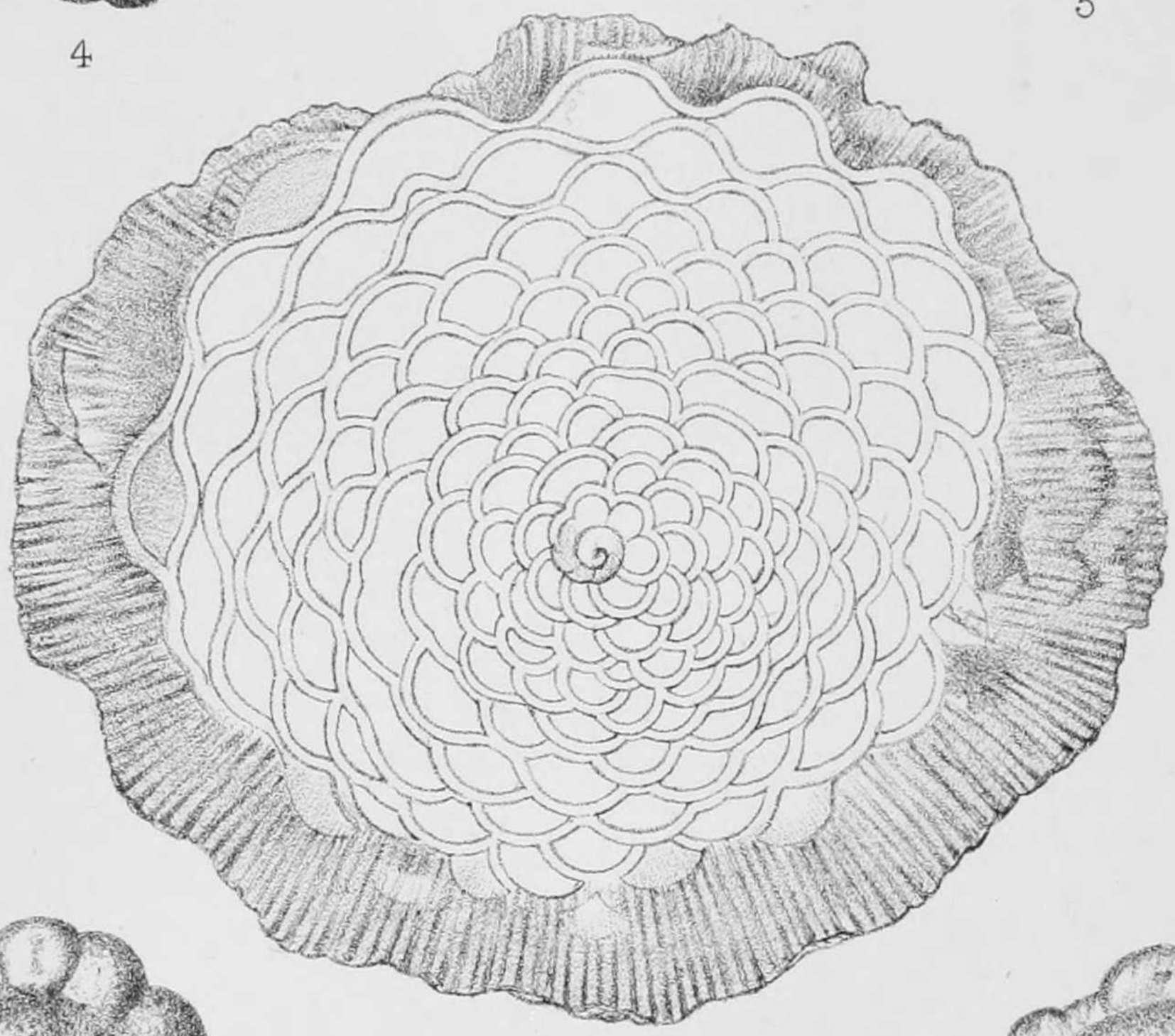

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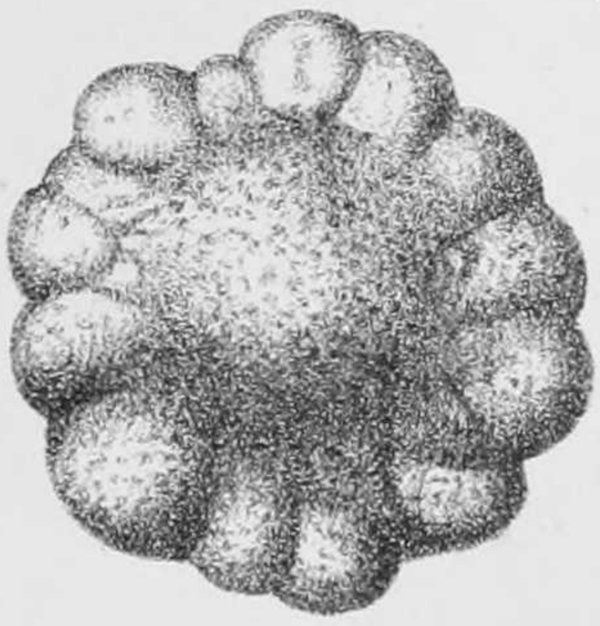

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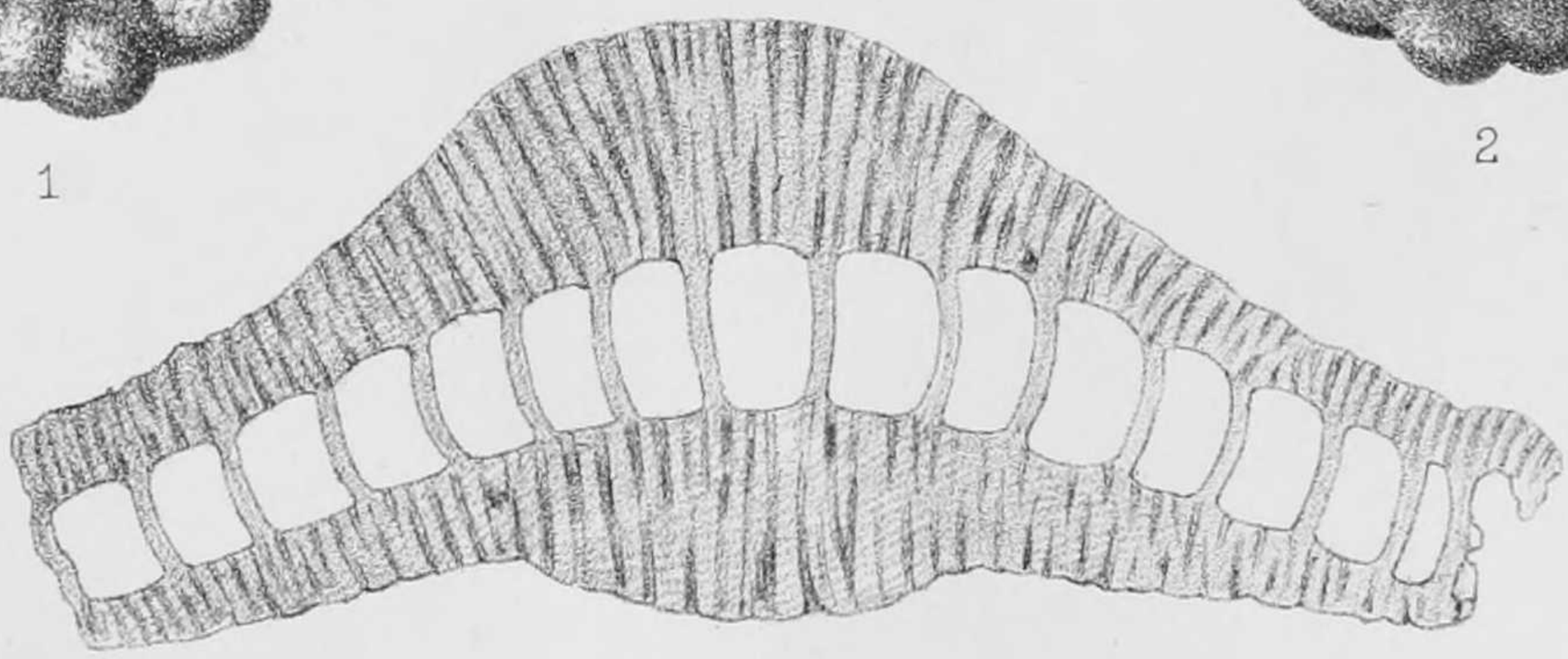

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West, Newman lith.

