THE FORAMINIFERA OF THE SHORE-SAND AT BOGNOR, SUSSEX.

By Arthur Earland.

(*Read May 19th*, 1905.)

Plates 11—14.

When staying at Bognor in October, 1895, I noticed that Foraminifera were abundant on the foreshore, and made a gathering at the western or Aldwick end of the town, beneath the old windmill, now removed, where the material was plentiful. No special examination of the material was, however, undertaken, as I was then busily engaged with other work. I formed the impression, moreover, based upon a cursory examination, that it was mainly a Milioline gathering and of no particular interest. In October, 1901, I was again at Bognor, and decided to collect material with the view of working out a complete list of the local species, little thinking what a heavy task I was undertaking. I found that, owing to some alteration in the local currents, there was practically no material obtainable on my former collecting-ground, or anywhere to the west of the town; but at Felpham, about a mile to the east, it was most abundant. In the course of two or three tides I gathered between twenty and thirty pounds of scrapings, which were packed off to London to be dried and cleaned. Having no microscope with me, I was unable to make any local examination of the material while fresh, and this is the more to be regretted as there are a few doubtful species, the true nature of which could have been settled without much doubt if living specimens had been procurable. It is to be hoped that some member of the Club, more fortunately situated than myself, or some local microscopist, will endeavour to clear up these doubtful points.

Upon my return to London I cleaned and floated the material, and my spare time ever since has been more or less occupied with its examination. I soon became aware of the fact that the list of species would prove a long one, and, indeed, it has kept constantly growing, nor do I imagine that the present list is

absolutely exhaustive. Probably a local rhizopodist would be able to add many species to it by varying his methods of collecting and extending the area of research, as the whole of my material was obtained from about fifty yards of the foreshore between tide-marks.

The gathering is primarily a Milioline one. The genus *Miliolina* in various species occurs in an abundance quite out of proportion to other forms, and gives a characteristic porcellaneous appearance to the coarse material. The finer material is, however, very varied in the character of its contents, and is principally responsible for the very long list of species observed.

The total number of species identified, exclusive of a few doubtful forms, is 140, and is made up as follows:—

Miliolidae . .	28	Lagenidae . .	38
Astrorhizidae .	1	Globigerinidae .	3
Lituolidae . .	10	Rotalidae . .	28
Textularidae .	24	Nummulinidae .	8

Many of the species now recorded are of very rare occurrence in Great Britain, and, in addition, the list contains one new species, *Spiroplecta fusca*, and one new variety, *Massilina secans*, var. *tenuistriata*. There are also the following species, 15 in number, which, to the best of my knowledge, have not previously been recorded in Great Britain:—

Spiroloculina antillarum, d'Orbigny.
Sigmoilina costata, Schlumberger.
Massilina secans, d'Orbigny, var. *denticulata*, Costa.
Gaudryina subrotundata, Schwager.
Bolivina tortuosa, Brady.
,, *nobilis*, Hantken.
Lagena stelligera, Brady.
Nodosaria soluta, Reuss.
Cristellaria aculeata, d'Orbigny.
Polymorphina regina, Brady, Parker & Jones.
Uvigerina porrecta, Brady.
Discorbina vesicularis, Lamarck.
Anomalina grosserugosa, Gümbel.
Pulvinulina hauerii, d'Orbigny.
Rotalia calcar, d'Orbigny.

Both in the total number of species recorded, and in the number of rare and previously unrecorded species observed, Bognor will now take precedence over all other British collecting-grounds. For about forty years this position has been held by Dog's Bay, Connemara, whose shore-sands have been familiar to most microscopists. A list of the species observed at Dog's Bay, Connemara, containing 124 forms, was published in the *Irish Naturalist* (vol. ix., No. 3, March, 1900) by my friend Mr. Joseph Wright, F.G.S., of Belfast.

The question arises why Bognor should form such a rich collecting-ground. At Littlehampton, only a few miles to the east, Foraminifera are almost non-existent. In 1902 I endeavoured to make a gathering there, for comparison with the Bognor fauna, but was unable to find any trace of shore deposits, although I examined the coast-line for a distance of two miles in each direction.

The south-east coast is, speaking generally, a very poor collecting-ground for Foraminifera, although careful search will give some results in most localities. This is, doubtless, due to the scour of the Channel tides and the absence of suitable areas for the growth of the animals. The majority of the Foraminifera found in shore gatherings are dead shells which have gradually drifted with the currents and tides to the beach. Off Bognor there lies an extensive reef, known as the Barn Rocks, which are a noted fishing-ground, and which are doubtless covered with Algae, and form a suitable home for swarms of the lower animals. The bulk of the specimens have probably come from this source, but there are certain species abundant in the gathering which may have travelled still farther. Both *Miliolina fusca*, Brady, and *Trochammina inflata*, Montagu, are usually considered to be distinctively brackish-water organisms; but the mud-flats of Bosham and Chichester Harbours, nearly thirty miles away, are the nearest localities from which brackish-water organisms could have been derived, and as both those species are of a delicate and friable nature, one would hardly expect them to make such a journey undamaged. Moreover, I have noticed many specimens in which the sarcode was still visible, and this would seem to prove that some of the specimens, at any rate, are of local marine origin, and that we must no longer regard them as essentially brackish-water types. Perhaps

some local microscopist may be able to decide this point of doubt.

As in nearly all the south-coast gatherings which I have had the opportunity of examining, there is a considerable number of fossil specimens observable. These are mostly derived from the Chalk, but there are others of Tertiary age, which have been washed out of the Eocene beds of Bracklesham and the Isle of Wight. No attempt was made to work out a complete list of the fossils, but I have notes of the occurrence of the following :—

Textularia globulosa, Ehr.
Bulimina affinis, d'Orb.
Lagena laevis, Mont.
,, *sulcata*, W. & J.
,, *hispida*, Rss.
,, *orbignyana*, Seg.
Nodosaria laevigata, d'Orb.
,, *raphanus*, Linné.
Frondicularia archiaciana, d'Orb.
Cristellaria acutauricularis, F. & M.
,, *recta*, d'Orb.
,, *cultrata*, Montft.
Sagrina nodosa, d'Orb.
Orbulina universa, d'Orb.
Globigerina cretacea, d'Orb.
Anomalina ammonoides, Rss.

Fruits of *Chara*.

In conclusion, I must express my deep indebtedness to my friend Mr. Joseph Wright, F.G.S., of Belfast, the chief authority on our British Foraminifera, but for whose encouragement and assistance this paper would never have been completed. Mr. Wright not merely undertook the laborious task of verifying all my specimens, but also examined a large quantity of the material, thereby adding to the list many forms which I had overlooked.

The illustrations reproduced in Plates 11 and 12 are from drawings made by my friend Mr. Archibald J. French; those on Plate 13 and the figure of *Discorbina* in the text are from drawings by my cousin, Mr. J. A. Lovegrove; while the figures reproduced in Plate 14 are from photographs taken specially for this paper by our President, Dr. E. J. Spitta, F.R.A.S., who devoted much time and trouble to photographing my specimens, a task the difficulty of which can only be appreciated by those who have attempted it. I think the actual photographs will be especially valuable as showing the range of form exhibited by some of the species. To these three gentlemen I beg to tender my grateful thanks for their assistance.

Sub-kingdom—**PROTOZOA.**

Class—RHIZOPODA.

Order—FORAMINIFERA.

Family II.—MILIOLIDAE.

Sub-family 1—NUBECULARINAE.

Nubecularia, Defrance.

Nubecularia lucifuga, Defrance.

Nubecularia lucifuga, Defrance, 1825, *Dict. Sci. Nat.*, vol. 25, p. 120; *Atlas Zooph.*, pl. xliv., fig. 3.
,, ,, Brady, 1884, *Report "Challenger,"* p. 134, pl. i., figs. 9—16.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common, and in all the usual protean forms, both attached and free and labyrinthic. The specimens are well developed and quite typical, but do not, of course, attain a very large size compared with those obtained from warm seas. Minute specimens, exhibiting the regularly spiral arrangement of the early chambers, are of frequent occurrence in the fine floatings. (Plate 11, Figs. 1, 2, 3, and Plate 14, Fig. 2.)

The species has been previously recorded from the Cornish coast, 60 fathoms, and Mounts Bay, Cornwall (F. W. Millett); also from the Southport coast (Chaster), and Kilchattan Bay, Bute, 25 fathoms (Robertson). It does not appear to have been recorded from Ireland.

Sub-family 2—MILIOLININAE.

Biloculina, d'Orbigny.

Biloculina ringens, Lamarck, sp.

Miliolites ringens, Lamarck, 1804, *Ann. du Muséum*, vol. v., p. 351, No. 1; vol. ix., pl. xvii., fig. 1.
Biloculina ringens, Brady, 1884, *Report "Challenger,"* p. 142, pl. ii., figs. 7, 8.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare; two specimens only were found, and these are weak.

Spiroloculina, d'Orbigny.

Spiroloculina planulata, Lamarck, sp.

Miliolites planulata, Lamarck, 1805, *Ann. du Muséum*, vol. v., p. 352, No. 4.
,, ,, Lamarck, 1822, *Anim. s. Vert.*, vol. vii., p. 613, No. 4.
Spiroloculina planulata, Brady, 1884, *Report "Challenger,"* p. 148, pl. ix., fig. 11, a, b.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare. The specimens are weak.

Spiroloculina excavata, d'Orbigny.

Spiroloculina excavata, d'Orbigny, 1846, *Foram. Foss. Vienne*, p. 271, pl. xvi., figs. 19—21.
,, ,, Brady, 1884, *Report "Challenger,"* p. 151, pl. ix., figs. 5, 6.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Spiroloculina limbata, d'Orbigny.

Spiroloculina limbata, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 299, No. 12.
,, ,, Brady, 1884, *Report "Challenger,"* p. 150, pl. ix., figs. 15—17.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Spiroloculina acutimargo, Brady.

Spiroloculina acutimargo, Brady, 1884, *Report "Challenger,"* p. 154, pl. x., figs. 12—15.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

One specimen only, found by Mr. J. Wright.

Previously recorded from the estuary of the Dee (Siddall), and from Southport, Lanc. (Chaster), rare. Also by Messrs. Balkwill & Wright, from Lambay, Irish Sea, 45 fathoms; specimens small and poor.

Spiroloculina antillarum, d'Orbigny.

Spiroloculina antillarum, d'Orbigny, 1839, *De la Sagra's Hist. Phisiq.*, etc., Cuba, "Foraminifères," p. 166, pl. ix., figs. 3, 4.
,, ,, Brady, 1884, *Report "Challenger,"* p. 155, pl. x., fig. 21, a, b.

One specimen found; weak, but identifiable.

Not previously recorded in Great Britain. The species is at home in the shallow water of warm seas.

Sigmoilina, Schlumberger.

Sigmoilina costata, Schlumberger.

Sigmoilina costata, Schlumberger, *c.* 1893, "Monographie des Miliolides de Golfe de Marseille," *Mem. Soc. Zool. France*, vol. vi., p. 69, pl. i., figs. 51, 52, and text fig 4.

Rare. This species has not been previously recorded in Great Britain, but Mr. Joseph Wright informs me that he has been acquainted with it for many years as a fossil in the estuarine clay of Magheramorne, near Belfast, and that he has recently found it in shore-sand from North Donegal, and also off Dublin; very rare at both places.

Miliolina, Williamson.

Miliolina trigonula, Lamarck, sp.

Miliolites trigonula, Lamarck, 1804, *Ann. du Muséum*, vol. v., p. 351, No. 3.
,, ,, Lamarck, 1822, *Anim. s. Vert.*, vol. vii., p. 612, No. 3.
Miliolina trigonula, Brady, 1884, *Report "Challenger,"* p. 164, pl. iii., figs. 14—16.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common.

Miliolina tricarinata, d'Orbigny, sp.

Triloculina tricarinata, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 299, No. 7; *Modèle*, No. 94.
Miliolina tricarinata, Brady, 1884, *Report "Challenger,"* p. 165, pl. iii., fig. 17, a, b.

Miliolina tricarinata, Brady, 1887, *Synopsis British Recent Foraminifera.*

Fairly common, but less frequent than the last species.

It occurs at many points round the coast of the British Isles, but is nowhere abundant, whereas *M. trigonula* frequently is.

Miliolina oblonga, Montagu, sp.

Vermiculum oblongum, Montagu, 1803, *Test. Brit.*, p. 522, pl. xiv., fig. 9.

Miliolina oblonga, Brady, 1884, *Report "Challenger,"* p. 160, pl. v., fig. 4, a, b.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Miliolina seminulum, Linné, sp.

Serpula seminulum, Linné, 1767, *Syst. Nat.*, 12th ed., p. 1264, No. 791.

,, ,, Linné, 1788, 13th (Gmélin's) ed., p. 3739, No. 2.

Miliolina seminulum, Brady, 1884, *Report "Challenger,"* p. 157, pl. v., fig. 6, a, b, c.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very common, as it is in most localities round our coast. There is also a considerable range of form.

Miliolina venusta, Karrer, sp.

Quinqueloculina venusta, Karrer, 1868, *Sitzungsb. d. k. Ak. Wiss. Wien*, vol. lvii., p. 147, pl. ii., fig. 6.

Miliolina venusta, Brady, 1884, *Report "Challenger,"* p. 162, pl. v., figs. 5—7.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare. This is normally a deep-sea species, and is most at home at depths below 1,000 fathoms. Out of fourteen *Challenger* stations from which it is recorded, Brady notes that twelve were below 1,800 fathoms. It has, however, been previously recorded in this country from the estuary of the Dee (Siddall), and from the Southport shore (Chaster); also by Robertson from deep water in Loch Fyne.

Miliolina auberiana, d'Orbigny, sp.

Quinqueloculina auberiana, d'Orbigny, 1839, *De la Sagra's Hist. Phisiq.*, etc., Cuba, "Foraminifères," p. 193, pl. xii., figs. 1—3.

Miliolina auberiana, Brady, 1884, *Report "Challenger,"* p. 162, pl. v., figs. 8, 9.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common. This appears to be very local in its distribution, and there are few British records of its occurrence, but it is common at Puffin Island, Lanc. (Chaster).

Miliolina contorta, d'Orbigny, sp.

Quinqueloculina contorta, d'Orbigny, 1846, *Foram. Foss. Vienne*, p. 298, pl. xx., figs. 4—6.

Miliolina contorta, Halkyard, 1889, *Trans. Manchester Mic. Soc.*, p. 6, pl. i., fig. 4.

,, ,, Sidebottom, 1904, *Mem. Manchester Lit. and Phil. Soc.*, vol. xlviii., No. 5, p. 13, pl. iv., figs. 7—9.

This most variable species occurs very frequently, and at least four distinct types are noticeable. They are characterised by (1) smooth test, (2) rough and subarenaceous test, (3) peripheral edges rounded, (4) peripheral edges angular. Halkyard's specimens from Jersey were mostly referable to variety (2), and his figure represents variety (4). Sidebottom's figure has also angular edges, and it is stated that the surface of his specimens is rough. They were from Delos, in the Mediterranean.