Polymorphina problema (d'Orbigny) Brady, Parker and Jones, 1870, Trans. Linn. Soc. Lond., vol. xxvii. p. 225, pl. xxxix. fig. 11.
Ditto. (d'Orbigny) Brady, 1870, Edinburgh Catalogue, p. 5.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 568, pl. lxxii. fig. 20, pl. lxxiii. fig. 1.
Ditto. (d'Orbigny) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (d'Orbigny) Millett, 1903, Malay Foraminifera, Journ. R. Micr. Soc., p. 264.

Most of our specimens are fossils, and judging from appearances, have been derived from various sources. The species extends back as far as the Lias, and is of world-wide distribution in shallow waters at the present day. The difference between *P. problema* and *P. communis* is so slight as scarcely to merit separation.

358. *Polymorphina thouini* d'Orbigny.

Polymorphina thouini d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 265, No. 8; Modèle, No. 23.
Ditto. (d'Orbigny) Brady, Parker and Jones, 1870, Trans. Linn. Soc. Lond., vol. xxvii. p. 232, pl. xl. fig. 17.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 567, pl. lxxii. fig. 18.

A single pyritized fossil, extremely attenuated. According to Brady this is an extremely rare form in the recent condition. As a fossil it occurs in the Eocene of the Paris Basin and subsequently.

359. *Dimorphina longicollis* Brady sp.

(Plate X. fig. 19.)

Polymorphina lanceolata (*pars*) Reuss, 1870, Sitz. d. k. Akad. Wiss. Wien, vol. lxii. p. 487, No. 12. Von Schlicht, 1870, Foram. Pietzpuhl, pl. xxxi. figs. 25–28.
Polymorphina longicollis Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. (n.s.) p. 64.
Ditto. (Brady) Brady, 1884, Foram. 'Challenger,' p. 572, pl. lxxiii. figs. 18–19.

We have a single perfectly preserved fossil specimen which, if Brady's identification of Von Schlicht's figures is correct, is referable to Brady's species. Our specimen, as will be seen from the drawing, agrees exactly with Von Schlicht's figure. The surface is quite smooth, whereas the recent specimens of *P. longicollis* are always, or nearly always, hispid.

The question of the necessity of allocating dimorphous types of *Polymorphina* to the sub-genus *Dimorphina* is one which is open to very great doubt, but if the sub-genus *Dimorphina* is to be retained at all it cannot be used to greater advantage than for the recording of such abnormal species as Brady's *P. longicollis*, which in the dimorphous arrangement of the chambers and produced Uvigerine neck differs widely from the accepted definition of *Polymorphina*. In the recent state *D. longicollis* is extremely rare, and

according to Brady essentially a deep-water species, ranging from 1100 to 2435 fathoms. Von Schlicht's specimens were from the Tertiaries of Pietzpuhl.

360. *Uvigerina asperula* Czjzek.

Uvigerina asperula Czjzek, 1847, Haidinger's Naturw. Abhandl., vol. ii. p. 146, pl. xiii. figs. 14, 15.
Uvigerina hispida Schwager, 1866, Novara Exped. geol. Theil, vol. ii. p. 249, pl. vii. fig. 95.
Uvigerina asperula (Czjzek) Brady, 1884, Foram. 'Challenger,' p. 578, pl. lxxv. figs. 6–8.
Ditto. (Czjzek) Flint, 1899, Report U.S. Nat. Museum for 1897, p. 320, pl. lxviii. fig. 4.

Many excellent specimens, some of which are apparently recent. The species is common round our coasts in comparatively deep water, i.e., at depths from 100 fathoms downward, but so far as we are aware it has not been recorded in shore-sands, except from the neighbouring locality of Bognor, where Earland found a single very weak specimen. As a fossil it is common in many Miocene and later Tertiary beds.

361. *Sagrina asperula* Chapman.

Sagrina asperula Chapman, 1896, Foram. of Gault of Folkestone, Journ. R. Micr. Soc., p. 581, pl. xii. fig. 1.

We have a few specimens of this little species, which was described from the Gault of Folkestone. Ours are apparently Cretaceous fossils.

362. *Sagrina dimorpha* Parker and Jones.

Uvigerina (*Sagrina*) *dimorpha* Parker and Jones, 1865, Phil. Trans., vol. clv. p. 420, pl. xviii. fig. 18.
Sagrina dimorpha (Parker and Jones) Brady, 1884, Foram. 'Challenger,' p. 582, pl. lxxvi. figs. 1–3.
Ditto. (Parker and Jones) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Parker and Jones) Goës, 1894, Arctic and Scandinavian Foram., p. 52, pl. ix. figs. 510–11.

A few small specimens, one apparently fossil, the others recent.

Sagrina dimorpha has a world-wide range, occurring at moderate depths in all the oceans. It is the only species of the genus which has a northern as well as a tropical distribution, for it occurs in many of the Norwegian fiords at least as far north as the Sögne Fiord, in which it has been dredged by Earland at a depth of 260 metres. It has been recorded by Robertson from low water at Girvan, Scotland, but otherwise we know of no British record, nor of any fossil record.

146. *Globigerina pachyderma* Ehrenberg.

We have found very typical specimens of this boreal form, but the figures we gave in Plate XVIII. figs. 4 and 5 (1909) were of a new species of *Nonionina*, which we describe and figure again *post* No. 390 and Plate XI. figs. 12–15.

363. *Spirillina lucida* Sidebottom.

Spirillina lucida Sidebottom, 1908, Foraminifera from Delos, Mem. Manchester Lit. and Phil. Soc., vol. lii. No. 13, p. 9, pl. ii. fig. 9.

We have several specimens, apparently derived fossils, which answer to Sidebottom's description and figures. The structure, however, is very obscure, and in the absence of any visible aperture we do not feel satisfied that the specimens may not represent the superior external shell of some species of *Discorbina* in which the septal divisions and base have been dissolved during a process of plastogamy.

364. *Discorbina araucana* d'Orbigny sp.

Rosalina araucana d'Orbigny, 1839, Foram. Amér. Merid., p. 44, pl. vi. figs. 16–18.
Discorbina araucana (d'Orbigny) Parker and Jones, 1872, Quart. Journ. Geol. Soc., vol. xxviii. p. 115.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 645, pl. lxxxvi. figs. 10–11.
Ditto. (d'Orbigny) Sidebottom (1908), Foram. from Delos, Mem. Manchester Lit. and Phil. Soc., vol. lii. No. 13, p. 12.

One small well preserved specimen; a pyritized fossil. The geological distribution of *D. araucana* is probably identical with the more typical form *D. rosacea*, but the records are few.

365. *Discorbina bertheloti* d Orbigny.

Discorbina bertheloti d'Orbigny, 1839, Foram. Canaries, p. 135, pl. i. figs. 28–30.
Ditto. (d'Orbigny) Brady, 1864, Trans. Linn. Soc. Lond., vol. xxiv. p. 469, pl. xlviii. fig. 10.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 650, pl. lxxxix. figs. 10–12.
Ditto. (d'Orbigny) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (d'Orbigny) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 327, pl. lxxii. fig. 4.
Ditto. (d'Orbigny) Earland, 1905, Journ. Quekett Micr. Club, ser. 2, vol. ix. No. 57, p. 223.

A few examples, typical and apparently all fossil, some of them highly pyritized. In the recent condition *D. bertheloti* has practically a world-wide distribution and ranges down to considerable depths. It is more typically an arctic or, at any rate, a northern form. Brady gives no information as to its occurrence in the fossil condition.

366. *Discorbina eximia* Hantken.

Discorbina eximia Hantken, 1875, Mittheil. Jahrb. d. k. ung. geol. Anstalt., vol. iv. p. 76, pl. xv. fig. 8.
Discorbina elegans Hantken, 1875. Id., p. 76, pl. ix. fig. 3.
Discorbina eximia (Hantken) Brady, 1884, Foram. 'Challenger,' p. 646, pl. lxxxviii. fig. 9.

One small specimen, fossil, which appears to be referable to this species, originally described from the Tertiaries of Hungary. In the recent condition it appears to be confined to shallow water in the tropics.

367. *Discorbina inæquilateralis* sp. n.

(Plate XI. figs. 3–5.)

The curious little specimen which we figure is so very distinctive in its appearance that it seems to merit a specific name, although its occurrence is so far limited to a single well preserved fossil specimen. The marked distinctive feature of the shell is the dissimilarity between its upper and under surfaces. The superior surface is in one plane and consists of about two convolutions, six or seven chambers in the outer whorl. The inferior surface is smaller, so that the shell when viewed on edge presents the appearance of a horizontal conic section. The superior surface is rough, owing to the fact that the perforations are abnormally large for such a small species, the sutural lines somewhat depressed, giving a "puckered" appearance to the surface of the shell. Viewed sidewise, the chambers are observed to be coarsely corrugated from edge to edge. The inferior surface is depressed, sinking away from the corrugated edge to a median line, running across the axis of the shell; this causes the central depression to be oval or elliptic, and not circular, as is usually the case. The perforations on the sides and base are very minute when compared with those on the apex of the shell; the septal divisions are not visible on the sides or inferior surface, and the general appearance of the inferior surface resembles *Spirillina* rather than *Discorbina*.

Length, 0·23 mm. Breadth, 0·2 mm.

368. *Discorbina nitida* Williamson sp.

Rotalina nitida Williamson, 1858, Recent Foram. of Gt. Britain, p. 54, pl. iv. figs. 106–108.
Ditto. (Williamson) Terquem, 1875, Ess. Anim. Plage Dunkerque, pt. i. p. 26, pl. ii. fig. 9.
Rotalia nitida (Williamson) Brady, 1884, Foram 'Challenger,' pp. 627, 705.
Ditto. (Williamson) Brady, 1887, Synopsis British Recent Foraminifera.
Discorbina nitida (Williamson) Wright, 1891, Proc. R. Irish Acad., ser. 3, vol. i. No. 4, p. 490.
Ditto. (Williamson) Sidebottom, 1908, Foram. from Delos, Mem. Manchester Lit. and Phil. Soc., vol. lii. No. 13, p. 13, pl. iv. fig. 6.

Fossil and recent specimens. The fossils are not in a good state of preservation, having been apparently obtained from some disintegrated crystalline deposit, probably a limestone of Tertiary age. Some of the recent specimens are exceptionally large and fine.

This is a very well marked type, and possesses certain characteristic features in the shape of a flat depressed shell with broad straplike sutures, which render it easy of identification. There is also a characteristic glassiness about the texture due to the extremely minute size of the perforations which separates it from other species of *Discorbina*, most of which are rather coarsely perforate.

Brady (*suprâ*), for some reason not very apparent, placed the species in the genus *Rotalia*, and considered it to be an isomorph of *Discorbina turbo* (d'Orbigny). He regarded it as a starved modification of *Rotalia beccarii* (Linné sp.), but it appears to us to have nothing in common with that species. On the other hand, it is evidently very closely allied to *Discorbina rosacea* d'Orb. sp., of which it may perhaps be regarded as a simple and original variety.

369. *Discorbina patelliformis* Brady var. *corrugata* var. n.

(Plate X. figs. 22–24.)

Discorbina patelliformis Brady, 1884, Foram. 'Challenger,' p. 647, pl. lxxxviii. fig. 3; lxxxix. fig. 1.

The curious little shell which we figure should, we think, be referred to this species, although it differs from the type in its sutures. These, instead of being broad but flush bands of clear shell-substance as in the type, are strongly limbate, some of them projecting almost as *carina*. The under surface of the shell is broken, and has somewhat the appearance of having once been joined in plastogamy with another shell.

The specimen is apparently a fossil. Brady's specimens were from the Pacific. It is generally distributed in warm seas.

Breadth, 0·2 mm. Height, 0·14 mm.

370. *Discorbina pileolus* d'Orbigny sp.

(Plate XI. figs. 1, 2.)

Valvulina pileolus d'Orbigny, 1839, Foram. Amér. Mérid., p. 47, pl. i. figs. 15–17.
Discorbina pileolus (d'Orbigny) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 385.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 649, pl. lxxxix. figs. 2–4.
Ditto. (d'Orbigny) Chapman, 1900, Journ. Linn. Soc. Lond. Zool., vol. xxviii. p. 191.

A few minute and very weakly developed specimens have been found, which we refer to this species. The shells, which are in

excellent preservation but are doubtless fossils, are extremely compressed, the relation of their height to the breadth being less than one quarter of the usual dimensions. The typical curve of the chambers is, however, present, as is also the customary radial line of beaded markings on the base, although these are remarkably delicate.

At the present day this species appears to be confined to the Pacific and Australian seas, where it is often fairly abundant. It is one of the few species of Foraminifera in which "plastogamy" appears to occur with any frequency, twin specimens being nearly always present in any gathering which contains many specimens of the form. It has been recorded from the Eocene of Paris and some later deposits.

Breadth, 0·37 mm. Height, 0·05 mm.

371. *Discorbina polystomelloides* Parker and Jones.

Discorbina polystomelloides Parker and Jones, 1865, Phil. Trans., vol. clv. p. 421, pl. xix. fig. 8.
Ditto. (Parker and Jones) Brady, 1884, Foram. 'Challenger,' p. 652, pl. xci. fig. 1.

A few well preserved specimens, all fossil, and, judging from their condition, derived from at least two and perhaps three different deposits. At the present day the species is of fairly common occurrence in the coral sands of the Australian and Pacific seas. We have no knowledge of any previous occurrence as a fossil, but our specimens are doubtless derived from some of the Tertiary deposits, characterized by tropical and sub-tropical fauna.

372. *Discorbina rosacea* d'Orbigny sp. var. *Selseyensis* var. n.

(Plate X. figs. 20, 21.)

We figure a curious little *Discorbina* which we think should be attributed to this species, or which perhaps may form a link connecting *D. rosacea*, *D. nitida*, and *D. orbicularis*. Two or three specimens only have been observed, all recent, and all characterized by the same constant features.

The shell, which seen from above is almost exactly circular in outline, consists of about two or three convolutions of chambers. The shell is dome-shaped on the superior surface, concave below; sutures flush, clear bands of shell-substance as in *D. nitida*; the outer margin of the shell presents a similar band of shell-substance. On the inferior side the surface of the chambers is covered with weak corrugations diverging from the central axis of the shell; texture glassy (hyaline); perforations extremely minute. Apart from the under surface of the shell this variety might readily be mistaken for a dome-shaped specimen of *D. nitida*, but the markings on the inferior surface are peculiarly distinctive. The tangential

curve of the chambers as seen on the superior face, and the arrangement of the chambers on the inferior face (apart from the superficial markings), approach more nearly to *D. orbicularis* than to either *D. rosacea* or *D. nitida*.

Diameter, 0·4 mm.

373. *Discorbina tabernacularis* Brady.