Miliolina subrotunda, Montagu, sp.

Vermiculum subrotundum, Montagu, 1803, *Test. Brit.*, pt. 2, p. 521.

Miliolina subrotunda, Brady, 1884, *Report "Challenger,"* p. 168, pl. v., fig. 10.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very common, and in a wide range of form.

Miliolina seminuda, Reuss, sp.

Quinqueloculina seminuda, Reuss, 1865, *Denkschr. K. Akad. Wiss. Wien*, xxv., p. 125, pl. i., fig. 11.

One specimen only, found by Mr. Wright.

The species is closely allied to *Miliolina subrotunda*, Montagu, from which it differs in having the peripheral edge striate. It has been recorded by Halkyard from Guernsey, Herm, and Jersey, and by Wright from Dog's Bay, etc. It occurs at many places round the Irish coast.

Miliolina circularis, Bornemann, sp.

Triloculina circularis, Bornemann, 1855, *Zeitschr. deutsch. geol. Ges.*, vii., p. 349, pl. xix., fig. 4.

Miliolina circularis, Brady, 1884, *Report "Challenger,"* p. 169, pl. iv., fig. 3, a, b, c, and pl. v., figs. 13, 14.

Abundant. The species is closely allied to *M. subrotunda*, Montagu, and is probably often confounded with it. In Brady's *Synopsis of the British Recent Foraminifera*, the two forms are apparently run together under the name *M. subrotunda*.

The species is very common all round our coast, and especially so at Dog's Bay, Connemara.

Miliolina ferussacii, d'Orbigny, sp.

Quinqueloculina ferussacii, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 301, No. 18; *Modèle*, No. 32.

Miliolina ferussacii, Brady, 1884, *Report "Challenger,"* p. 175, pl. cxiii., fig. 17, a, b.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Miliolina insignis, Brady.

Miliolina insignis, Brady, 1884, *Report "Challenger,"* p. 165, pl. iv., figs. 8—10.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

One specimen only found.

Previously recorded by Mr. J. Wright from the shore-sand of Dog's Bay, Connemara, and from Belfast Lough, 60 fathoms.

Miliolina bicornis, Walker & Jacob, sp.

Serpula bicornis, Walker & Jacob, 1798, *Adam's Essays*, Kanmacher's ed., p. 633, pl. xiv., fig. 2.

Miliolina bicornis, Brady, 1884, *Report "Challenger,"* p. 171, pl. vi., figs. 9, 11, 12.

Miliolina bicornis, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rather common. The specimens exhibit much variation in shape, arrangement of chambers, and strength of the costae.

Miliolina pulchella, d'Orbigny, sp.

Quinqueloculina pulchella, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 303, No. 42.
,, ,, Soldani, 1798, *Testac.*, vol. ii., p. 53, pl. xviii., fig. *f*.
Miliolina pulchella, Brady, 1884, *Report "Challenger*, p. 174, pl. vi., figs. 13, 14, and pl. iii., figs. 10—13.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent. The specimens are somewhat small, and have their surfaces ornamented with smooth longitudinal ridges, without secondary striae.

The species is not uncommon round our coast in dredgings from depths below 30 fathoms, but it is of very rare occurrence in shore-sands.

Miliolina fusca, Brady.

Quinqueloculina fusca, Brady, 1870, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. vi., p. 286, pl. xi., fig. 2.
Miliolina fusca, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very common; the specimens are both triloculine and quinqueloculine. This species is usually regarded as one of the most typical of brackish-water Foraminifera, and its presence at Bognor in such numbers is one of the most noticeable features of the gathering. Further remarks on the subject will be found in the preface to this paper.

Massilina, Schlumberger.

Massilina secans, d'Orbigny, sp.

Quinqueloculina secans, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 303, No. 43; *Modèle*, No. 96.
Miliolina secans, Brady, 1884, *Report "Challenger,"* p. 167, pl. vi., figs. 1, 2.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Massilina secans, Schlumberger, 1893, *Mem. Soc. Zool. France*, vol. vi., p. 218, figs. 31—34, pl. iv., figs. 82, 83.

Most abundant, the shells forming a large proportion of the entire gathering. The species occurs in similar profusion in the Jersey shore-sands, and at Dog's Bay, Connemara.

As might be expected, there is a considerable range of form observable. Abnormal and monstrous specimens are of frequent occurrence, and do not call for any special notice; but two well-marked varieties have been observed which deserve to be recorded.

Massilina secans, var. **denticulata**, Costa, sp.

Quinqueloculina denticulata, Costa, 1856, *Atti. Accad. Pontaniana*, vii., fas. 2, p. 325, pl. xxv., fig. 6, a, b, c.

This is a handsome and well-marked variety, in which the periphery is extended into an elegantly denticulate keel. It occurs in the Mediterranean, though never in any abundance, and it has not hitherto been recorded in Great Britain. A single very fine and typical specimen was found at Bognor, and several small specimens were observed, which exhibited a tendency towards variation in this direction. (Plate 11, Fig. 4.)

Massilina secans, var. **tenuistriata**, var. nov.

In this variety the entire surface of the test is covered with fine longitudinal striae, which are roughly parallel with the periphery. The striae vary in coarseness in different specimens, being in some cases as well marked as in *Biloculina comata*, Brady, while in others they are so fine and close together as to be difficult of detection with less than a 1-in. objective. The variety must not be confused with Halkyard's var. *obliquistriata*,* in which the test has "oblique, somewhat curved grooves ploughed in the surface of the last segment."

Very rare compared with the type, but a considerable number of specimens have been observed. (Plate 11, Fig. 5.)

* *Sigmoilina secans*, d'Orbigny, var. *obliquistriata*, var. nov., Halkyard, 1889, *Trans. Manchester Mic. Soc.*, p. 61, pl. i., fig. 7. This variety was subsequently withdrawn by the author; see *Trans. Manchester Mic. Soc.*, 1891, p. 20.

Sub-family 4—PENEROPLIDINAE.

Cornuspira, Schultze.

Cornuspira involvens, Reuss.

Operculina involvens, Reuss, 1849, *Denkschr. d. K. Akad. Wiss. Wien*, vol. i., p. 370, pl. xlv., fig. 20.

Cornuspira involvens, Brady, 1884, *Report "Challenger,"* p. 200, pl. xi., figs. 1—3.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent, but all the specimens are small.

Cornuspira ? *sp.*

Some doubt exists as to the nature of the organism figured in Pl. 13, Fig. 2, and it is desirable that an attempt should be made to observe living specimens, which should not be difficult to obtain, as they are of common occurrence. I had referred my specimens to *Cornuspira foliacea*, Philippi, to which the outspread test bears some resemblance. Mr. Joseph Wright, however, on examining them, informed me that he was well acquainted with the form, which he regarded as the tube of an Annelid, and he added that this opinion had been confirmed by the late Mr. H. B. Brady, to whom he had submitted specimens. Mr. Wright kindly supplied me with a British example of *C. foliacea*, Philippi, which certainly differs widely from the Bognor specimens, being very depressed and outspread.

I thereupon withdrew *C. foliacea* from my list; but having subsequently found the abnormal specimens figured in Pl. 13, Figs. 3, 4, which closely resemble examples of multiple plastogamy, such as is frequently observed in the Foraminifera, I have thought it advisable to draw attention to them in the hope that some local observer may settle the nature of the organism.

Family III.—ASTRORHIZIDAE.

Sub-family 4—RHABDAMMININAE.

Hyperammina, Brady.

Hyperammina vagans, Brady.

Hyperammina vagans, Brady, 1879, *Quart. Jour. Micr. Sci.*, xix., p. 33, pl. v. 3.

,, ,, Brady, 1884, *Report "Challenger,"* p. 260, pl. xxiv., figs. 1—9.

Frequent. Previously recorded in Great Britain only from Oban (Norman).

All the specimens found are more or less fragmentary. This is doubtless due to the nature of the organism, which is normally adherent to other bodies, and perfect specimens will doubtless be forthcoming if looked for in suitable positions, such as among the Algae and Bryozoa thrown up on the beach.

Family IV.—LITUOLIDAE.

Sub-family 1—LITUOLINAE.

Haplophragmium, Reuss.

Haplophragmium canariense, d'Orbigny, sp.

Nonionina canariensis, d'Orbigny, 1839, *Foram. Canaries*, p. 128, pl. ii., figs. 33, 34.

Haplophragmium canariense, Brady, 1884, *Report "Challenger,"* p. 310, pl. xxxv., figs. 1—5.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common. The specimens are all very neatly built, and with a large proportion of reddish brown cement. They are all of the compressed variety.

Haplophragmium anceps, Brady.

Haplophragmium anceps, Brady, 1884, *Report "Challenger,"* p. 313, pl. xxxv., figs. 12—15.

,, ,, Chaster, 1892, *Report Southport Soc. Nat. Sci.*, p. 57, pl. i., fig. 2.

Very rare. The specimens are also very small.

Previously recorded in Great Britain only by Dr. Chaster (*op. cit.*), from Southport, where also it is very small and rare. It is normally a deep-water species, at home in depths of 1,500—2,000 fathoms.

Placopsilina, d'Orbigny.

Placopsilina cenomana, d'Orbigny.

Placopsilina cenomana, d'Orbigny, 1850, *Prodr. Paléont.*, vol. ii., p. 185, No. 758.

,, ,, Brady, 1884, *Report "Challenger,"* p. 315, pl. xxxvi., figs. 1—3.

Placopsilina cenomana, Brady, 1887, *Synopsis of British Recent Foraminifera.*

Rare.

Sub-family 2—TROCHAMMININAE.

Thurammina, Brady.

Thurammina papillata, Brady.

"Orbuline *Lituola*," Carpenter, 1875, *The Microscope*, 5th ed., p. 533, fig. 273, g, h.

Thurammina papillata, Brady, 1879, *Quart. Jour. Micr. Sci.*, vol. xix., N.S., p. 45, pl. v., figs. 4—8.

" " Brady, 1884, *Report "Challenger,"* p. 321, pl. xxxvi., figs. 7—18.

" " Brady, 1887, *Synopsis British Recent Foraminifera.*

The specimens figured in Plate 11, Figs. 6, 7, and Plate 14, Figs. 1, 3, give but a very faint idea of the protean forms assumed by the organism which is, with some hesitation on the part of Mr. J. Wright and myself, referred to this species. They are of fairly frequent occurrence in the shore-sand, and no two specimens are alike, some being comparatively smooth and more or less regular in shape, while others are of the roughest construction and more or less lobate in outline. The specimens are both free and attached, and the free-growing tests are usually of much neater and more regular construction than the attached specimens. In colour they are of a light grey, and composed of sand-grains and a grey cement. The size of the sand-grains is very variable, even in a single specimen, and frequently one or more sand-grains of relatively enormous size (one-sixth to one-fourth of the whole bulk of the test) are built into the test, from the surface of which they project, giving a very rough and unfinished appearance to the shell. The sand-grains are attached to a delicate chitinous membrane which lines the cavity, and which in detached specimens is observable as a transparent film enclosing the body cavity. The "irregularly disposed perforate papillae," which, according to Brady, are characteristic of the test, are well marked in some specimens; in others they are entirely absent.

Brady records a single specimen of *Thurammina papillata* from Loch Scavaig, West Scotland, 45—60 fathoms, but does not state whether it was of normal character. Mr. Wright has

records from the south-west of Ireland, 38—110 fathoms, but he informs me that his specimens were as spherical as *Orbulina universa*, d'Orbigny.

Although the Bognor specimens are so different in appearance from Brady's figures and Mr. Wright's Irish specimens, they agree fairly well with Brady's description of the species, which is admittedly subject to great variation. It further appears that fossil specimens are of greater diversity than recent ones. Writing of Dr. Haeusler's Jurassic specimens, Brady states that "comparatively few show any signs of external symmetry."

Ammodiscus, Reuss.

Ammodiscus incertus, d'Orbigny, sp.

Operculina incerta, d'Orbigny, 1839, *De la Sagra's Hist. Phisiq.*, etc., Cuba, "Foraminifères," p. 49, pl. vi., figs. 16, 17.

Ammodiscus incertus, Brady, 1884, *Report "Challenger,"* p. 330, pl. xxxviii., figs. 1—3.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

One specimen only found.

Ammodiscus gordialis, Jones & Parker, sp.

Trochammina squamata gordialis, Jones & Parker, 1860, *Quart. Jour. Geol. Soc.*, vol. xvi., p. 304.

Ammodiscus gordialis, Brady, 1884, *Report "Challenger,"* p. 333, pl. xxxviii., figs. 7—9.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Trochammina, Parker & Jones.

Trochammina squamata, Jones & Parker.

Trochammina squamata, Jones & Parker, 1860, *Quart. Jour. Geol. Soc.*, vol. xvi., p. 304.

,, ,, Brady, 1884, *Report "Challenger,"* p. 337, pl. xli., fig. 3.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Trochammina inflata, Montagu, sp.

Nautilus inflatus, Montagu, 1808, *Test. Brit. Suppl.*, p. 81, pl. xviii., fig. 3.
Trochammina inflata, Brady, 1884, *Report "Challenger,"* p. 338, pl. xli., fig. 4, a—c.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common. The specimens are very fine and strongly built, and much larger than those which I obtained at Hampton, near Whitstable, in Kent. Brady states that the species is rarely met with, except in brackish waters, but many of the specimens have every appearance of having lived in the neighbourhood where they were gathered, the sarcode being still visible in many broken shells.

Trochammina inflata, var. **macrescens,** Brady.

Trochammina inflata, var. *macrescens*, Brady, 1870, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. vi., p. 290, pl. xi., fig. 5.

Rare. Brady regards this as merely a depauperated form of *T. inflata*, due to existence in brackish pools, where the proportion of mineral constituents is so small that the animal is unable to secrete a firm shell. The test thus becomes little more than a chitinous envelope, so thin that the inflated contour of the segments is lost when the specimens are taken out of fluid and dried.

It is difficult to understand how such a fragile shell can have been transported many miles, such as would be required to meet the conditions required in the above hypothesis, without being entirely destroyed.

Trochammina robertsoni, Brady.

Trochammina robertsoni, Brady, 1887, *Journ. R. Micr. Soc.*, pt. vi., p. 893.
,, ,, J. Wright, 1890—1, *Proc. R. Irish Acad.*, 3rd ser., vol. i., No. 4, p. 469, pl. xx., fig. 4, a, b.

One specimen only found by Mr. Wright.

Family V.—TEXTULARIDAE.

Sub-family 1—TEXTULARINAE.

Textularia, Defrance.

Textularia gramen, d'Orbigny.

Textularia gramen, d'Orbigny, 1846, *For. Foss. Vienne*, p. 248, pl. xv., figs. 4—6.
,, ,, Brady, 1884, *Report "Challenger,"* p. 365, pl. xliii., figs. 9, 10.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Spiroplecta, Ehrenberg.