Discorbina tabernacularis Brady, 1881, Quart. Journ. Micr. Sci., vol. xxi. (n.s.) p. 65.
Ditto. (Brady) 1884, Foram. 'Challenger,' p. 648, pl. lxxxix. figs. 5–7.
Ditto. (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 390. pl. xv. figs. 58–60, 79.
Ditto. (Brady) Millett, 1903, Malay Foram., Journ. R. Micr. Soc., p. 700.
Ditto. (Brady) Sidebottom, 1908, Foram. from Delos, Mem. Manchester Lit. and Phil. Soc., vol. lii. No. 13, p. 15.

A few specimens, apparently recent. This has usually been regarded as a warm-water species, the 'Challenger' localities being tropical, the northernmost being Cape Verde. We have, however, met with it in many localities in the Mediterranean, so that its occurrence on our southern coasts is rendered not improbable. We are not aware of records of its occurrence in the fossil condition.

374. *Discorbina ventricosa* Brady.

Discorbina ventricosa Brady, 1884, Foram. 'Challenger,' p. 654, pl. xci. fig. 7.

Many specimens, fossil, in good preservation. The umbilical depression on the inferior surface typical of the species is particularly marked, more so even than in Brady's figure. The superior surface is smooth, not hispid, and in this respect our specimens may perhaps be regarded as connecting Brady's *D. ventricosa* with *D. saulcii* of d'Orbigny. Brady's specimens were obtained from several localities in different parts of the world at depths from 155 to 620 fathoms. We do not know of any other record of the species as a fossil.

172. *Cycloloculina annulata* H.-A. and E.
173. *Cycloloculina polygyra* H.-A. and E.

During the three years which have intervened since we commenced this series of papers nothing has transpired to modify the views which we expressed as to the affinities of this interesting type. Although an enormous number of specimens in all stages of growth has now been picked out from every part of the shore between the point of Selsey Bill and Chichester Harbour, we are still in complete ignorance as to the exact deposit from which these fossils have been derived. An examination of all the various zones and beds exposed in the same area has not yielded any definite evidence of origin. Found principally in elutriated material from the shore-sand, occasional specimens are found in many samples of

the Eocene Clays exposed on the shore, but whether as derived fossils or not it has been impossible to determine. As, however, with three exceptions all the specimens present the same superficial appearance, we are still inclined to think that the original home of the species is in some early Tertiary deposit which has been denuded to such an extent that it now exists only below the sea level. This theory would account for the presence of the isolated specimens which we have obtained from later Tertiary beds still *in situ* on the shore, and also for the very large number of specimens continually washed up upon the sands.

The exceptional specimens to which we have referred above are of a very much whiter appearance and calcareous texture. Apart from their surroundings they might easily be mistaken for Cretaceous fossils. This is, however, no doubt due to some accidental conditions of preservation or weathering. We do not suppose that *Cycloloculina* ranges back to the Cretaceous period. In spite of the considerable amount of work which is now being done on the Continent with the fossil Foraminifera, especially those of the Tertiary period, no further records of the genus have been published.

We may take this opportunity of acknowledging a suggestion which we have received from Mr. J. J. Lister, F.R.S., to the effect that *C. polygyra* may probably be the microspheric form of the genus, *C. annulata* being the megalospheric form. There seems every reason to believe that this may be the case, as the relative proportions to one another of the specimens appear to carry out this theory. In the absence of definite micrometric observations, we are not at present prepared to go into this, but the great profusion of the shells found in our sands supplies us with material of which we hope shortly to avail ourselves, with a view to going into this matter, to some extent at any rate, on the lines on which Lister, Carpenter and others have dealt with the *Nummulites*.

Linderina Schlumberger.

375. *Linderina brugesii* (Schlumberger).

(Plate XII. figs. 1–7.)

Linderina brugesii Schlumberger, 1893, Bull. Soc. Géol. France, s. iii. vol. 21, p. 118, and figs. 3–5.

Among the fossil specimens commonly found in the shore-sands of Selsey Bill were many of a shell which very early attracted our

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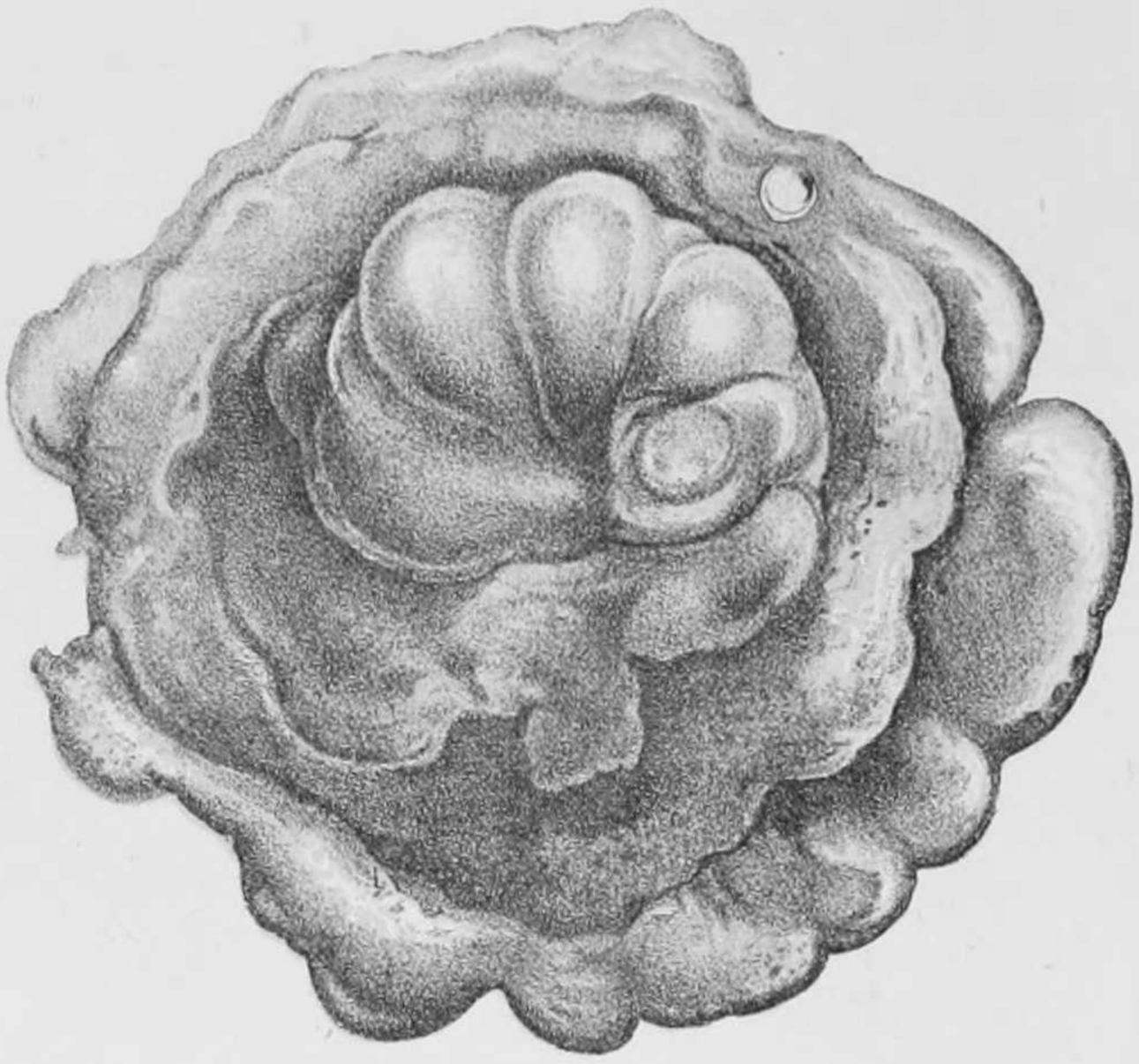
EXPLANATION OF PLATE XIII.

Pulvinulina vermiculata d'Orbigny sp.

Fig. 1.—Superior surface.
,, 2.—Inferior surface of same specimen.
,, 3.—Superior view of a small specimen.
,, 4.—Inferior view of same specimen.

(All figures on this plate are magnified 50 diameters only.)



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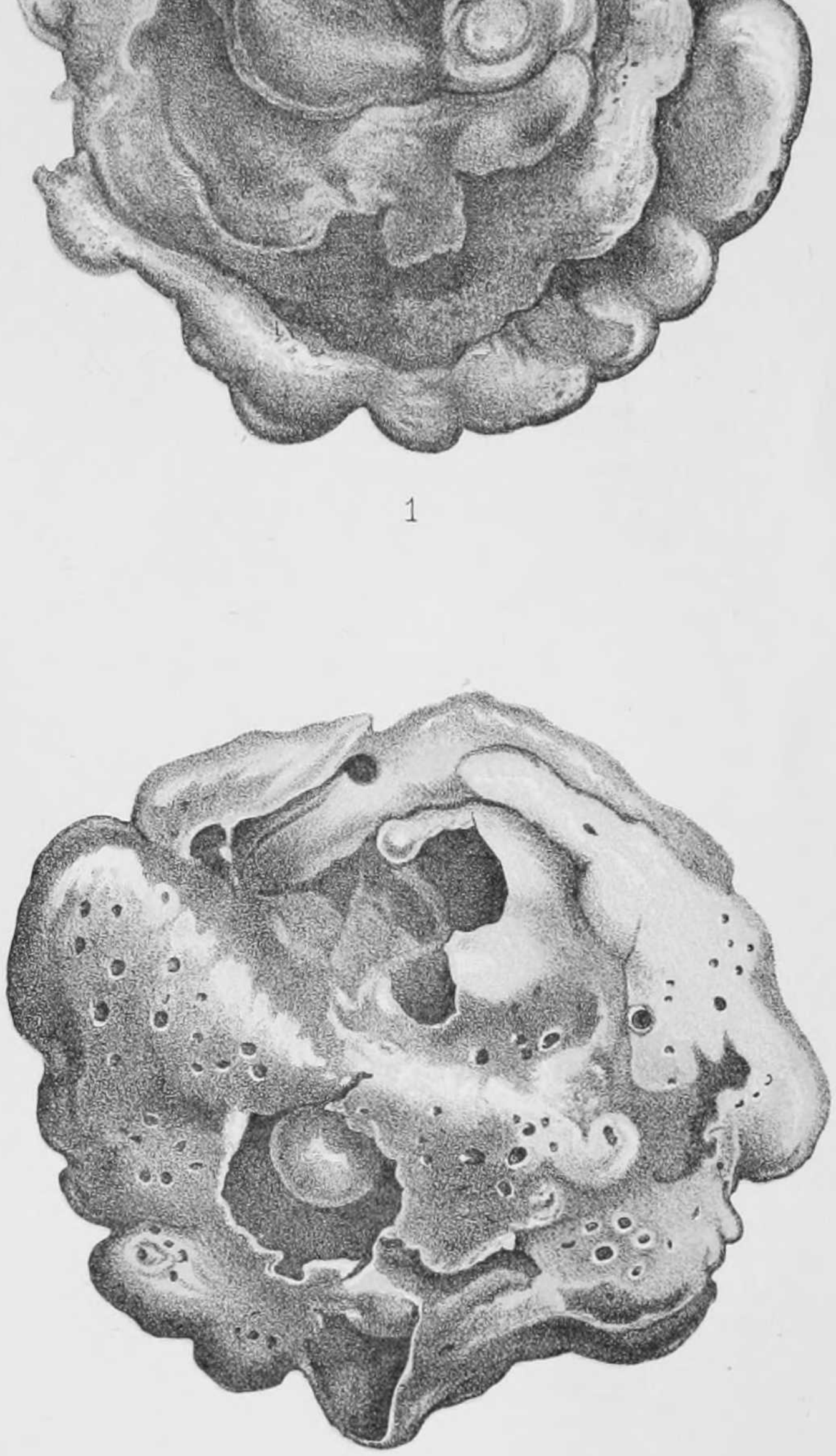

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W. Thornton Shiells del.

West, Newman lith.

attention, but which, in the earlier stages of our examination, were set aside and regarded as probably referable to the genus *Planorbulina*. After a considerable number of specimens in all stages of growth had been collected, we found that they presented features which could not be correlated with that genus, and as a result of careful examination, including the cutting of sections of the test in various planes, we are enabled definitely to identify our specimens with an interesting type, of which the first, and we believe only, record appears as above from the pen of the late Charles Schlumberger. As his paper has received little or no notice, we cannot do better than quote its essential parts, which are as follows :—

"The species was discovered by "mon ami M. Linder, Inspecteur Général des Mines," in the rubbish from borings in the Dept. of the Gironde.

"Test discoidal, thickened in the centre, composed of a single layer of numerous chamberlets disposed circularly around a central chamber and on the same plane. The partition-walls of each circle of chambers extend towards the centre above the already formed chambers. This calcareous envelope is traversed by coarse perforations which communicate directly with the inner chambers. He describes two forms, A and B.

Linderina Brugesii Schlumb. sp. n.

"Form A.—A transverse section made perpendicularly to the circumference, shows in the centre a large primordial chamber, spherical, and accompanied on the right and left, and on a more or less curved line, by a series of chambers which grow gradually taller. They are invested above and below by a calcareous deposit which is thicker at the centre than at the periphery; this massive formation is produced as is seen by the sutural lines, by the prolongation, towards the centre, of the walls of the chambers.

"These walls are coarsely perforated, and these perforations are continued in a straight line, increasing slightly in diameter, across the whole thickness of the calcareous envelope to reach the surface of the test, and thus establish a communication between all the chambers and the exterior. The section being rather thick, one sees in the outermost chambers unevenly distributed openings by which the adjoining chambers of the same ring communicate with one another.

"In a section at right angles to the last (horizontal) it is impossible to see all the chambers from the megalosphere outwards, because they are generally situated on a concave surface. One sees by a higher magnification that the wall of all the chambers is continuous right round the test without any sutures, and forms the chambers by its waviness.

"Form B only differs from Form A in that it is microspheric.

"Test discoidal, thicker in the centre than at the edges, where one sees only two annular rows of chamberlets. Test rough by reason of little prominences which stand up between the perforations.

"Habitat.—Upper Eocene of Bruges (Gironde). Rather rare.

"Observations.—In its exterior aspect this fossil closely resembles an *Orbitoides* or a *Cycloclypeus*. It differs from the former in the absence of chambers in the thickness of the central boss, and from the latter in the absence of the system of partitional canals and the compact pillars which traverse the test."

There are several points in M. Schlumberger's description with which we cannot agree. As seen in horizontal section, our specimens commence with a regular Rotaline spiral of about 2 to 3 whorls. There are 8 to 10 chambers in the last convolution, and up to this point the chambers are fairly regular in size. Subsequent chambers are added in more or less regular annuli and vary considerably in size and shape. The earlier annuli have apparently simple walls, i.e., each chamber consists of a semicircular wall secreted over the outer surface of a bead of protoplasm, which had been protruded through the tubuli of an earlier chamber. Later on the chamberlets appear to have compound walls, i.e., the protruded bead of protoplasm secreted a basal wall of its own, separating it from the wall of the preceding annulus. This double cell-wall gives the appearance of a wavy line of chambers, referred to by Schlumberger and illustrated by him diagrammatically.