Spiroplecta saggitula, Defrance, sp.

Textularia sagittula, Defrance, 1824, *Dict. Sci. Nat.*, vol. xxxii., p. 177; vol. liii., p. 344; *Atlas Conch.* pl. xiii., fig. 5.
,, ,, Brady, 1884, *Report "Challenger,"* p. 361, pl. xlii., figs. 17, 18.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*
Spiroplecta sagittula, Wright, 1902, *Irish Naturalist*, vol xi., p. 211, pl. iii., figs. a—e.

Rare.

Spiroplecta fusca, nov. sp.

Test sub-arenaceous, elongate, compressed, stoutly built; lateral edges slightly lobulate, sub-angular, being more or less rounded in the terminal segments; chambers somewhat inflated; colour, brown. The spiral commencement consists of from four to six segments, the biserial portion of from five to ten segments in each series. The contour of the shell varies considerably, some specimens being very elongate, while others are short and widen rapidly towards the distal end. Length, $\frac{1}{30}$ in.; breadth, $\frac{1}{60}$ in. (Plate 12, Figs. 1, 2, 3.)

The foregoing is the description of a foraminifer which is of fairly frequent occurrence in the gathering, and for which Mr. J. Wright has happily suggested the specific name of *fusca*, owing to its characteristic reddish brown colour. Mr. F. W. Millett,

F.R.M.S., to whom specimens were submitted by Mr. Wright, regards them as hybrids between *Spiroplecta biformis*, Parker & Jones, and *Spiroplecta americana*, Ehrenberg.

Spiroplecta biformis, Parker & Jones, sp.

Textularia agglutinans, var. *biformis*, Parker & Jones, 1865, *Phil. Trans.*, vol. clv., p. 370, pl. xv., figs. 23, 24.

Spiroplecta biformis, Brady, 1884, *Report "Challenger,"* p. 376, pl. xlv., figs. 22, 23, a, b.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Two specimens only found.

Gaudryina, d'Orbigny.

Gaudryina subrotundata, Schwager.

Gaudryina subrotundata, Schwager, 1866, *Novara Exped. Geol.* (2), p. 198, pl. iv., fig. 9, a, b, c.

,, ,, Brady, 1884, *Report "Challenger,"* p. 380, pl. xlvi., fig. 13, a, b, c.

Very rare. Not previously recorded in Great Britain.

Gaudryina filiformis, Berthelin.

Gaudryina filiformis, Berthelin, 1880, *Mem. Soc. Geol. France*, sér. 3, vol. i., No. 5, p. 25, pl. i., fig. 8.

,, ,, Brady, 1884, *Report "Challenger,"* p. 380, pl. xlvi., fig. 12, a, b, c.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare. The species is not uncommon in Irish dredgings.

Verneuilina, d'Orbigny.

Verneuilina spinulosa, Reuss.

Verneuilina spinulosa, Reuss, 1849, *Denkschr. d. K. Ak. Wiss. Wien*, vol i., p. 374, pl. xlvii., fig. 12.

,, ,, Brady, 1884, *Report "Challenger,"* p. 384, pl. xlvii., figs. 1—3.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

This species is included in the list with some hesitation, as only a single specimen was found, and this is very poor and small. It is one of the most typical and widely distributed of all

species in tropical and sub-tropical shallow waters, and has also been recorded in Great Britain from Westport, Ireland (Brady), Dublin coast (Balkwill & Wright), and the estuary of the Dee (Siddall).

Verneuilina polystropha, Reuss, sp.

Bulimina polystropha, Reuss, 1845, *Verstein. Böhm. Kreid.*, pt. ii., p. 109, pl. xxiv., fig 53.
Verneuilina polystropha, Brady, 1884, *Report "Challenger,"* p. 386, pl. xlvii., figs. 15—17.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common. Both the short and broad and the long and slender varieties occur.

Clavulina, d'Orbigny.

Clavulina obscura, Chaster.

Verneuilina polystropha, Reuss, sp., *dimorphous* form, Wright, 1886, *Proc. Belfast Nat. Field Club* (1885—6), Appendix, p. 320, pl. xxvi., fig. 2.
Clavulina obscura, Chaster, 1892, *First Rep. Southport Soc. Nat. Sci.* (1890—1), p. 58, pl. i., fig. 4.

Very rare.

Bulimina, d'Orbigny.

Bulimina elegans, d'Orbigny.

Bulimina elegans, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 270, No. 10; *Modèle*, No. 9.
,, ,, Brady, 1884, *Report "Challenger,"* p. 398, pl. l., figs. 1—4.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Bulimina ovata, d'Orbigny.

Bulimina ovata, d'Orbigny, 1846, *Foram. Foss. Vienne*, p. 185, pl. xi., figs. 13, 14.
,, ,, Brady, 1884, *Report "Challenger,"* p. 400, pl. l., fig. 13.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Bulimina pupoides, d'Orbigny.

Bulimina pupoides, d'Orbigny, 1846, *Foram. Foss. Vienne*, p. 185, pl. xi., figs. 11, 12.
,, ,, Brady, 1884, *Report "Challenger,"* p. 400, pl. l., fig. 15, a, b.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Bulimina elongata, d'Orbigny.

Bulimina elongata, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 269, No. 9.
,, ,, Brady, 1884, *Report "Challenger,"* p. 401, pl. li., figs. 1, 2.

Frequent. This form has been recently recorded in the *Irish Naturalist* for the first time in Great Britain by Mr. George Gough, F.G.S., from Larne Harbour. Mr. Wright informs me that he has met with it at a few other Irish stations.

Bulimina squamigera, d'Orbigny.

Bulimina squamigera, d'Orbigny, 1839, *Foram. Canaries*, p. 137, pl. i., figs. 22—24.
,, ,, Siddall, 1878, *Proc. Chester Soc. Nat. Sci.*, pt. ii., p. 49.

Rare. Previously recorded in Great Britain only by Siddall from the estuary of the Dee, but Mr. Wright has found it at a number of Irish stations.

Bulimina marginata, d'Orbigny.

Bulimina marginata, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 269, No. 4, pl. xii., figs. 10—12.
,, ,, Brady, 1884, *Report "Challenger,"* p. 405, pl. li., figs. 3—5.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Bulimina aculeata, d'Orbigny.

Bulimina aculeata, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 269, No. 7.
,, ,, Soldani, *Testaceographia*, vol. i., pt. 2, p. 118, pl. cxxvii., fig. I., pl. cxxx., fig. v.v.

Bulimina aculeata, Brady, 1884, *Report "Challenger,"* p. 406, pl. li., figs. 7—9.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare; the specimens are also very weak.

Bulimina elegantissima, d'Orbigny.

Bulimina elegantissima, d'Orbigny, 1839, *Foram. Amér. Mérid.*, p. 51, pl. vii., figs. 13, 14.
,, ,, Brady, 1884, *Report "Challenger,"* p. 402, pl. l., figs. 20—22.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Bolivina, d'Orbigny.

Bolivina punctata, d'Orbigny.

Bolivina punctata, d'Orbigny, 1839, *Foram. Amér. Mérid.*, p. 63, pl. viii., figs. 10—12.
,, ,, Brady, 1884, *Report "Challenger,"* p. 417, pl. lii., figs. 18, 19.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Bolivina laevigata, Williamson, sp.

Textularia variabilis, var. *laevigata*, Williamson, 1858, *Rec. For. Gt. Br.*, p. 77, pl. vi., fig. 168.
Bolivina textilarioides, Reuss, 1862, *Sitzungsb. d. k. Akad. Wiss. Wien*, vol. xlvi., p. 81, pl. x., fig. 1.
,, ,, Brady, 1884, *Report "Challenger,"* p. 419, pl. lii., fig. 23—25.
Bolivina laevigata, Brady, 1887, *Synopsis British Recent Foraminifera.*

One specimen only found.

Bolivina dilatata, Reuss.

Bolivina dilatata, Reuss, 1849, *Denkschr. d. k. Akad. Wiss. Wien*, vol. i., p. 381, pl. xlviii., fig. 15.
,, ,, Brady, 1884, *Report "Challenger,"* p. 418, pl. lii., figs. 20, 21.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Bolivina tortuosa, Brady.

Bolivina tortuosa, Brady, 1881, *Quart. Jour. Micr. Sci.*, xxi., p. 57.

,, ,, Brady, 1884, *Report "Challenger,"* p. 420, pl. lii., figs. 31—34.

Rare. Not previously recorded in Great Britain. It is of fairly frequent occurrence in tropical and sub-tropical seas, ranging from shallow water down to 675 fathoms, the deepest record, which is in the *Challenger* dredging, Station 120, off Pernambuco. It does not appear to have been recorded anywhere north of the Cape Verde Islands.

Bolivina nobilis, Hantken.

Bolivina nobilis, Hantken, 1875 (1876), *A magy. Kir. földt. int. évkönyve*, iv., 56, pl. xv., fig. 4, and *Mitth. a. d. Jahrb. K. ungar. geol. Anstalt*, iv., 1875 (1881), 65, same plate and figure.

,, ,, Brady, 1884, *Report "Challenger,"* p. 424, pl. liii., figs. 14, 15.

Very rare. Not previously recorded in Great Britain, but Mr. Wright informs me that he has found it at Rockport, Belfast Lough, Strangford Lough, and Carlingford, and that Mr. F. W. Millett has obtained specimens from Torbay, Devonshire.

Brady records it from the South Pacific only. Mr. Millett found it in the Malay Archipelago, and I have specimens from anchor mud, Mauritius.

Bolivina plicata, d'Orbigny.

Bolivina plicata, d'Orbigny, 1839, *Foram. Amér. Mérid.*, p. 62, pl. viii., figs. 4—7.

,, ,, Brady, 1870, *Ann. and Mag. Nat. History*, ser. 4, vol. vi., p. 302, pl. xii., fig. 7.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common.

Sub-family 3—CASSIDULININAE.

Cassidulina, d'Orbigny.

Cassidulina crassa, d'Orbigny.

Cassidulina crassa, d'Orbigny, 1839, *Foram. Amér. Mérid.*, p. 56, pl. vii., figs. 18—20.

Cassidulina crassa, Brady, 1884, *Report "Challenger,"* p. 429, pl. liv., figs. 4, 5.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

One specimen only found.

Family VII.—LAGENIDAE.

Sub-family 1—Lageninae.

Lagena, Walker & Boys.

Lagena globosa, Montagu, sp.

Vermiculum globosum, Montagu, 1803, *Test. Brit.*, p. 523.
Lagena globosa, Brady, 1884, *Report "Challenger,"* p. 452, pl. lvi., figs. 1—3.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Lagena laevis, Montagu, sp.

Vermiculum laeve, Montagu, 1803, *Test. Brit.*, p. 524.
Lagena laevis, Brady, 1884, *Report "Challenger,"* p. 455, pl. lvi., figs. 7—14, 30.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common.

Lagena laevis, var. **clavata,** d'Orbigny, sp.

Oolina clavata, d'Orbigny, 1846, *For. Foss. Vienne*, p. 24, pl. i., figs. 2, 3.
Lagena vulgaris, var. *clavata*, Williamson, 1858, *Rec. For. Gr. Br.*, p. 5, pl. i., fig. 6.
Lagena clavata, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common.

Lagena lineata, Williamson, sp.

Entosolenia globosa, var. *lineata*, Williamson, 1858, *Rec. For. Gr. Br.*, p. 9, pl. i., fig. 17.
Lagena lineata, Brady, 1884, *Report "Challenger,"* p. 461, pl. lvii., fig. 13.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Lagena hispida, Reuss.

Lagena hispida, Reuss, 1858, *Zeitschr. d. deutsch. geol. Gesell.*, vol. x., p. 434.
,, ,, Brady, 1884, *Report "Challenger,"* p. 459, pl. lvii., figs. 1—4, and pl. lix., figs. 2—5.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Lagena sulcata, Walker & Jacob, sp.

Serpula (Lagena) sulcata, Walker & Jacob, 1798, *Adam's Essays*, Kanmacher's ed., p. 634, pl. xiv., fig. 5.
Lagena sulcata, Brady, 1884, *Report "Challenger,"* p. 462, pl. lvii., figs. 23, 25, 26, 27, 33, 34, and pl. lviii., figs. 4, 5, 6, 17, 18.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent. Nearly all the specimens belong to Williamson's var. *interrupta*, in which the costae are of unequal length and discontinuous on the surface of the test. The variety, however, is of such a trivial character that it does not seem to be worth a separate record. Nearly every specimen of *L. sulcata* from shallow water possesses these features in a more or less marked degree.

Lagena striata, d'Orbigny, sp.

Oolina striata, d'Orbigny, 1839, *Foram. Amér. Mérid.*, p. 21, pl. v., fig. 12.
Lagena striata, Brady, 1884, *Report "Challenger,"* p. 460, pl. lvii., figs. 22, 24, 28, 29, etc.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Lagena semistriata, Williamson.

Lagena striata, var. *semistriata*, Williamson, 1848, *Ann. Mag. Nat. Hist.*, ser. 2, vol. i., p. 14, pl. i., figs. 9, 10.
Lagena semistriata, Brady, 1884, *Report "Challenger,"* p. 465, pl. lvii., figs. 14, 16, 17.

Lagena semistriata, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Lagena williamsoni, Alcock, sp.

Entosolenia williamsoni, Alcock, 1865, *Proc. Lit. and Phil. Soc. Manchester*, vol. iv., p. 195.

Lagena williamsoni, Balkwill & Wright, 1885, *Trans. R. Irish Acad.*, xxviii. (*Sci.*), p. 339, pl. xiv., figs. 6—8.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common.

Lagena stelligera, Brady.

Lagena stelligera, Brady, 1881, *Quart. Jour. Micr. Sci.*, vol. xxi., N.S., p. 60.

,, ,, Brady, 1884, *Report "Challenger,"* p. 466, pl. lvii., figs. 35, 36.

A single long and narrow specimen found by myself. The radiating base is well defined. Not previously recorded in Great Britain.

This is a deep-water form. Brady records it from fourteen localities in the Atlantic, Pacific, and southern oceans, ranging down to 2,740 fathoms. Only three of the records are of less depth than 1,300 fathoms.

Lagena squamosa, Montagu, sp.

Vermiculum squamosum, Montagu, 1803, *Test. Brit.*, p. 526, pl. xiv., fig. 2.

Lagena squamosa, Brady, 1884, *Report "Challenger,"* p. 471, pl. lviii., figs. 28—31.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Lagena squamosa, var. **montagui**, Alcock, sp.

Entosolenia montagui, Alcock, 1865, *Proc. Lit. and Phil. Soc. Manchester*, vol. iv., No. 15.

Lagena squamosa, var. *montagui*, J. Wright, 1900, *Irish Naturalist*, vol. ix., No. 3, p. 54, pl. ii., fig. 2.

Very rare. This striking variety, although described by Alcock in 1865, was not figured, and appears to have been over-

looked until Mr. J. Wright recognised and figured it in his paper on the Foraminifera of Dog's Bay, Connemara. Its appearance is very striking when compared with the type, the test being much larger and more globular, while the surface markings are smaller and sometimes very weakly marked. The shell is often more or less irregularly compressed. According to Mr. Wright, the variety is generally distributed round the Irish coast, though rare compared with the type. This probably agrees with its distribution elsewhere. I first observed the variety nearly twenty years ago in the shore-sands of St. Brélade's Bay and St. Clement's Bay, Jersey, where it occurs with some frequency, the type being very abundant.

Lagena reticulata, MacGillivray, sp.

Lagenula reticulata, MacGillivray, 1843, *Hist. test. anim. Aberdeen*, etc., p. 38.

Lagena reticulata, Reuss, 1862 (1863), *Sitz. k. Ak. Wiss. Wien*, xlvi. (1), p. 333, pl. v., figs. 67 and 68.

Frequent. Usually regarded as a variety intermediate between the last species and the next (*L. hexagona*, Will.).

Lagena hexagona, Williamson, sp.

Entosolenia squamosa, var. *hexagona*, Williamson, 1848, *Ann. Mag. Nat. Hist.*, ser. 2, vol. i., p. 20, pl. ii., fig. 23.

Lagena hexagona, Brady, 1884, *Report "Challenger,"* p. 472, pl. lviii., figs. 32, 33.

" " Brady, 1887, *Synopsis British Recent Foraminifera.*

One specimen only found.

Lagena marginata, Walker & Boys.

Serpula (Lagena) marginata, Walker & Boys, 1784, *Test. Min.*, p. 2, pl. i., fig. 7.

Lagena marginata, Brady, 1884, *Report "Challenger,"* p. 476, pl. lix., figs. 21—23.

" " Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Lagena lucida, Williamson, sp.

Entosolenia marginata, var. *lucida*, Williamson, 1858, *Rec. For. Gt. Br.*, p. 10, pl. i., figs. 22, 23.

Lagena oblonga (Seguenza), J. Wright, 1876—7, *Proc. Belfast F.C.* (Appx.), p. 104, pl. iv., fig. 9, a, b.
Lagena lucida, Brady, 1887, *Synopsis British Recent Foraminifera.*

Most abundant. Trigonal specimens, similar to that figured by Mr. Wright under the name of *L. oblonga* (Seguenza), also occur, as they do wherever the type is common, but as usual they are very rare.

Lagena quadrata, Williamson, sp.

Entosolenia marginata, var. *quadrata*, Williamson, 1858, *Rec. For. Gt. Br.*, p. 11, pl. i., figs. 27, 28.
Lagena quadrata, Brady, 1884, *Report "Challenger,"* p. 475, pl. lix., figs. 3 and 16.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

One long and slender specimen found by Mr. Wright.

Lagena quadricostulata, Reuss.

Lagena quadricostulata, Reuss, 1870, *Sitz. k. Ak. Wiss. Wien*, lxii. (1), p. 469; figured by Von Schlicht, "Foram. Septar. Pietzpuhl," 1870, pl. iv., figs. 25—30.
,, ,, Brady, 1884, *Report "Challenger,"* p. 486, pl. lix., fig. 15.

Rare.

Lagena orbignyana, Seguenza, sp.

Fissurina orbignyana, Seguenza, 1862, *Foram. Monotal. Mess.*, p. 66, pl. ii., figs. 25, 26.
Lagena orbignyana, Brady, 1884, *Report "Challenger*, p. 484, pl. lix., figs. 1, 18, 24—26.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Sub-family 2—NODOSARINAE.

Nodosaria, Lamarck.

Nodosaria laevigata, d'Orbigny.

Nodosaria (*Glandulina*) *laevigata*, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 252, No. 1, pl. x., figs. 1—3.

Nodosaria laevigata, Brady, 1884, *Report "Challenger,"* pp. 490, 493, pl. lxi., figs. 17—22 and 32.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Nodosaria soluta, Reuss, sp.

Dentalina soluta, Reuss, 1851, *Zeitschr. deutsch. geol. Ges.*, iii., p. 60, pl. iii., fig. 4.
Nodosaria soluta, Brady, 1884, *Report "Challenger,"* p. 503, pl. lxii., figs. 13—16.

Very rare. Not previously recorded in Great Britain.

Nodosaria communis, d'Orbigny.

Nodosaria (*Dentalina*) *communis*, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 254, No. 35.
Nodosaria communis, Brady, 1884, *Report "Challenger,"* p. 504, pl. lxii., figs. 19—22.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Nodosaria scalaris, Batsch, sp.

Nautilus (*Orthoceras*) *scalaris*, Batsch, 1791, *Conchyl. des Seesandes*, No. 4, pl. ii., fig. 4.
Nodosaria scalaris, Brady, 1884, *Report "Challenger,"* p. 510, pl. lxiii., figs. 28—31, and lxiv., figs. 16—19.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

One small and broken specimen was found.

Vaginulina, d'Orbigny.

Vaginulina legumen, Linné, sp.

Nautilus legumen, Linné, 1758, *Syst. Nat.*, 10th ed., p. 711, No. 248; 1767, *ibid.*, 12th ed., p. 1164, No. 288.
Vaginulina legumen, Brady, 1884, *Report "Challenger,"* p. 530, pl. lxvi., figs. 13—15.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

One large specimen was found by Mr. Wright.

Cristellaria, Lamarck, sp.

Cristellaria crepidula, Fichtel & Moll.

Nautilus crepidula, Fichtel & Moll, 1803, *Test. Micr.*, p. 107, pl. xix., figs. g—i.

Cristellaria crepidula, Brady, 1884, *Report "Challenger,"* p. 542, pl. lxvii., figs. 17, 19, 20, and pl. lxviii., figs. 1, 2.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

One large broken specimen found.

Cristellaria gibba, d'Orbigny.

Cristellaria gibba, d'Orbigny, 1826, *Ann. Sci. Nat.*, vii., p. 292, No. 17.

,, ,, Brady, 1884, *Report "Challenger,"* p. 546, pl. lxix., figs. 8, 9.

Very rare. The specimens are very small.

Cristellaria aculeata, d'Orbigny.

Cristellaria aculeata, d'Orbigny, 1826, *Ann. Sci. Nat.*, vii., p. 292, No. 14.

,, ,, Brady, 1884, *Report "Challenger,"* p. 555, pl. lxxi., figs. 4, 5.

One small and immature specimen, found by Mr. Wright, and one much larger shell found by myself. The species has not been previously recorded in Great Britain.

Polymorphina, d'Orbigny.

Polymorphina lactea, Walker & Jacob, sp.

Serpula lactea, Walker & Jacob, 1798, *Adam's Essays*, Kanmacher's ed., p. 634, pl. xiv., fig. 4.

Polymorphina lactea, Brady, 1884, *Report "Challenger,"* p. 559, pl. lxxi., figs. 11—14, pl. lxxiii., fig. 14.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Polymorphina lactea, var. **oblonga**, Williamson.

Polymorphina lactea, var. *oblonga*, Williamson, 1858, *Rec. For. Gt. Br.*, p. 71, pl. vi., figs. 149, 149A.

One specimen only found.

Polymorphina lanceolata, Reuss.

Polymorphina lanceolata, Reuss, 1851, *Zeitschr. d. deutsch. geol. Gesell.*, vol. iii., p. 83, pl. vi., fig. 50.
,, ,, Brady, 1884, *Report "Challenger,"* p. 564, pl. lxxii., figs. 5, 6.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Polymorphina compressa, d'Orbigny.

Polymorphina compressa, d'Orbigny, 1846, *For. Foss. Vienne*, p. 233, pl. xii., figs. 32—34.
,, ,, Brady, 1884, *Report "Challenger,"* p. 565, pl. lxxii., figs. 9—11.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Polymorphina rotundata, Bornemann, sp.

Guttulina rotundata, Bornemann, 1855, *Zeitschr. d. deutsch. geol. Gesell.*, vol. vii., p. 346, pl. xviii., fig. 3.
Polymorphina rotundata, Brady, 1884, *Report "Challenger,"* p. 570, pl. lxxiii., figs. 5—8.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Polymorphina regina, Brady, Parker & Jones.

Polymorphina regina, Brady, Parker & Jones, 1870, *Trans. Linn. Soc.*, xxvii., p. 241, pl. xli., fig. 32, a, b.
,, ,, Brady, 1884, *Report "Challenger,"* p. 571, pl. lxxiii., figs. 5—8.

A single specimen found.

Not previously recorded in Great Britain. Brady states that its distribution is confined to shallow water in the warm Pacific. It is common round the Australian coast-line.

Polymorphina concava, Williamson.

Polymorphina lactea, var. *concava*, Williamson, 1858, *Rec. For. Gt. Br.*, p. 72, pl. vi., figs. 151, 152.

Very rare.

Uvigerina, d'Orbigny.

Uvigerina canariensis, d'Orbigny.

Uvigerina canariensis, d'Orbigny, 1839, *Foram. Canaries*, p. 138, pl. i., figs. 25—27.

,, ,, Brady, 1884, *Report "Challenger,"* p. 573, pl. lxxiv., figs. 1—3.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent. Brady mentions the species as having been recorded from three British localities—viz. Holy Island (Brady), estuary of the Dee (Siddall), and South-west Ireland (J. Wright), at all which it is very rare. Since 1887 a fourth locality, Southport, has been recorded, a single specimen having been found there by Dr. Chaster.

Uvigerina asperula, Czjzek.

Uvigerina asperula, Czjzek, 1848, *Haidinger's Naturw. Abh.*, ii., p. 146, pl. xiii., figs. 14, 15.

,, ,, Brady, 1884, *Report "Challenger,"* p. 578, pl. lxxv., figs. 6—8.

A single very weak specimen found.

Uvigerina angulosa, Williamson.

Uvigerina angulosa, Williamson, 1858, *Rec. For. Gt. Br.*, p. 67, pl. v., fig. 140

,, ,, Brady, 1884, *Report "Challenger,"* p. 576, pl. lxxiv., figs. 15—18.

Very rare.

Uvigerina porrecta, Brady.

Uvigerina porrecta, Brady, 1879, *Q. Jour. Mic. Sci.*, xix., p. 60, pl. viii., figs. 15, 16.

,, ,, Brady, 1884, *Report "Challenger,"* p. 577, pl. lxxiv., figs. 21—23.

Very rare. The species has not been previously recorded in Great Britain. It is of frequent occurrence in tropical shallow waters.

Family VIII.—GLOBIGERINIDAE.

Globigerina, d'Orbigny.

Globigerina bulloides, d'Orbigny.

Globigerina bulloides, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 277, No. 1; *Modèle*, No. 17 (young), No. 76.

Globigerina bulloides, Brady, 1884, *Report "Challenger,"* p. 593, pl. lxxvii. and pl. lxxix., figs. 3—7.
Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Sphaeroidina, d'Orbigny.

Sphaeroidina bulloides, d'Orbigny.

Sphaeroidina bulloides, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 267, No. 1 ; *Modèle*, No. 65.
,, ,, Brady, 1884, *Report "Challenger,"* p. 620, pl. lxxxiv., figs. 1—7.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare. The specimens are poor, and are recorded with some hesitation. It is not uncommon off the south-west of Ireland in some of Mr. Wright's dredgings.

Pullenia, Parker & Jones.

Pullenia quinqueloba, Reuss.

Nonionina quinqueloba, Reuss, 1851, *Zeitschr. d. deutsch. geol. Gesell.*, vol. iii., p. 71, pl. v., fig. 31.
Pullenia quinqueloba, Brady, 1884, *Report "Challenger,"* p. 617, pl. lxxxiv., figs. 14, 15.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Family IX.—ROTALIDAE.

Sub-family 1—SPIRILLININAE.

Spirillina, Ehrenberg.

Spirillina vivipara, Ehrenberg.

Spirillina vivipara, Ehrenberg, 1841, *Abhandl. k. Akad. Wiss. Berlin*, p. 442, pl. iii., fig. 41.
,, ,, Brady, 1884, *Report "Challenger,"* p. 630, pl. lxxxv. figs. 1—5.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

A single specimen found.

Sub-family 2—Rotalinae.

Patellina, Williamson.

Patellina corrugata, Williamson.

Patellina corrugata, Williamson, 1858, *Rec. For. Gt. Br.*, p. 46, pl. iii., figs. 86—89.
,, ,, Brady, 1884, *Report "Challenger,"* p. 634, pl. lxxxvi., figs. 1—7.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Discorbina, Parker & Jones.

Discorbina globularis, d'Orbigny, sp.

Rosalina globularis, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 271, No. 1, pl. xiii., figs. 1—4; *Modèle*, No. 69.
Discorbina globularis, Brady, 1884, *Report "Challenger,"* p. 643, pl. lxxxvi., figs. 8 and 13.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Discorbina obtusa, d'Orbigny, sp.

Rosalina obtusa, d'Orbigny, 1846, *Foram. Foss. Vienne*, p. 179, pl. xi., figs. 4—6.
Discorbina obtusa, Brady, 1884, *Report "Challenger,"* p. 644, pl. xci., fig. 9, a, b, c.

Common. The specimens are small. Plastogamic specimens are not uncommon. (Plate 12, Fig. 8, and Plate 14, Fig. 4.)

Mr. J. Wright informs me that this form is very common in many boulder clays.

Discorbina rosacea, d'Orbigny, sp.

Rotalina rosacea, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 273, No. 15; *Modèle*, No. 39.
Discorbina rosacea, Brady, 1884, *Report "Challenger,"* p. 644, pl. lxxxvii., figs. 1 and 4.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Discorbina orbicularis, Terquem, sp.

Rosalina orbicularis, Terquem, 1876, *Anim. sur la plage de Dunkerque*, fasc. 2, p. 75, pl. ix., fig. 4.

Discorbina orbicularis, Brady, 1884, *Report "Challenger,"* p. 647, pl. lxxxviii., figs. 4—8.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Discorbina parisiensis, d'Orbigny, sp.

Rosalina parisiensis, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 271, No. 1; *Modèle*, No. 38.

Discorbina parisiensis, Brady, 1884, *Report "Challenger,"* p. 648, pl. xc., figs. 5, 6, 9—12.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very common. The specimens are small and somewhat variable, showing a great tendency to merge in the next species, *Discorbina wrightii*, Brady, from which it is not always easily distinguishable. I am of opinion that the two forms are very closely allied, if, indeed, they are not identical. (Plate 12, Figs. 4—7, and Plate 14, Fig. 5.)

A very noticeable feature in connection with the occurrence of these two forms at Bognor is the exceptionally large number of "twin" or *plastogamic** specimens which are to be found.

* *Plastogamy.*—Plastogamy is the term used to describe the more or less permanent union of two or more specimens of a foraminifer, and it appears to be due "to the conjugation of two or more individuals, whose nuclei are in a state of rest—*i.e.* not undergoing sub-division" (Chapman).