We have been unable to trace any direct communication between adjacent chamberlets of the same or adjacent convolutions. The horizontal sections show no trace of any tubuli in the partition walls or any definite oral aperture. If any tubuli are present in the side walls of the chambers they must be extremely minute, as they are not visible under $\frac{1}{4}$-in. objective. Vertical sections, however, show that the top and bottom walls of every chamber were perforated with coarse tubuli, extending right through the thick deposit of shell-substance to the external surface. It would, therefore appear that each chamberlet was a separate and self-contained unit so far as nutrition was concerned, and that the growth of the shell depended on extrusions of protoplasm through these apertures, which formed at first isolated chambers round the rim and subsequently a tube with constrictions at intervals. The whole question is, however, so difficult to follow owing to the friability of the test and the trouble of preparing sections, that we put forward our conjectures with some diffidence.

We are unable to confirm Schlumberger's statement that "the partition walls of each circle of chambers extend towards the centre above the already formed chambers." If this were the case a vertical section would show strong bands of clear shell-substance cutting

the coarse vertical tubuli at an angle. Nothing of the kind is visible in our sections, and it is possible that Schlumberger was confused by the pillar-like appearance of the shell-substance of the boss caused by the coarse perforations of the tubuli. The central boss appears to be a simple deposit of shell-substance, such as occurs in *Cycloloculina*, and is in no way connected with "the prolongation towards the centre of the walls of the chambers."

Schlumberger gives no clue to the position to which he intended to relegate his genus *Linderina*, beyond pointing out certain points of external resemblance to *Orbitoides* and *Cycloclypeus*. In the doubling of the shell wall of the later chambers it certainly shows a tendency towards the Cycloclypeinæ, but on the whole we are disposed to regard it of much simpler type, closely allied to *Cycloloculina* and *Planorbulina*, and perhaps as a transition type between these and the more highly developed Cycloclypeinæ.

The specimens are of very frequent occurrence in the elutriated material from the shore-sands all round the Selsey peninsula, and vary from young specimens in which only the central boss is apparent, surrounded by a ring of deeply sutured and bead-like chamberlets (which led Mr. Millett, to whom we submitted some of the earliest found tests, to suggest that they were *Planorbulina larvata*), to large specimens in which many rings of chamberlets surround the central boss, thus producing a shell suggestive of *Cycloclypeus*, as noted by Schlumberger. This was before we had made the sections, which we found to conform to the descriptions given by Schlumberger, as set forth above.

From the external appearance of the shells and the micro-structure of their material, there seems every reason to suppose that they reach the Selsey shore-sands from the same geological deposit as *Cycloloculina*. M. Schlumberger, as is seen above, gives no very definite clue to the precise formation from which his specimens were derived, and in the absence of further and better evidence we are constrained to suppose that our specimens are, like *Cycloloculina*, derived from an exposure of Eocene clay, which, so far, we have failed to discover between or above tide-marks at Selsey Bill.

It would be interesting if more definite information as to the locality of the original specimens could be obtained, and if it could be ascertained whether any deposit of similar age is known among the Tertiary deposits of Great Britain.

376. *Truncatulina refulgens* Montfort sp.

Cibicides refulgens Montfort, 1808, Conchyl. Systém., vol. i. p. 122, 31e Genre.
Truncatulina refulgens (Montfort) d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 279, pl. xiii. figs. 8–11; Modèle, No. 77.
Ditto. (Montfort) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 382, pl. xvi. fig. 19.
Ditto. (Montfort) Brady, 1865, Nat. Hist. Trans. Northd. and Durham vol. i. p. 105, pl. xii. fig. 9.

Truncatulina refulgens (Montfort) Brady, 1884, Foram. 'Challenger,' p. 659, pl. xcii. figs. 7–9.
Ditto. (Montfort) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Montfort) Millett, 1904, Malay Foraminifera, Journ. R. Micr. Soc., p. 491.

A few small specimens, recent, from the shore-sands, and, perhaps, fossil from the Chalk flints. According to Brady, this is not uncommon in coarse rough sands from 20 fathoms downwards on the Atlantic coasts of Scotland and Ireland, rare on the east coast, but the species occurs in very great profusion and also attains a maximum size in shallow-water dredgings on the east coast of Scotland.

377. *Truncatulina reticulata* Czjzek sp.

Rotalina reticulata Czjzek, 1848, Haidinger's Naturw. Abhandl., vol. ii. p. 145, pl. xiii. figs. 7–9.
Siphonina fimbriata Reuss, 1849, Denkschr. d. k. Akad. Wiss. Wien, p. 372, pl. xlvii. fig. 6.
Planorbulina reticulata (Czjzek) Parker and Jones, 1865, Phil. Trans., vol. clv. p. 379.
Truncatulina reticulata (Czjzek) Brady, 1884, Foram. 'Challenger,' p. 669, pl. xcvi. figs. 5–8.
Ditto. (Czjzek) Chaster, 1892, First Rep. Southport Soc. Nat. Sci. (1890–91), p. 66, pl. i. fig. 16.
Ditto. (Czjzek) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 334, pl. lxxviii. fig. 3.
Ditto. (Czjzek) Millett, 1904, Malay Foram., Journ. R. Micr. Soc., p. 490.
Ditto. (Czjzek) Earland, 1905, Journ. Quekett Micr. Club, ser. 2, vol. ix. No. 57, p. 226.

A few fossil specimens referable to this species, which is widely distributed throughout the Tertiary period. Our specimens, judging from their appearance, are derived from a clay; some of them show the tubulation of the peripheral edge with great distinctness. The species has been recorded from the London Clay of the Isle of Wight by Brady.

378. *Anomalina ariminensis* d'Orbigny sp.

Planulina ariminensis d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 280, pl. v. figs. 1–3; Modèle, No. 49.
Planorbulina ariminensis (d'Orbigny) Parker, Jones and Brady, Ann. and Mag. Nat. Hist., ser. 3, vol. xvi. p. 26, pl. iii. fig. 78.
Anomalina ariminensis (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 674, pl. xciii. figs. 10, 11.
Planorbulina ariminensis (d'Orbigny) Goës, 1894, Arctic and Scandinavian Foraminifera, p. 91, pl. xv. figs. 784, 785.
Anomalina ariminensis (d'Orbigny) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 335. pl. lxxix. fig. 1.
Ditto. (d'Orbigny) Millett, 1904, Malay Foram., Journ. R. Micr. Soc., p. 495.

Common; pyritized fossils, probably derived from the London Clay to the east of Selsey Bill. This species, which is commonly

distributed in moderately deep water at the present time, occurs in the fossil state as far back as the Cretaceous period, where it is not uncommon, and is subsequently found in many late Tertiary deposits all over the world.

186. *Anomalina coronata* Parker and Jones.

(Additional Note.)

Anomalina coronata (Parker and Jones) Brady, 1887, Synopsis British Recent Foraminifera.
Planorbulina coronata (Parker and Jones) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 335, pl. lxxix. fig. 2.

A few more fairly typical though small examples of this interesting species. The specimens are fossils, from two different sources, a clay and apparently a shell-sand. They are of small size compared with recent specimens from North British seas, but in other respects are quite characteristic. At the present day *A. coronata* has a very wide distribution, but it only occurs in any abundance in certain localities, favouring high latitudes and low temperatures. In many of the 'Goldseeker' dredgings in the Shetland-Faeroe area the species occurs in enormous profusion, so as to form an almost typical deposit, and the specimens attain a comparatively large size and robust character.

379. *Pulvinulina auricula* Fichtel and Moll sp.

Nautilus auricula **var.** *a* Fichtel and Moll, 1803, Test. Micr., p. 108, pl. xx. figs. *a*, *b*, *c*.
Valvulina excavata d'Orbigny, 1839, Foram. Canaries, p. 137, pl. i. figs. 43–45.
Pulvinulina auricula (Fichtel and Moll) Parker and Jones, 1865, Phil. Trans., vol clv. p. 393.
Ditto. (Fichtel and Moll) Brady, 1884, Foram. 'Challenger,' p. 688, pl. cvi. fig. 5.
Ditto. (Fichtel and Moll) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Fichtel and Moll) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 329, pl. lxxiii. fig. 2.