The Foraminifera in general are reproduced by a process of sub-division. The nucleus breaks up into a number of nucleoli. Each nucleolus takes to itself a portion of the parent's protoplasm, secretes a test or shell, and commences a separate existence, either within the parent shell or in its immediate vicinity. This method of reproduction by means of the sub-division of an active nucleus has been called "karyogamy." It is asexual, and, continued indefinitely, would no doubt end in the weakening and perhaps extinction of the stock.

Plastogamy, on the other hand, probably partakes more or less of the nature of a sexual conjugation, although there is at present no evidence in support of the sexual theory, and its object may be the rejuvenescence of a stock exhausted by long-continued karyogamy. It has been observed in many genera; I have myself notes of its occurrence in *Peneroplis*, *Textularia*, *Verneuilina*, *Bulimina*, *Lagena*, *Marginulina*, *Cristellaria*, *Patellina*, *Discorbina*, *Rotalia*, *Nonionina*, and *Polystomella*. It is,

Probably not less than 10 per cent. of all the specimens show more or less evidence of this phenomenon.

From the large number of specimens observed at Bognor it is possible to add several observations to the foregoing description. I have noted :—

1. The two specimens are rarely identical in size, and sometimes the disparity is very noticeable.

2. The apertures do not necessarily coincide, and in a great number of instances the edges overlap, or the smaller specimen is set to one side of the vertical axis of the larger specimen.

3. Sometimes three, four, or more specimens are united in a more or less irregular manner (Plate 12, Fig. 7).

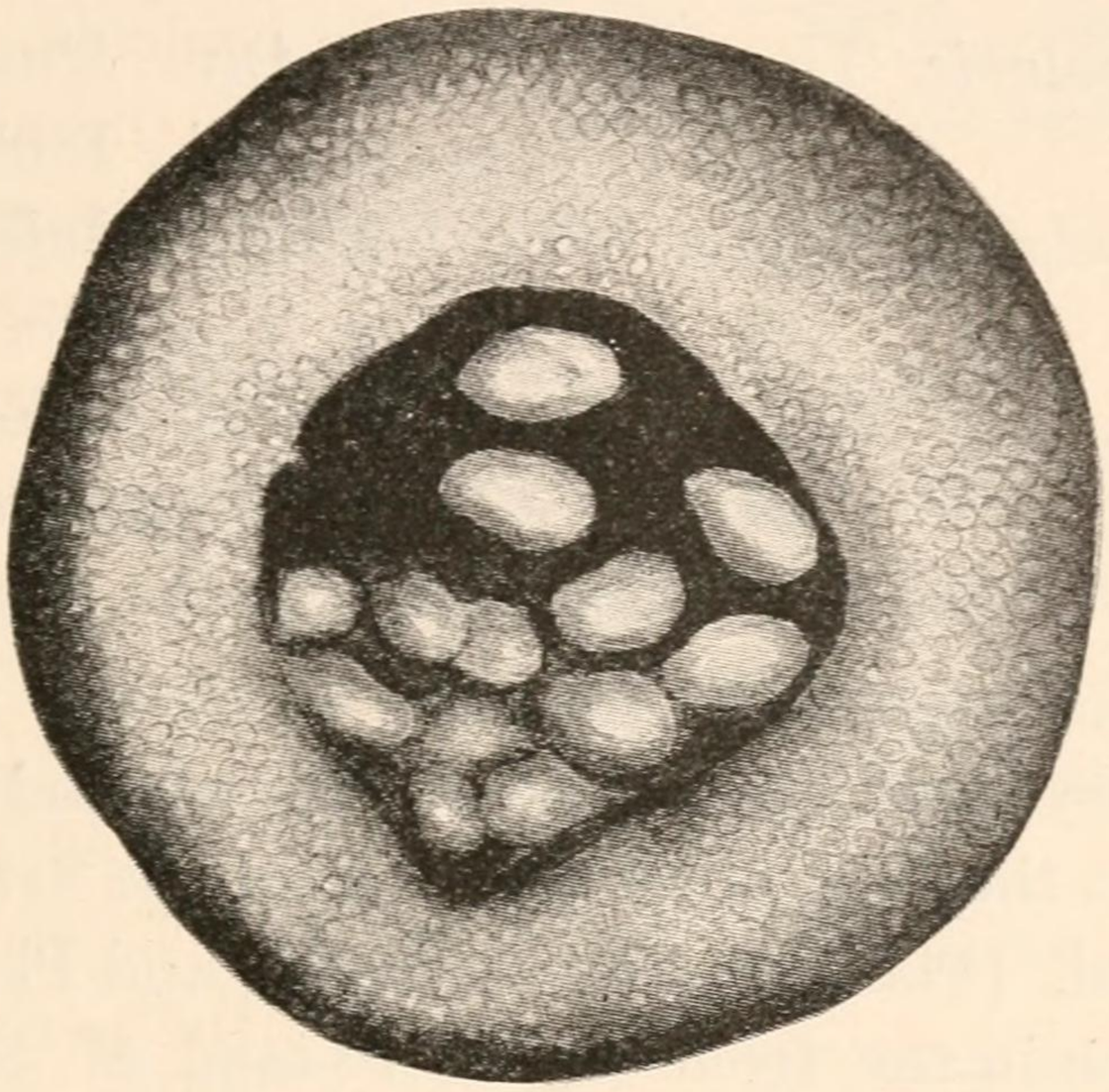
4. That in many instances the two specimens represent varying types, one being of the outspread *D. parisiensis*, while the other comes nearer to the more compact *D. wrightii*.

After the fusion of the protoplasm and the formation of the young brood within the cavities of the united parent shells, it appears that the shell substance by which the parents are united is again absorbed, and that separation of the parent shells ensues, the young tests escaping through the large opening produced by the absorption of the parent's base. Such separated specimens are of frequent occurrence, and one is represented in Plate 12, Fig. 5. It is noticeable that the whole of the internal septa have been absorbed, their position being marked only by septal lines on the inner wall of the test. The test thus resembles a hollow cone, the whole of the cavity being available for the growth of the young brood while they remain in the cavity. Probably the carbonate of lime thus obtained from the absorption of the septa and basal wall is utilised for the secretion of the monothalamous shells of the young brood. I have noted this complete absorption however, of infrequent occurrence except in the genera *Textularia* (*T. folium*, P. & J.) and *Discorbina*.

Chapman, in his book *The Foraminifera* (Longmans, Green & Co., 1902, p. 31), quotes a description of the process of plastogamy as observed by Schaudinn in a species of *Discorbina*. "The flat or inferior faces of the tests are brought together with the apertures coinciding. The walls of the last-formed chambers are sometimes resorbed, and an enclosing shell made around the space between the tests. Then follows the breaking up of the nuclei and the formation of embryonic young, which speedily form their own investment to the extent of two or three chambers before breaking away from the enclosing shell."—Schaudinn, "Ueber Plastogamie bei Foram.," *Sitz. Gesellsch. naturforsch. Freunde*, 1895, No. 10.

of the septa in *Textularia* and *Verneuilina*, and I think it probably occurs in all cases of advanced plastogamy.

I was so fortunate as to find two specimens in which plastogamy had taken place, with subsequent separation of the parents, and in which the young shells still remained inside the cavity. One of these was unfortunately lost again, but I have the other, and the accompanying figure is reproduced from a careful



drawing made by my cousin, Mr. J. A. Lovegrove. It will be observed that the young specimens are monothalamous. They are extremely delicate and hyaline, and appear to be imbedded in sarcode.

Discorbina wrightii, Brady.

Discorbina wrightii, Brady, 1881, *Denkschr. d. k. Ak. Wiss. Wien*, vol. xliii., p. 104, pl. ii., fig. 6; *Ann. Mag. Nat. Hist.*, ser. 5, vol. viii., p. 413, pl. xxi., fig. 6.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common, but probably less so than the last species.

Discorbina bertheloti, d'Orbigny, sp.

Rosalina bertheloti, d'Orbigny, 1839, *Foram. Canaries*, p. 135, pl. i., figs. 28—30.

Discorbina bertheloti, Brady, 1884, *Report "Challenger,"* p. 650, pl. lxxxix., figs. 10—12.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Discorbina tuberculata, Balkwill & Wright.

Discorbina tuberculata, Balkwill & Wright, 1885, *Trans. R. Irish Acad.*, vol. xxviii. (*Science*), p. 350, pl. xiii., figs. 28—30.

A single weak specimen found by Mr. Wright.

Discorbina vesicularis, Lamarck, sp.

Discorbites vesicularis, Lamarck, 1804, *Ann. Mus.*, v., p. 183; and *f.* 7, pl. 62, viii., 1806.

Discorbina vesicularis, Brady, 1884, *Report* "*Challenger*," p. 651, pl. lxxxvii., fig. 2, a, b, c.

,, ,, Halkyard, 1889, "Recent Foraminifera of Jersey," *Trans. Manchester Mic. Soc.*, 1889, p. 15, pl. ii., fig. 8.

Frequent. Not previously recorded in Great Britain. The specimens are very small compared with those found in Australian shore-sands; but they are quite typical, and the asterigerine flaps are well developed. (Plate 12, Figs. 9 and 10, and Plate 14, Fig. 6.)

Halkyard's specimens from the shore-sand of St. Catherine's Bay, Jersey, must have been identical with the Bognor specimens, to judge by his figure. Mr. Wright informs me that he has met with the species in shore-sand from North Donegal (rare); also at Rockfort, Belfast Lough, between tides, where it was abundant. Mr. Millett has also found it on the south coast of England.

Discorbina turbo, d'Orbigny.

Rotalia (*Trochulina*) *turbo*, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 274, No. 29; *Modèle*, No. 73.

Discorbina turbo, Brady, 1884, *Report* "*Challenger*," p. 642, pl. lxxxvii., fig. 8, a, b, c.

Two specimens (one attached) were found, which are probably referable to this species, which does not appear to have been previously recorded in Great Britain. Mr. Wright, on examining them, wrote: "Your specimens, I think, come nearer to *turbo* than anything else. At the same time, it might be advisable to mark it with a query, as the specimens are not sufficiently typical to name with certainty."

Planorbulina, d'Orbigny.

Planorbulina mediterranensis, d'Orbigny.

Planorbulina mediterranensis, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 280, No. 2, pl. xiv., figs. 4—6 ; *Modèle*, No. 79.

,, ,, Brady, 1884, *Report "Challenger,"* p. 656, pl. xcii., figs. 1—3.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare. The specimens are far from typical.

Truncatulina, d'Orbigny.

Truncatulina refulgens, Montfort, sp.

Cibicides refulgens, Montfort, 1808, *Conchyl. Systém.*, vol. i. p. 122, 31^e^ genre.

Truncatulina refulgens, Brady, 1884, *Report "Challenger,"* p. 659, pl. xcii., figs. 7—9.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare. The specimens are small.

Truncatulina lobatula, Walker & Jacob, sp.

Nautilus lobatulus, Walker & Jacob, 1798, *Adam's Essays*, Kanmacher's ed., p. 642, pl. xiv., fig. 36.

Truncatulina lobatula, Brady, 1884, *Report "Challenger,"* p. 660, pl. xcii., fig. 10, pl. xciii., figs. 1, 4, 5.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare. Minute specimens are fairly common.

Truncatulina variabilis, d'Orbigny.

Truncatulina variabilis, d'Orbigny, 1826, *Ann. Sci. Nat.*, vii., p. 279, No. 8.

,, ,, Brady, 1884, *Report "Challenger,"* p. 661, pl. xciii., figs. 6, 7.

Rare.

Truncatulina haidingerii, d'Orbigny, sp.

Rotalina haidingerii, d'Orbigny, 1846, *Foram. Foss. Vienne*, p. 154, pl. viii., figs. 7—9.

Truncatulina haidingerii, Brady, 1884, *Report "Challenger,"* p. 663, pl. xcv., fig. 7, a, b, c.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare.

Truncatulina ungeriana, d'Orbigny, sp.

Rotalina ungeriana, d'Orbigny, 1846, *Foram. Foss. Vienne*, p. 157, pl. viii., figs. 16—18.

Truncatulina ungeriana, Brady, 1884, *Report "Challenger,"* p. 664, pl. xciv., fig. 9, a, b, c, d.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Truncatulina reticulata, Czjzek, sp.

Rotalina reticulata, Czjzek, 1848, *Haidinger's Nat. Abh.*, ii., p. 145, pl. xiii., figs. 7—9.

Truncatulina reticulata, Brady, 1884, *Report "Challenger,"* p. 669, pl. xcvi., figs. 5—8.

,, ,, Chaster, 1892, *First Report Southport Soc. Nat. Sci.*, p. 66, pl. i., fig. 16.

Very rare. Specimens poor and worn.

Previously recorded in Great Britain by Dr. Chaster, from Southport (Lancs.), shore-mud (one specimen only). Mr. J. Wright has a specimen dredged by his brother off Kinsale, which is quite typical, as also is Dr. Chaster's specimen.

Anomalina, d'Orbigny.

Anomalina grosserugosa, Gümbel, sp.

Truncatulina grosserugosa, Gümbel, 1868 (1870), *Abh. m.-ph. Cl. k. bayer. Ak. Wiss.*, x., p. 660, pl. ii., fig. 104, a, b.

Anomalina grosserugosa, Brady, 1884, *Report "Challenger,"* p. 673, pl. xciv., figs. 4, 5.

Rare. Not previously recorded in Great Britain. The specimens are very poor, and the species is now recorded with some hesitation.

Pulvinulina, Parker & Jones.

Pulvinulina concentrica, Parker & Jones.

Pulvinulina concentrica, Parker & Jones, 1865, *Phil. Trans.*, vol. clv., p. 393.

Pulvinulina concentrica, Brady, 1884, *Report "Challenger,"* p. 686, pl. cv., fig. 1, a, b, c.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare. The specimens are weak.

Pulvinulina auricula, Fichtel & Moll, sp.

Nautilus auricula, var. *a*, Fichtel & Moll, 1803, *Test. Micr.*, p. 108, pl. xx., figs. a, b, c.
,, ,, var. *β*, id., *ibid.*, figs. d, e, f.
Pulvinulina auricula, Brady, 1884, *Report "Challenger,"* p. 688, pl. cvi., fig. 5, a, b, c.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare. The specimens are of the depressed form.

Pulvinulina hauerii, d'Orbigny, sp.

Rotalina hauerii, d'Orbigny, 1846, *Foram. Fossiles Vienne*, p. 151, pl. vii., figs. 22—24.
Pulvinulina hauerii, Brady, 1884, *Report "Challenger,"* p. 690, pl. cvi., figs. 6, 7.

Very rare. Not previously recorded in Great Britain.

Pulvinulina menardii, d'Orbigny, sp.

Rotalia menardii, d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. vii., p. 273, No. 26; *Modèle*, No. 10.
Pulvinulina menardii, Brady, 1884, *Report "Challenger,"* p. 690, pl. ciii., figs. 1, 2.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare. Specimens very small.