A few fossil specimens have been observed, but, curiously enough, no recent ones. They are well preserved, probably from a Tertiary shell-sand. It has already been recorded from the Eocene of the Paris basin and later Tertiary deposits.

380. *Pulvinulina brongniartii* d'Orbigny sp.

Rotalia brongniartii d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 273, No. 27.
Rotalina brongniarti (d'Orbigny) d'Orbigny, 1846, Foram. Foss. Vienne, p. 158, pl. viii. figs. 22–24.
Pulvinulina auricula (Fichtel and Moll) Parker, Jones and Brady, 1871, Ann. and Mag. Nat. Hist., ser. 4, vol. viii. p. 173, pl. xii. fig. 143.

Pulvinulina auricula (Fichtel and Moll) Brady, 1884, Foram. 'Challenger,' p. 688.
Pulvinulina bonquiartii (d'Orbigny) Millett, 1904, Malay Foram., Journ. R. Micr. Soc., p. 498, pl. x. fig. 4.

Abundant and well preserved specimens, all fossil. D'Orbigny's original specimens were from the Miocene of Vienna: "common." He also records it as living in the Adriatic. Millett figures a variety from the Malay seas which differs from d'Orbigny's type considerably, in that the shell is more compressed and has a tendency to form a carina on the outer edge. The sutures also are limbate, whereas in d'Orbigny's type they are flush or simple. Our specimens agree with d'Orbigny's, though there is some tendency towards a thickening of the sutures on the inferior surface.

Brady (*supra*) regards this type as an intermediate between *Pulvinulina auricula* (F. and M. sp.) and *Pulvinulina hauerii* (d'Orb. sp.).

381. *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'Orbigny) Owen, 1867, Journ. Linn. Soc. Lond., vol. ix. Zool. p. 148, pl. v. figs. 8 (?), 9.
Ditto. (d'Orbigny) Brady, 1884, Foram. 'Challenger,' p. 694, pl. ciii. figs. 11, 12.
Ditto. (d'Orbigny) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 416, pl. xviii. figs. 7–12.
Ditto. (d'Orbigny) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 329, pl. lxxiv. fig. 1.
Ditto. (d'Orbigny) Rhumbler, 1900, Nordisches Plankton, Heft xiv. p. 17, figs. 12, 14, 15.

Many specimens, well preserved fossils, from clays and shell-sands. At the present time *P. crassa* is recorded only from deep water in the great oceans, the records ranging from 150 to 2740 fathoms. Brady states that it is not uncommon from Chalk in the neighbourhood of Paris and from Kent, but adds that there is no mention of its occurrence in other formations.

382. *Pulvinulina haliotidea* sp. n.

Plate XI. figs. 6–11.

We have a single imperfect specimen, which we figure, of a little Foraminifer which Earland has found in some quantity at practically all the shallow-water stations worked by the 'Goldseeker' round the north and east of Scotland. It may be regarded as an extreme variation of the type *P. auricula* (F. and M.) in the direction of compression of the test and evolution of the spiral. Our description is based upon the general characteristics of the North Sea specimens.

Test compressed, ear-shaped, consisting of about two convolutions and six to ten chambers, rapidly increasing in size, the whole usually visible on both sides of the shell. Superior surface, rounded; periphery more or less acute; the earliest chambers usually project above the curved surface of the superior face, in a low mammillate spire. The appearance of the inferior surface varies greatly, according to the degree of evolution of the spiral. In some specimens the central portion presents a sunken umbilicus, the later chambers being turgid and attached to the previous convolution; in others the whole series of chambers of the final convolution and some of those of the previous convolution are seen to form an evolute spire, which is only held together by an extension of the superior wall connecting it with the previous convolution. This is fairly well shown in the drawing, fig. 6, representing the inferior side of the Selsey specimen. Some of the North Sea examples present this depauperate stage in an even more striking degree; the whole shell viewed both from above and below presents a somewhat significant resemblance to the human ear; hence the specific name which we have given to this shell.

In the North Sea the species is most frequent in the muddy sands of the Moray Firth and analogous areas, but it also extends to the Faeroe Channel and the west coast of Scotland. We have seen specimens probably referable to this species in its less extreme type in some of Mr. Joseph Wright's dredgings from the west of Ireland.

It may be remarked that all the specimens appear to have a somewhat large primordial chamber. It is not improbable that our species may represent the megalospheric type of some other form, perhaps of *P. auricula* or *P. oblonga*.

Length, 0·15–0·25 mm. Breadth, 0·1 to 0·2 mm.

383. *Pulvinulina lateralis* Terquem sp.

Rosalina lateralis Terquem, 1878, Mém. Soc. Géol. France, sér. 3, vol. i. Mém. 3, p. 25, pl. ii. fig. 11.
Pulvinulina lateralis (Terquem) Brady, 1884, Foram. 'Challenger,' p. 689, pl. cvi. figs. 2, 3.
Ditto. (Terquem) Egger, 1893, Abhandl. k. bayer. Akad. Wiss. Cl. II. vol. xviii. p. 413, pl. xviii. figs. 48–50.
Ditto. (Terquem) Millett, 1904, Malay Foraminifera, Journ. R. Micr. Soc., p. 497.
Ditto. (Terquem) Sidebottom, 1909, Foram. from Delos, Mem. Manchester Lit. and Phil. Soc., No. 21, p. 5, pl. ii. fig. 6, pl. iii. figs. 1, 2 (?)

A few specimens, probably fossil. The recent records of this species appear to be confined to tropical warm seas in shallow water. Terquem's original specimens were from the Pliocene of Rhodes.

384. *Pulvinulina repanda* Fichtel and Moll sp.

Nautilus repandus Fichtel and Moll, 1803, Test. Micr., p. 35, pl. iii. figs. *a–d.*
Rotalina concamerata (mature) (Montagu) Williamson, 1858, Recent Foram. Great Britain, p. 52, pl. iv. figs. 101–3.
Rotalia repanda (Montagu) (Williamson) Parker and Jones, 1860, Ann. and Mag. Nat. Hist., ser. 3, vol. v. p. 175, No. 25.
Pulvinulina repanda (Montagu) (Williamson) Brady, 1884, Foram. 'Challenger,' p. 684, pl. civ. fig. 18.
Ditto. (Montagu) (Williamson) Brady, 1887, Synopsis British Recent Foraminifera.
Ditto. (Montagu) (Williamson) Egger, 1893, Abhandl. k. bayer. Akad. Wiss. Cl. II. vol. xviii. p. 405, pl. xviii. figs. 28, 30, 34, 35.
Ditto. (Montagu) (Williamson) Goës, 1894, Arctic and Scandinavian Foraminifera, p. 95, pl. xvi. fig. 801.
Ditto. (Montagu) (Williamson) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 328, pl. lxxii. fig. 8.

Recent and fossil. This is a fairly common shallow-water type, in most parts of the world, and occurs as a fossil as far back as the Middle Tertiaries.

385. *Pulvinulina repanda* var. *concamerata* Montagu var.

Serpula concamerata Montagu, 1808, Test. Brit., Suppl., p. 160 (*fide* Williamson).
Rotalina concamerata "*mature*" (Montagu) Williamson, 1858, Recent. Foram. Great Britain, p. 52, pl. iv. figs. 102, 103.
Pulvinulina repanda var. *concamerata* (Montagu) Brady, 1884, Foram. 'Challenger,' p. 685, pl. civ. fig. 19.

Recent and fossil. The specimens are small compared with those found on many parts of our coast.

199. *Pulvinulina semi-marginata* d'Orbigny sp.