Pulvinulina karsteni, Reuss, sp.

Rotalia karsteni, Reuss, 1855, *Zeitschr. d. deutsch. geol. Gesell.*, vol. vii., p. 273, pl. ix., fig. 6.
Pulvinulina karsteni, Brady, 1884, *Report "Challenger,"* p. 698, pl. cv., figs. 8, 9.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very rare. The specimens are very small.

Rotalia, Lamarck.

Rotalia beccarii, Linné, sp.

Nautilus beccarii, Linné, 1767, *Syst. Nat.*, 12th ed., p. 1162; 1788, *ibid.*, 13th (Gmélin's) ed., p. 3370, No. 4.

Rotalia beccarii, Brady, 1884, *Report "Challenger,"* p. 704, pl. cvii., figs. 2, 3.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Common. A smooth, thin-shelled variety also occurs, which appears to possess characters intermediate between *R. beccarii*, Linné, and *R. orbicularis*, d'Orbigny. The same form has been met with by Messrs. Balkwill & Wright in deep water off Dublin Harbour, and by Mr. F. W. Millett in shore-silt from Broad Sand, Torbay.

Rotalia calcar, d'Orbigny, sp.

Calcarina calcar, d'Orbigny, 1826, *Ann. Sci. Nat.*, vii., p. 276, No. 1; *Modèle*, No. 34.

Rotalia calcar, Brady, 1884, *Report "Challenger,"* p. 709, pl. cviii., figs. 3, 4.

Rare. Not previously recorded in Great Britain.

Sub-family 3—TINOPORINAE.

Gypsina, Carter.

Gypsina inhaerens, Schultze, sp.

Acervulina inhaerens, Schultze, 1854, *Organ. der Polythal.*, p. 68, pl. vi., fig. 12.

Gypsina inhaerens, Brady, 1884, *Report "Challenger,"* p. 718, pl. cii., figs. 1—6.

,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Frequent.

Family X.—NUMMULINIDAE.

Sub-family 2—POLYSTOMELLINAE.

Nonionina, d'Orbigny.

Nonionina depressula, Walker & Jacob, sp.

Nautilus depressulus, Walker & Jacob, 1798, *Adam's Essays*, Kanmacher's ed., p. 641, pl. xiv., fig. 33.

Nonionina depressula, Brady, 1884, *Report "Challenger,"* p. 725, pl. cix., figs. 6, 7.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

Very common.

Nonionina umbilicatula, Montagu, sp.

Nautilus umbilicatulus, Montagu, 1803, *Test. Brit.*, p. 191; *Suppl.*, p. 78, pl. xviii., fig. 1.
Nonionina umbilicatula, Brady, 1884, *Report "Challenger,"* p. 726, pl. cix., figs. 8, 9.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Nonionina asterizans, Fichtel & Moll, sp.

Nautilus asterizans, Fichtel & Moll, 1803, *Test. Micr.*, p. 37, pl. iii., figs. e—h.
Nonionina asterizans, Brady, 1884, *Report "Challenger,"* p. 728, pl. cix., figs. 1, 2.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

Very common. The specimens are weakly marked and not easily distinguishable from *N. depressula*, Walker & Jacob, but Mr. Wright agrees with me that they are correctly referred to this species. He states that the form is common in British gatherings and usually associated with *N. depressula*, Walker & Jacob. Brady, in his *Synopsis*, considers it doubtful whether the species should be retained in the British fauna, as all specimens which he had seen were minute and ambiguous. There seems to be no doubt that all the British records of this species refer to such weak forms as are found at Bognor.

Nonionina stelligera, d'Orbigny.

Nonionina stelligera, d'Orbigny, 1839, *Foram. Canaries*, p. 128, pl. iii., figs. 1, 2.
„ „ Brady, 1884, *Report "Challenger,"* p. 728, pl. cix., figs. 3—5.
„ „ Brady, 1887, *Synopsis British Recent Foraminifera.*

Rare.

Nonionina pauperata, Balkwill & Wright.

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

Rare.

Polystomella, Lamarck.

Polystomella crispa, Linné, sp.

Nautilus crispus, Linné, 1767, *Syst. Nat.*, 12th ed., p. 1162, 275.
,, ,, Linné, 1788, *ibid.*, 13th (Gmélin's) ed., p. 3370, No. 3.
Polystomella crispa, Brady, 1884, *Report "Challenger,"* p. 736, pl. cx., figs. 6, 7.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very abundant and well-developed. Young specimens exhibit the peripheral armature of spines in a very marked degree, and the spines are frequently noticeable in shells of a considerable size.

Polystomella macella, Fichtel & Moll, sp.

Nautilus macellus, Fichtel & Moll, 1803, *Test. Micr.*, p. 66, var. *a*, pl. x., figs. e—g; var. *β*, pl. x., figs. h—k.
Polystomella macella, Brady, 1884, *Report "Challenger,"* p. 737, pl. cx., figs. 8—11.

Very common. Previously recorded in Great Britain only by Mr. J. Wright from the shore-sand of Dog's Bay, Connemara, and from off Rathlin Island; but he informs me that it is generally distributed around the Irish coast.

Polystomella striatopunctata, Fichtel & Moll, sp.

Nautilus striatopunctatus, Fichtel & Moll, 1803, *Test Micr.*, p. 61, pl. ix., fig. a—c.
Polystomella striatopunctata, Brady, 1884, *Report "Challenger,"* p. 733, pl. cix., figs. 22, 23.
,, ,, Brady, 1887, *Synopsis British Recent Foraminifera.*

Very common.

Explanation of Plates 11—14.

Plate 11.

Fig. 1. *Nubecularia lucifuga*, Defrance. Upper surface of attached specimen.

„ 2. *Nubecularia lucifuga*, Defrance. Under surface of detached specimen, in which the chambers show a regularly spiral arrangement. The internal septa are visible through the shell substance.

„ 3. *Nubecularia lucifuga*, Defrance. Very young specimen, showing the unseptate spiral shell surrounding the primordial chamber.

„ 4. *Massilina secans*, d'Orbigny sp., var. *denticulata*, Costa.

„ 5. „ „ „ „ var. nov. *tenuistriata*.

„ 6. *Thurammina papillata*, Brady. Free specimen of irregular growth.

„ 7. *Thurammina papillata*, Brady. Underview of adherent specimen which has become detached, showing at *a* the delicate chitinous membrane (broken) which lines the test and forms a continuous wall between the sarcode body and the object to which the test is attached.

Plate 12.

Fig. 1. *Spiroplecta fusca*, sp. nov. Lateral view.

„ 2. „ „ „ Peripheral view.

„ 3. „ „ „ Oral view.

„ 4. *Discorbina parisiensis*, d'Orbigny, sp. Superior aspect.

„ 5. *Discorbina*. Inferior aspect of a specimen after plastogamic union. The greater part of the basal wall has been absorbed; the internal septa, which are indicated by the thick septal lines on the inner surface of the test, have also been absorbed.

„ 6. *Discorbina parisiensis*, d'Orbigny, sp. Inferior aspect.

„ 7. „ „ „ „ Plastogamic union of three specimens.

„ 8. *Discorbina obtusa*, d'Orbigny, sp. Superior aspect.

„ 9. *Discorbina vesicularis*, Lamarck, sp. Superior aspect.

„ 10. „ „ „ „ Inferior aspect.

Plate 13.

Fig. 1. *Cornuspira foliacea*, Philippi, sp. British specimen from Mr. Joseph Wright's collection. Dredged off South-west Ireland, 38—41 fathoms.

,, 2. Specimen from Bognor shore-sand.

Figs. 3, 4. Specimens of the same from Bognor, showing the union (query, plastogamic) of several individuals.

Plate 14.

Note.—The figures on this plate are reproduced from photographs taken by Dr. E. J. Spitta, F.R.A.S., and are intended to give an idea of the general appearance of the species.

Fig. 1. *Thurammina papillata*, Brady, × 10 diam.

,, 2. *Nubecularia lucifuga*, Defrance, × 15 diam.

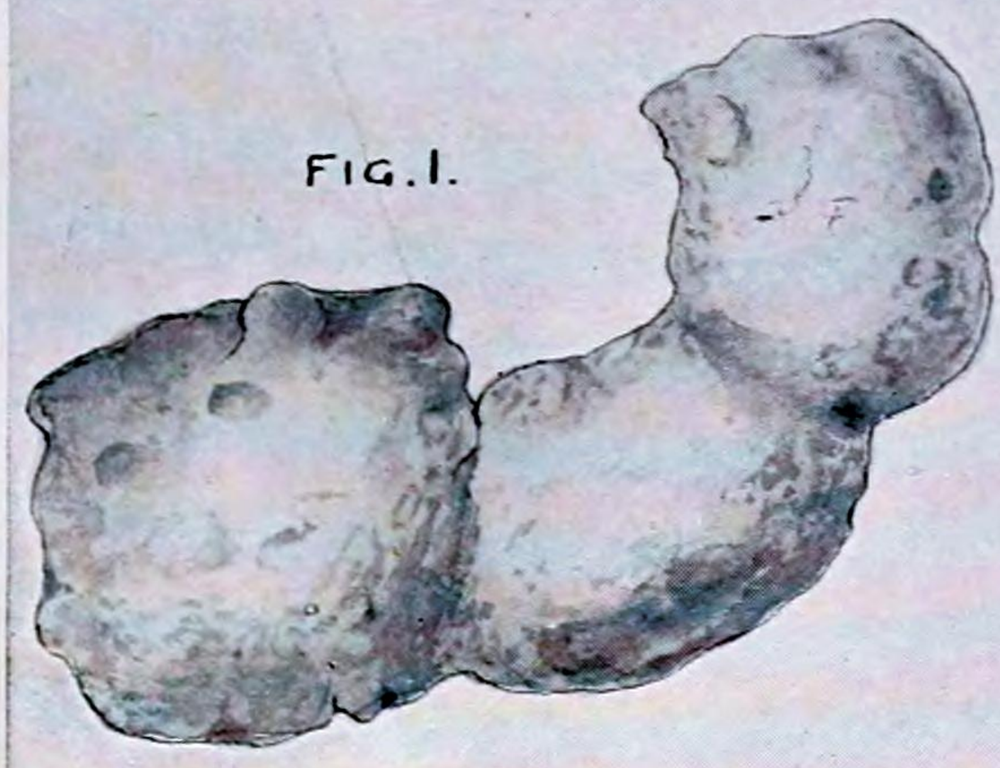
,, 3. *Thurammina papillata*, Brady, × 12 diam., showing the papillate processes.

,, 4. *Discorbina obtusa*, d'Orbigny, × 24 diam. Plastogamic specimen in the centre.

,, 5. *Discorbina parisiensis*, d'Orbigny, × 26 diam. The three specimens at the top show the basal view of specimens which have undergone plastogamic union and subsequent separation. The greater part of the base and the internal septa have been absorbed, so that the interior of the test is visible. The second and third rows contain specimens in plastogamic union. It will be seen that the specimens vary in size, and that their apertures rarely coincide.

,, 6. *Discorbina vesicularis*, Lamarck, × 28 diam.

FIG. 1.



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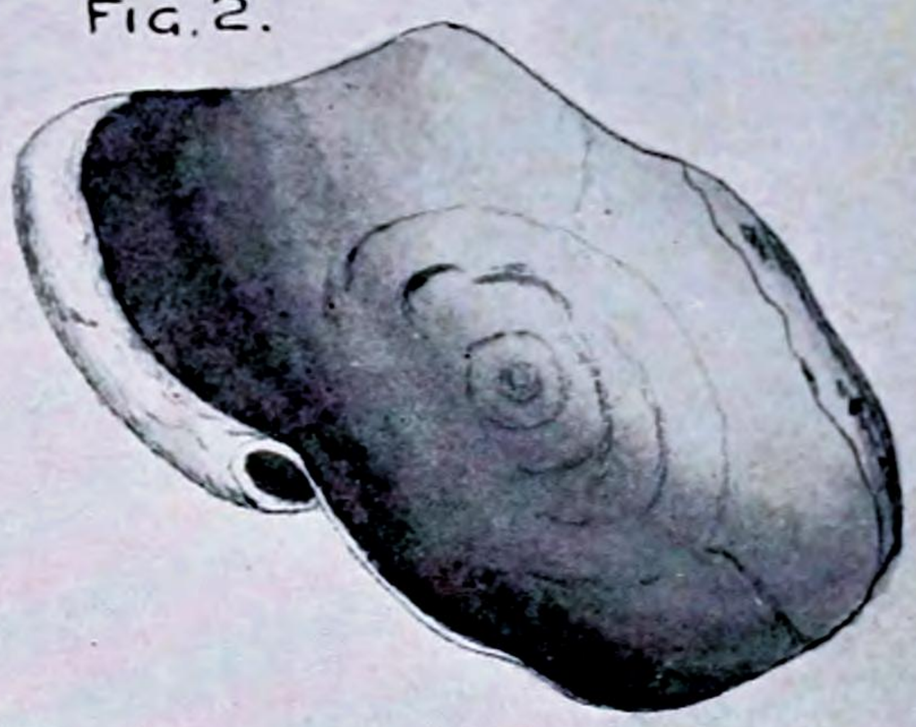
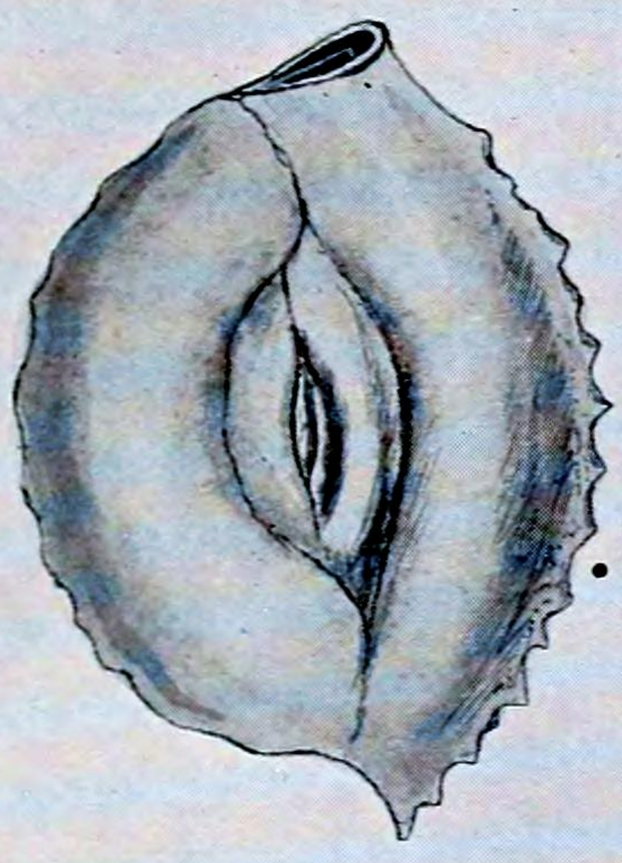


FIG. 3.

FIG. 4.



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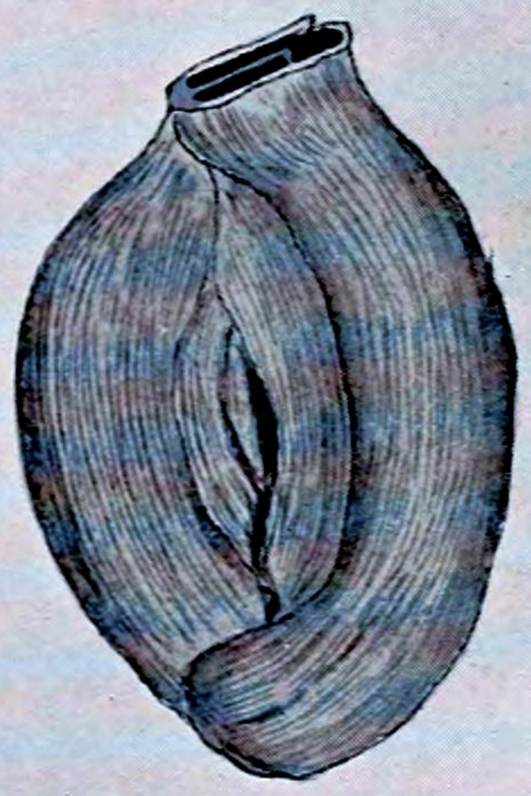

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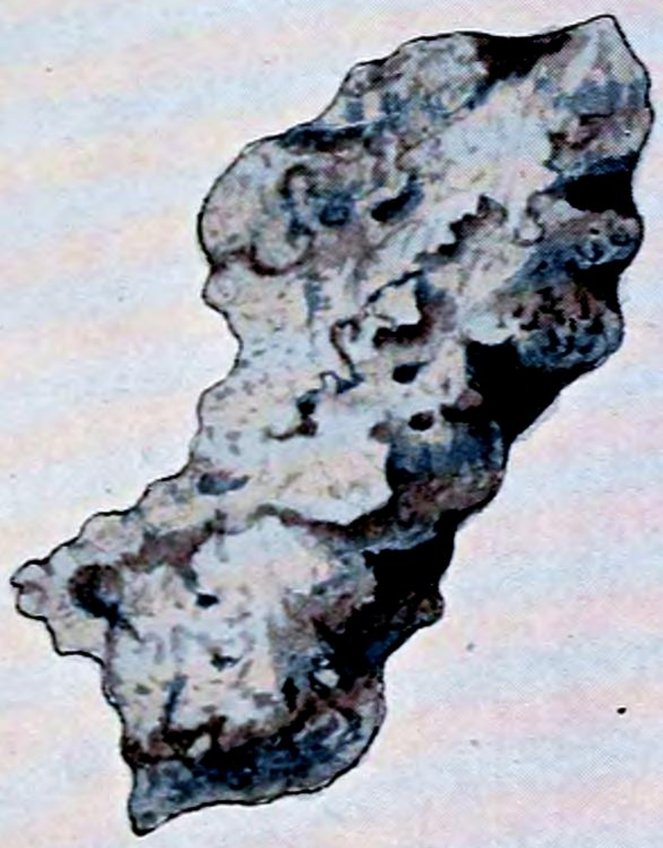

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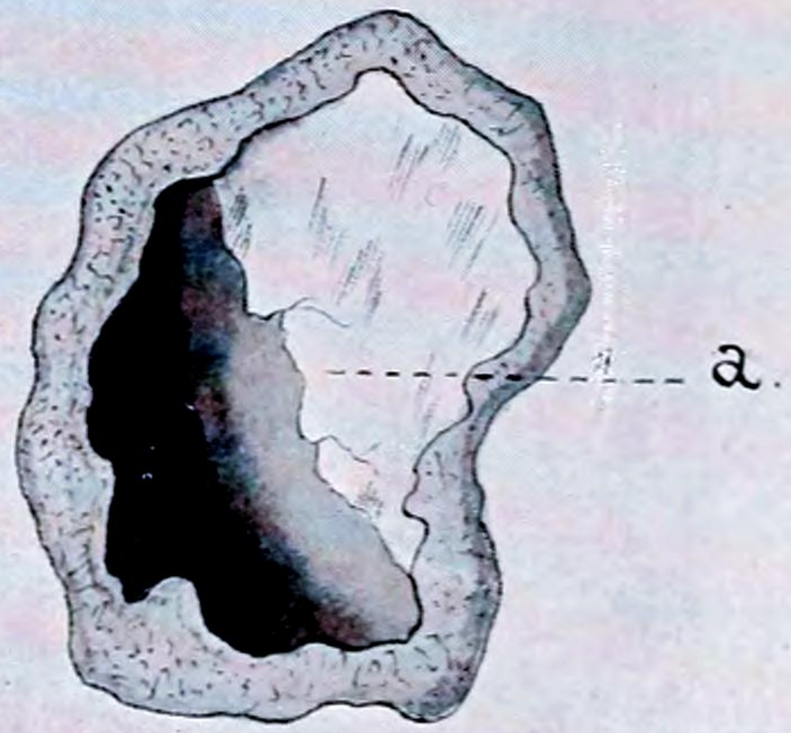


A. J. FRENCH, *del. ad nat.*

FORAMINIFERA FROM BOGNOR, SUSSEX.

FIG. 1.

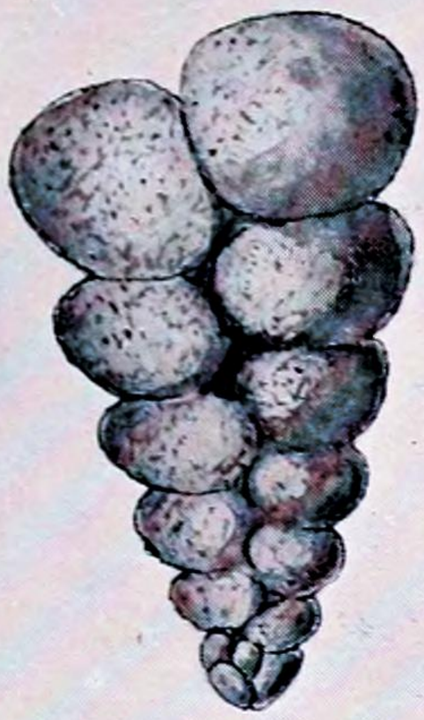
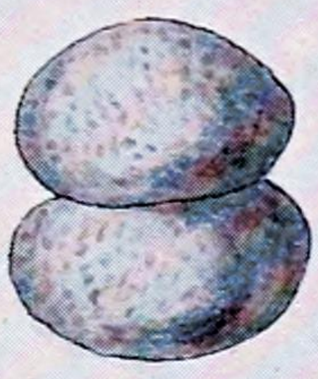


FIG. 2.

FIG. 3.



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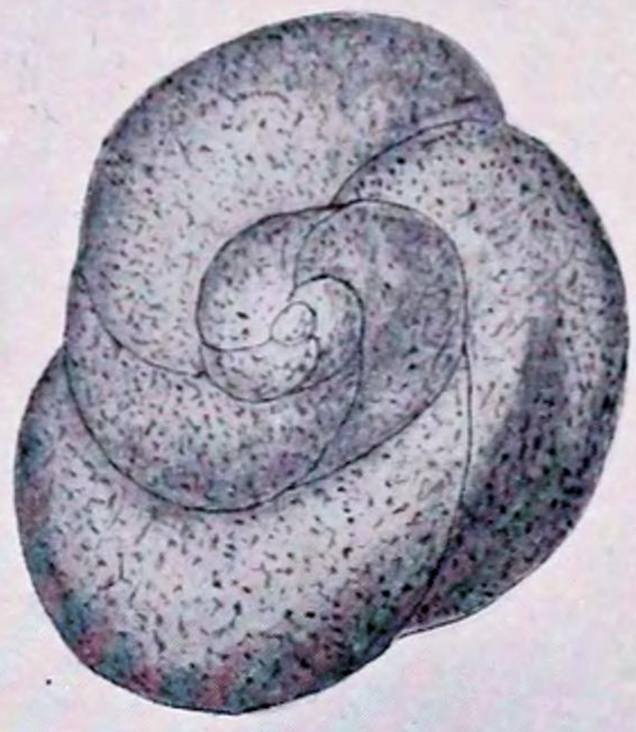

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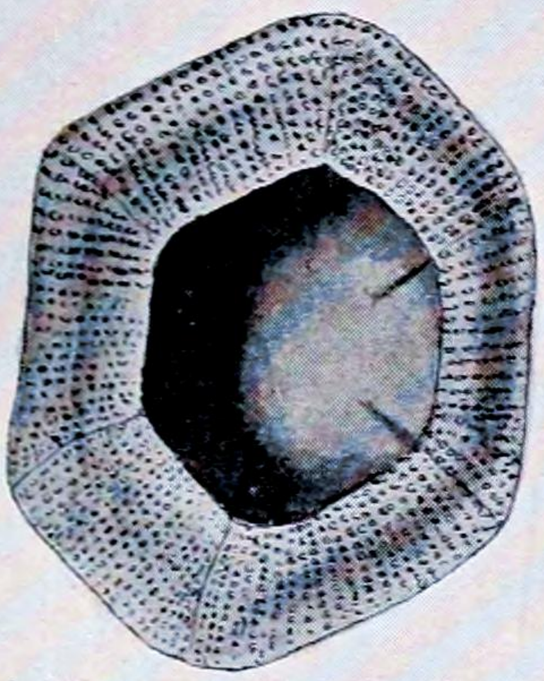

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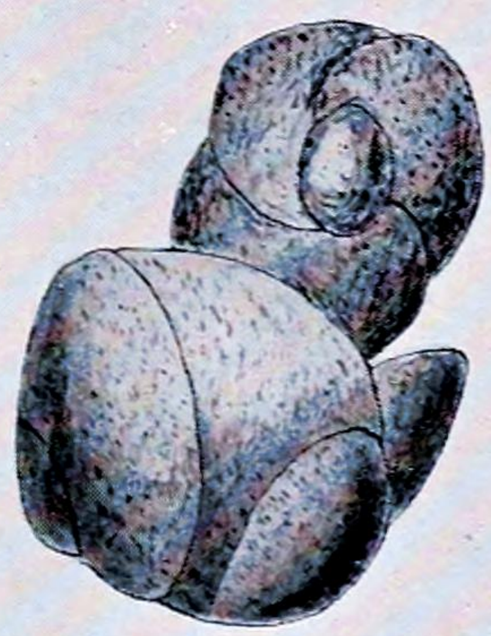

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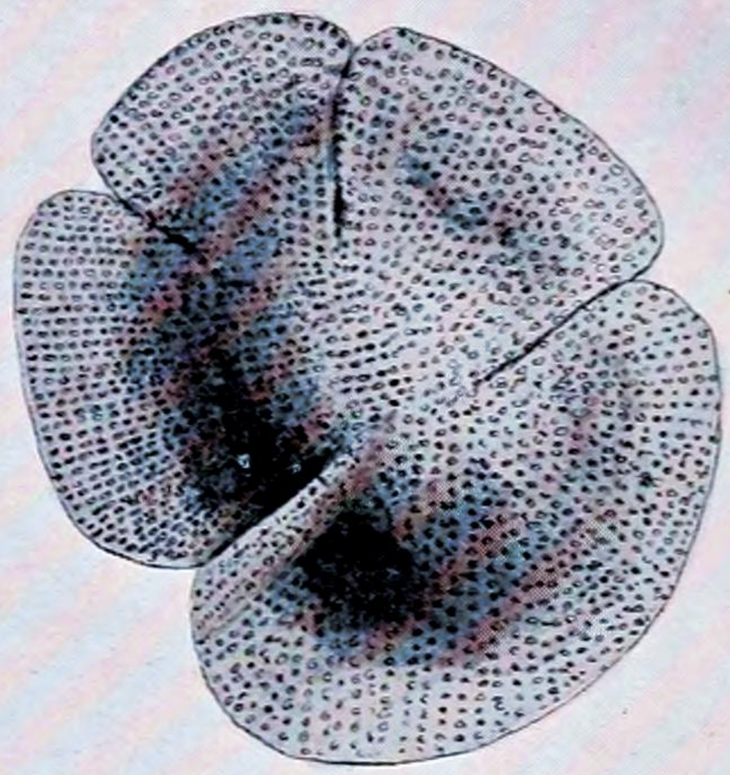
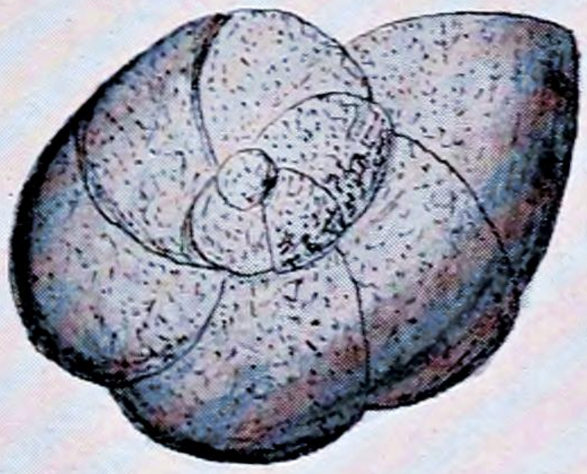


FIG. 8.

FIG. 9.