In our description of this form we regret that we should have overlooked the description and figures published by our friend Mr. F. W. Millett in the Journal of this Society.* Mr. Millett has also drawn our attention to the fact that Signor Fornasini has in his series of papers reproducing the "Planches inédites" of d'Orbigny, figured d'Orbigny's original drawing.† According to Mr. Millett, the species occurs in great profusion at some stations in the Malay Archipelago. He describes it under the name *Discorbina semi-marginata*, and his figure, and the Malay specimens with which he has been kind enough to supply us, are of markedly Discorbine growth. Our specimens, on the other hand—and we have found a very large number—are distinctly Pulvinuline, and we can only conclude that this is one of those species which bridges the gap between the allied genera *Discorbina* and *Pulvinulina*. The characteristic feature of the species, the subsidiary asterigerine chambers, are equally well marked in both types.

* See this Journal, 1903, p. 703, pl. vii. fig. 8.
† C. Fornasini, 1906, Mem. R. Acc. Scienze dell' Istituto di Bologna, ser. vi. tom. iii. p. 36, pl. iv. fig. 5.

386. *Pulvinulina reticulata* Reuss sp.

Rotalia reticulata Reuss, 1862, Sitzungsb. d. k. Akad. Wiss. Wien, vol. xlvi. Abth. i. p. 83, pl. x. figs. 4 *a–c*.
Epistomina reticulata (Reuss) Uhlig. 1883, Jahrb. k.k. geol. Reichsanst., vol. xxxiii., p. 768, p. vii. figs. 8, 9.
Pulvinulina reticulata (Reuss) Chapman, 1898, Journ. R. Micr. Soc., p. 8, pl. i. figs. 10 *a–c*.

A single specimen, fossil. This may be derived from Gault or lower Cretaceous formations, to which zones the species appears to be confined.

387. *Pulvinulina tumida* Brady.

Pulvinulina menardii var. *tumida* Brady, 1877, Geol. Mag., Dec. II. vol. iv. p. 294.
Ditto. Brady, 1879, Quart. Journ. Micr. Sci., vol xix. (.s) p. 80.
Pulvinulina tumida (Brady) Brady, 1884, Foram. 'Challenger,' p. 692, pl. ciii. figs. 4–6.
Ditto. (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 414, pl. xvii. figs. 4–6, 35–37, 44.
Ditto. (Brady) Flint, 1899, Rep. U.S. Nat. Museum for 1897, p. 329, pl. lxxiii. fig. 5.

Many fossil specimens, well preserved, and apparently from a shell-sand. The specimens are small compared with those commonly found in recent deposits. It is widely distributed at the present day within the tropics and at all depths down to 2750 fathoms. Of its fossil distribution, Brady only records its occurrence in the limestone from New Britain, in the Pacific, as of unknown geological age, but its records may very possibly be confused with those of its older and better known ally, *Pulvinulina menardii*, of which it is merely a turgid and solid form, and which has been recorded as far back as the Cretaceous period.

388. *Pulvinulina umbonata* Reuss.

Rotalina umbonata Reuss, 1851, Zeitschr. d. deutsch. geol. Gesellsch., vol. iii. p. 75, pl. v. fig. 35.
Pulvinulina umbonata (Reuss) Reuss, 1886, Denschr. d. k. Akad. Wiss. Wien., vol. xxv. p. 206.
Ditto. (Reuss) Brady, 1884, Foram. 'Challenger,' p. 695, pl. cv. fig. 2.
Ditto. (Reuss) Flint, 1899, Rep U.S. Nat. Museum for 1897, p. 330, pl. lxxiv. fig. 4.

One fossil specimen from above the Selsey beds, opposite West Street. This species, now known only from deep water in the great oceans, occurs in many Teritary deposits on the continent of Europe.

190. *Pulvinulina vermiculata* d'Orbigny sp.

Plate XIII. figs. 1–4.

Since we described the single small specimen of *Pulvinulina vermiculata*, which we had found when this species was dealt with

in Paper No. 4 of our series,* we have had the good fortune to discover the specimen now figured, which in itself is ample confirmation of those affinities referred to by Brady, which we had previously seen reason to doubt. The specimen was found on the shore to the N.W. of New Road, and to all external appearances is a recent one, although the occurrence of such a remarkably fine and well developed southern form on British shores must, in a neighbourhood like Selsey Bill, where fossil forms predominate, certainly remain open to question. The test, however, shows no sign of fossilization or staining. The earlier chambers are remarkably well developed, and taken apart from the ensuing growth would be assigned without hesitation to *P. lateralis* Terquem sp. Subsequently to our finding of this specimen, an extended series of this species, showing all gradations from *P. lateralis*, was gathered by Heron-Allen on the shore of the Lido, at Venice: there is no doubt that upon such a series as this the late H. P. Brady based his observations on the affinities of the species.

We take this opportunity of figuring the small specimen on which our original record was based.

389. *Nonionina pauperata* Balkwill and Wright.

Plate XI. figs. 16, 17.

Nonionina quadriloculata Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Science) p. 353, pl. xiii. figs. 25, 26.
Ditto. (Balkwill and Wright) Brady, 1887, Synopsis British Recent Foraminifera.

Several recent and typical specimens of this interesting form.

390. *Nonionina quadriloculata* sp. n.

Plate XI. figs. 12–15.

Globigerina pachyderma (Ehrenberg) Heron-Allen and Earland, 1909, Journ. R. Micr. Soc., p. 438, pl. xviii. figs. 4, 5. (*Figures only.*)

By an oversight in illustrating the species *Globigerina bulloides* Ehrenberg sp. in a previous number of this paper, the artist selected specimens which had been inadvertently associated with our examples of *G. pachyderma* without sufficient care in determining their affinities. *G. pachyderma* remains on our list as we have good typical specimens, and the printed remarks which we published (*vide supra*) remain unqualified. On a more protracted examination of our material we have found a very large number of the specimens such as were figured as *G. pachyderma*, and a minute examination of these, both by reflected and transmitted light, has proved them to be a Nonionine isomorph of the species *Globigerina pachyderma*, to which they were at first referred.

* See this Journal, 1909, p. 684.

The test is almost spherical, slightly flattened at right angles to the axis, consisting of eight or nine chambers coiled in an involute spiral, the last four chambers only being visible externally. There is a slight umbilical depression on either side, and the neighbourhood of the aperture of the final chamber is surrounded with stout but short tubercles which almost entirely conceal the actual aperture. This apparently consists of the usual Nonionine series of fine pores at the extreme line of junction of the last and previous whorls.

The specimens, which are all fossil, are generally well preserved; a few are pyritized, the remainder, as a rule, deeply stained. The perforations of the shell are extremely minute.

We publish two further figures of the species in which the position and nature of the tubercles are better shown than in the previous drawings.

Breadth, 0·2–0·27 mm. Thickness, 0·1–0·15 mm.

Journal of the
Royal Microscopical Society

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS

AND

A SUMMARY OF CURRENT RESEARCHES RELATING TO

ZOOLOGY AND BOTANY

(principally Invertebrata and Cryptogamia)

MICROSCOPY, &c.

EDITED BY

R. G. HEBB, M.A. M.D. F.R.C.P.

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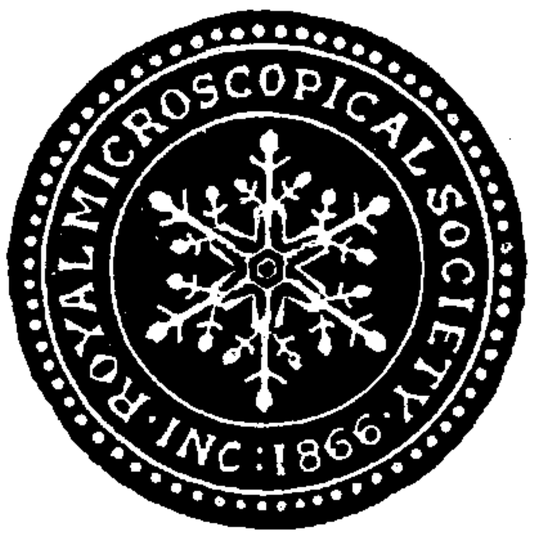

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