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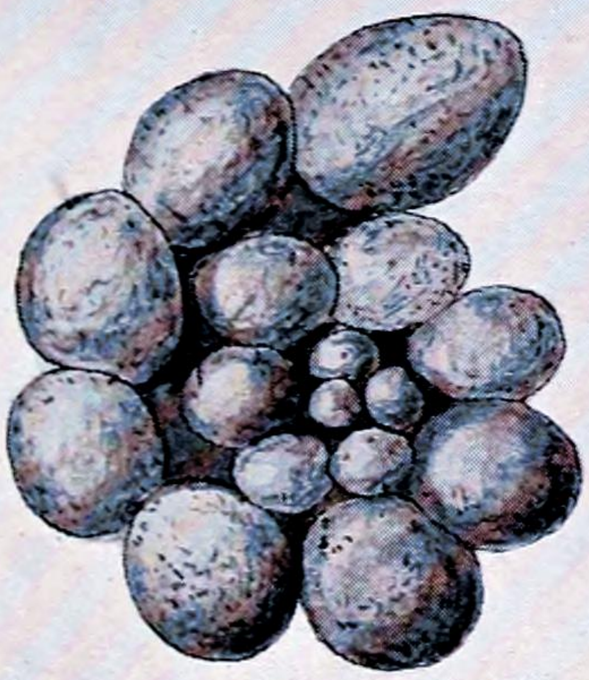

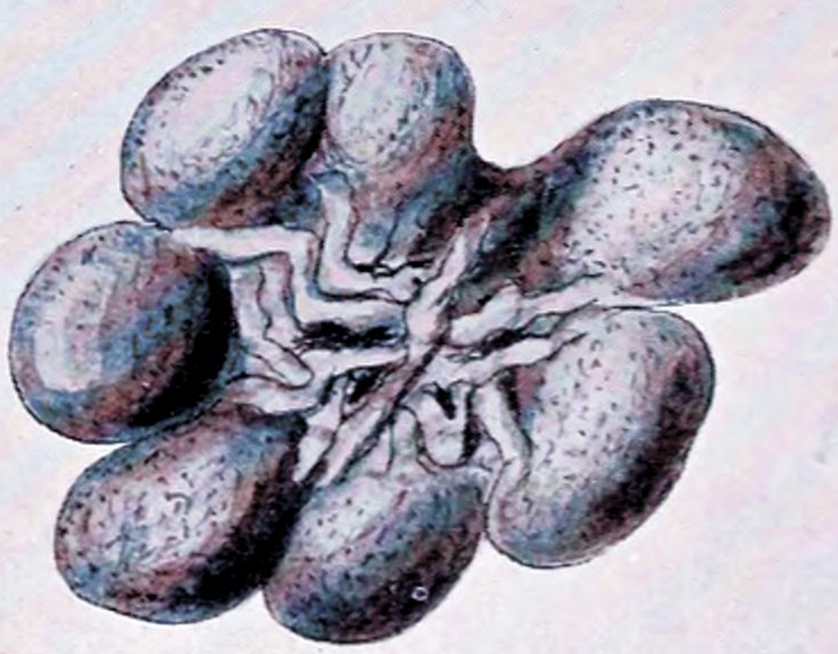

A. J. FRENCH, *del. ad nat.*

FORAMINIFERA FROM BOGNOR, SUSSEX.

J. A. LOVEGROVE, *del. ad nat.*

FORAMINIFERA—*CORNUSPIRA*.

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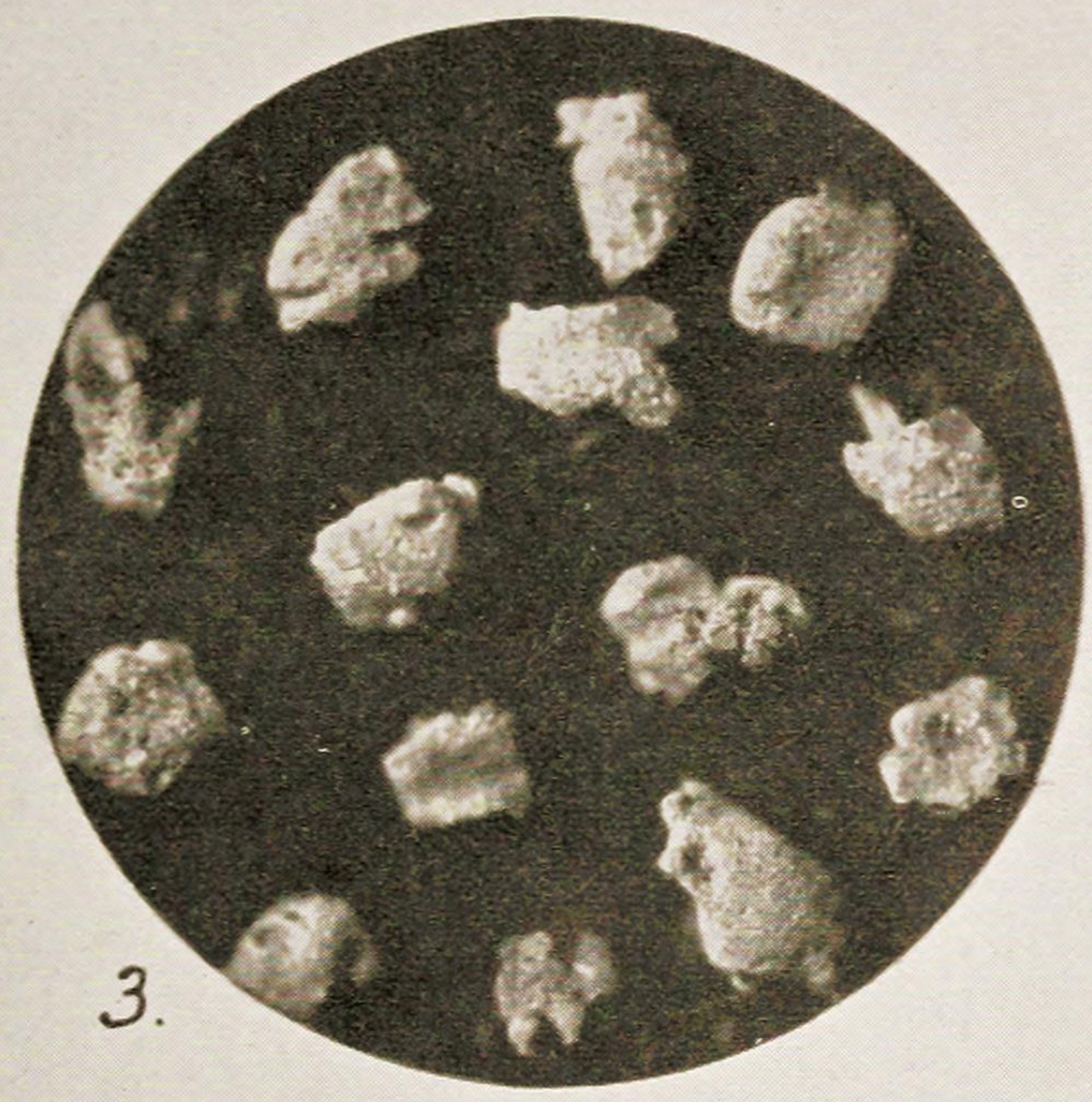
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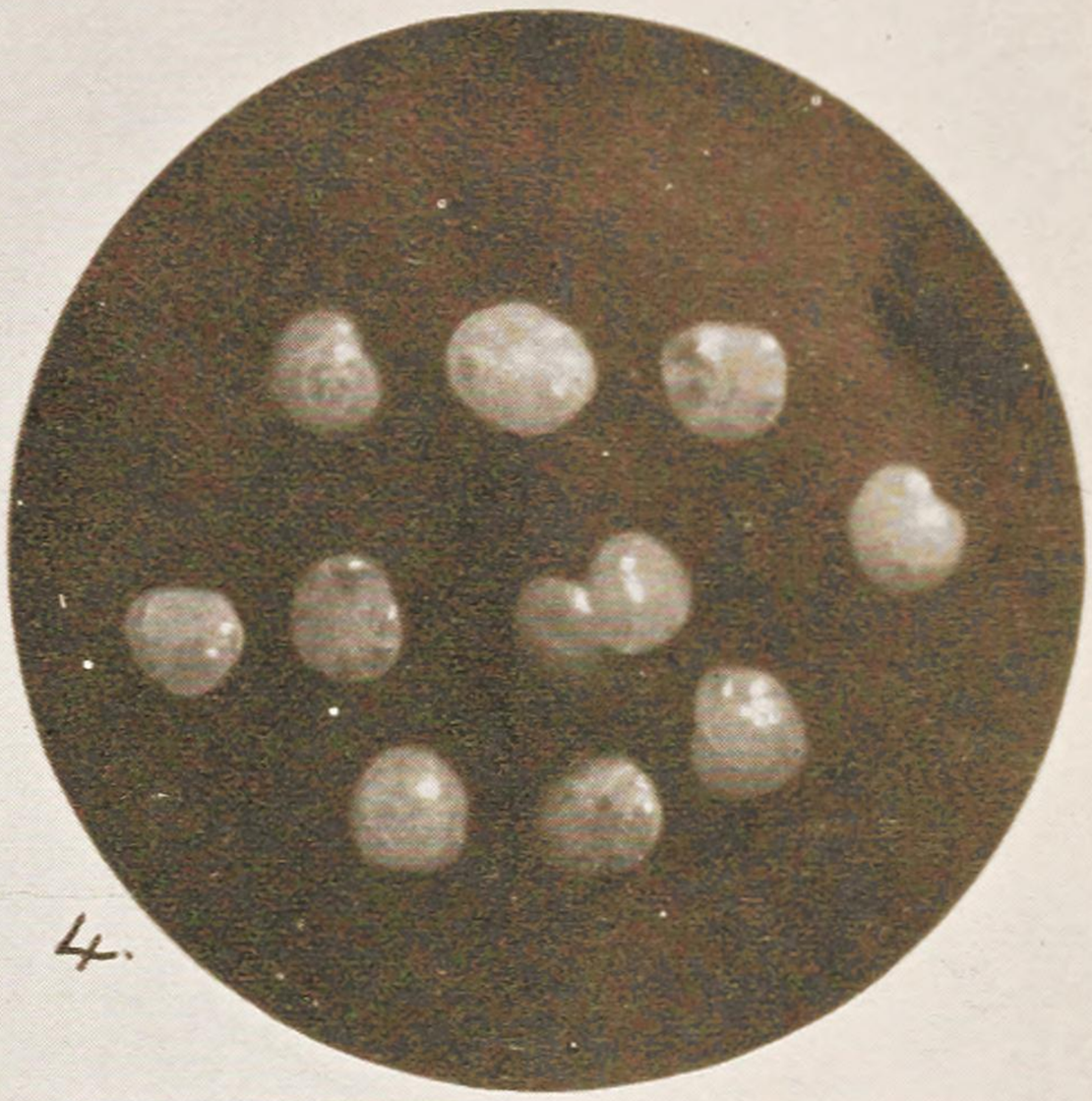
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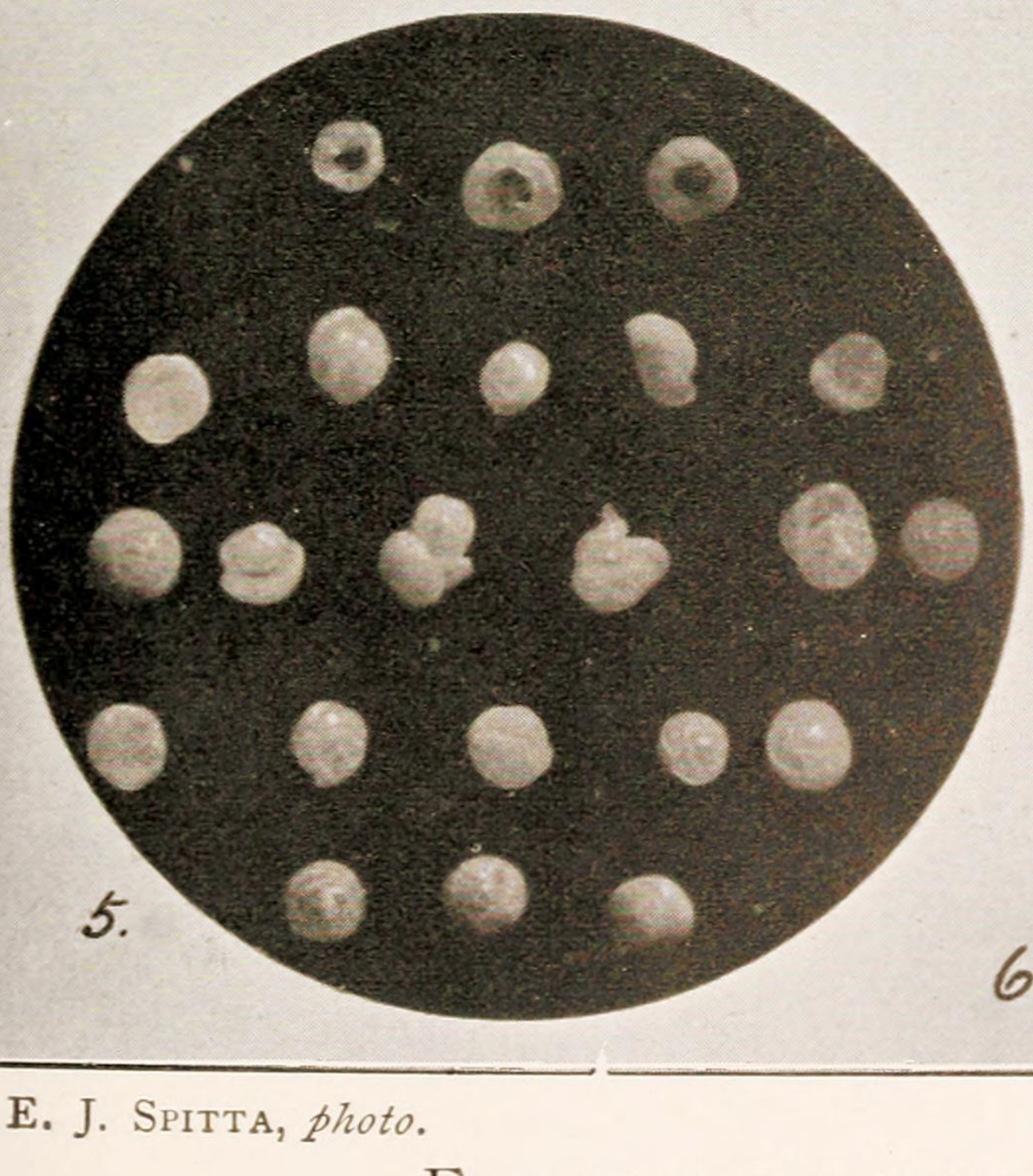
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6.

E. J. SPITTA, *photo.*

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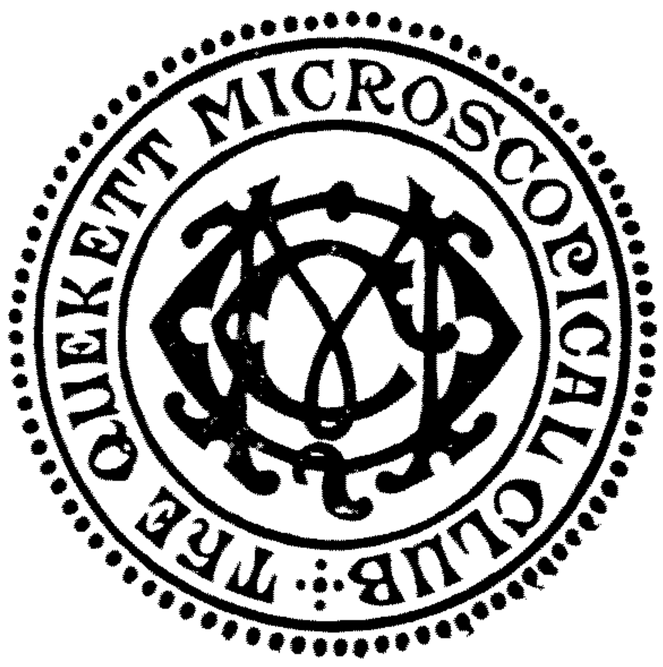
SECOND SERIES.

VOLUME IX.

1904-1906.



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WILLIAMS AND NORGATE,

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